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DEVELOPMENT OF LAND AND WATER RESOURCES PLAN FOR A SMALL WATERSHED IN CHHATTISGARH

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A study on planning of land and water resources for a small agricultural watershed of Mungeli district in Chhattisgarh was conducted in the Department of Soil and Water Engineering, SVCAET & RS, Faculty of Agricultural Engineering, IGKV, Raipur during the year 2015-16. This study deals with the use of modern tools and technology for micro level land and water resource planning. Tesua watershed of Mungeli district was selected in this study. The Tesua watershed covers an area of 279.7 km² and is bounded by North latitudes 21˚ 56’ 30” to 22˚ 09’ 30” and East longitudes 81˚ 28’ 30” to 80˚ 45’ 30” with intended boundary falling in Survey of India topographic map no. 64G09, 64G13, 64F12 and 64F16 on 1:50,000 scale. Average annual rainfall of study area is reported to be 973 mm. The minimum temperature during in November-January was about 28˚ C to 30˚ C. The maximum temperature ranges between the 40˚ C to 48˚ C during April-May. The predominant soil of watershed is sandy clay loam; sandy loam, loam and clay loam are also found in the watershed. Based on analysis of agro meteorological, hydrological and geomorphological data, it was found that, the Tesua watershed consists of 4th order stream network. Total length, bifurcation ratio and drainage density was found to be 179.25 km, 3.7 and 0.64, respectively. Cadastral level land use plan was developed based on the suitable farming situations, soil texture, topography and current land use pattern. It was found that 2538.3 ha comprising of current fallow under matasi farming situation, 178.16 ha comprising of current fallow under Dorsa farming situation and 0.347 ha of current fallow under kanhar farming situation can be brought under cultivation. Water resource plan was developed based on the surface and ground water availability. On the basis of estimate it was found that 41.02 Mm³ of water can be stored and recharged by the Water Harvesting Structure (WHS) and can support 2716.75 ha of additional crop area. Based on superimposing technique (overlaying) of various thematic maps different water harvesting and recharge structures such as percolation tank (59 nos.), check dam (126 nos.) for storage, check dam (21 nos.) for ground water recharge and farm ponds (341 nos.) are proposed at appropriate locations in the Tesua watershed of Mungeli district of Chhattisgarh state. On the basis of this study it can be concluded that the modern tools and technology can successfully be adopted for micro level land and water resources planning of a small agricultural watershed.

Keywords: GIS, Groundwater, Recharge structure, Watershed, Water harvesting structure

Abstract Id: 5
RED-EDGE INDICES TO DIAGNOSE ORANGE SPOTTING DISEASE OF OIL PALM IN MALAYSIA

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The use of hyperspectral remote sensing techniques for plant disease diagnosis is gaining much prominence due to its non-destructive feature. The steep gradient in reflectance between visible and near-infrared region is known as the red-edge, which is located between 680 and 780 nm. Red-edge is a stress diagnostic indicator that provides for non-destructive diagnosis of plant disease. This paper investigates the potential of two selected red-edge wavebands (680 nm and 754 nm) in diagnosing Orange Spotting (OS) disease of oil palm. OS is a fast emerging disease in Malaysian oil palm plantations. Coconut cadang-cadang viroid (CCCVd) is the causal agent of OS disease. Four well-known red-edge indices namely Ratio Vegetation Index (RVI), Red Edge Position (REP), Normalized Difference Red Edge Index (NDREI) and Chlorophyll Index-Red Edge (CI-RE) were evaluated using selected wavebands. A spectroradiometer (Model: ASD FieldSpec® HandHeld 2), which operates in the spectral range of 325-1075 nm, was deployed to measure leaf reflectance of fifteen inoculated and five healthy oil palm seedlings grown under glasshouse conditions. A highly effective CCCVd variant, OP246, was used to inoculate the seedlings. Reflectance was measured at 15, 30, 45 and 60 days after inoculation. This work was aimed at investigation of variations on red-edge indices within the specific intervals of inoculation. Red-edge indices were calculated from inoculated and healthy seedlings and analyzed using two-way analysis of variance. Mean differences are interpreted at 0.05 significance level using the Bonferroni test. Results will be discussed further.

Keywords: Orange spotting, Hyperspectral remote sensing, Red-edge indices

Abstract Id: 7
Modelling Potential Hydrological Impact of Abandoned Opencast Mines using SWAT model

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This paper explores the potential hydrological impact of abandoned open cast mines in Olidih watershed of Jharia coalfield region. It uses Soil and Water Assessment Tool (SWAT) model with Sequential Uncertainty Fitting (SUFI-2) optimization technique for model calibration. Daily streamflow and sediment yield data from the years 2005-2006 were used for calibration and 2007-2008 for validation. The potential influences of these mines were assessed by modelling an alternative scenario assuming no-mines (unmined) for the period 2005-2010. Results show that the abandoned open cast mines plays a dominant role in changing hydrological process and thus watershed hydrology. The potential hydrological impact of these mines is an increased annual lateral flow of 2%, annual sediment yield of 16%, decrease in annual surface flow by 51% and, annual water yield by 6% for the Olidih Watershed.

Keywords: Open cast mines; Watershed hydrology; SWAT, SUFI-2

Abstract Id: 8
Pink bollworm (Pectinophora gossypiella (Saunders), PBW) is a major pest of cotton worldwide. The system of cotton pest management adopted in Egypt is described in relation to the economic thresholds of infestation (infested green boll 3%). The best way to minimize impacts of a pest outbreak is to regularly monitor the crop to detect the onset of pest and to take timely action if the pest is present. Monitoring should be done on the basis of local knowledge and up-to-date and reliable global information. Reduction in losses caused by pests by timely and effective control measures will considerably add to food production in the country. Monitoring of this pest is generally undertaken through regular field surveys, which is labour intensive, time consuming and error prone. Alternately, radiometry is a reliable technique for rapid and non-destructive assessment of plant health. The purpose of this research was to develop a new method to detect infested cotton plant with PBW without any losses to boll. Thus, a study was conducted to characterize reflectance spectra of cotton plants with known PBW infestation, and seek to identify specific narrow wavelengths sensitive to PBW damage. Reflectance measurements were made in the spectral range of 350-2500 nm using a hyperspectral radiometer. Reflectance sensitivity analysis of the hyperspectral data to PBW damage also determined. Results of this study could suggest potential usage of remote sensing in monitoring spatial distribution of the PBW, and thereby enable effective planning and implementation of site-specific pest management practices. The study shows that it is feasible to detect PBW infestation using the hyperspectral data and recognize its level, which could be utilized to monitor trade and predictions.

Keywords: Remote sensing, hyperspectral data, Pink bollworm (PBW), cotton, predictions

Abstract Id: 10
HYDROGEOLOGY, REMOTE SENSING AND GIS IN SIWA OASIS

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The evaluation of water resources potentiality (in terms of hydrogeological setting and its water quality for different purposes) is a prime importance for future development of Siwa Oasis, Northwestern Desert of Egypt. The achievement of the present study is based on the analysis and interpretation of different integrated methods including geology, geomorphology, hydrogeology, and hydrochemistry. In addition to availability of advanced technologies for managing significant quantities of data. These advanced technologies are termed Remote Sensing (RS) and Geographic Information System (GIS), for handling geo-referenced data in digital format. The using of these technologies in assessing water resources in Siwa Oasis can help the planners to organize the environmental data, and understanding their spatial association. Monitoring and analysis of the recent landcover dynamics through the integration of remote sensing and GIS could provide base information for documenting water salinity, soil change and expansion in surface lakes. Different landsat images are used in the present study during different dates (change detection). Hydrogeologically, the groundwater occurrence in the fissured carbonate aquifers at the top and the Nubia Sandstone aquifer at the base are discussed. The hydrogeological conditions are controlled by the geologic structure. The feeding source of the fractured carbonate aquifer is investigated to evaluate and manage the water resources in connection with future agriculture development. Due to the increase of drilling activities for groundwater extracting Siwa area recently, some problems concerning the water resources potentiality in the area are happened. This necessitates an urgent need for a policy or management scheme to decrease these problems in the area. The study will help the planners and decision makers to organize the information, understand their spatial association, and provide a powerful means for analyzing and synthesizing the related information.

Keywords: Hydrogeology, Remote sensing and GIS, Siwa, oasis

Abstract Id: 11
STUDY OF MORPHOLOGICAL CHANGES OF THE RIVER GANGA IN PATNA DISTRICT, BIHAR USING REMOTE SENSING AND GIS TECHNIQUES

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There are continuous changes upon earth’s surface by a variety of natural and anthropogenic agents cut, carry away and depositing of minerals from land. This research work has been carried out on Ganga River, whose channel is continuously changing under the influence of geomorphic agents and human activities in the surrounding regions. The main focus is to study morphological characteristics and sand dynamics of Ganga River with particular emphasis on bank lines and width changes using remote sensing and GIS techniques. The advance remote sensing data and topographical data were interpreted for obtaining 52 years of changes. For this, remote sensing data of different years (LANDSAT TM 1975, 1988, 1993, ETM 2005 and ETM 2012) and toposheet 1960 were used as base maps. Sinuosity ratio, braiding index and migratory activity index were also established. It was found to be 1.16 in 1975 and in 1988, 1993, 2005 and 2005 it was 1.09, 1.11, 1.1, and 1.09 respectively. The analysis also shows that the minimum value found in 1960 was in reach 1 and maximum value is 4.8 in 2012 found in reach 4 which suggests creation of number of islands in reach 4 for the year 2012. Migratory activity index (MAI), which is a standardized function of both length and time, was computed for the 8 representative reaches. MAI shows that maximum migration was in 1975-1988 in reach 6 and 7 and minimum migration was in 1993-2005. From the channel change analysis, it was found that the shifting of bank line was cyclic and the river Ganges showed a trend of southward maximum values. The advanced remote sensing data and topographical data helped in obtaining 52 years changes in the river due to various natural and manmade activities like flood, water velocity and excavation fertile soil excavation.

Keywords: Braided index, Migratory activity index (MAI), Ganga river, River morphology

Abstract Id: 15
APPLICATIONS OF UAV REMOTE SENSING - CASE EXAMPLES OF NORTH EASEREN REGION

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Unmanned Aerial Vehicles (UAVs), popularly known as Drones, is an airborne system or an aircraft operated remotely by a human operator or autonomously by an on-board computer. UAV based Remote Sensing (UAV-RS) is the new addition to the North Eastern Space Applications Centre (NE-SAC) for large-scale mapping and real time assessment and monitoring activities of various applications.

NE-SAC has taken the initiative for design and assembling of UAVs for various applications. Different components of the UAV are selected based on the design parameters and assembled as per the requirements. A Hex Copter was designed and assembled at NE-SAC, which can carry maximum payload up to 2.5 Kg of different sensors such as thermal, multi-spectral, optical and hyper-spectral etc. Multiple UAVs have been procured with varying payload capabilities and supporting software tools for all State Remote Sensing Centres of North Eastern Region with the full financial support of North Eastern Council. NESAC is also venturing into fixed wing UAVs which will have higher flying time and thereby covering larger areas.

The UAVs are added advantage of providing very high resolution imagery and the benefit of repeat coverage of any particular area, otherwise very difficult to obtain from satellites. The major advantage of UAVs is getting minute details, generation of seamless mosaics, DEMs with centimeter level accuracy, ortho photo and video coverage etc and useful for large number of applications.

The NESAC has carried out large number application studies such as dam site analysis, rice crop infestation, landslides, urban studies, survey for butterfly park, cherry blossom mapping, flying of airport area and line of sight studies, multi-spectral studies of crops, mapping cultural events and its surveillance etc. The details of all the application studies carried out will be discussed as part of technical presentations.

Keywords: UAVs, RS Applications, Legal Issues, crop damages, hydropower

Abstract Id: 16
SPACE-BORNE-SYNTHETIC APERTURE RADAR (SAR) SYSTEM FOR REAL TIME SURVEILLANCES OF EARTH SURFACE FOR DETECTION AND MANAGEMENT OF FLOOD DISASTER IN INDIAN SUB-CONTINENT

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Earth Observation System consisting of remote sensing satellite in optical and microwave spectrum provides the information of different environmental and earth surface parameters by mapping and monitoring the earth surface for natural disasters such as earth quake, landslides, floods and forest fire apart from natural resource management. The remote sensing satellite images of multi-spectral sensors in the optical spectrum are affected by weather conditions due to clouds and rains as well as climatic conditions, restricting its application during clear sky conditions apart from limiting its image acquisition during the day time only. The development in the space borne synthetic aperture radar (SAR) technology and imaging techniques to reduce the repeat pass period using multi-SAR systems in orbits makes its suitable for real time monitoring and mapping of earth surface for the flood and water resource management due inherent cloud and rain penetrating capability as well as backscattering properties of radar signals in different frequency band. The recent development of space-borne SAR systems in bi-static and multi-static configuration by different space agencies ensures the availability of multi-sensor SAR in different microwave radar bands for the development of space-based flood disaster management system. The inherent characteristics to generate high contrast in SAR image between surfaces such as soil and water is due to very low backscattering coefficient of radar signals from water bodies acting as a mirror reflecting surface and earth surface gives higher backscattering coefficient due to surface roughness consisting of soil characteristics and vegetation, which increases the radar reflectivity of the surface. Major rivers in India like Indus, Ganga and Brahmaputra are snow-fed as well as monsoon rainfall dependent, while the other river basins are purely rainfall dependent. A large variability in the characteristics of rainfall has been observed over the basin in different seasons and months. The southwest (SW) monsoon, which brings about 80% of the total precipitation over the country, is critical for the availability of freshwater for drinking and irrigation. Flooding in rivers are caused due to excessive rainfall and discharge of water in the river basins leading to the overflow of the water submerging the landmass depending upon its terrain profile, river bed characteristics, raindrop size distribution and rainfall characteristics. In this paper, the concept of the bi-static and multi-static space-borne SAR sensors has been described for development of real time space-borne surveillance system for Indian Sub-continent as Disaster Management System (DMS), which can be used for flood detection and flood disaster management. The concept of geostationary radar illuminator and constellation of multi-SAR-satellites in LEO has been described.

Keywords: Synthetic Aperture Radar, Flood Disaster Management System, Bi-static and multi-static SAR sensors

Abstract Id: 19
APPLICATION OF LANDSAT-8 AND ASTER DATA IN LITHOLOGICAL MAPPING OF PRECAMBRIAN BASEMENT ROCKS AT WADI MAARAFAWI AREA, SOUTH EASTERN DESERT OF EGYPT.

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The exposed Precambrian basement rocks at Wadi Maarafawi area in the extreme eastern desert of Egypt comprise Abu Dahr ophiolitic serpentinites-talc carbonates rocks which were thrust over Wadi Rahaba biotite and hornblende gneisses and island-arc metavolcanics. The whole sequence was intruded by syn to late tectonic intrusions including granodiorite-tonalite, gabbro and and monzogranite forming Gabal Maarafawi-El Farayid intrusions.

The integrated remote sensing data of landsat-8 and ASTER including band rationing, principal components analysis (PC) and various ASTER indices have been used to discriminate and identify the exposed lithological units. The present study concluded that, the integrated processed remotely sensed data of Landsat-8 band ratio images (b6/b2, b6/b7, b6/b5xb4/b5) and PC (PC4, PC5, PC2) in addition to ASTER PC (PC2, PC6, PC5) are effective in discrimination most of the widely exposed basement rock units in the study area. On the other hand, the various ASTER indices including; calcite, carbonate, kaolinite, clay and sericite-muscovite indices images successfully identified the different exposed rock units based on their enrichment with in some essential and secondary minerals. Based on the field investigation, petrographic study and the interpreted remote sensing data, a detailed lithological map for the study area has been produced.

Keywords: Gabal Maarafawi; Eastern Desert; Egypt; ASTER; Landsat-8

Abstract Id: 21
LIDAR DEM-BASED ASSESSMENT OF THE EXPOSURE AND VULNERABILITY TO SEA LEVEL RISE OF COASTAL COMMUNITIES IN NORTHEASTERN MINDANAO, PHILIPPINES

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Sea Level Rise (SLR) is one of the major threats of global climate change that is currently being experienced in the Philippines. A 2016 study published in the Proceedings of the National Academy of Sciences indicated that a well above average annual SLR of 14.7 ± 4.39 mm/year is found regionally near Mindanao, Philippines. At this rate, it can be estimated that by the year 2100 (or 84 years since 2016) the accumulated SLR will reach approximately 1.23 m. It is very crucial to identify those coastal zones in Mindanao that can get inundated in the years to come, including the exposure and vulnerability of the coastal communities. In this work, we utilized available 1-meter spatial resolution LiDAR-derived Digital Elevation Models (DEMs) of the coastal cities and municipalities of the provinces of Agusan del Norte, Dinagat Islands, Surigao del Norte, and Surigao del Sur, all located in northeastern Mindanao, Philippines for elevation-based SLR assessments. The LIDAR DEMs vertical accuracy (in terms of Root Mean Square Error) of 0.20 m which was determined from ground validation surveys allows detailed mapping of SLR coastal inundations at increments of ≥ 0.5 m at 95% confidence level. The DEMs were used as inputs to a single-value surface model or bathtub model to map inundation from SLR increments of 0.5, 1 and 1.5 m, taking into consideration hydrologic connectivity. A GIS-based spatial analysis was further conducted to determine the number and type of structures that are highly vulnerability to different levels of SLR. This was made possible through the use of building footprints and heights information that were extracted from the LiDAR data. Overall, the study showed the importance of LIDAR DEMs in providing a much more detailed delineation of the potential inundation zone due to SLR when compared to other types of elevation models.

Keywords: Sea Level Rise, Coastal Inundation, Climate Change, LiDAR DEMs

Abstract Id: 22
Mapping built-up land is important for city growth monitoring and building models for city growth forecasting. Aerial and satellite ortho-imagery is popularly used for this purpose. Knowledge-based, semi-automated approach for this task is challenging and requires significant human intervention and application of subjective expertise for iterative refinement of rule sets used for semantic segmentation. This is due to high heterogeneity in shape, density and composition of built-up land aggregates. This paper investigates a fully automated deep learning approach based on convolutional neural network for this task. This eliminates the need of human expertise for defining complex rule sets for semantic segmentation. Specifically, this paper discusses design, training and performance evaluation of a deep convolutional neural network based on SegNet architecture and presents analysis of design choices for the network. SegNet is a deep encoder-decoder architecture for semantic scene segmentation. The network is trained on multi-spectral LISS-4 satellite orthoimagery covering the central core and peripheral developing areas of a city. This paper also discusses algorithmic preprocessing and data augmentation techniques that resulted in improvement in accuracy and generalization.

Keywords: convolutional neural network, segmentation, remote sensing, built-up land

Abstract Id: 23
A Bayesian machine learning algorithm was developed to map burned areas in the boreal region of North-Eastern Siberia (70°N 120°E - 60°N 170°E). The algorithm was applied to the Long Term Data Record (LTDR) data set, with a spatial resolution of 0.05° using surface reflectance for channel 1 (0.5-0.7 μm), surface reflectance for channel 2 (0.7-1.0 μm) and the brightness temperature from channel 3 (3.55-3.93 μm) from the Advanced Very High Resolution Radiometer (AVHRR) sensor for the periods 1982-1999 and 2009-2015. For the period 2000-2008, the algorithm used the corrected surface reflectance BRDF (Bidirectional Reflectance Distribution Function) band 1 (0.62-0.67 μm), BRDF band 2 (0.84-0.88 μm) and the brightness temperature at the top of the atmosphere (TOA) of the band 31 (10.78-11.28 μm) from the Moderate Resolution Imaging Spectroradiometer (MODIS) sensor. The annual burned areas series produced by the algorithm was compared with the respective time series of the MODIS MCD45A1 and MCD64A1 burned area products. The results show a similar temporal pattern in the common years for the study region, with a high correlation in the estimation of annual burned area for all products. The spatial accuracy of the burned areas was assessed using Landsat scenes throughout the study region for the years 2002, 2010 and 2011. All burned area products analysed underestimated the total burned area in the region of study for those years. Although MCD64A1 showed the best overall results, the proposed algorithm improved the results of MCD45A1 and proved to be a reliable and coherent alternative for mapping burned areas from 1982 to the present through remote sensing in Siberia.

Keywords: Siberia, Burned Area, LTDR, MCD64A1, MCD45A1

Abstract Id: 25
GIS AND REMOTE SENSING APPLICATION IN DYNAMIC ROAD SEGMENTATION OF LAGELU LOCAL GOVERNMENT AREA, OYO STATE.

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GIS and Remote Sensing can play a vital role in dynamic road segmentation and its data model finds maximum application in Transportation studies and analysis; serving as a data model that separate linear features into new set of segments wherever its attributes change. This Paper investigates the Dynamic road segmentation of part of Lagelu Local Government Area of Oyo State using Topographic map of Ibadan and other field survey acquired data. Geometric and attribute data were used. The geometric data were obtained with the use of Handheld GPS receivers while the attribute data was acquired through the social survey approach (administration of questionnaires, direct observations and on-site interviews). The designed and created of Geo-database was done using Arc GIS 10.2. Analysis and queries were also performed to solve some relevant issues relating to the route segments and also to highlight the nearest infrastructural facility in case of emergencies. The result draw attention to the present road pavement condition of the considered road segments, adjacent land use, the rate of traffic congestion, notable crime spots and accident hotspots. This study also suggested that the building up of traffic congestion along Akobo axis is due to the road width (7m), high traffic volume and the dilapidating state of the road’s pavement.

Keywords: GIS in Transportation, Road Network, Dynamic Segmentation, Linear Referencing Database, Adjoining Land Use, Road Traffic Acciden

Abstract Id: 26
QUANTITATIVE ANALYSIS OF IMPERATIVE PARAMETERS ASSOCIATED WITH PHYTOPLANKTON BLOOMS IN CHILIKA LAGOON, USING LANDSAT-8 SATELLITE DATA

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This study focuses on analysing two vital parameters associated with surface algal blooms, i.e. Chlorophyll-‘a’ and Total Phosphorus. Various Quantitative Retrieval Models have been used to estimate and quantify these parameters with the use of primary and derived variables from satellite data obtained by the Operational Land Imager sensor of Landsat-8. Chlorophyll-‘a’ is known to be the indicator of algal/phytoplankton biomass; hence, surface algal biomass quantification is synonymous to evaluation of Chlorophyll-‘a’ concentration. Existing algae or phytoplankton in water bodies grows out of proportion to develop into blooms potential to cause threat for aquatic life as well as human health. This phenomenon is triggered by the increase in essential nutrients in the water body creating a favourable environment for phytoplankton to proliferate. Phosphorus is one of such nutrients found in agricultural and household wastes, industrial effluents and fertilizers which end up in water bodies through runoff and inflowing streams. Chlorophyll-‘a’ and Total Phosphorus were quantified for 20 sampling sites in Asia's largest brackish water lagoon, Chilika, India. The lagoon is internationally acclaimed as a wetland housing a prosperous biodiversity. Two recent multispectral satellite images obtained in January and February 2017 showed an increase of 4.56% in Total Phosphorus and relatively 13.52% increase in Chlorophyll-‘a’. A correlation between the two parameters was established using Linear Regression Analysis. The Determination of Coefficient ($R^2$) was found to be 0.6306 and 0.6774 for January and February 2017 respectively, which represents high positive correlation. The present condition of Chilika Lagoon is thus illustrated by the spatial distribution maps of Chlorophyll-‘a’ ($\mu g/l$) as well as Total Phosphorus (mg/l)

Keywords: Chlorophyll-a, Total Phosphorus, Phytoplankton Bloom, Landsat-8, Regression Analysis

Abstract Id: 30
USE OF DIGITAL TOPOGRAPHIC DATA IN PREDICTING POTENTIAL SOIL INFILTRATION PATTERNS

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Infiltration of water into the soil is a function of soil properties as well as land-use land-cover conditions. Mapping soil infiltration variability is crucial for better inputs to physics-based rainfall-runoff simulations. However, a substantial time and effort is spent in mapping the spatial variability especially for large catchments. Spatial patterns representing the potential soil infiltration variability can be used to guide the interpolation of field based point infiltration data. These patterns can be obtained from digital elevation models and field mapped stream hydrographic data. Channel head locations are controlled by the upstream catchment area, the topographic slope, and the permeability of surface cover. Drainage extracted from digital elevation models is usually based on channel initiation thresholds that combine upstream catchment area and slope in different proportions, without, of course, considering the permeability of surface cover. The differences in drainage patterns mapped in the field and extracted from the elevation models must, therefore, yield signatures of potential surface permeability variations. With this underlying premise, field based and DEM based drainage networks were compared using GIS tools to yield potential spatial variability of surface permeability. This was compared with the interpolated pattern of field based soil infiltration patterns in a hard rock catchment in southern India. Good correlation was found between the two patterns, confirming the usefulness of the spatial patterns obtained from digital topographic data in guiding the interpolation of field based soil infiltration data.

Keywords: DEM, GIS, infiltration, drainage pattern

Abstract Id: 31
EVALUATION OF FACTORS AFFECTING EROSION USING REMOTE SENSING APPROACH, GIS AND ANN TECHNIQUES: A CASE STUDY OF SERANG WATERSHED, KULONPROGO, INDONESIA

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This study aimed to determine the factors that affect erosion in Serang watershed through erosion modeling with the integrated use of satellite remote sensing, geographical information system and artificial neural network. Erosion modeling is an important measurement tool for the evaluation of dominant factors that affect erosion by looking at the pattern of spatial distribution of erosion rates in the study sites.

The research conducted a test to some input combinations of erosion control factors as input data in simulation of artificial neural network to determine which the factors had the greatest influence. Factors controlling erosion that could represent the real condition in the field used in this research were topography by using the equation of the length slope steepness (LS); erosivity (R) by using rainfall intensity; erodibility (K) obtained from soil data from field data; vegetation (C) obtained from NDVI transformation; and management of land cultivation (P) extracted from contour data. Field observation of the qualitative indicators of erosion was undertaken instead of quantitative calculations of the actual erosion for validation of the model generated by the simulation of artificial neural networks, while model evaluation by expert judgments. The satellite remote sensing technology and the artificial neural network approach gave valuable support to this study.

The results of various combinations generated the highest of accuracy by 90.57 % with extremely erosion dominating the area of study. The factors with the highest contribution to erosion in Serang Watershed were slope length and steepness (LS) and erodibility (K).

Keywords: soil erosion, remote sensing, qualitative models, artificial neural network

Abstract Id: 33
ASSESSMENT OF WATER ENVIRONMENT HEALTH USING FUZZY EVALUATION THEORY AND AHP METHOD IN XIXI WETLAND, HANGZHOU, CHINA

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Water environment health is the foundation of the wetland ecosystem health, effecting the sustainable development and social function services of wetlands. In this paper, a framework of combination fuzzy evaluation theory and AHP method was developed to realize water environment health assessment of the Xixi National Wetland Park in Hangzhou, China. The indicators including water environment quality indicators, water ecological character indicators and water habitat indicators were organized to assess the wetland water environment in various seasons and locations from 2008 to 2014. Results indicated the whole wetland water environment was in the state of sub-health in 2008 and 2009, improving from 2010, turning into the state of health. The Xixi wetland water environment in summer was better than winter. The current study may provide useful information for valid wetland environment restoration and management.

Keywords: water environment health assessment, fuzzy evaluation theory, AHP method, the Xixi Wetland

Abstract Id: 34
CREATING A SPECTRAL LIBRARY OF COASTAL RESOURCES IN THE PHILIPPINES

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Mapping of coastal resources using the recent advances in remote sensing provides information to support the wide-scale monitoring, protection and conservation of these vulnerable resources. Development of a spectral library of coastal resources is a key component which will serve as a reference data for its remote sensing applications including spectral characterization of the features. This paper describes the sampling and field protocols in collecting spectral signatures of coastal resources (corals, seagrass, seaweeds, mangroves) in the Philippines. Field data collection using the standardized techniques was carried out by fifteen universities in various sites of the country. The instrument used for spectral measurement consisted of a 10-meter optical fiber probe cable attached to a portable visible-near infrared spectrometer unit which covers the 350 - 1000 nanometer wavelength range. The reflectances were measured at an average depths of up to 5 meters in most of the study sites. Seventy-five in-situ spectral measurements for each sample were averaged and filtered using the Savitzky-Golay algorithm. This method fits a least square polynomial curve in smoothing the data and is a function of filter size - for the calculation of the curve equation, and the degree of polynomial to be used. A complete and comprehensive metadata indicating the characteristics of the features, the equipment used, the sampling location, the acquisition settings, the parameter measured and the sky conditions at the time of measurement, was formulated to properly identify each sample during data processing, to assess the measured spectral data quality and to maximize the long-term value of the field spectral measurements. In summary, spectral signatures of various coastal resources in the Philippines were acquired. The developed spectral library could be used as aid in creating a detailed and accurate maps for the monitoring of the resources status.

Keywords: spectroscopy, spectral library, Savitzky-Golay, remote sensing

Abstract Id: 37
This study is proposed for the lithological and iron oxides detection of rock units and in iron old mining areas in Western Desert at El Baharyia Oasis using ASTER and Landsat 8 remote sensing data. The Landsat 8 data is used in mapping lithological units, while ASTER data was used for mineral detection. The study area contains four iron mines area at the Western Desert in Egypt. There are two types of iron deposits in the study area (Hematite and Limonite deposits) represented in El Gedida, El Harah, Ghurabi and Nasir mine areas. The main objective of this study is to find new high potential areas for iron mineralization around El Baharyia depression. Image processing methods such as principle component analysis (PCA), band ratios (b4/b5, b5/b6 and b6/b74/2, 6/7 and band 6) and minimum noise fraction (MNF) have been applied for the purpose of lithological and iron zones mapping. ASTER and Landsat 8 visible and short wave infrared data found to be helpful for mapping the ferruginous sandstones, iron oxides as well as the clay minerals, while the thermal bands were used for silicate mapping. Landsat-8 band ratio and principle component of this study showed well distribution of the lithological units, especially ferruginous sandstones and iron zones (hematite and limonite) along with detection of probable high potential areas for iron mineralization which can be used in the future and proved the ability of Landsat 8 and ASTER data in mapping these feature.

Keywords: Geology Remote Sensing

Abstract Id: 38
APPLICATION OF REMOTE SENSING DATA ANALYSIS IN LITHOLOGICAL MAPPING OF PRECAMBRIAN ROCKS AT GABAL KORAB KANSI AREA, SOUTH EASTERN DESERT OF EGYPT

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Gabal Korab Kansi area in the extreme South Eastern Desert of Egypt comprises Precambrian metamorphosed dismembered ophiolitic assemblages thrust over the metasediments and calc-alkaline island-arc metavolcanic assemblages. The whole sequence is intruded by syn to late tectonic mafic-ultramafic and granitoids intrusions including gabbro-diorite, granodiorite-tonalite and late tectonic layered gabbro and monzogranite.

The integrated remote sensing data of landsat-8 and ASTER images including principal component analysis, band rationing and various ASTER indices have been used to discriminate and identify the exposed lithological units.

The present study concluded that, the processed remotely sensed data of ASTER (PC2, PC6, PC5) and Landsat-8 (PC4, PC5, PC2) are effective in discriminated most of the widely-exposed basement rock units in the study area. The Landsat-8 band ratio image (b6/b2, b6/b7, b6/b5 x b4/b5) differentiated these lithological units with enhanced lithological boundaries. The various ASTER indices including; calcite, carbonate, kaolinite, clay and sericite-muscovite indices images successfully identified the different exposed rock units based on their enrichment with in some essential and secondary minerals. Based on the field investigation, petrographic study and the interpreted remote sensing data, a detailed lithological map for the study area with enhanced lithological boundaries has been produced.

Keywords: Eastern Desert; Egypt; ASTER; Landsat-8; Principal component

Abstract Id: 39
Smart cities are cities that provide core infrastructure and give a decent quality of life to its citizens. Core infrastructure includes adequate water supply, assured electricity supply, sanitation including solid waste management, health and education etc. Since cities always lack open space, roof area of buildings can be used to provide infrastructure. For example, solar Photovoltaic (PV) Systems can be installed on rooftops of residential, commercial or industrial premises and the electricity generated from such systems could either be entirely fed into the grid or used for self consumption. Given the importance of roof area, this research emphasized on automated extraction of urban roof area in both tropical and nordic urban environment to compare and contrast the set of rules needed for their automated delineation. Bhopal city, India and Trondheim City, Norway are selected as study areas because they represent tropical and nordic urban environment respectively. An existing set of rules for automated extraction of urban roof area of Bhopal city was developed in 2016 using object-oriented classification tools, available through eCognition Developer (V. 8.7.2). A smaller residential neighbourhood in Bhopal city has been selected as Test Site and World View 2 stereo pair & multispectral images were used as input data. After successful extraction of urban roofs of Bhopal city, the method was applied to extract residential roofs of Trondheim city from high resolution orthophotoes. Several adjustments were needed due to the morphologic differences between roofs of two different cities. Visual comparison with manually delineated roof area confirms the success of this revised automated method in two different environments. The quantification of roof area further helped to estimate solar energy potential through rooftop PV of these two cities.

Keywords: Smart; City; Roof top PV, object-oriented classification

Abstract Id: 40
Soil erosion removes and redistributes the soil carbon sediment and accelerates the process of mineralization and alters the soil organic carbon sequestration (SOC) flux. Various modeling approaches are used to measure the erosion induced changes in soil organic carbon pools by estimating the gains in carbon storage under different management scenarios. Among these models, biophysical model coupled with GIS environment have received wider acceptance in recent decades. The current study depicts the impact of climate change on soil erosion and SOC in the Doon valley of Uttarakhand state, India with the help of GIS based Environmental Policy Integrated Climate model (GEPIC). The study area covers complex landscapes of the Himalayan region and the GIS based EPIC model is capable of taking into account the variability in topography soil and climatic conditions by incorporating high resolution data sets. Simulations were performed to understand the impact of climate change on SOC sequestration and soil erosion process. For erosion assessment, the model predicted rainfall erosivity index factor adjusted to the observed monthly values of the study area ($r^2 = 0.95$). The current SOC stock for top 30 cm for three dominant soil series namely Barwa, Doiwala and Jassuwala representing the agricultural landscape were simulated. Jussuvala series in the study area showed an improvement of 6.3 t ha$^{-1}$ SOC over 12 year period (2000 to 2012). The GEPIC model after calibration was used to assess climate change impact on soil erosion and SOC sequestration under different climatic scenarios. The climate change impact on SOC and erosion process under A2a50 scenarios were assessed and the results shows that the soil erosion rate will be double than that of the baseline period and this is mainly due to increased rainfall of about 20 per cent during the time period. The study showed a decrease in soil carbon in the soil series for A2a50 scenario. The results obtained were promising which shows the spatial variability with in a particular region.

Keywords: Soil erosion, soil carbon sequestration, GEPIC model

Abstract Id: 44
SEASONAL VARIATION OF TOUZI SCATTERING ASYMMETRY FOR MONITORING SNOW COVER OVER THE INDIAN HIMALAYAS

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Recent studies have highlighted the depleting trend of snowfields and receding glaciers in parts of the Hindu-Kush Himalayan (HKH) region. It is believed that the onset of this recession commenced during the mid-19th century (Bolch et al., 2012). A number of glaciers situated outside the Karakoram region have demonstrated ablation patterns. Since the HKH region is the source to some of the major Asian river systems, such exhausting trends of glacier volume has risen concerns for the water resources. Therefore, in order to resolve such uncertainties a reliable snow cover monitoring technique capable of monitoring snow cover is much desired.

In the recent past the Touzi scattering asymmetry parameter has been utilized for segregating tree species over a wetland based on the diversity of their leaf structures (Touzi et al., 2009). The scattering asymmetry defines the corresponding randomness in scattering mechanism denoted by each Eigen component.

We propose a seasonal approach to monitor snow cover over the Indian Himalayas by exploiting the variation in the scattering asymmetry that occurs by virtue of the metamorphosing matrix of the snow crystals (Muhuri et al., 2017). Among several factors that drive snow metamorphosis, temperature significantly contributes towards the process in the tropical region along with the overlying weight. The investigation reports the sensitivity of the radar signatures to the local temperature profile prevailing over the test site. Due to antipodal nature of the dominance scattering mechanisms in the classes present over the area the proposed algorithm is also effective in segregating snow-free vegetation canopy from the snow laden barren areas. The results are in conjunction with the NDSI based optical snow-cover maps and real-time observatory measurements.

Keywords: Hindu-Kuch Himalaya, Touzi, SAR Polarimetry, Temporal Analysis

Abstract Id: 46
FOUR-DIMENSIONAL MARS CRATER RECONSTRUCTIONS USING 4-D SPLINE ALGORITHM

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A crater is most visual feature which exists in Mars surface. Crater can be created by two cosmic bodies crashed each other, for instance, a meteorite striking a planet. The main contribution of this work is to simulate 4-D of Mars carters. In doing so, 3-D data of HRSC was acquired and then 4-D spline algorithm implemented to sequences of HRSC data with different frame of times. The study shows that B-spline can determine the 4-D flow pattern which could indicate for the existence of water. The series of elastic transforms for B-spline are used with involving automatic detection algorithm of landmarks. The study shows that 4-D axis is seen clearly as floating objects on the middle of crater. The study also shows that the deep of crater is covered by ice which is an excellent proof of liquid water existence on the Mars. In conclusion, modification of 4-D B-spline by involving elastic transform and landmarks algorithms could be an excellent promise for 4-D visualization.

Keywords: Mars, Crater, High resolution Camera, Four-dimensional

Abstract Id: 47
PHYTOSOCIOLGY AND LANDSAT TM DATA: A CASE STUDY FROM RIVER BEAS BED, PUNJAB, INDIA

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The present work was designed to study the phytosociology and its correlation with Landsat TM data from the catchment areas of river Beas, Punjab, India, for a stretch of 63 km between the towns of Beas and Harike for four seasons, i.e., summer, pre-monsoon, post-monsoon and winter seasons respectively. Various phytosociological parameters (density, abundance, frequency, relative density, evenness and relative abundance) and diversity indices (Simpson's, Shannon's, Margalef's, Brillouin's, Chao-I and Menhinick indices) were studied. During the pre-monsoon and winter seasons Beas recorded maximum abundance and density. Maximum abundance was found for Harike during the post-monsoon season. Maximum Menhinick, Maragalef's, Chao-I, Simpson's and Shannon's indices were found for the Harike during the winter season. Significant positive correlation of band ratios (G/R) was found with Simpson's, Shannon's and Brillouin's indices, whereas negative correlation of band ratios (R/NIR) existed with Simpson's, Shannon's and Brillouin's indices. Various multivariate statistical techniques (Principal component analysis (PCA), factor analysis (FA) and artificial neural networks analysis (ANN)) were applied for the analysis of results. ANN models were fitted to the data. Correlation between target and output values was found to be highly significant.

Keywords: River Beas, Vegetation, Remote sensing, Diversity indices and multivariate techniques

Abstract Id: 48
Flourishing vegetation blocks river flow and causes riverbank erosion in Japanese rivers. It is expected that vegetation monitoring by satellite remote sensing contributes to more frequent monitoring and effective river management.

In this study, we proposed a method to estimate vegetation height in Japanese rivers using two synthetic aperture radar (SAR) satellite images with different wavelengths. While L band microwave penetrates vegetation, X band microwave is scattered by vegetation. The difference of reflection scattering properties between L and X band microwaves affected backscattering of map projected SAR images. We proposed estimating height of vegetation in rivers using the difference of the properties.

As a case study, at the Saba river in Yamaguchi prefecture, Japan, we estimated height of a bamboo grove in the river using L and X band SAR images and compared with measured height by drone aerial shooting. While we observed shadow areas behind a bamboo grove on the line-of-sight of the satellite in the X band SAR image, any distinctive shadow area was not observed in the L band SAR image.

We proposed an equation to estimate a bamboo grove height from the width of the shadow area observed in only X band SAR image. We showed the distribution of relative errors between measured value and estimated value calculated by the proposed equation and discussed the accuracy of our proposed method.

Keywords: synthetic aperture radar (SAR), extraction of difference between L and X band SAR image, vegetation monitoring in river

Abstract Id: 50
A THEMATIC MAP FOR UPM, ENGINEERING CAMPUS PRODUCED BY OBJECT-BASED CLASSIFICATION METHOD

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Thematic maps generated by image classification process are useful for numerous geospatial applications such as urban planning, natural disasters, site selection, and change detection. This study proposed a classification workflow based on object-based analysis for producing thematic maps from Worldview-2 satellite data. The image was segmented by multiresolution segmentation algorithm in eCognition software and image objects were classified by support vector machine. Results indicate that the propose method is suitable for thematic map creation. The overall accuracy achieved in this study was 89.9% and the kappa was 0.86. Findings indicate the usefulness of the object-based image analysis for very high-resolution image processing and producing thematic maps at small and medium scales. Future works should focus on optimization of parameters required by algorithms and improving the segmentation results.

Keywords: Thematic maps, object-based image analysis, support vector machine, worldview-2

Abstract Id: 51
This paper presented results of creation of thematic map for Kelantan city using an integration of object-based analysis and random forest algorithm. The thematic map was generated based on SPOT image with a spatial resolution of 5 m. Object-based analysis was used for its advantages over per-pixel based methods. On the other hand, random forest algorithm was selected because it was suggested in very recent literature and it has advantages of good generalization. A thematic map with six classes was generated with an overall accuracy and kappa index of 92% and 0.90, respectively using the proposed method. Other details are included in the paper.

Keywords: Random forest, object-based image analysis, thematic map, classification

Abstract Id: 52
Urbanization Growth, one of the core issue in the developing countries, has negative impacts on the cities. The rapid urbanization has become a common phenomenon for developing countries across the globe. This, according to popular notions especially among economists, is a good sign because rapid urbanization indicates economic development. According to the UN-Habitat, half of humanity now lives cities, and that the urban population will increase to 60% within next two decades. For developing countries, experiencing rapid urbanization, the inability of the existing social infrastructure to meet the growing needs emanating from urbanization, pose a major challenge for governments, with Pakistan as no exception. Lahore as the capital of Punjab Province and as the 2nd largest city of Pakistan is the largest growth pole and undergone rapid urbanization and infrastructure and social transformation. In this study detect the changes of urban sprawl and urban growth in Lahore district. Urban growth starts from a small point and after that it spreads in different directions. The growth pattern varies from one urban place to another and it is necessary to study such phenomenon for appropriate urban planning. Urban growth can be mapped, measured and modelled by using remote sensing data and GIS techniques along with several statistical measures. The outcomes of this study gives a difference between the proposed land use in the master plan and existing land use. To overcome this rapid urbanization, need a detailed strategic development planning and effective master planning. For this purpose, master plan prepare and then implemented to achieve better results like economic development, utilities services and make a better cities for living.

Keywords: urbanization, land use, urban planning, remote sensing, master plan

Abstract Id: 53
Recent developments on Web 2.0 technique and scanning equipment have yielded an increasing number of 3D building models in Web-based data-sharing platforms. For example, the Google 3D Warehouse is a web-based data-sharing platform which allows users upload and share their models. Based on the concept of data reuse, an automatic 3D building model retrieval system is created to query the similar models by using point clouds which acquired by airborne light detection and ranging (LiDAR) systems. To encode LiDAR point clouds with sparse, noisy, and incomplete sampling, a novel encoding scheme is introduced based on a set of low-frequency spherical harmonic basis functions. These functions provide compact representation and ease the encoding difficulty coming from inherent noises of point clouds. Additionally, a data filling and resampling technique is proposed to solve the aliasing problem caused by the sparse and incomplete sampling of point clouds. The key idea behind the proposed method is to represent noisy point clouds using a complete set of spherical harmonics (SHs). Point clouds represented by a few low-frequency SHs are insensitive to noises. In addition, SH encoding reduces data description dimensions and yields a compact shape descriptor, resulting in both storage size and search time reduction. Moreover, the inherent rotation-invariant property and multi-resolution nature of SH encoding enable the efficient matching and indexing of the model database. Besides, a data filling and resampling approach is proposed to solve encoding problems coming from the incomplete shapes of point clouds and the aliasing problems of SH coefficients attributed to the sparse sampling of point clouds.

Keywords: Open Data, Open Source

Abstract Id: 54
Microwave remote sensing SAR data from airborne and space borne platforms are being increasingly used for mapping and monitoring earth surface features, inventorying natural resources and management and monitoring natural disasters. Flooding is one of the most catastrophic forms of natural disasters and may occur due to heavy rainfall, inadequate capacity of rivers to carry the high flood discharge and urbanization. SAR amplitude data of linear polarization, either HH or HV/VH or VV has a high potential for rapid based flood mapping and monitoring. The historic multi-temporal satellite imagery can be used for identifying the flood hazard zones in the basin. SAR images can also be used for calibration and validation of the simulated flood inundation derived from hydrologic and hydraulic models. However, for assessing flood damages especially crop damage, information on crop submergence and duration is a very important input and linear polarization does not provide this information completely. An attempt is made to investigate the potential of phase information using fully polarimetric SAR (PolSAR) data for identifying the partially submerged vegetation. Polarimetric analysis is carried out including polarimetric decomposition, segmentation and wishart classification. The H/A/α decomposition technique is used to identify the relevance of each scattering mechanism within a given resolution cell. Further, a first-order classification is achieved by sub-zoning the H/α segmentation space in order to distinguish scattering mechanisms on a pixel-by-pixel basis. It is observed that vegetation scattering is dominant in zone four and five and some vegetation scattering is identified in the flood class which may be partially flooded vegetation. This paper discusses the potential use of SAR amplitude and phase information for rapid flood mapping, flood hazard zonation and flood damage assessment.

Keywords: SAR amplitude, SAR phase, flood mapping, flood hazard, flood damage

Abstract Id: 55
Global velocity data from drifters of the Surface Velocity Program and the sea surface height and geostrophic velocity data from satellite altimetry observations under tropical cyclones (TCs) were analyzed to demonstrate strong ocean currents and their characteristics under various storm intensities in the Northern Hemisphere (NH) and in the Southern Hemisphere (SH). Mean TC's translation speed (Uh) is faster in the NH (~4.7 m s\(^{-1}\)) than in the SH (~4.0 m s\(^{-1}\)), owing to the fact that TCs are more intense in the NH than in the SH and the steering flow is more favorable in the NH. The rightward (leftward) bias of ocean mixed-layer (OML) velocity occurs in the NH (SH). As a result of this slower Uh and thus a smaller Froude number in the SH, the flow patterns in the SH under the same intensity levels of TCs are more symmetric relative to the TC center and the OML velocities are stronger than those in the NH. Several special cases were reported in this study showing the occurrence of prominent cyclonic eddies with a life span of several months which were induced by slow-moving (Uh ~ 1 m s\(^{-1}\)) and intense (category 3, 4, and 5 of the Saffir-Simpson Scale) TCs, both in the NH and SH. This study provides the first characterization of the near-surface OML velocity response to all recorded TCs in the SH from direct velocity measurements. Our findings provide observational evidence of generation of extremely strong cyclonic oceanic eddy or enhancement of weak existing cyclonic oceanic eddy under slow-moving category-5 TCs, which will support further improvements of their representation in ocean dynamics and numerical air-ocean prediction.

Keywords: tropical cyclone, eddy, mixed-layer current, surface drifter, satellite altimetry
Urban areas are characterized by heterogeneous land uses. The city development pattern, socio-economic and anthropogenic activities results in the formation of urban heat island (UHI) which are characterized by high land surface temperatures (LST). Cities are experiencing a rapid increase in LST. Urban green spaces such as parks, play grounds, lawns and blue spaces such as ponds, lakes, rivers that are present in and around the city can help in regulating the land surface temperature. These spaces also lead to formation of urban cooling island (UCI) around them due to shading from the trees, evapotranspiration from the waterbodies, wherein the temperature is comparatively cooler than surrounding temperatures. This formation of a cooling island is known as the Park Cooling Island (PCI) effect. The present research aims at identifying the effect of urban green and blue spaces on LST through a multitude of data sources and geospatial technologies. Pune city is chosen as a study area for the research. The data used in the research includes secondary data from various government and semi government organizations, Landsat 8 temporal satellite images and field data. LST was calculated from Landsat 8 thermal bands by using emissivity reference channel algorithm. Various indices such as normalized difference vegetation index (NDVI), normalized difference built-up index (NDBI), normalized difference water index (NDWI), land shape index (LSI), size and perimeter-area ratio (PAR) were calculated from Landsat 8 images. A bivariate regression analysis was performed by taking LST response variable and other indices as exploratory variables. The results show that there is a high spatial variability in LST as well as urban green, blue spaces have a stronger influence on the LST.

Keywords: LST, Spatial variability, LANDSAT-8, UHI, Green and blue spaces

Abstract Id: 57
Since the shifting of civilization from the Indus to the Ganga river basin, the Indian Ganga river basin (IGRB) has been under land and vegetation cover transformation. Satellite derived vegetation indices holds proxy to the change in vegetation photosynthetic capacity. We mapped the vegetation cover and land use for the periods 1975 & 2010 from Landsat images, and modeled the human-induced land degradation using residual trend (RESTREND) analysis. We classified 29 forest classes and 18 other land use/cover classes; and estimated loss of 5571 km2 forest cover during past 3.5 decades. Area under active land degradation was evaluated using time-series analysis (during 1982-2010) of normalized index vegetation index (NDVIg3) data provided by the NASA and GSFC- GIMMS group. We performed RESTREND analysis on GIMMS-NDVI3g which identified areas with significant vegetation photosynthetic change. All the RESTREND models showed monotonic nature of the residual trends and resulted as moderately positive but highly significant (p< 0.001). We argue on the possibility of further expansion of land degradation in the Indian Ganga Basin in event of massive vegetation cover loss and other anthropogenic activities.

Keywords: Land degradation, Ganga river basin, time series, NDVI, RESTREND

Abstract Id: 58
FRAGMENTED LANDSCAPES OF EAST BOKARO COALFIELDS: A REMOTE SENSING BASED APPROACH HIGHLIGHTING FORESTLAND DYNAMICS

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The study focuses primarily on the East Bokaro coalfield region of Bokaro district in Jharkhand, India. Due to massive mining practices and subsequent spurt of human habitation, the area has faced enormous changes in the landscape. Remote Sensing based satellite imageries combined with spatial analysis was used to derive the land cover and fragmentation dynamics over the last 44 years. The results reveal the existence of six primary land cover types with agriculture and forest as the dominant categories. Forest and agricultural land decreased while mining, settlements and barren lands increased at the expense of forests and agriculture. Fragmentation analysis brings out significant trends in landscape changes that have occurred from 1972 to 2016. The most prominent fragmentation metrics were observed for forests and agriculture classes. Agricultural land has continuously been converted and fragmented into other classes. The forests also show strong fragmentation during 1972-2001 period but in 2016 the level of fragmentation is not very high. This study is a preliminary step towards evaluating the long term impact of mining and its related activities on the landscape fragmentation in East Bokaro.

Keywords: land cover, mining, fragmentation, landscape metrics, forests

Abstract Id: 59
TARGETING HYDROTHERMAL ALTERATIONS UTILIZING LANDSAT-8 AND ASTER DATA IN SHAHR-E-BABAK, IRAN

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Shahr-e-Babak tract of the Kerman metalogenic belt is one of the most potential segments of Urumieh-Dokhtar (Sahand-Bazman) magmatic arc. This rich area encompasses several porphyry copper deposits in exploration, development and exploitation hierarchy. The aim of this study is to map hydrothermal alterations related to early Cenozoic magmatic intrusions in Shahr-e-Babak area. To this purpose mineral mapping methods including band combinations, ratios and multiplications as well as PCA and MNF data space transforms in SWIR and VNIR for both ASTER and OLI sensors carried out. Alteration zones according to spectral signatures of each alteration assemblage are successfully mapped. For enhancing the target areas false color composites (FCC) and HSI-RGB color space transform are performed on developed band combinations. Previous studies have proven the robust application of ASTER in geology and mineral exploration; nonetheless, the results of this investigation prove applicability of OLI sensor from landsat-8 for alteration mapping. According to the results, evidently OLI sensor data can accurately map alteration zones. Additionally, the 12-bit quantization of OLI data is its privilege over 8-bit data of ASTER in VNIR and SWIR, thus OLI high quality results, which makes it easy to distinguish targets with enhanced color contrast between the altered and unaltered rocks.

Keywords: Landsat-8, Operational Land Imager (OLI), ASTER, hydrothermal alteration, Shahr-e-babak, porphyry copper exploration

Abstract Id: 67
Open source Digital Elevation Models (DEM) are very useful in providing an elevation reference for various applications. In the Geographical Information System (GIS), DEM provides a terrain model to facilitate drainage network analysis, watershed demarcation, soil erosion mapping, contour generation and for area and volume calculation. In this study Open Source DEMs namely Advanced Space borne Thermal Emission and Reflection Radiometer (ASTER), Shuttle Radar Topographic Mission (SRTM) and CartoDEM are analyzed with Ice, Cloud, and land Elevation Satellite (ICESat) footprints. The selection of DEM is very much dependent on geographical features of earth affecting its quality in the study area. The accuracy assessment was carried out for the Open source DEMs with the help of ICESat land altimetry data. ICESat carries a single instrument, the Geoscience Laser Altimeter System (GLAS), which measures the travel time of laser returns from the earth surface along profiles, with a spatial resolution of approximately 70 m and an along-track sampling of 172 m. It is used to measure ice sheet elevations, change in elevation through time, height profiles of clouds and aerosols, land elevation and vegetation cover and can approximate the sea ice thickness. Total 400 footprints of ICESat data are considered for analysis of elevation derived from Geoscience Laser Altimeter System (GLAS) data. The elevation derived using ASTER, SRTM and CartoDEM are compared with these footprints. These footprints are passing through two districts i.e. Kanpur and Unnao of Uttar Pradesh. All 400 footprints of ICESat/GLAS are divided into six classes for statistical analysis. The result shows that the accuracy is highest in CartoDEM followed by SRTM. The elevation profile of CartoDEM has a better linear correlation as compare to other DEMs. The Root Mean Square Error value of cartoDEM is varying for different classes from 2.40 m (fallow land) to 3.71 m (Built-up area).

Keywords: Spaceborne LiDAR, GLAS, CartoDEM, ASTER, SRTM

Abstract Id: 71
LAND USE LAND COVER (LULC) CLASSIFICATION USING FUSION OF MULTI-SENSOR OPTICAL and MICROWAVE DATA FROM SENTINEL MISSION

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Land Use land Cover (LULC) mapping from satellite imagery is of great important since it allows to analyze terrain features and is also useful for monitor temporal changes (change detection) like dynamics of water resource, forest cover or urban environment economically. Optical satellite sensors usually detect reflection from features of earth in the visible and infrared part of the electromagnetic spectrum. In contrast, Synthetic Aperture Radar (SAR) has ability to penetrate cloud and also independence of requirement of daylight. These advantages make SAR remote sensing technique different and attractive data source for land-use land-cover mapping. In this study the objective is the mapping of Land use land cover using both Synthetic Aperture Radar (SAR) & Optical remotely sensed datasets through fusion techniques. Sentinel-1A and sentinel-2A mission datasets are used here for parts of Uttar Pradesh. The classification of fused data has been done with help of HPF (High pass Filter) resolution merge and Ehlers fusion methods. In addition both the sentinel imageries from the sentinel mission has proved to be the best contemporary possible open source images which suit the study. The fusion of SAR data (sentinel 1A) and multispectral image (sentinel 2A) has improved the separability of classes and hence the accuracy is improved from 76.17% in sentinel 2A image to 82.42% and 82.81% in the HPF and Ehlers fused images respectively. Thus, the study depicted that the resultant fused image from multisensory data has better quality for classification.

Keywords: Multi-sensor fusion, LULC, Sentinel Mission, SAR, Ehlers Fusion

Abstract Id: 72
USING 3D LASER SCANNING DATA TO RETRIEVE WOOD PLATE AUTOMATICALLY TO ESTIMATE DBH

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Two-dimensional form data has some limitations and its stand characteristics cannot be measured for same results. In this study, we use the Ground-based LiDAR (Light Detection and Ranging) to detect the geometric features of woods and its results show that retrieving the wood volume from LiDAR has a significant relative with the volume form true value. However, considering about the problem of occlusions, it’s an easier method to calibrate for missing point cloud data into a circle plate directly because we cannot conquer the exist occlusions. Both measured value and the circle fitting and math estimate model combined with Matlab software to develop automatically computing systems for investigating the most proper method of estimating the DBH (Diameter at Breast Height) of tree plate by LiDAR point cloud. Through directing measure method, circle fitting method and neighboring point connected method retrieve DBH with F test to investigate the variances of tree modeling by these three algorithms. We assumed that these variances were equal, then we use one-way ANOVA (Analysis of Variance) and Tukey test as after test to investigate these three timber DBH estimate methods. The results show that the ratio of point cloud shows as 100% and 50%, the average absolute value of error of three methods is fewer than 3 cm. But when the ratio of point cloud reduced to 25%, the average absolute value of error of three methods is more than 3 cm. With calculations we found that the most important variance is point cloud amount - direct measurement can be affected by lack of point cloud amount and caused wrong interpretations and lower value. We demonstrate that circle fitting method is used circle to simulate the real DBH, it still can estimate DBH from only 50% and 25% point cloud.

Keywords: Circle fitting, Point clouds, Ground-based LiDAR, Individual tree measurement, Neighbor connected method

Abstract Id: 73
EVALUATION OF PIXEL- AND OBJECT-BASED CLASSIFICATION APPROACHES USING SENTINEL-2 DATA IN EL FAYOUM AREA, EGYPT

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Recently the trend toward the use of higher spatial, spectral, and temporal resolutions for more accurate classifications of the Earth’s surface is prevailed. For dealing with this trend a new paradigm has emerged, the object-based classifier as an alternative to pixel-based traditional classifier in the last decade. This study is based on Sentinel-2 image covering part of El Fayoum area, Egypt. We evaluated and compared the performance of pixel- and object-based classification approaches in delineating urban, land use and land cover areas using eCognition software. The spectral and spatial/contextual properties of pixels and a segmentation process were used to achieve the best classification. We selected the optimum image segmentation scale and applied the appropriate Support Vector Machine (SVM) algorithm. Since the object-based classification relied on abstraction of comparatively homogenous areas, its overall accuracy results demonstrated better classification. The overall classification accuracies of the pixel- and object-based were (93.09% and 95.06%) respectively. This result shows the capability, potential and superiority of the object-based approach compared to the pixel-based one.

Keywords: Pixel- and object-based classification, Image segmentation, Sentinel-2 Data, Support Vector Machine (SVM).

Abstract Id: 74
AUTOMATIC SATELLITE IMAGE PROCESSING SYSTEM FOR DROUGHT RISK MAPPING FOR THAILAND

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Drought is one of the most complex natural hazards. It has negatively affected agricultural productivity and human well-being. Water scarcity in agricultural sector led to slow economic growth in Thailand for decades. In 2016, Thai government declared 74 of the country’s 77 provinces as drought-affected areas. For this reason, the government is focused on improving drought monitoring and mitigation. In response to those need, the fully automatic satellite image processing chain was designed and developed. In this paper, demonstration methods of preparing, processing, interpreting, indexing, and displaying the productions of Suomi-NPP imagery were pointed out in order to meet the government requirement for mapping drought-related indicators. Conceptual themes of meteorological drought, agricultural drought, and hydrological drought were adopted to formulate optimum drought risk indices for the whole country. Automatic image processing routines to derive vegetation condition index (VCI), temperature condition index (TCI), vegetation health index (VHI), and standard precipitation index (SPI) have been done. A drought risk index (DRI) was then developed through the multiplication between drought hazard index (DHI) and drought vulnerability index (DVI). These were successfully performed by Unix shell scripts and Python codes by means of web-based application. The process consists of four steps processes, namely, (1) satellite data retrieval and corrections, (2) cross-sensor calibration and calculation of satellite-based drought indices, (3) formulating and quantifying DHI, DVI and DRI, and (4) producing web maps. Finally, the results such as drought risk maps since December 2016 were demonstrated and investigated for the improvement of the processing strategies and algorithm.

Keywords: Drought Risk Mapping

Abstract Id: 75
It continues to remain as a topic of interest whether the aerosol radiative forcing (ARF) aids evapo-transpiration from the plants or suppresses it for various ecosystems. As the ET depends on net radiation at the surface and aerosols have the potential to reduce the net radiation, it is expected that aerosol-induced change in ET could be a function of spatial heterogeneity of land surface. In this perspective we have made an attempt to quantify the effect of aerosols on ET. Aerosol-induced evaporative fraction \((\Delta L/E/ARF)\) defined as the ratio of change in evapotranspiration\((\Delta LE \text{ or } \Delta ET)\) to the ARF is estimated using satellite and reanalysis products at daily and monthly scales for the period October 2008 - May 2009. The stations under study in the Indo Gangetic Basin (IGB) represent, irrigated crop area (Amritsar), industrial area (Kanpur), seasonal agricultural area (Gopalgunj) and dense canopy (Dibrugarh, NE). Aerosol optical depth (AOD) and ET from satellite are validated against ground truth observations. ARF is computed using net shortwave radiation for ‘clean-clear sky’ and ‘clear sky’ conditions. \(\Delta L/E\) due to ARF is obtained by using the significant linear relationship (> 0.70) obtained between ET and net radiation on daily scale. ET is observed to correlate well (>0.80) with soil moisture on monthly scale but not on daily scale. In further part of study response of terrestrial ecosystems across the IGB has been compared with the bowen ratio. Normalized reductions in LE and H (\(dLE/ARF\) and \(dH/ARF\)) as a function of bowen ratio indicates that reduction in evapotranspiration (ET or LE) is much higher than that in sensible heat flux over wet surfaces. Similarly over dry surfaces with high bowen ratio, reduction in sensible heat flux is considerably higher as compared to that in evapotranspiration for a given aerosol radiative forcing over these stations of IGB.

Keywords: Evapotranspiration; Bowen Ratio; Aerosol Radiative Forcing; IGB

Abstract Id: 76
MOOREA AVATAR - PHYSICAL ECOSYSTEM MODELING OF A TROPICAL ISLAND

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The Moorea Island Digital Ecosystem Avatar (IDEA) project has been initiated in 2013 by a group of international researchers to build a virtual representation of Moorea Island. The main aim of the project is to model an entire ecosystem, observe the changes through it and be able to predict future changes reliably. The Moorea IDEA project incorporates observations, experiments, data, and theory across a coupled 3-D marine-terrestrial landscape to model, where physical, chemical, biological, and social processes interact to shape the island’s phenotype.

In order to generate the 3D physical model of the Island, multi-sensor data with varying accuracies, timestamps and spatial resolutions need to be processed and fused. High resolution optical satellite images (Pleiàdes), LIDAR data over land and water, existing DTMs, aerial film photography extracted and scanned from archives, underwater sonar measurements for modelling the bathymetry, underwater photogrammetry for monitoring the coral growth, UAV flights for accurate building reconstruction and recording of archaeological sites are among the data being processed in the project.

This presentation describes some of the aspects of the project in detail and addresses the processing methods and the problems encountered during the processing of multi-sensor and multi-resolution data. High resolution DSMs and orthoimages have already been generated by image matching using Pleiàdes images with 70 cm pan resolution acquired over Moorea and Tetiaroa in summer 2014. A DSM and a DTM of Moorea have been generated by manual measurements. Tetiaroa has been scanned by a green laser. This allows us to compare the different techniques with each other. High resolution bathymetry data from green Lidar flights of both Moorea and Tetiaroa is available and will also be integrated into the generated DSM.

We also measured in Moorea the footprints of the houses and a single height and the roads in 3D from the Pleiades images.

The final physical 3D model, amended by landuse data and other semantic information will provide a presentation and a geospatial analysis platform to the project participants from many other disciplines.

Building on the Moorea Island Digital Ecosystem Avatar (IDEA) platform (http://mooreaidea.ethz.ch), our overall goal is to develop data-driven models of the spatio-temporal dynamics of all processes of relevance on land and in the sea. Advanced computational simulations will be developed.

Keywords: Environmental modeling, multi-sensor data, DSM generation, satellite imagery, data integration

Abstract Id: 79
Flood inundation mapping was performed on time series images produced from Sentinel 1A synthetic aperture images over the Agusan River basin area, Philippines. The inundation mapping was done using segmentation technique that is contextually dependent on the land cover and fine-scale elevation. The results were compared with flood inundation levels generated from interpolated water levels sensors installed over the river basin flood plain area over a common elevation datum. The method could provide a rapid way of assessing and evaluating flood extents and distribution.

Keywords: Sentinel 1a, flood, Mindanao, change detection

Abstract Id: 80
Coimbatore city is one of the largest city in Tamil Nadu with over 1 million population. This city is also falls under Zone-III (Moderate vulnerability) categorized by Nation Disaster Management Authority (NDMA) of India. Any city which fall under Zone-III and has population over 1 million urgently needs Seismic Microzonation study. Hence, Coimbatore city was selected. Various Earthquake Tremor data form many National and international websites like ISC, NEIC, USGS has been collected for entire southern peninsular India. By interpreting Seismotectonic Atlas (GSI, 2000), various thematic maps like Structure, Geology, Lineaments and Fault has been created. The collected data was initially Homogenized, Geo-referenced & thematic maps showing tremor locations were prepared using ArcMap 10. Subsequently Declustering was carried out to remove Foreshock/Aftershock and only Mainshocks were taken into consideration for further analysis. Further tremor location map is overlaid on fault and lineament map and each faults were assigned maximum magnitude based on tremors. After assigning the maximum PGA was calculated for all the faults & lineaments using Deterministic Seismic Hazard Analysis (DSHA) by using formula proposed by Iyengar and Raghukanth (2004) for calculating Peak Ground Acceleration (PGA).

Keywords: Deterministic Seismic Hazard Analysis, Peak Ground Acceleration

Abstract Id: 81
We aimed to study the feasibility of Landsat-8 OLI sensor data competence at highly turbid costal (Case-II) waters in compare with operational ocean colour sensors (Oceansat-2 OCM & Aqua MODIS). Operational ocean colour algorithms failed in retrieval of chlorophyll-a in case-II water due to complexity in nature. At the same time the atmospheric correction preformed with NIR bands in the case of OCM and MODIS, but in OLI we considered MIR bands. The analysis carried at selected locations of Ganga river estuary, Gulf of katch, Nagapatinam coast and Gulf of Mannar in the North Indian Ocean where the coastal waters are considered to be very complex. The analysis of Rrs's relating to wavelengths, a proportional relation exists. Comparisons between Rrs_443 and Rrs_665 manifest the case-II water classification in Rrs_665.

Approaching to the chlorophyll-a retrieval from OLI, OCM-2 and Aqua-MODIS, OLI capable to reproduce the chlorophyll-a at case-II water, where as OCM-2 and MODIS unable to reproduce due to the limitation in the sensor bands. To perform the atmospheric correction at case-II water we need middle IR bands which are absent in OCM-2 and MODIS. Statistical analyses of chlorophyll-a between OLI, OCM-2 and MODIS; OLI is comparable with MODIS, while as in OCM-2 higher estimates observed compare with MODIS.

Finally the study convince the higher capabilities of OLI to execute island effects on chlorophyll-a and it’s dispersal/diffusion pattern due to its higher spatial resolution and having additional middle IR bands.

Keywords: Case-2 waters; remote sensing, chlorophyll-a.
We present an object-based image classification method to detect aircraft from high-resolution satellite images. The detection of all varieties of aircraft is a difficult problem due to the large intra-class variability of aircraft objects, the presence of complex foreground/background scenarios in the image and the large volume of data to be processed. Further as the resolution of data increases the intra-object homogeneity decreases. In the proposed approach we use localised processing and leverage object-level attributes for classification. Localised adaptive segmentation is proposed for segmenting probable aircraft objects from the image and then object classification is performed using k-Nearest Neighbours (k-NN) and Support Vector Machine (SVM). Three band (Red, Green and Blue) data having about 0.5m spatial resolution are used in the experiments. We achieve an accuracy of 81% and 93% using k-NN and SVM respectively.

Keywords: Target Detection, High-resolution Satellite Images, Localised Adaptive Segmentation, k-NN, SVM

Abstract Id: 84
MAPPING OF SHORELINE CHANGE ALONG MAHARASHTRA STATE, WEST COAST OF INDIA, USING GEOSPATIAL TECHNIQUE

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Shore line shifts landward or the seaward due to natural or anthropogenic factors thereby changing the coastal area. The changes occur mainly due to the forces that move the sand, wind, waves, and currents. The current study presented here analyzes the shoreline of Coastal Maharashtra, to assess the change in shorelines. Landsat MSS, TM, ETM and OLI band images taken from 1978 to 2017 at an interval of about 10 years and the monthly sea level change data collected from GLOSS were taken to determine the change in the shoreline. The satellite images were being used for the change assessment and were evaluated using the digital shoreline analysis system (DSAS). The rate of shoreline change was assessed using statistical method and end point rate method. It was found that sea level change near north coast of Maharashtra is changed severely, the southern part of the Maharashtra is having less changes and the middle of the coastal Maharashtra is slightly changed from the earlier. This method proves to be useful and this enhance the quality of the change detection map.

Keywords: Change detection, EPR method, Shoreline mapping, DSAS

Abstract Id: 86
COASTAL PROCESSES AND CAUSES OF SHORELINE EROSION AND ACCRETION OF THE BATHTHALANGUNDUWA ISLAND IN SRI LANKA

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Battalangunduwa is an elongated sandy island. It is located in the Portugal Bay extending about 16 km long from north to south, and maximum width is about 680m east to west. Coastal Processes mainly erosion, transportation and deposition of the Baththalangunduwa island is calculated from the period since 1985 to 2017. Remote sensing technology such as aerial photographs, satellite imageries used to do the temporal analysis for identifying the change of island. Field survey in November, 2016 was undertaken with GPSs used for verification and to identify some prominent and permanent locations of the island. After analyzing data spatially, erosion can be seen especially in the western flank of the island. The area is faced to waves, swells, storm winds and tides of the Palk Strait during the south-west monsoon period and vice versa accretion can be seen especially in the northern and eastern flanks and along the southern corner during the north-east monsoon period. The waves, wind pattern and tide of the Portugal Bay are responsible for the transportation and deposition (accretion) in the area. Due to these processes, along the eastern and southern flanks of the island, there form micro landforms such as sandy lobes and hooks, mud flats, sea grass beds, mangrove patches, incomplete small bays and lagoon features. Most of these features are temporal, and limited to a week or a month or a season. According to the results about 1 km erosion measured from the far point to the present coastal line, and total land extent change from 501 ha to 226 ha. Sea waves especially high tides and wind speed are reasons to change the shape of the sand deposited island daily.

Keywords: Coastal Process, Erosion, Accretion, Baththalangunduwa

Abstract Id: 87
EFFECTIVITY OF SUPER RESOLUTION CONVOLUTIONAL NETWORK FOR THE ENHANCEMENT OF LAND COVER CLASSIFICATION FROM MULTISPECTRAL MID-RESOLUTION SATELLITE IMAGES

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Remote sensing data are of particular importance and provides essential information for monitoring the earth from the above. For a precise quantification of land cover change, availability of spatially fine resolution data is a necessity. Since 1972, NASA’s LANDSAT Satellites are providing terrestrial images covering the whole earth, which have been proved to be a highly useful resource for terrestrial change analysis and has been used in different sectors. However, freely accessible LANDSAT images are spatially mid-resolution (30m spatial resolution) which is a hindrance for precision of the analysis. Lower spatial resolution of image data makes it difficult to detect the features when classified under supervised algorithm. In this paper, we investigated the effectiveness of upscaling satellite images by Super Resolution Convolutional Neural Network (SRCNN) for land cover change detection. We upscaled LANDSAT images in three different techniques - binary interpolation, bicubic interpolation and SRCNN and then observed their performance along with the original images for being successfully classified in a supervised learning algorithm. It was found that, the images upscaled by SRCNN outperformed all the other images and features which are only few pixel across were detected successfully which went misclassified otherwise.

Keywords: Super Resolution, Land cover change detection, LANDSAT, Deep Learning

Abstract Id: 88
A NEW SPECTRAL-SPATIAL FRAMEWORK FOR CLASSIFICATION OF HYPERSPECTRAL DATA

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In this paper, an innovative framework, based on both spectral and spatial information, is proposed. The objective is to improve the classification of hyperspectral images for high resolution land cover mapping. The spatial information is obtained by a marker-based Minimum Spanning Forest (MSF) algorithm. A pixel-based SVM algorithm is first used to classify the image. Then, the marker-based MSF spectral-spatial algorithm is applied to improve the accuracy for classes with low accuracy. The marker-based MSF algorithm is used as a binary classifier. These two classes are the low accuracy class and the remaining classes. Finally, the SVM algorithm is trained for classes with acceptable accuracy. To evaluate the proposed approach, the Berlin hyperspectral dataset is tested. Experimental results demonstrate the superiority of the proposed method compared to the original MSF-based approach. It achieves approximately 5% higher rates in kappa coefficients of agreement, in comparison to the original MSF-based method.

Keywords: Hyperspectral image, Spectral-spatial classification, Support Vector Machines, Minimum Spanning Forest

Abstract Id: 90
AN EXTENDED SPECTRAL-SPATIAL CLASSIFICATION APPROACH FOR HYPERSPECTRAL DATA

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In this paper an extended classification approach for hyperspectral imagery based on both spectral and spatial information is proposed. The spatial information is obtained by an enhanced marker-based minimum spanning forest (MSF) algorithm. Three different methods of dimension reduction are first used to obtain the subspace of hyperspectral data: (1) unsupervised feature extraction methods including principal component analysis (PCA), independent component analysis (ICA), and minimum noise fraction (MNF); (2) supervised feature extraction including decision boundary feature extraction (DBFE), discriminate analysis feature extraction (DAFE), and nonparametric weighted feature extraction (NWFE); (3) genetic algorithm (GA). The spectral features obtained are then fed into the enhanced marker-based MSF classification algorithm. In the enhanced MSF algorithm, the markers are extracted from the classification maps obtained by both SVM and watershed segmentation algorithm. To evaluate the proposed approach, the Pavia University hyperspectral data is tested. Experimental results show that the proposed approach using GA achieves an approximately 8% overall accuracy higher than the original MSF-based algorithm.

Keywords: Hyperspectral image, Spectral-spatial classification, Subspace extraction, Support Vector Machines, Minimum Spanning Forest, Seg

Abstract Id: 91
Higher Order Singular Value Decomposition (HOSVD) of a tensor, High performance computing, big data analytics for image processing of remote sensing imagery. Computing Challenges in Hyperspectral Analysis: The large computational demand of hyperspectral image analysis stems from two particular issues. First, the images can be extremely data-rich because they have a large number of spectral bands. Second, and more importantly, the analysis techniques often utilize the shape of the spectra, not just the discrete bands, to remotely sense the chemical and structural attributes of materials. Typical methods for spectral analysis include the use of spectral derivatives, Monte Carlo simulations, and the inversion of physically-based reflectance models. Each of these approaches requires a different type and level of computational power, and can benefit from a well-matched computing architecture, to achieve the analytical speeds needed to make hyperspectral imaging truly operational or ‘science ready.’ Here, we use a couple of examples from our own work to highlight the different types of computational needs. Spectral mixture analysis (SMA) is a common approach to decomposing image pixels into fractional cover estimates of various Earth surface materials. The diversity of materials to be estimated depends upon the spectral and spatial resolution of the imagery, the fidelity of the spectral measurements, and the uniqueness of the spectral properties of each material. Higher Order Singular Value Decomposition for Image Fusion: The process of combining information from two or more images of the same scene in order to obtain the resulting image more suitable for human and machine perception or further image processing tasks like segmentation, feature extraction, and target recognition is known as Image Fusion. Partial differential equation (PDE), fractional fourier transform, wavelet transform, mathematical morphology, etc are employed for optical signal processing and image analysis and then interpretation for geomorphological studies. Image analysis follow three steps: Image processing (Image to Image)

Keywords: image processing, hosvd, remote sensing imagery, mathematical morphology, partial differential equation

Abstract Id: 92
DROUGHT MONITORING USING OPEN SOURCE REMOTE SENSING DATASETS

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Droughts are more complicated phenomena occurs due to the lack of moisture. It has very harsh effect on the society’s economy and livelihood. There are three types of drought viz. Agriculture, Hydrological and Meteorological. The occurrences of different droughts are depending upon different parameter but all are highly correlated. Agriculture drought occur when soil moisture decreases which cause serious impact on the crop’s health and its productivity. Normalized difference vegetation index (NDVI), Land surface temperature (LST) and Soil moistures are different parameter used to study of drought, NDVI is used for monitor changes in vegetation whereas LST indicates about temperature of the different land’s surface. Soil moisture one of the most valuable factor which indicate drought. In this study NDVI and LST calculated from Landsat dataset and soil moisture from AMSRE product, is used. The data was calibrated to standard pixel value and resampled in a homogeneous resolution. This study is conducted over the Indian state Maharashtra and Madhya Pradesh because of dependencies on agricultural activities and suffering from water unavailability which makes highly affected from drought. According to statistical correlation between different indicators visualizing toward the droughts in different parts of the state, and it is varying from year 2001 to 2016. South eastern part of Maharashtra getting higher LST whereas vegetation index and soil moisture is Low. The R² of LST and NDVI is more than 0.6 whereas NDVI and soil moisture index is > 0.7.

Keywords: Drought, Agriculture, LST, AMSRE, Soil Moisture

Abstract Id: 93
DERIVATION OF VELOCITY OF THE POTSDAM GLACIER, EAST ANTARCTICA USING SAR INTERFEROMETRY

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The Synthetic Aperture Radar Interferometry (InSAR) is a robust method for monitoring Earth's surface mainly to measure its topography and deformation. It is a widely used technique in multidisciplinary applications. By using two SAR images interferogram are generated which shows phase as well as the amplitude information. The phase information from two and more interferogram further helps to extract information about height and displacement of the surface. We used this technique to derived glacier velocity for Potsdam glacier which is located south of the Schirmacher oasis and north of Wohlthat Massif, east Antarctica using Sentinel-1 Single Look Complex images captured in Interferometric Wide mode. For velocity estimation, Persistent Scatterer interferometry (PS-InSAR) method has been applied. This method uses time coherent of permanent pixel of master images and correlates to same pixel of the slave image to get displacement. C-band sensor of European Space Agency, Sentinel-1A and 1B data were used in this study. Estimated average velocity is around 0.12 m per day which varies annually from 30 m to 60 m. The velocity varies from higher elevation to lower elevation. The study suggest that, at higher altitude toward the south west of the glacier flow is at 30-35 m annually and at lower altitude it measured as 55 m to 60 m.

Keywords: InSAR, Glacier Velocity, Sentinel-1, Potsdam Glacier.

Abstract Id: 94
DEVELOPMENT OF A FORMAT CONVERSION ALGORITHM FOR COMMERCIAL GIS PROGRAM DISPLAY OF RAINFALL RADAR DATA

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In this study, a file conversion algorithm was proposed to display rainfall radar data in commercial GIS programs. The rainfall radar data used in this study are local moisture index data measured at one minute intervals and provide raw data for a specific area. The provided raw data were converted to images to be interpreted as GIS data and to be viewed by universal image viewers. In addition, coordinate data files were created to be used in commercial GIS programs. Using this method, it was possible to visualize provided raw data and to display the rainfall radar along with the satellite images of the corresponding area in commercial programs such as QGIS and ArcGIS.

Keywords: Rainfall Radar, Data Convert, GIS, Shapefile

Abstract Id: 97
SUBSIDENCE IN THE KATHMANDU BASIN BEFORE AND AFTER 2015 MW 7.8 GORKHA EARTHQUAKE REVEALED FROM SBAS-DINSAR ANALYSIS

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The Kathmandu Basin located in the Lesser Himalayas is composed of thick Quaternary sediments overlaying bedrocks; these sediments have experienced severe groundwater drawdown in recent years, which leads to land subsidence. In addition, the basin lies in a very tectonically active zone that was devastated by large crustal deformation from the Mw 7.8 Gorkha earthquake on April 25, 2015, measured as ~1 m uplift. We acquired 16 scenes of Advanced Land Observation Satellite - Phased Array L-band Synthetic Aperture Radar 1 (ALOS-PALSAR) and 20 scenes of SENTINEL-1 SAR datasets during pre- and post-seismic periods, respectively. We developed spatial and temporal velocity profiles of land subsidence in the Kathmandu Basin before and after the earthquake by applying the Small BAseLine Subset - Differential Interferometric Synthetic Aperture Radar (SBAS-DInSAR) technique. The mean land subsidence rate during 2007-2010 was ~7 cm/yr in the central part of the basin, however, this rate of subsidence significantly increased to ~12 cm/yr during 2015-2016, after the Gorkha earthquake. The InSAR derived post-seismic time series results were well correlated with local Global Positioning System (GPS) observations. The distribution of subsidence areas observed before and after Mw 7.8 mainshock are almost identical, indeed the subsidence rate has increased after the mainshock, which is anticipated because of lowering of the water table due to the large crustal uplift of the basin. These results are useful for assessing the spatiotemporal distribution of land subsidence in the Kathmandu Basin and the influence of Earthquake Environmental Effects such as large co-seismic deformation on compressible sediment layers, which may lowers the groundwater table level in shallow and deep aquifers.

Keywords: Kathmandu Basin; Subsidence; Groundwater withdrawal; 2015 Gorkha Earthquake; SBAS-DInSAR

Abstract Id: 101
Pan-sharpening is very common in high-spatial resolution multispectral imagery. Most satellite data in the past 15 years are provided in both panchromatic and multispectral bands, so that pan-sharpened dataset becomes a standard option. However, automatic classification methods in both per-pixel and object-based approaches require high-quality pixel values representing objects' spectral responses to the sensors, which are sometimes discouraged by the pan-sharpening results. This study tried to evaluate the effect of pan-sharpening methods on the per-pixel and object-based classification accuracies. ALOS data consisting of PRISM panchromatic (2.5 m) and AVNIR-2 multispectral (10 m) bands were explored for this purpose. Western part of urban fringe area of Yogyakarta, Indonesia was used as a case study. The image bands were pan-sharpened using four methods, i.e. HSV, Brovey, PC and Gram-Schmidt. After that, all pan-sharpened datasets were classified using per-pixel (in terms of maximum likehood algorithm) and simple object-based (in terms of segmentation-based and majority rules) approaches. This study found that all pan-sharpening methods altered the original pixel values, although PC and Gram-Schmidt tend to show higher correlation with the original bands. This results were consistent with the obtained accuracy assessment, where PC and Gram-Schmidt pan-sharpened images gave higher accuracies than HSV and Brovey, when they were classified using both per-pixel and OBIA approaches. When the performance of both approaches was compared to the classification result obtained from the original bands, the PC and Gram-Schmidt images consistently showed higher accuracies. This study also showed that OBIA classification is more suitable for pan-sharpened imagery than per-pixel method.

Keywords: pan-sharpening, per-pixel classification, OBIA, ALOS

Abstract Id: 102
SPATIAL ANALYSIS OF HOT SPOT DISTRIBUTION IN SUMATRA, INDONESIA

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Forest fires are an important concern for the environment. One of the concern areas in Indonesia is Sumatra. Based on land cover data of 2015, Sumatra is dominated by shrubs, bushes, plantations with hardwoods, and plantations. It is the island with the largest peat distribution in Indonesia. The Center for Agricultural Land Resources stated that the peat area on Sumatra Island in 2016 is 6.44 million hectares or 13.6% of the entire Sumatra region. Forest fires can occur due to natural and/or human factors. Fire incidents can be indicated through hot spots distribution data. The data used is the distribution of hot spots of Sumatra Island in 2005-2016. The purpose of this study was to analyze the pattern of hot spot distribution and its relations with land cover changes. Overlay results indicate that 31.75% fires occur in shrubs and bushes, 20.87% in plantations with hardwoods, 16.60% in other natural cleared areas, 14.55% in forest crops, and the rest spreads in lowland crops, dry season crops, and swamp/peat forests. The highest hot spots are in 2005 and 2015 due to the El Nino effect that causes prolonged drought. Available land cover data indicates a change during 1990 through 2011. Most of peat land turn into plantation between 1990 to 2000. Then, some peat lands are classified as shrubs in the land cover data. The result of overlay of hot spot distribution with land cover data from 2006-2015 shows that forest fires mostly occur in industrial plantation forest. This can be seen from the land cover classification where previously a plantation forest, then it is burned into a field and become an industrial plantation forest. Nevertheless, this analysis still need to be validated through ground truth to check the actual land cover and land use in field.

Keywords: forest fire, hot spot, land cover change

Abstract Id: 103
TEXTURE MEASURES FOR THE QUANTIFICATION OF SPATIAL VARIABILITY OF VEGETATION IN SAVANNA LANDSCAPES

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If biodiversity can be considered as the total variability of life on earth, vegetation variability plays a significant part in its sustenance. Vegetation at any given location changes over time and space. Reliable information in this regard is key to identifying sources of ecosystem stress and devising adequate management strategies. Conservation efforts traditionally have focused on changes at the local scale and at species levels. Limitations of space and time did not enable such studies to adequately explain the processes that are in operation and their interrelationships across hierarchic levels. Spatial analysis of vegetation index images derived from medium resolution sensors such as Landsat could be a possible source of this information at broader spatial and temporal scales. The present study analyses the spatial dynamics of savanna vegetation in Kruger National Park, South Africa using Landsat derived Soil Adjusted Vegetation Index images. Spatial variability is assessed through its constituent elements of heterogeneity and diversity. Changes in vegetation conditions while contributing to spectral changes will also induce changes in the spatial structure of the image. Texture measures operating within local neighborhoods will be able to quantify this change in local image variance and hence spatial variability. Texture measures of mean, variance, skewness and kurtosis were calculated for quadrats of size 2*2 km using moving windows of size 3*3, 31*31 and 61*61 corresponding to local, patch and landscape scales for the four years considered in the study - 1984, 1990, 1996 and 2002. Results indicate that the park is a constantly changing and evolving ecosystem. Seasonality is the primary contributor to intra-year vegetation variability. Differences in geology plays the dominant role in deciding inter-year variability though at coarser spatial scales the effect is negligible. Spatial heterogeneity and diversity as measured by skewness and kurtosis show a declining trend from 1984 to 2002.

Keywords: Texture, SAVI, spatial variability, heterogeneity, diversity

Abstract Id: 104
USING LANDSAT 8 THERMAL DATA FOR GEOTHERMAL EXPLORATION AROUND GAZLIGÖL (AFYONKARAHISAR-TURKEY) AREA

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The heat from the soil, measured since many years is used in many different fields as parameter. The soil heat has been measurement by using a field thermometer for agriculture. As the working field boundaries expand, it is difficult to make these measurements using a thermometer. Due to rapidly developing satellite technology in recent years, it is now possible to obtain the spectral data of the whole area and the temperature values of this data at a time. The determination of the soil temperature and the construction of the soil temperature map of the field will be an effective method for revealing the geothermal field characteristic of the area.

Gazlıgöl geothermal area, which is located about 20 km north of Afyonkarahisar, is one of the most important geothermal fields in Afyonkarahisar. The geology of the region is characterized by Paleozoic and Cenozoic aged rocks. The basement rocks of the region are composed of Palaeozoic aged Afyon Metamorphics containing schists and marbles. These basement rocks are overlain by Cenozoic rocks such as conglomerate-tuff and andesite. Alluvium and travertine are the youngest units in the region. There are many thermal and mineral water sources in Gazlıgöl region. Generally, the temperatures of the thermal waters are between 400 and 850 °C. Besides, Gazlıgöl thermal and mineral waters are of the Na-HCO₃ type.

Landsat 8 is the newest satellite that can be used to establish a soil heat map and identify potential geothermal sites. This satellite has two thermal bands. In this study, Gazlıgöl area were investigated according to geothermal potential by using the thermal bands belong to Landsat 8.

The heat maps and the usage of Landsat 8 satellite data for the preparation of these maps especially around well-known geothermal regions in Gazlıgöl will be increase the effective usage of thermal bands of new satellites

Keywords: Landsat 8, Thermal Data, Soil heat, Gazlıgöl, Afyonkarahisar.

Abstract Id: 106
INTEGRATED USE OF REMOTE SENSING AND GIS TECHNOLOGY FOR MONITORING THE ENVIRONMENTAL PROBLEM OF SHYAMNAGAR UPAZILA

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Cultivation of shrimp mostly in unplanned way has been considered as one of the major environmental disasters of Shamnagar Upazila (Sub-district), Bangladesh. Villagers surrounding the rivers are mainly involved with fish (shrimp) cultivation. So, fertile agriculture land has been converted to shrimp cultivation. Conventional methods for collecting this information are relatively time consuming. Contrarily, Remote Sensing satellite observation with its unique capability to provide cost-effective support in compiling the latest information about the natural resources. Remote sensing, in conjunction with GIS, has been widely applied and been recognized as a powerful and effective tool in detecting land use and land cover changes. RapidEye and Landsat8 images were used to identify land use of the area during the period 2008 and 2015. Google images were used to identify the micro-level land use features of the same period. Multi-spectral classifications using unsupervised and supervised classification were done and results have been compared based on the field investigation. The study reveals that during the period 2008 to 2015 agricultural practice has been reduced from 35% to 21% and shrimp cultivation area increased from 38% to 50%. Due to the impact of high salinity and salt water intrusion agricultural activities is reduced and farmers have been converted to other practices, as a result shrimp farming is gaining popularity in the area. Rural settlement has been slightly increased and inter tidal area has also been increased to 2% due to the effect of cyclone.

Keywords: Environmental disaster, Shrimp, Agriculture, Remote Sensing

Abstract Id: 107
COMPARISON OF LANDSAT 8 AND SENTINEL 2 DATA FOR ACCURATE MAPPING OF BUILT-UP AREA AND BARE SOIL

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Accurate mapping of built-up area and bare soil, having similar spectral characteristics, using remote sensing data is important for urban mapping because of their relationship with environmental quality and urban growth. Landsat 8 and Sentinel 2 data for February 2016 were used to derive three indices: Normalized Built-up Area Index (NBAI), Band Ratio for Built-up Area (BRBA) and Bare Soil Index (BSI) and used in combination of actual images for accurate discrimination between bare soil and built-up area over Kurukshetra (Haryana). Bands 11 and 12 of Sentinel 2 data were resampled to 10 m resolution so as use them with Bands 2, 3, 4 and 8 for indices calculation and further classification. Three different dataset consisting of (1) three indices only (2) six actual bands and (3) combination of 3 indices and 6 bands for both Landsat 8 and Sentinel 2 data were used for classification using four classes i.e. bare soil, built-up area, water and vegetation. Support vector machine classifier was used to classify different combination of images used in this study. A post classification field visit was also carried using different classified image and a GPS set. Comparison of results in terms of area for both built-up area and bare soil using classified images and field visit suggest that Sentinel 2 data consisting of 6 wavebands and three indices was able to better discriminate both classes (12.99 and 27.72 Km$^2$) in comparison to 6 bands and three indices (3.5 and 38.98 Km$^2$) and other combinations using Landsat 8 Data

Keywords: Sentinel 2, Normalized Built-up Area Index, Band Ratio for Built-up Area, Bare Soil Index, support vector machines

Abstract Id: 108
A REMOTE SENSING MODEL TO EXTRACT THE PETROLEUM POLLUTION CONCENTRATION IN WATER BASED ON THE ABSORPTION COEFFICIENT AT THE REFERENCE BAND

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The absorption coefficient of petroleum pollution water is one of the inherent optical properties of ocean color remote sensing field. The absorption coefficient in the $\lambda_0$ reference wavelength $a(\lambda_0)$ is an important parameter of the petroleum pollution water absorption coefficient parameterized model. If using the basic physical quantities which the remote sensors can detected to extract the parameters, the space application of biological-optical model can be achieved. For this purpose, according to the 2008, 2009, 2010, 2012, 2013 and 2015 conducted six times oily water ratio test data and sampling data in situ, according to ocean optics survey technical regulations (NASA), the absorption coefficients of petroleum pollution water were measured by n-hexane and carbon tetrachloride as reference fluid respectively. Firstly, analyzed the spectrum data measured in situ with the petroleum substance reference wavelength absorption coefficient, then researched the detectable basic physical quantities’ characteristic (remote sensing reflectance or water-leaving radiance) in petroleum pollution water by optical sensor in order to find the sensitive wavelength or parameters which can influence the petroleum pollution water absorption coefficient. Secondly, based on the relationship between remote sensing reflectance and absorption coefficient of water sensitive wavelength, established the inversion mode of the water petroleum substance absorption coefficient $a(\lambda_0)$ in the reference wavelength (for example, 440 nm) by using the remote sensing reflectance. Thirdly, made use of the measured absorption coefficient of petroleum polluted water data to get the normalized unit absorption coefficient. Used remote sensing band ratio to calculate the $a_{oil}(440)$ and combined with the known spectral slope of absorption coefficient $S$, then solved each band’s $a_{oil}(\lambda_0)$. Finally, on the basis of the relationship that absorption coefficient is equal to the product of the petroleum content and unit absorption coefficient, adopted the least-squares to solve the corresponding petroleum concentration.

Keywords: petroleum pollution water, petroleum concentration, absorption coefficient, inversion model, absorption coefficient

Abstract Id: 109
STUDY ON DISTRIBUTION CHARACTERISTIC OF CHLOROPHYLL CONCENTRATION AT OFFSHORE AQUACULTURE WATERS BASED ON VIRTUAL CONSTELLATION

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Chlorophyll-a exists in all water plants and is one of important components of algae. It can reflect the standing crop of phytoplankton and the eutrophication degree, and thus become an important indicator of water quality monitoring. In offshore aquaculture area due to the effect of land area, the spatial and temporal changes of chlorophyll-a concentration are high. This not only affects the manager's choice of farm location and scale of farming, and influence the farmers scientific arrangement and economic benefit of production measures. According to the practical production requirements, it needs to carry on the long-term high dynamic monitoring, and the space and time resolution are for 3 to 5 days and 50-100 m, respectively. Satellite remote sensing is very effective means to implement for high dynamic monitoring of these parameters. The scale can satisfy the requirement of time and space resolution by carrying a high spatial resolution of remote sensing satellite sensor to constitute a goal oriented virtual constellation. However, chlorophyll-a concentration obtained by using different inversion algorithm of multi-source sensors will exist a certain differences among data. In order to make the data comparable and constitute a time series data, satellite-ground synchronous experiments were done in May 2015, may and June 2016 and June 2017 in liaodong bay sea and yellow sea. Employing the existing chlorophyll-a remote sensing inversion algorithm and using the high spatial resolution satellite data such as CBERS-04, HJ-1A, GF-1, GF-2, GF-4, Landsat 5 and Landsat 8, the chlorophyll concentration were obtained. On the basis of ocean chlorophyll products of EOS/MODIS for reference, the chlorophyll normalization equations for different sensors were build. Thus, each sensor data have comparable. Finally, the accuracy of inversion results were verified according to the field observation data of chlorophyll-a and the spatial variability were analyzed.

Keywords: Virtual constellation, Offshore aquaculture waters, Chlorophyll concentration, Inversion algorithm, distribution characteristics

Abstract Id: 110
REMOTE SENSING ON MINERAL EXPLORATION

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Remote sensing is a strategic key tool for mineral exploration, due to its capacity of detecting hydrothermal alteration minerals or alteration mineral zones associated with different types of mineralization systems. The advancement in remote sensing has ease the monitoring, mapping and various analysis. The development of multispectral and hyperspectral remote sensing, LIDAR has assisted in fast growing of the remote sensing technology. The various bands are recorded by the sensors and the recorded spectral characteristics is analyzed further to identify, investigate the features on the basis of their spectral reflectance.

Nepal is a developing country and the remote sensing technology is the new term, so the application of remote sensing in the country like Nepal has its great importance. The various research on the past reveals that the country has mineral deposits like gold, petroleum, uranium, quartz etc. Recently, the Department of Mines and Geology has done research that there may be the Uranium deposits in Mustang district, Nepal but couldn’t predict the probable geospatial location of the uranium deposits, so the application of remote sensing can be applied in such fields. The mineral exploration is very much useful and this study aims at exploiting multi-spectral data, acquired from ASTER, satellite to explore areas of hydrothermal alteration and mineral deposits. Major steps involved in the analysis of ASTER satellite data can be using ERDAS Imagine Software. The extent of interdependence among spectral regions, hydrothermal alteration and deposits can be studied through digital image analysis and classification. The visual interpretation techniques can be employed to identify and earmark hydrothermal alteration and deposits on the satellite image for carrying out subsequent supervised image classification.

Keywords: Multi-spectral, Hydrothermal alteration, Reflectance, Spectral, ERDAS Imagine

Abstract Id: 112
Monitoring of Rice in Small Paddy Fields Using Multi-Temporal Sentinel-1 Data

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Rice is the staple food for more than half of the world’s population. The prompt assessment of its conditions is critical for diagnosis and decision making especially under threats of climate change. With the recent availability of C-band synthetic aperture radar (SAR) data from Sentinel-1, a 6320-m² rice paddy field employing farmer’s practice in Argao, Cebu, Philippines was monitored, such that its growth can be modeled from the satellite’s backscatter readings. The multi-temporal backscatter of rice and its polarimetric difference were as well compared with reference surfaces. The results have shown that in terms of vertical-vertical (VV) and vertical-horizontal (VH) polarized backscatter magnitude alone, rice cannot be differentiated from the other reference surfaces. However in terms of its trend over time, rice can be identified using its unique specular signature during land preparation. The polarimetric difference (VV-VH and VH-VV) was also found to be a better metric in identifying rice areas. The results have also shown that canopy height and hill diameter are highly correlated with the VH polarized backscatter with R² values equal to 0.74 and 0.65, respectively. The other biophysical parameters measured in situ did not correlate well with backscatter and its polarimetric difference. Finally, Sentinel-1 has the potential to detect small vegetative differences at closely-located ground truth (GT) points. It is recommended that further studies be conducted in this area such that the potential of Sentinel-1 as an agricultural monitoring tool be maximized.

Keywords: SAR Backscatter, Polarimetric difference, Lowland rice, Cebu, Philippines

Abstract Id: 113
LANDSCAPE METRICS FOR ANALYSING SPATIO-TEMPORAL CHANGES OF URBAN LAND USE PATTERN

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Dynamic urban land use/land cover processes influence the landscape pattern at multiple scales in terms of infrastructure, amenities, environment quality and local climate. In addition rapid and unplanned urban expansion increase the social, physical and environmental problems in an area. Therefore, it is necessary to quantify and manage urban growth for sustainable development of city. This study intends to assess the effectiveness of landscape metrics in quantifying the urbanization-induced land use/land cover (LULC) changes for Kota city of Rajasthan state. Based on satellite images derived land use/land cover data, landscape metrics were calculated to characterize long-term trends and patterns of urbanization during 1989-2016. Changes of landscape pattern during the study period were analyzed by different landscape metrics viz. shannon's entropy, Edge Density (ED), Number of Patches (NP), Largest Patch Index (LPI), patch cohesion index, clumpiness, Landscape Shape Index (LSI) and fractal dimension index. The spatial and temporal heterogeneity of the land use/cover changes reveals significant increase in built-up land. NP results explains that there was increase in number of patches for built-up and cropland class during 1989 to 2011, this signifies the patched/fragmented growth in city. However, in 2016, the NP decreases which indicates that there was coalescence of grown patches to a single patch. ED and LPI results reveal increasing trend for built up area during the study period. Agricultural land at the urban fringe is converted into residential and industrial areas, which has been supported by decrease in NP and ED of cropland and fallow land. Results reflects that city was more compact in 1989 and began to expand in all directions, especially in the north-east and north-west region of the city. This study will help the decision makers to understand the landscape dynamics and linking the agents of change for better planning and sustainable development of the city.

Keywords: Urbanization, landscape metrics, land use/land cover, landscape pattern

Abstract Id: 114
Chromophoric dissolved organic matter (CDOM) is a kind of significant light-absorbing substance in water. Chemical oxygen demand (COD) refers to using the chemical method (manganese or chromium method) to measure the amount of reducing substances in water samples by calculating the chemical oxygen consumption. Most reducing substance are organic matters, thus chemical oxygen demand (COD) is one of the important parameters for measuring organic pollution degree. Firstly, according to the CDOM absorption coefficient and apparent spectral data of water obtained from 2013, 2014 and 2017 in the Pearl River estuary and the northern Yellow Sea, combined with field COD analysis data, inversion model of ag (440) (CDOM spectral absorption coefficient at 440 nm, which can represent CDOM concentration) using remote-sensing reflectance was established for sensors data from different satellites including HJ-1A, HJ-1B, GF-1, GF-2, GF-4, Landsat-5 and Landsat-8. Secondly, based on the correlation between the COD and the CDOM absorption coefficient in water, the proposed algorithm of CDOM based on remote sensing reflectance was modified, and further a remote-sensing model using CDOM to derive COD was established. Thirdly, the results of these satellite inversions were normalized so that these data can be comparable and form a time series. Fourthly, the COD remote sensing inversion model was applied to the Yellow Sea water area, and the thematic map of COD spatial distribution in the coastal waters is obtained. Finally, COD spatial distribution variation in these areas was analyzed.

Keywords: remote sensing analysis; chemical oxygen demand; Inversion algorithm; spatial distribution

Abstract Id: 117
REMOTE SENSING ANALYSIS OF THE SPATIAL AND TEMPORAL CHANGES OF DISSOLVED OXYGEN IN CHINA'S COASTAL WATERS

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Dissolved oxygen (DO) is an important parameter of water quality, and it is of great significance especially for offshore aquaculture areas. Mortality of lots of fish occurs causing huge losses to farmers when DO is little. The occurrence of low DO level in the sea is often associated with red tides and land-sourced pollutants. Therefore, it is a routine monitoring project in both the national Marine monitoring standard and the water quality monitoring standard of the Ministry of Environmental Protection. In this paper, a networked measurement and management model was introduced to distribute the field observation and sampling points. Twice of satellite-field synchronous observation data of aquaculture areas in the Weihai and Zhanjiang were recorded, and the model of the remote sensing inversing DO content in the sea area was established. The marine DO content was calculated using the existing inversion model based on lakes, reservoirs and rivers. On this foundation, model performance test index such as MAE (Mean Absolute Error (Wm-2)), RMSE (Root Mean Square Error (Wm-2)), IA (Index of Agreement) and LCC (Linear Correlation Coefficient) were used to analyze the accuracy of these models. Based on the data obtained from laboratory analysis, field instrument observation and remote sensing inversion model, the spatial variability of DO in the sea area was studied. Finally, using the nearly 20 years of landsat 5 and landsat 8 remote sensing data, the spatial and temporal variation characteristics of DO causes in China's Weihai and Zhanjiang coastal waters were analyzed.

Keywords: Dissolved oxygen; Remote sensing analysis; spatial and temporal changes; coastal waters

Abstract Id: 118
COMPARATIVE STUDY OF USING DIFFERENT IONOSPHERE MODELS IN THAILAND FOR SINGLE-FREQUENCY GNSS USERS

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One cause of inaccuracy of GNSS signal is from an Ionosphere layer. The ionosphere layer contains free electrons which delay the speed of GNSS signal. Dual frequency receivers can overcome this problem by using an ionosphere-free linear combination, while a single frequency receiver cannot. Therefore, selection of suitable ionosphere model is vital to eliminate inaccuracy of GNSS signal. This article presents a comparative study of applying various ionosphere models in Thai region including Klobuchar model, Global Ionosphere Maps, Ionosphere Model from QZSS and local ionosphere model. The local ionosphere model is generated with the use of locally available GNSS stations by the BERNESE software. With the use of single frequency data, the coordinates derived from the above-mentioned models were compared with the coordinates obtained from applying an ionosphere-free linear combination from dual frequency receivers by statistical test. The experimental results confirmed that the local ionosphere model produces the most accurate positioning results and they are similar to the results obtained from an ionosphere-free linear combination of dual frequency receivers.

Keywords: Ionosphere model, GNSS, BERNESE

Abstract Id: 119
FLOOD RISK EVALUATION, ANALYSIS AND MAPPING OF KOCAELI EŞME MADEN VALLEY USING REMOTE SENSING, GIS AND HEC-RAS TECHNOLOGIES

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Purpose of this study is to use Geographic Information Systems (GIS), GIS’s extended program HEC-GeoRAS to preparing geometry data that is necessary for hydraulic modelling, remote sensing technology and Hydraulic modelling program HEC-RAS in order to prepare flood hazard maps according to different discharge of the valley. It is used, 1:5000 scale topographic map of region with 5 meters elevation differences for contour lines to prepare TIN map (Triangulated Irregular Networks) that is the primary data for hydraulic and hydrologic modelling. By the collaborative evaluation of remote sensing and geographical information system data and 25, 50 and 100 years basin return period of the valley hydraulic modeling performed and according to the attained data the flood risk maps were produced. According to produced different discharges flood risk maps areas, which would face by flood risk identified. This study will provide useful data against the loss of life and property of people living in the area and also for construction activities, risk assessment for existing buildings and feature regulations and development plans of the region.

Keywords: Flood Analysis, Geographic Information Systems, HEC-GeoRAS, HEC-RAS, Remote Sensing

Abstract Id: 120
REMOTE SENSING ANALYSIS OF SPATIAL AND TEMPORAL DISTRIBUTION OF OIL CONTENT IN DALIAN PORT WATER AREA OF CHINA

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Dalian Port is located in Liaodong Peninsula, as one of the 15 key construction port cities of the Belt and Road Initiatives, has a construction history of more than one hundred years. Most of the crude and refined oil in Northeast China has long been transported from here, which results in economic growth to some degree and at the same time, has an impact on the environment of the port water area. Due to crude oil spill, large ship transport and some other factors during loading and unloading, the waters in terminal area will be subjected to serious oil pollution. Analyzing spatial and temporal distribution of oil content in Dalian Port water area can provide important reference for marine environmental regulation, pollution prevention, marine ecological protection and restoration. 20 remote sensing images shot by USA Landsat satellites (10 by Landsat-5 and 10 by Landsat-8) were used, 20 oil-bearing and 20 oil-free seawater test points were selected on each remote sensing image by means of profile method. The spectral characteristics of these test points were analyzed and compared to find out the differences between the characteristics of oil-bearing seawater and oil-free seawater. The threshold of NDPRI (Normalized Difference Petroleum Remote Sensing Reflectance Index) derived from above steps was used to determine whether the waters is polluted by oil, and further the parameters of the remote sensing model for retrieving oil content in water were corrected. Finally, based on the Landsat-5 and Landsat-8 image data, the temporal and spatial variation characteristics of oil content in Dalian Port water area from June 1996 to June 2016 were analyzed, and the causes of temporal and spatial variation were analyzed combined with specific oil pollution diffusion characteristics.

Keywords: Remote sensing, spatial and temporal distribution, oil content, Dalian port

Abstract Id: 121
RESEARCH ON RELATIVE RADIATION CALIBRATION METHODS OF MULTI-SOURCE SENSORS IN OFFSHORE CULTURE ZONES

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Aquaculture environment parameters in offshore aquaculture zones have the features that they fluctuate strongly in time and space. Marine remote sensing satellite and Meteorological satellite cannot satisfy the mariculture production demand due to their low spatial resolution, although they have the high temporal resolution. If the remote sensing satellites carrying with medium or high spatial resolution sensors can constitute a virtual constellation oriented the goal, it can be realized for long-term high dynamic monitoring of these parameters. One of the problems of the multi-source sensors integrated application is the difference between sensors in band width and the characteristics of the radiation. The solution of this problem can be that the high spatial resolution sensors are applied to the quantitative relative calibration technique of regional water. At present there are many successful research precedent that the relative radiation work were applied in a single landsat sensors with EOS/MODIS sensor as a reference. However, the research on multi-source remote sensor relative radiation calibration are not reported both at home and abroad. Taking culture zones in dalian in liaoning province,China as the study area and based on the analysis of the existing satellite data characteristics such as CBERS - 04, HJ-1A, HJ-1B,GF -1, GF-2, GF- 4, Landsat 5 and Landsat 8, the relative radiation calibration equations for different sensors were build on the basis of EOS/MODIS satellite sensor reference to relative radiation sensor calibration. It make each sensor data have comparability and lay the foundation for subsequent environment parameters of remote sensing quantitative accurate inversion model. Finally, according to the field observation data the accuracy of the result of the relative radiation calibration were verified, and the spatial variability analyzed.

Keywords: relative radiation calibration, multi-source sensors, offshore culture zones, spatial variability

Abstract Id: 122
DROUGHT MONITORING USING HIGH RESOLUTION SATELLITE-BASED RAINFALL PRODUCT ACROSS DIFFERENT RAINFALL REGIMES OF ETHIOPIA

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Drought is a recurrent phenomenon in the arid and semi-arid regions of Ethiopia. In the past two decades, millions of people are affected by drought throughout the country. Therefore, to assess and monitor historical drought, accurate rainfall record is crucial at different spatial and temporal scales. Although rain gauge observations provide long-term and accurate rainfall data, the distribution of most the rain gauges are sparsely distributed and very limited in many regions of the world and particularly in developing countries like Ethiopia. To solve this limitation, satellite-based rainfall products have been widely and successfully used in many hydrological applications. Therefore, in this study by considering its high spatial resolution and longer period record, the Climate Hazard group Infrared Precipitation with Stations version 2 (CHIRPSv2) satellite rainfall data has been used for drought monitoring across the rainfall regimes of Ethiopia. In the current study, due to its adaptability to different time scale, climatic conditions and its ability to determine the start and end of drought period, Effective drought index (EDI) has been applied for drought monitoring. Preliminary analysis indicates that the combination of EDI and CHIRPS rainfall product can be used to compute severity of drought. Detailed analysis being carried out and will be presented later

Keywords: Drought, EDI, CHIRPS, Rainfall-regime

Abstract Id: 123
REMOTE SENSING FOR TRACKING OF THE TARUMANEGARA KINGDOM IN KARAWANG DISTRICT, WEST JAVA PROVINCE - INDONESIA

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From various inscriptions and news of China stated that the kingdom Tarumanegara it ever existed in West Java with Purnawarman greatest king. As for the script Wangsakerta, Tarumanegara kingdom ruled for 311 years (358-669), which is ruled by 12 kings. In the Tugu inscription written by Rajadirajaguru Candrabhaga river excavation and trenching along the Gomati River 6112 spears or 12 km by Purnawarman in year 22 of his reign. Not yet known whether for more than three centuries the center of the kingdom settled in one place or move to move, but it is believed that in the area around the Citarum river to the capital (the capital) kingdom. The purpose of this study was to determine the extent to which remote sensing can be used to trace the Tarumanegara Kingdom believed to be in Karawang district, West Java province. The method used is the integration of the study of literature, visual observation of remote sensing and field checks. The study results indicated that, the center of the kingdom (city king) Tarumanegara been located on the banks of the Citarum river Rengasengklok subdistrict of Karawang district. As for the allegations of river candraboga touted connects to the capital (capital) Tarumanegara kingdom by the sea is the River Bungin (according Ongkosongo, OSR. 1984) or Sedati River (by Perum Jasa Tirta II).

Keywords: remote sensing, tracking, Tarumanegara Kingdom

Abstract Id: 124
ROAD EXTRACTION BASED ON UNSUPERVISED CLASSIFICATION AND GEOMETRIC-TEXTURE-SPECTRAL FEATURES FOR HIGH RESOLUTION REMOTE SENSING IMAGES

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The high resolution remote sensing image road extraction for complex scenes is normally performed by using the supervised classification method. However, it is necessary to select samples manually, which leads to the low degree of automation and unstable in the supervised classification. The pixel-based road extraction method often results in the low extraction integrity and salt & pepper noise. The object-oriented approach tends to extract the adjoined non-road area. In order to improve the completeness, the accuracy and the automation degree of road extraction, a road extraction method based on the unsupervised classification and the combined geometric-texture-spectral feature is proposed in this paper. First, the unsupervised classification based on the spectral feature is used to carry on the preliminary segmentation. Since the non-road with similar spectral characteristics of road is easily misclassified into the road, the texture feature classification is also performed to obtain the further road area. Two classification results are combined to get the initial road area. Then a complete set of non-road area filter system is established according to characteristics of roads: the edge filter disconnects the road and the non-road connection; the texture filter filters out large non-road areas; and the shape filter removes the remaining small non-road areas. Finally, the tensor voting algorithm is used to obtain the coherent and smooth road centerline. The high resolution IKONOS and QuickBird city images for complex scenes are chosen to do experiments. In addition, the typical road extraction methods are selected to carry out comparative experiments. The integrity rate, the correct rate and the detection quality are adopted to objectively evaluate the results. The experimental results show that this proposed method can effectively reduce the salt & pepper noise and the adjoining non-road extraction; moreover, it has high integrity rate, high correct rate and high degree of automation.

Keywords: Road extraction, high resolution remote sensing image, unsupervised classification, texture feature, spectral feature

Abstract Id: 125
A THREE-YEAR ANALYSIS OF NORMALIZED DIFFERENCE DROUGHT INDEX (NDDI) AS A MEASURE OF DROUGHT CONDITIONS OF CORNFIELDS IN CAUAYAN CITY, ISABELA, PHILIPPINES

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Drought is one of the most damaging hazards in the world. In the Philippines, drought is traditionally determined using only rainfall data, in which an area experiences below normal rainfall conditions for three consecutive months. However, rainfall data does not directly show soil and plant conditions. This study aimed to use remote sensing techniques in analyzing drought conditions, as remotely-sensed data enables researchers to observe plant conditions which are necessary to assess drought. It utilized the Normalized Difference Drought Index (NDDI), a derivative of the Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI), as a measurement index of corn drought conditions in Cauayan City, Isabela, Philippines from 2014-2016. During this period, Isabela experienced dry spells and droughts as reported by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). One of the most affected industries by these conditions was the corn production with which Isabela is the top corn producer in the country; thus, making it a good study area. For data analysis, a combination of line and bar graph reflected the correlation between NDDI and the Drought Dry-spell Assessment of PAGASA. A bubble graph was also used to show the relationship of NDDI with different timeframes of temperature and rainfall anomalies. Findings showed that the observation timeframe of temperature and rainfall anomalies that best translate drought conditions is three months prior to the quarterly periods

Keywords: drought, Normalized Difference Drought Index, NDDI, Philippines, corn, last three months

Abstract Id: 129
MONITORING FOREST FIRE IN MOUNT BANAHAW, LAGUNA AND QUEZON, PHILIPPINES USING LANDSAT

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Forest fire or wildfire is an uncontrolled fire that occurs in the forest ecosystem destroying all life forms such as plants, animals and land within it. Once it spreads, the actual cause of a forest fire can be unclear. It can be caused by nature itself, or human activities. According to the 1995 Forest Fire Management in the Philippines, forest wildfires in the country are mainly caused by human and no known wildfires are caused by lightning. As of 2010, the country has 7,168 hectares of forest, which is 24% of its total land area. Majority of the forest ecosystem are found in the mountains. The study focuses on Mount Banahaw, a dormant volcano that is within the Mts. Banahaw-San Cristobal Protected Landscape in the provinces of Laguna and Quezon, Philippines. Mount Banahaw is considered a sacred mountain and was a popular hiking destination for mountaineers and trekkers until its closure in 2004 due to stresses cause by human visitors. The study aims to use free Landsat imageries to monitor forest cover change which can be primarily caused by forest fires in the mountain. Furthermore, the study shall make use of different indices such as Normalized Difference Vegetation Index (NDVI) to assess its vegetation. Results of the study shall provide information on forest cover and wildfire patterns within the area that can be useful to decision-makers and authorities in preserving the protected landscape.

Keywords: Forest fire, forest cover, Landsat, Mount Banahaw, Protected Landscape

Abstract Id: 130
Land surface phenology (LSP), especially spring phenology, has been reported as the most effective indicators of climate change, and has been widely estimated from multiple satellite data. It is important to understand how these phenology estimation. In this study, the start of spring phenology (SOS) were extracted from current major LSP products, and were compared to each other and to ground observations. Moreover, MODIS enhanced vegetation index (EVI, 250m) were sampled to 2×250m and 3×250m, 4×250m, ..., 35×250m, and calculated SOS at various spatial resolutions by the piecewise logistic models to examine the influence of spatial scale effects on SOS estimation. Our results indicated that SOS from AVHRRP showed a larger root mean square error (RMSE) (~30 days) compared to other products and ground-based observations. SOS in evergreen forest or sparse vegetation in western and southeastern contiguous United States (CONUS) generally had the larger RMSE than which in other land cover types. Average and percentile approaches generally showed similar results for aggregating SOS as measured at 250m resolution to scale it up to 8km resolution pixels. The standard deviation of SOS across scales in a 35×250m grid (~8km) was less than 1 day and 5 days respectively in about 50% and 70% of area over the CONUS, where the standard deviation was smaller in northeastern than in southern and western regions. 60% regions in CONUS where spatial resolution of images can be larger than 8km when the standard deviation < 20 days, especially in the eastern CONUS. The SOS scaling effect was significantly associated with heterogeneity of vegetation properties.

Keywords: Land surface phenology; Spatial scale effect; Remote sensing

Abstract Id: 132
ASSESSMENT OF ATMOSPHERIC XCO2 CONCENTRATION SENSITIVITY OBSERVED BY SCIAMACHY, GOSAT AND OCO-2

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The main atmospheric CO₂ datasets generated from three satellites observation, SCIAMACHY, GOSAT and OCO-2 have shown the valuable application in detecting spatial and temporal variation at global and regional scales from the year 2003. These CO₂ datasets, however, could be different in the same location and time due to sensitivity of different satellite sensors and CO₂ retrieved algorithms, which is an issue for their application. This paper aims to assess the differences of CO₂ concentrations derived from these three satellites respectively. We collect the CO₂ column-averaged dry air mole fractions (XCO₂) datasets generated and by the SCIAMACHY (referred to as BESD-XCO₂) during the years of 2003-2012, GOSAT (referred to as ACOS-XCO₂) during the years of 2009-2014 and OCO-2 (referred to as OCO-XCO₂) during the years of 2014-2016 respectively. The simulated XCO₂ data by CarbonTracker is used as a compared base. The sensitivities of satellite sensors are evaluated in CO₂ profiles. The CO₂ profiles of BESD-XCO₂, ACOS-XCO₂ and OCO-XCO₂ are converted into the common profile (25 levels) by using a prior CO₂ profile of Carbon Tracker respectively. Comparing difference between the converted and original XCO₂ data, we found that the difference in BESD-XCO₂ presents a significant seasonal cycle with the maximum in June and minimum in December, an amplitude of approximately 0.8 ppm ranging from -0.6 to 0.2 ppm. The difference in BESD-XCO₂ is significantly larger than those from the other two satellite datasets. The difference in ACOS-XCO₂ shows seasonal variation with 0.2 ppm of amplitude which is much lower than that from BESD-XCO₂. The difference in OCO-XCO₂ is less than 0.05 ppm. As a conclusion, the OCO-2 observations demonstrate better than the other two satellites in sensitivity to the a priori CO₂ profiles. We should consider the calibrations of XCO₂ sensitivities for SCIAMACHY and GOSAT.

Keywords: SCIAMACHY, GOSAT, OCO-2, XCO₂, vertical sensitivity

Abstract Id: 135
LAND CHANGE ANALYSIS IN THE LAKE MOST SURROUNDINGS FROM THE SENTINEL-1, SENTINEL-2 IMAGES (THE CZECH REPUBLIC)

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Lake Most (Czech Republic) is an anthropogenic lake, which was created as a project for the reclamation of a former brown coal quarry. The lake does not have a natural surface runoff, and after the complete filling with water it is supposed to be a recreation area as well as its surroundings. During the filling of the lake, however, significant water losses occurred. Obviously, these losses are not due to evapotranspiration. The water leak may be caused by imperfect sealing of the bottom of the lake. Another reason for the lake's leak may be old mining works, which are the remains of the underground mining in this area.

In 2017 a project was launched to find out the cause of water loss from the lake. The project should also propose technical measures to avoid further water losses. The evaluation of data obtained by remote sensing techniques helps to identify phenomena on the Earth's surface (landslides, anomalous soil moisture and other) that may be related to water leakage. For the area of interest analyses, Sentinel-1 and Sentinel-2 data are currently being used. The project is expected to support higher education, consequently. New tutorials focused on remotely sensed image processing are being created. This should contribute to the improvement of the tasks students have to fulfill in the practical part of the subject.

Keywords: coal quarry, InSAR, land change, landslides, water leak

Abstract Id: 136
DESIGN AND DEVELOPMENT OF ICAR GEOPORTAL USING OPEN SOURCE SOFTWARE: A WEB BASED GIS REPOSITORY OF INDIAN AGRICULTURAL INFORMATION


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Growing demand for geospatial data to support decision making in agricultural management using new technologies is increasing worldwide and much efforts is being made in the direction of developing WebGIS based portals using Open Source technologies. Under the aegis of KRISHI project (Knowledge Based Resources Information Systems Hub for Innovations in Agriculture), ICAR decided to develop a Geoportal to act as a repository of all agricultural research information related to different sectors which can be represented as maps and could be made available to all stakeholders on the web. The paper describes the design, development and status of ICAR KRISHI Geoportal. This portal is comprised of three components, (a) a viewer, (b) a catalogue describing the use of geospatial tools, (c) a geodatabase. The spatial layers are prepared from raw data in tabular form provided by various ICAR institutes which they have collected from field surveys and research. The web architecture and user interface were implemented using open source tools and map APIs to ensure the application sustainability with customizable geospatial tools as required by the project stakeholders. The server-tier includes Apache web server, PHP and Geoserver. Geoexplorer having HTML/ CSS tags along with GeoEXT were used to develop all components of web application. PostgreSQL/PostGIS is acting as data warehouse for preparing geodatabase and its management. To ensure the data to reach everyone, a web portal has been set up using Joomla CMS on Linux server and is running successfully on a public domain server in ICAR data-center (http://geoportal.icar.gov.in:8080/geoexplorer/composer/). While developing this framework the parallel goal was to assure the fast speed of access to vast amount of data through distributed agriculture databases and automated live images from IARI satellite ground station from TERRA/AQUA and MODIS Sensor. Developing the agricultural web-portal for India can help the stakeholders in better planning

Keywords: WebGIS, Open Source, PostGIS, GeoEXT, Satellite Data

Abstract Id: 137
ESTIMATION OF DISTRIBUTED IRRIGATION WATER REQUIREMENT OF MULA COMMAND AREA USING REMOTE SENSING

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Irrigated agriculture, which produces two-fifths of the world’s food, competes heavily with other sectors for the already limited water resources. Appropriate planning of water allocations for different sectors is becoming increasingly important given the challenges of already-stressed water resources, climate change, growing population, and potential food shortages. To prepare water management and adaptation strategies, accurate information about water requirement of each sector is very essential. However, traditional techniques of irrigation demand estimation using point based observations have limitation in terms of spatial validity. Recent advancements in remote sensing has paved an avenue of estimating the crop/irrigation water requirement at a spatially distributed scale. Keeping this in mind an attempt has been made in the present study to estimate spatially distributed crop/irrigation water requirement of the Mula command area, Ahmednagar, India, using remote sensing based energy balance approach. Crop acreage mapping of the command area for Rabi season of 2013-14 has been done using temporal IRS-LISS-III images. Twenty scenes of Landsat 8 OLI and TIRS acquired from November 2013 to April 2014, have been used to estimate crop evapotranspiration (ETc) on pixel basis by applying Satellite-based energy balance for Mapping EvapoTRanspiration with Internalized Calibration (METRIC) model. The results showed that, the ETc for Gram, Sugar Cane and Wheat crops in the Rabi season varies from 0.54-2.21mm/day, 0.53-2.58mm/day, and 0.55-2.24mm/day, respectively. Ten daily irrigation water requirement (IWR) of the major crops in the command has been calculated using ETc and taking the value of overall field irrigation efficiency equal to 0.7. Total IWR at the head of main canal of Mula irrigation project has been estimated by considering overall conveyance efficiency of the canal system as 0.8. Total water requirement of Mula command in the Rabi (2013-14) was estimated to be around 371Mm³.

Keywords: Evapotranspiration, Landsat-8, METRIC, Crop Water Requirement, Irrigation Water Requirement, Mula Command

Abstract Id: 138
ESTIMATING THE FOREST STAND VOLUME AND BASAL AREA USING PLEIADES SPECTRAL AND AUXILIARY DATA

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Besides spectral data, the structural characteristics of a forest such as volume and basal area are important factors in forest management. The aim of this study was to improve estimation of some of the structural characteristics of forests (volume and basal area) using (PLEIADES) spectral data and auxiliary data (physiographic, soil and climate) in the Darabkola's forest of Sari, Iran. In-situ data were taken in 144 circular sample plots using simple random sampling design method. Tree information including diameter at breast height (DBH) of all trees within sample plots and height of some trees were recorded in each plot to calculate the stand volume and basal area per hectare. Geometric and radiometric corrections of spectral data were performed on the images. In addition, the auxiliary maps of slope, aspect, elevation, soil pH and texture (through ground sampling and interpolation), precipitation and temperature (through interpolation of climate stations) were prepared from different sources. Digital values corresponding to ground plots were extracted from spectral bands and auxiliary data and considered as independent variables while volume and basal area were selected as dependent variables. Forest modeling was carried out using non-parametric method of random forest (RF) applying 70% of sample plots. The results were validated using 30% of the remaining sample plots. The results indicated that using spectral and auxiliary data caused a 5% reduction in RMSE in comparison to only using spectral data for volume modeling. This value was obtained as 1 to 3% for basal area.

Keywords: Pleiades data; Auxiliary data; Nonparametric methods; Volume; Basal area

Abstract Id: 139
ASSESSING LAND ENCROACHMENTS AND CONVERSION VULNERABILITIES OF RICE FIELDS AROUND URBAN AREAS IN INDIA USING SENTINEL - I AND RISAT-I DATA

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Agricultural land conversion in rural-urban fringes, adversely affects the environment and food production in a region. The aim of this paper is to assess the vulnerabilities of areas under rice cultivation around urban areas in southern part of West Bengal, India. Twelve grid and Single Look Complex (SLC) Sentinel - I dual polarimetric images from January 2015 to October 2016 and four fine resolution (FRS 1) SLC RISAT - I images from December 2015 to February 2016 were used for the study. Rice fields were identified by temporal observation of changes in backscatter coefficients and polarimetric decomposition by m-δ method. Results were verified using ground data collected from 150 locations around the Kolkata and Haora during the growing seasons. Rice fields were identified with an accuracy of 73% for the whole region and 81% around Kolkata and Haora. Areas at the greatest risk of conversion were identified with the help of hotspot analyses (Getis Ord Gi) from Landsat 8 images captured in 2013 and 2015. It was observed that in 2013, about 7% of agricultural lands which were more susceptible to conversion have already been converted to built up areas in 2015. Around 1% of rice fields are at high risk for conversion in the future with a GiZscore of more than 2. Another 37% of rice fields in the region are vulnerable to conversion with a GiZcore of more than 1. Around Kolkata and Haora, 50% of the agricultural lands susceptible to conversion are under rice cultivation. The research presents a picture of the vulnerability of agricultural lands to conversion to other uses in fast urbanizing countries like India. The results presented in this research is useful for agricultural and landuse planning and formulation of policies to bring overall sustainable development of the area

Keywords: RISAT-1, hot spot analysis, polarimetry, land conversion, sustainable development

Abstract Id: 140
INVESTIGATION ON ACCURACY ASSESSMENT OF GNSS SURVEY IN JHARIA COAL FIELD USING VARIOUS PROCESSING PARAMETERS

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The accuracy assessment of Global Navigation Satellite System (GNSS) with various processing parameters has been analysed in Jharia Coal field (JCF) monitoring including Basta-cola, Putki (Kachi Balihari, Bhagabandh and Gopalichak) and Moonidih with a burning issue of land surface deformation due to mining activities. The acquisition of GNSS data has been carried out from fourteen monitoring stations in four phases where data acquisition of base station requires 9 hours and rovers take 20 minutes each during all the phases. This experiment started by data acquisition during first phase on 5th August, 2016 and continued as second, third and fourth phase corresponding on 6th October, 2016, 11th January, 2017 and 17th March, 2017 for the above mentioned study areas. It has been examined by authors that both position and height quality vary from first phase to fourth phase in Single Point Positioning (SPP) as well as precise Ephemeris with SP3 format. However, every point in almost all phases shows enhanced position and height quality during SPP processing except in G7 which provides erroneous results. So mainly first and second phase have provided enhanced position and height quality in the processing of SPP. It has also been shown that SP3 contributes the best result in position and height quality of third phase for almost all measured points. At most of the points, both processing methods for fourth phase remain the same result in position as well as height quality. The comparison of position and height quality between SP3 and SPP has been shown to offer minute changes in each phase. It has been suggested that variation in height and position quality with respect to time are considerable. Remedial majors are required to mitigate the errors in variation of position and height quality during various phases.

Keywords: GNSS, SPP, Accuracy assessment, Jharia Coal field, India

Abstract Id: 141
EVALUATION OF LAND COVER CHANGE IN SUMATERA ISLAND

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Land cover shows the actual form of a terrain which is affected by human activities. Sumatra Island is one of the areas in the Republic of Indonesia which experienced a dynamic land use changes. This study aims to identify land cover changes in Sumatra on 2003, 2009, and 2015. Time series from remote sensing data acquisition allow the analysis of land cover changes. The data used are topography map and medium resolution of satellite images identified by interpretation method. Land cover topography are determined based on general theme in the research area. The most intensive land cover changes are peatland and forest. Peatland is shrinking by 3.56% and forest is shrinking by 0.69%. The land use change has a tendency for plantations, fields, and rice fields. Plantations grew by 2.38%, fields grew by 1.03%, and rice fields grew by 1.42%. This result indicates some rapidly growing activities of plantations and food crop agricultures in Sumatra

Keywords: land cover, topography, interpretation, peat

Abstract Id: 143
COMPARISON OF VALUATION RESULT OF ECOSYSTEM SERVICES DEPENDING ON THE SPATIAL RESOLUTION OF IMAGERY: USING KOMPSAT-3 AND LANDSAT 8 SATELLITE IMAGERY

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Despite the continuing effort to estimate the value of function and services of the ecosystem, most of the studies have used low and medium resolution satellite imagery such as MODIS or Landsat. It means that the studies to measure the ecosystem service value using VHR(Very High Resolution) satellite imagery have not been performed much, while the source of available VHR imagery is increasing. Furthermore, it is a lack of study to compare and demonstrate the impact of spatial scale of ecosystem service valuation using VHR and low-medium resolution satellite imagery.

There is a previous study which evaluates the scale dependency of ecosystem service value using satellite imagery with different ground resolution, however, it seems hard to use VHR imagery because NOAA-AVHRR and Landsat TM imagery were used in this paper. In addition, it was limited to find the common characteristics or correlation as they did not use temporally accumulated dataset, and the result was shown that there is no specific relationship or dependency according to the difference of resolution when they perform the analysis over the mainland of USA.

Thus, the aim of this study is to compare and evaluate the difference of ecosystem service value using KOMPSAT-3 (0.7m GSD) and Landsat 8 (15m GSD) imagery over Sejong City, the new administrative capital of S. Korea. Total 6 scenes (3 scenes for each satellite) will be used for this study, which were collected during spring (March ~ May) in every year from 2014 to 2016. As the multi-temporal images over the same study area will be used to compare the result, it is also expected to find any correlation or common trend depending on the difference of resolution.

Keywords: Ecosystem service value, satellite imagery, dependency of resolution, KOMPSAT-3, Landsat 8

Abstract Id: 144
MODELING OF ELECTRIC DEMAND FOR SUSTAINABLE DEVELOPMENT AND MANAGEMENT IN INDIA USING OF DMSP-OLS NIGHT-TIME DATA

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The nighttime light database provides a good approximation of availability of energy. Over a period of time change in electric power consumption patterns in the country reflect on its socio-economic development and energy utilization processes. Understanding of the spatial distribution of electricity consumption is, thus, most important for infrastructural planning and the projection of energy resource availability in the future. This paper makes an assessment of the Defense Meteorological Satellite Program-Operational Linescan System (DMSP-OLS) nighttime satellite imagery after calibration for modeling the future demand for electricity. It also attempts to examine sensitiveness of electric consumption to gross domestic product (GDP) and population growth. We have constructed a model using night time light data and statistical data sets (1993-2013) of electric consumption, GDP and population growth with regression value of \( r^2 = 0.91 \) The result shows that electric demand is more sensitive to GDP \( (r = 0.96) \) than population growth \( (r=0.76) \) as it is envisaged through correlation analysis. Hence, calibrated DMSP as well as model has provided realistic information on the electric demand with respect to GDP and population, with a better accuracy of \( r^2 = 0.91 \). This skill may help in the management of sustainable development of electricity in future.

Keywords: GDP, Population, Electric consumption per capita, Regression, Fisher Analysis, Remote Sensing.

Abstract Id: 145
TEXTURE BASED CLASSIFICATION OF REMOTELY SENSED IMAGES USING MULTIRESOLUTION METHODS

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Multi-resolution analysis (MRA) has been used in image processing applications of texture based classification and segmentation. Texture analysis is often discussed in image processing domain, but most methods do not exploit the fact that texture occurs at various spatial scales. Often used techniques such as the gray level co-occurrence statistics is limited to altering inter-neighbor spacing and hence does not capture the texture very well. This is particularly true in case of remotely sensed images and therefore it is necessary to adopt a proper model that can overcome the above limitation in order to segment remotely sensed images. Wavelet based MRA showed great effect when dealing with 1D and 2D signals with point singularity features. Wavelets can only capture limited directional information due to its poor orientation selectivity and might not capture enough directional information in remotely sensed images. In order to avoid this shortcoming and process images of high dimension more effectively, curvelet and contourlet transforms are used. This paper explores and proposes a texture based classification scheme using moment based features derived from wavelet, curvelet and contourlet transforms. These features characterize the textural properties of the images and classification is done using minimum Euclidean and Mahalanobis distance to mean classifier. Using these MRA based feature descriptors class separability is defined in feature space and accuracy analysis is done. To evaluate the performance, a simulated image using Brodatz textures and IRS-1C panchromatic (spatial resolution of 5.8m) image of Mumbai city are utilized. This is suitable for texture analysis since its resolution is not adequate to extract individual roads or narrow roads but groups of them render a visible checked pattern in dense urban areas. The results are very encouraging and suggest that the new MRA methods based on curvelets and contourlets for texture analysis can be pursued further.

Keywords: Classification, wavelet, curvelet, contourlet, texture analysis, statistical moments

Abstract Id: 146
TYPHOON EFFECTS ON SEA SURFACE TEMPERATURE AND SALINITY FROM REMOTELY-SENSED DATA

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Temperature and salinity are two major hydrographic parameters of the ocean states. Their fluctuations may affect the ocean circulation and mixing. Typhoons (tropical cyclones) with intense wind and precipitation are notable for inducing strong vertical oceanic mixing over their lifetimes to cause the hydrographic parameters changes. To understand the influences of sea surface temperature (SST) and sea surface salinity (SSS) on the ocean east of Taiwan after typhoons passed by, SSS data collected from spray glider cruises, SST data retrieved from microwave optimally interpolated daily dataset, and daily rain rate data obtained from the Tropical Rainfall Measuring Mission’s Microwave Imager (TRMM/TMI) are employed in this study. The results show that the SST drops more than 1 degree C in the open oceans after typhoon passed by. Nevertheless, the SSS was firstly decreased and then increased. This is caused by the heavy rainfalls of typhoons which reduce the SSS firstly, but then the higher salinity of subsurface water is uplifted to the sea surface by the strong winds.

Keywords: satellite, typhoon, sea surface, hydrography

Abstract Id: 147
Radiometric normalization is necessary to do since the acquired satellite images contain errors due to several factors such as atmospheric effect. For most historical experiments, the associated atmospheric properties may be difficult to obtain even for planned acquisitions. A relative normalization method is an alternative whenever absolute radiances are not required. Key to the relative normalization is the selection of pseudo-invariant features (PIFs), a group of pixels which is statistically nearly-constant over two images in two different acquisition dates. Several methods; e.g. manual selection, histogram matching, and principal component analysis; had been proposed for extracting PIFs. Yet, a spectral inconsistency, a change in pixel's spectral signature before and after normalization, is detected whenever those PIFs extraction methods, associated with a regression process, are performed. To overcome these shortcoming, the commonly used PIFs selection, called multivariate alteration detection (MAD), is utilized as it considers the relationship among bands. Further, a constrained regression is adopted to enforce the normalized pixel's spectral signature to be consistent as possible. These approach is applied to multi-temporal Landsat-8 imageries. Moreover, spectral distance and similarities are utilized for evaluating the consistency of the normalized pixel's spectral signature

Keywords: Spectral consistency, relative normalization, pseudoinvariant features (PIFs), constrained regression

Abstract Id: 148
Solar energy is one of the most sustainable form of renewable energy, both environmentally as well as economically, particularly so for developing countries. India, which has a cumulative installed capacity of 9.23 GW of grid-connected solar power as on January 1, 2017, has set an ambitious target of attaining 100 GW of solar capacity by 2022, which includes 40 GW of grid-connected roof-top solar installations as well. Furthermore, in order to mitigate the ever increasing challenges of resource constrained urban areas in India, 98 cities have been identified under Smart Cities Mission to further their infrastructure development goals with the aid of information and communication technology. These proposed Indian Smart Cities have been encouraged to meet 10-15% of respective energy demand from renewable energy resources, wherein solar energy can contribute significantly. This study, therefore, attempts to estimate the roof-top photovoltaic (PV) potential of these 98 cities. The built-up area of these study cities is obtained from various spatial databases from legacy projects, subsequently updated from LISS-3 images acquired by Indian Remote Sensing satellites. The global (total) horizontal insolation, combining direct as well diffuse component of incident solar energy, is obtained from KALPANA-1 VHRR data for past years. The monthly as well as annual solar insolation over each study city was computed and total roof-top solar PV potential was thus estimated. The study estimates 10.02 GW of grid-connected roof-top PV potential with 103.51 TWh of energy annually in the proposed 98 smart cities of India. The results of the study were further published on a web-portal for wider dissemination and usage.

Keywords: solar energy, solar insolation, smart cities, smart energy, roof-top photo voltaic
Earth Observation based Forest Monitoring and Conservation in Biodiversity Hotspots of South Asia


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Biodiversity hotspots are large regions where exceptional concentrations of biodiversity and plant endemism exists. Biodiversity hotspots have become a tool for setting conservation priorities. The role of earth observation data in biodiversity monitoring was recognized in globally agreed biodiversity targets to be achieved by 2020. Earth Observation data provides unique information on biodiversity with reference to composition, structure, function and disturbance across the scales. This study presents state of art earth observation based analysis for forest biodiversity and conservation in ‘biodiversity hotspots’ of South Asian countries. The spatial indicators of biodiversity derived from multi-temporal satellite data in terms of land cover, forest cover monitoring, forest type area and change, forest fragmentation, fire occurrence and protected area representation was analysed. Forest cover change analysis indicates highest loss (36%) of forest area in Western Ghats-Sri Lanka hotspot followed by Indo-Burma (parts of Bangladesh, Andaman and North East India), Himalayas (parts of India, Nepal, Bhutan, Pakistan and Afghanistan) and Sundaland (Nicobar) over last eight decades. Forest fragmentation had major spatial variation across the biodiversity hotspots. Fire monitoring specifies widespread occurrence of fires in deciduous forests of Indo-Burma and Western Ghats from 2005 to 2016. Analysis for forest cover change from 2005 to 2014 indicates increasing conservation effectiveness in Himalayas, Western Ghats-Sri Lanka and part of Sundaland except Indo-Burma. The results demonstrate ensured long-term continuity of earth observations as a key requirement for understanding of biodiversity change and contribute to achieve sustainable development goals.

Keywords: Forest, Threat, Hotspots, Conservation, Spatial Indicators.

Abstract Id: 150
SEASONAL VARIABILITY OF UPPER OCEAN HEAT CONTENT IN THE NORTH INDIAN OCEAN

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The thermal energy needed for hurricanes and monsoons come from the upper layers of the oceans, but not from the thin layer represented by sea surface temperature alone. Different ocean layers have different modes of variability of the Ocean Heat Content (OHC) due to the ocean-atmosphere interaction that varies with the ocean depth. However, which layer of the ocean has which type of variability is not precisely known due to the non-availability of the in situ measurements at required spatial and temporal scales. Here, we use the OHC estimated using the remote sensing observations of sea surface height anomalies and sea surface temperature estimated at a spatial scale of 0.25 degrees on daily basis and report the OHC variability of the north Indian Ocean during 1998-2014. Daily, monthly, seasonal and annual variations are estimated for the Arabian Sea (AS) and the Bay of Bengal (BoB) separately. Seven layers (surface to 50m, 100m, 150m, 200m, 300m, 500m and 700m) are considered for this analysis. OHC has both temporal and seasonal variations. The OHC values are high in AS compared to BoB for all months at 50m depth and it is reversed at 700m depth. Tropical Cyclone Heat Potential (TCHP), an integral of OHC from surface to 26°C isotherm, has the maximum value in May for both AS, BoB.

Keywords: OHC, OHC variability, TCHP, seasons, north Indian Ocean

Abstract Id: 152
AUTOMATIC CROP PHENOLOGY DERIVATION USING NDVI TIME-SERIES AND ITS DISSEMINATION USING WEBGIS

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Information of crop phenology is essential for crop management. Remote Sensing has been found as one of the consistent and reliable ways for crop phenology estimation. Time series data of various vegetation indices derived from medium and high resolution satellite data are widely used for vegetation monitoring on a global and regional level. Normalized Difference Vegetation Index (NDVI) is one of the popular indices to study the vegetation phenology. NDVI time series is associated with vegetation growth cycles. Using temporal analysis of NDVI series, it is possible to estimate cropping intensity, which is the numbers of crops (single, double and triple) per year in a unit area. Although NDVI data sets are pre-processed to minimise noises due to orbital and sensor degradation, still some noise remains in the data sets, primarily due to varying cloud and atmospheric conditions. This requires filtering of the data. For smoothening NDVI series two filtering methods namely, Gaussian filtering and Fourier Transform filtering algorithm based on harmonic analysis, were applied and compared. Using spatio-temporal analysis of smoothed NDVI series, variations in annual vegetation phenology were estimated. Based on crop cycles at particular pixel location, number of crops is estimated at that location. OCM and Proba-V NDVI data series of one agricultural year over Gujarat is used for carrying out this study.

It was found that Fourier transform based algorithm works better than the Gaussian filter for minimising noise in OCM and Proba-V NDVI datasets. Automated module is developed in python for NDVI smoothening and crop cycle estimation. Web-GIS is a distributed information system which holds the potential to make geographic information available worldwide in cost effective and an easy way. Thus, Final output showing crop intensity in particular period over study area are derived and presented using Web-GIS technology.

Keywords: NDVI, OCM, Proba-V, Crop, WebGIS

Abstract Id: 157
ESTIMATING THE FLYING TRAJECTORY OF TILT UAV PHOTOGRAPHY FROM IMAGE SPACE TO OBJECT SPACE USING IMAGE FEATURES

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To analyze and visualize the environment, optical imagery is one of the great resources to acquire spatial information. In past years, two techniques have been well developed in processing the spatial data, namely photogrammetry and computer vision. No matter which method is adopted, three elements are defined, including the exterior orientation parameters of the camera, the photography, and the ground objects. As for exterior orientations, they can be measured by GPS/INS or estimated via spatial resection with ground control points. However, the optimized space resection may not be able to find the camera exterior orientations due to inappropriate initial values especially for off-nadir imagery. In order to overcome this obstacle, this study aims to utilize the relative translations in image space and transform them into object space by image features, such that initial exterior orientations can be approximated. The result indicates that incorrect matched features would lead to great error prorogation for a sequence of photography with the increased flying path. Hence, a few of ground control points are introduced to improve the accuracy and precision of the exterior orientation parameters. As a consequent, this research provides a novel perspective to approximate the initial camera exterior orientation parameters from image space to object space, and conquers one of the important difficulties toward oblique photography when performing the robust spatial data processing.

Keywords: Off-nadir photography, Space resection, Exterior orientations, Flying path

Abstract Id: 159
EVALUATION OF DROUGHT HAZARD AREA IN AMNAT CHAROEN PROVINCE USING GEOGRAPHIC INFORMATION SYSTEMS AND REMOTE SENSING

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Drought is the phenomenon that impossible to prevent completely, but it can be reduced by analyzing the drought’s historical records. The study uses Geographic Information Systems (GIS) and Remote Sensing (RS) techniques to evaluate the drought hazard areas in the Amnat Charoen province which is located in the most drought region in Thailand. Moreover, 77% of the farm holding land consist of paddy fields. Standardized Precipitation Index (SPI) was calculated to determine the meteorological drought in both temporal and spatial variability using 20 years (1996 - 2015) of monthly rainfall records. The SPI was calculated at the 3-, 6- and 12-month timescales, then generated the spatial maps of SPI at the rate of 3 timescales by using IDW interpolation technique with 30 meters resolution. Normalized Difference Vegetation Index (NDVI) was analyzed to determine the agricultural drought by using surface reflectance with 30 meters resolution from Landsat 5 and Landsat 8 OLI/TIRS. The dates of satellite are then considered based on the SPI results that presented as the maximum drought years. The first three maximum drought years considering based on the SPI results for all 3-, 6- and 12-month timescales are 2010, 2012 and 2015. The extreme drought events mostly affected to the upper parts of this province that covered Senangkhanikhom, Chanuman, Pathumratchawongsa and Mueang districts. However, the satellites data on 2012 are not available. Therefore, the NDVI chose to do most of their area of studies in 2010 and 2015. The results of NDVI in 2015 indicated that the percentages of “Very high” vegetation area have decreased from the year of 2010. A correlation was studied between SPI-3 and NDVI in 2015. The results found out that on the month of January, February and December had the highest correlation because these three months are the offseason of rice farming.

Keywords: Drought, SPI, NDVI, GIS, RS

Abstract Id: 160
SNOW DENSITY RETRIEVAL USING HYBRID POLARIMETRIC SPACEBORNE SAR DATA

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Snow cover is important for global climate system. In regulating the global temperature snow cover plays a significant role. After the snow melts, snow converts in water and is a source of river and reservoirs. Hence proper monitoring of the snow covered areas is required. Snow parameters like snow density, snow depth and snow water equivalent are able to provide proper information about snow pack. This study is focused on retrieval of snow density parameter using hybrid Polarimetric technique. Previous studies for snow density retrieval have utilized the linearly polarized dual and quad pol datasets (Shi & Dozier, 2000; Thakur et al., 2013). Here, utilizing the hybrid polarimetric RISAT-1 dataset snow density parameter is retrieved. The datasets were acquired for the date 24-Feb-2014 in FRS-1 mode. The snow density was retrieved utilizing the theoretical and the modeled parameters. The Integral equation model (IEM) is implemented in this study. IEM model uses the Fresnel reflection coefficients which is the function of local incidence angle and the dielectric constant of the of the snow pack. The output snow density ranged from the 0.05g/cc to 0.50g/cc. Here fresh snow density varies from ranges from the 0.05g/cc to 0.20g/cc. The mean retrieved snow density from the model was 0.26g/cc with the mean standard deviation of 0.1841 and the observed snow density measured from the automatic weather station was 0.28g/cc.

Keywords: Snow Density, Integral equation model (IEM), Fresnel reflection coefficient, local incidence angle

Abstract Id: 162
Landslide is the most common natural hazard in Himalaya that mainly triggered by the earthquake and rainfall. Landslide Susceptibility analysis is the spatial prediction of landslide occurrence based on local terrain condition. In Sikkim, every year occurrences of intense rainfall and earthquake cause landslide and related casualties along different parts of national highways. The present study based on GIS-based probability analysis with Information Value and Frequency Ratio Method. These methods are used to derive the weighted value of causative factors and classes for landslide susceptibility zonation along major roads. Eleven causative factors viz. slope, elevation, aspect, relative relief, land use, NDVI, distance to drainage, distance to lineament, and rainfall used for landslide susceptibility analysis. Landslide Spatial prediction model analyzed the Information value method, and the result shows 6.14% is very high, 21.06% is high, 28.31% is medium, 19.53% is low & 24.96% is very low susceptibility zone. Another analysis of frequency ratio result shows 9.36% is very high, 18.03 % is high, 30.26% is medium, 18.97% is low & 23.38% is very low susceptibility zone. The both methods have predict the probability of landslide susceptibility for the study area. Receiver Characteristic Curve (ROC) for landslide susceptibility are drawn for both the Information Value and Frequency Ratio methods and derived AUC value are found 0.88 and 0.84 respectively. These results suggest that the Information Value method has better performance than Frequency Ratio method in landslide susceptibility mapping. This statistical method ROC curve result validated by field survey and ground truth data used for accuracy assessment of LSZ map. Landslide density curve also prepared for both Information Value and Frequency Ratio methods. These curves show that general trend of the result by indicating a gradual and smooth decrease in the density of the very high susceptibility zone to shallow susceptibility zone.

Keywords: Landslide Susceptibility; Information Value; Frequency Ratio; Co-relation; ROC Curve

Abstract Id: 163
The release of Sentinel-1 synthetic aperture radar (SAR) imagery data opens the path to many new possibilities. Other than its high resolution, the data are provided freely from time to time, make it easy to use as the multitemporal data. With this reason, we use the SAR images from Sentinel-1 to make the change detection in an area of northeast of Iran, including Mashhad and other two cities. Mashhad, the second largest city of Iran which is experienced an earthquake (M 6.1) on April, 2017. Our change detection method is based on the Level set method which used for identifying urban area to see how it changes from the pre-event imagery and post-event imagery. Moreover, we also investigated how seasonal changes affect the area and what kind of changes happened to the agriculture area. The change detection results could tackle the problem of how characteristics or properties of remotely sensed surfaces in the images have changed by the time.

Keywords: Sentinel-1, SAR, Mashhad, Earthquake, Change Detection

Abstract Id: 167
CLASSIFICATION ANALYSIS OF MULTI RESOLUTION SYNTHETIC APERTURE RADAR DATA USING RANDOM FOREST AND SUPPORT VECTOR MACHINE ALGORITHMS

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Accurate and continuous monitoring of forest cover and land use-land cover (LULC) types is essential and useful for climate change analysis. Active SAR microwave systems have huge advantages such as high penetration, all weather capable, multi resolution, different polarization and scattering mechanisms. Further, availability of advanced classification algorithms such as deep learning and data mining techniques makes easy to automate classification and change detection of LULC using synthetic aperture radar (SAR) data. In the present study, we have been used Support Vector Machine (SVM) and Random Forest (RF) supervised machine learning algorithms to classify Advanced Land Observing Satellite (ALOS) Phased Array L-band SAR (PALSAR) data for forest types and LULC classes over Central Indian region. We have used 50 m ALOS-1 and 25 m, 5 m ALOS-2 PALSAR datasets. In addition to HH, HV, and VV backscatter images, grey level co-occurrence matrix (GLCM) textures were derived. Optimal features for classification was selected using SVM recursive feature elimination (SVM RFE) method. In this study we evaluated the classification performances of SVM and RF algorithms for different resolution ALOS PALSAR datasets. The classified results shows that ALOS PALSAR L-band dual polarization 50 m resolution data with combination of GLCM textures using RF classifier produced highest classification accuracy (73.93%, kappa=0.67). ALOS-2 PALSAR full polarization 5 m resolution data produced lowest RF classification accuracy (30.54%, kappa=0.12). The SVM classifier follows the same trend but showed lower accuracy than RF. The present study suggested that medium resolution SAR data is good for forest type and land cover classification. In high resolution SAR image data, miss-classification expected due to speckle noise, single tree covered in multiple pixels cause multiple scattering, multiple incidence angles within the canopy crown diameter. In future studies, we will include polarimetric decompositions with high to medium resolutions to improve classification accuracy.

Keywords: ALOS-2 PALSAR, Classification, Multi-resolution, Random Forest, SVM, Textures

Abstract Id: 168
DETECTION OF STATISTICALLY SIGNIFICANT SPATIAL ANOMALIES IN TEMPORAL TRENDS FROM DISEASE SURVEILLANCE DATA

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In this article, we have studied the temporal trends of various diseases and symptoms reported weekly under Integrated Disease Surveillance Data (IDSP) program. The objective of this study is to analyse the study area to find out the regions where the temporal trend inside the region is significantly varying (Either high or low rate) from that of outside the region. We have analysed IDSP weekly data of Dehradun District, UK (India) for 4 years. After geocoding all the reporting locations and storing in the open source spatial DBMS, we pre-process the data. Then for each disease we have modelled them as poison process under the null hypothesis over the study area. Each reporting location taking as center we create various circular zones around it by increasing its radius. Then for each zone the number of cases reported is calculated as the sum of cases reported for each reporting location which falls under the zone. The zone with maximum likelihood ratio is selected as primary region and subsequent zones are considered as the secondary regions. The p values of the primary and secondary anomaly regions are calculated using Monte-Carlo simulations. We finally bring all the reporting location falling under primary and secondary anomaly regions into GIS environment. Normally the region boundary is represented as the circular window but we have used novel way of representing region boundary as convex hull of reporting locations which falls under that region.

Keywords: Spatial Anomalies, temporal trends, Disease Surveillance, IDSP

Abstract Id: 169
MODELLING FOR SUITABILITY FOREST ROAD ALIGNMENT

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Forest roads play a crucial role in sustainable forest management. The main objective of forest roads are to provide access to the forest for transporting forest products. To assist forest planning and management, existing roads locations in the forest must be mapped and inventoried. However, forest roads inventory is costly and time consuming task as it is mostly done manually. Hence, the use of remote sensing and GIS can be an alternative method to align and locate forest road network by using best-path modelling method. It can help the forest managers to evaluate alternatives and select the optimal location for forest road network in effective way time consuming and in reduce costs. From this study, the main parameters influencing the road construction were identified, i.e. elevation, slope, aspect and river. The 1 metre IFSAR digital elevation model (DEM) data was utilized as terrain data to calculate slope and aspect. Meanwhile, the GIS was used since it is becoming the mainstream tool in forest road network alignment and location analysis. The results showed that the road alignment planning by best-path model has an accuracy of 85% compared to road networks produced by surveyors and thus, it also fulfilled Forestry Department’s standard guidelines. The result was not only associated with forest transportation, but at the same time it is useful to identify risk of road construction to the environment. This revealed that the minimum density of forest road construction can help mitigate the loss of ecological services of tropical forest subject to logging pressure and lead to greater financial benefit in future operations.

Keywords: Forest road, Remote Sensing, GIS, DEM, Best path modelling

Abstract Id: 170
INTEGRATED REMOTE SENSING AND GIS FOR IDENTIFICATION AND EVALUATION OF GROUNDWATER POTENTIAL ZONES IN A SEMIARID REGION OF HARYANA, INDIA

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Groundwater is a very important resource which plays a fundamental role in sustaining living system. The groundwater concerns are growing due to overexploitation of the resource for irrigation and industrial purposes. A systematic planning of groundwater exploitation using modern techniques is essential for proper utilization and management of this precious but shrinking natural resource. With the advent of powerful and high-speed personal computers, efficient techniques for water management have evolved, of which Geoinformatics technology including RS (Remote Sensing), GIS (Geographic Information System) and GPS (Global Positioning System) are of great significance. In the present investigation, remote sensing data, field observations and GIS techniques were collectively applied for the identification of groundwater potential zones in Panipat district of Haryana, India. Different maps were generated using remote sensing and Survey of India (SOI) toposheets and integrated in GIS for the identification of groundwater potential zones. For the study area the groundwater potential zones were further classified into five categories very poor, poor, moderate, good and excellent. This information will be helpful in better planning and management of groundwater resource of semiarid region. The Geoinformatics technology is very efficient and useful for the identification of groundwater potential zones.

Keywords: Groundwater, Geoinformatics, Remote Sensing, Geographic Information System, Semiarid Region

Abstract Id: 171
COMPARISON OF HH AND VV POLARIZATIONS FOR DEFORMATION ESTIMATION USING PERSISTENT SCATTERER INTERFEROMETRY

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Persistent Scatterer Interferometry technique (PSI) exploits time series of interferometric data to estimate deformation over an area. The process involves analysing stable phase pixels from differential interferograms formed with respect to a single master. In this study, eight RADARSAT-2 C-band fine quad polarization images from 2014 to 2016 are used to identify Persistent Scatterer (PS) points and estimate deformation over Vijayawada city in India. With a full graph approach, 29 interferograms are produced. All the interferograms are unwrapped to aid stable deformation estimation. The prime objective of our research is to study the effect of HH and VV polarizations in PS point selection and deformation estimation. Initially, pixels with Amplitude Stability Index > 0.75 are selected as PS points. Later, PS pixels exhibiting temporal coherence > 0.75 are selected for deformation estimation. Before refinement, PS points for HH and VV polarization are identified as 49409 and 48395 respectively, whereas, after refinement, they are 30137 and 40678. Atmospheric Phase Screen (APS) is estimated and removed using inverted residuals approach. After APS removal, mean line of sight (LOS) displacement and velocity maps are generated. A linear model is used to invert displacements into velocities. Velocity obtained using HH polarized data ranges from +17 to -20 mm/year, and for VV it ranges from +15 to -15 mm/year. The spatial trend is linear throughout the observation period except in Oct. 2014. Deformation around this month shows up and down pattern. We attribute this to the devastating Hudhud cyclone that hit the state of Andhra Pradesh in Oct. 2014. Atmospheric variations due to the presence of strong troposphere component varied radar signal delay before and after the cyclone. Excluding this phenomenon, time series plots of selected points showed linear deformation pattern in both polarizations.

Keywords: synthetic aperture radar, interferometry, persistent scatterers, deformation, polarization

Abstract Id: 172
DIFFERENCE OF ATMOSPHERIC XCO2 CONCENTRATION SENSITIVITY OBSERVED BY SCIAMACHY, GOSAT AND OCO-2

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Currently satellite instruments including the Scanning Imaging Absorption Spectrometer for Atmospheric Cartography (SCIAMACHY), the Greenhouse gases Observing Satellite (GOSAT) and Orbiting Carbon Observatory-2 (OCO-2) have been sent into space to measure CO2 column-averaged dry air mole fractions (XCO2). Temporal and spatial differences exists among retrieved XCO2 products derived from these instruments for many reasons including different averaging kernels, which indicates the altitude sensitivity of satellites in retrieving XCO2. This paper converts the level 2 (L2) XCO2 observations of the SCIAMACHY Bremen optimal estimation (BESD), the GOSAT Atmospheric CO2 Observations from Space (ACOS) and the OCO-2 to a common prior CO2 profile (25 levels) by using the a prior CO2 profile of Carbon Tracker, which can correct the difference between these XCO2 observations caused by different response characteristics of sensors. By analyzing these difference between the adjusted and original XCO2 data, we find that, data from SCIAMACHY presents a significant seasonal cycle with a peak-to-peak amplitude of approximately 0.8 ppm ranging from -0.6 to 0.2 ppm. The differences derived from SCIAMACHY XCO2 data are typically larger than those from other two satellite data sets, with the maximum and minimum occurring in June and December, respectively, which corresponds well to the seasonal variation of CO2 absorption caused by vegetation activity in terrestrial ecosystems; the difference for GOSAT also shows seasonal variation with its amplitude(0.2 ppm)much lower than that of differences for SCIAMACHY; the differences for OCO-2 are always less than 0.05 ppm and presents little temporal variation. Therefore, the OCO-2 data performs better than the other two satellite product in sensitivity to the a priori CO2 profiles. This corrected method proposed in this paper can eliminate up to 1 ppm difference between SCIAMACHY-BESD-XCO2 and GOSAT-ACOS-XCO2.

Keywords: SCIAMACHY; GOSAT; OCO-2; XCO2; sensitivity

Abstract Id: 173
ANALYSIS OF DETECTED IMAGE FEATURES FROM DIFFERENT IMAGE RESOLUTIONS WITH THE SURF METHOD

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Developed for computer vision applications, the SURF method is a fast and robust algorithm for local, similarity invariant representation and comparison of images. The SURF algorithm is based on three consecutive steps including feature detection, feature description and feature matching. The scale invariant analysis is usually implemented in the feature based matching. Instead of using Gaussian scale space, SURF algorithm adopts “box-space” to speed up the detection of interest points with the concept of scale invariant. Consequently, the SURF algorithm is often implemented in feature detection with high resolution images to solve time-consuming procedure.

However, the detected results exist some differences in the low and high resolution images in our preliminary research. In our experiment, we choose a pair of stereo images with high resolutions. To analyze the influences of the image resolution, we attempt to investigate the special structure of the box-space which consists of different octaves and layers. In addition, we gradually reduce the sizes of the original images to observe the numbers and the locations of the detected features. At last, we conclude some reasonable explanations for the image resolutions issue and provide the feasible strategy in different image resolutions with the SURF method.

Keywords: Feature Based Matching, SURF, Box-Space, High Resolution Images, Invariant Feature

Abstract Id: 176
Alpine glaciers are dynamic in nature; and are thus seen as sensitive indicators of climate change. The study of glaciers with respect to these changes must be carried out by first mapping the glacier surface facies. This study has attempted to map the available range of surface facies of an unnamed glacier from the Chandra Basin, in the Great Himalayan Range, Himachal Pradesh. The classification of these facies has been carried out using object-based and pixel-based approaches. Conventional glacier facies classification has usually utilized data acquired in the melt season. This study however has endeavoured to map facies on data acquired during early winter. WorldView-2 high-resolution imagery has been used to develop customized spectral indices using the new bands in its multispectral range. Error matrices were utilized to assess the classification accuracies. The object based approach has been found to have an overall accuracy of 88.33%. Two pixel based classifiers were utilized, yielding overall accuracies of 81.67% and 78.33% respectively. The highest kappa statistics obtained for the object based strategy is 0.86 and the pixel based classifiers delivered Kappa statistics of 0.78 and 0.74 respectively. The results clearly indicate that the object based classification is superior to the pixel based classification methods.

Keywords: Object Based Classification, Pixel Based Classification, Customized Spectral Indices, Error Matrices

Abstract Id: 177
SPATIO-TEMPORAL STUDY OF SELECTED ICEBERG CALVING EVENTS IN ANTARCTICA USING LANDSAT DATA

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Calving is the breaking of large chunks of icebergs from glaciers or ice shelves. The alarming rate at which the process is taking place needs a special attention. In this study there were quite a few events that have already taken place and at the same time many that are yet to happen. This paper discusses 3 such calving events in Antarctica using Google Earth imageries and Landsat imageries. The first event is observed in the vicinity of Caird Coast in West Antarctica where a rift is growing wide and long within a very short span of time. Based on Google Earth imageries, the rift has grown from a 22 km stretch in 1984 to 55 km in 2017. The second event is reported in West Antarctica along the Luitpold Coast that shows a rift formed in the year 2013 and has since then showed a steady increase both in terms of length and width. The width has been increasing at the rate of half a km per year. Another rift runs somewhat parallel to the former rift and is around 8km from away. The third event is reported close to Princess Astrid Coast in East Antarctica that took place in the year 2016 which was the result of an ongoing process that started in the year 2009. The calved portion covers an area of around 1 sq.km. This study highlights the effective usage of Google Earth imageries and Landsat satellite imageries for monitoring iceberg calving events in Antarctica.

Keywords: Landsat, Antarctica, iceberg calving

Abstract Id: 178
The present study examines the applicability of standard MODIS algorithms in determining chlorophyll concentration in Malaysian waters. Two MODIS chlorophyll algorithms, OC2M and OC3M were validated using an extensive bio-optical dataset collected on a series of cruises between 2007 and 2015 in two contrasting water types, the east coast of Peninsular Malaysia (ECPM) and Straits of Malacca (SoM). This dataset covers both coastal and offshore waters and collected during different monsoon seasons, with Chl concentration ranging from 0.05 to 14.3 mg m\(^{-3}\). The results of validation revealed large systematic errors in chlorophyll retrievals with both algorithms tend to overestimate in-situ concentrations at low (>0.4 mg m\(^{-3}\)) and high chlorophyll values (>1.0 mg m\(^{-3}\)). The overestimation is more obvious in SoM water with RMS errors and mean relative percentage difference (RPD) of more than 2.0 mg m\(^{-3}\) and 200%, respectively, making these operational algorithms inadequate to be used in this area. Using our large bio-optical dataset, we therefore propose regionally adapted algorithms for accurate retrieval of chlorophyll. The results of comparisons between in situ and satellite data confirmed that our new algorithms perform well and significantly improve the prediction of chlorophyll. Validation using a match up dataset in ECPM showed that chlorophyll estimates agreed well with in situ measurements (rmse ~ 0.11 mg m\(^{-3}\); RPD ~ 25%). In SoM, the regionally-tuned algorithms although revealed significant improvement over their global counterparts, they tend to overestimate in situ chlorophyll (rmse ~ 0.37 mg m\(^{-3}\); RPD ~ 76%). The application of the regionally-tuned algorithm although provides a more accurate estimation of chlorophyll, the presence of two contrasting water types could pose a major challenge for ocean colour observations in Malaysian waters.

Keywords: regional algorithm, MODIS, chlorophyll, South China Sea, Malaysia

Abstract Id: 179
Building extraction from high spatial resolution data is a challenging task in the remote sensing community because of the spectral similarity between man-made objects, such as buildings, roads, and parking lots, in urban areas. This study utilizes two data types, Worldview-3 (WV3) and airborne Light Detection and Ranging (LiDAR), to extract buildings. The main goal of this study is to investigate the capability of these data sources and its effectiveness in fusing both to extract buildings. Different classification approaches, including pixel-based and object-oriented (OO) approaches, were applied to single WV3 and WV3 + LiDAR fused data. The support vector machine (SVM) was used for both classification approaches. Results show that the OO classification accuracies produced from the fused dataset was higher than that of the pixel-based dataset with 96% accuracy. Our findings also demonstrate that the fusion of LiDAR data with high spatial resolution satellite imagery can improve classification accuracy, especially for building extraction. The fusion of LiDAR data can also decrease the effect of spectral similarity between different man-made objectives in urban areas. The results also show that the OO approach has significant potential for building extraction by utilizing the WV3 + LiDAR dataset.

Keywords: high resolution, lidar, optical, buildings, urban

Abstract Id: 180
SHIP DETECTION WITH NDWI IN OPTICAL SATELLITE IMAGERY

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This paper is a continued research effort in ship detection using optical satellite imagery in general and DMC-3/TripleSat imagery in particular, as reported in ACRS 2016. In the previous paper [1], a ship detection algorithm with suitable post processing was presented to overcome difficulties when using optical satellite imagery. The most significant progress in this work is the use of the Normalized Difference Water Index (NDWI), which is derived from the green and the near-infrared spectral bands. Shorelines are still used to mask out land areas, and NDWI is used additionally to extract objects in water bodies. This is a much more robust approach than solely using pixel intensities as in [1]. The extended use of DMC-3/TripleSat imagery for deriving NDWI in this work is also a proof for its superior radiometric properties. Another progress in this work is the determination of the moving directions of ships. This is achieved by inferring ship heading from the trailing wakes. Wakes exhibit distinct features in images as well as in NDWI values, and detecting wakes alongside ships needs more elaborate procedures. Even though the shapes of wakes can be extracted, deriving ship speed from wakes is a challenging task and is not a goal of this paper. In the research literature, there are numerous reports on using NDWI for ship detection using optical satellite imagery. Majority of these reports demonstrated the effectiveness of using NDWI in ship identification. This paper represents a comprehensive approach to the problem in large-scale automated productions using DMC-3/TripleSat imagery.

Keywords: NDWI, optical ship detection, wake detection, TripleSat

Abstract Id: 182
ASSESSING LEAF SCALE MEASUREMENT FOR NITROGEN CONTENT OF MULTI-AGES OIL PALM USING DATA MINING APPROACH

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Nitrogen (N) is a crucial element in sustaining oil palm production. However, assessing N status of tall perennial crops such as oil palm is complex and not as straightforward as assessing annual crops, due to complex N partitioning, age, and larger amounts of respiratory loads. Hence, the objectives of this study were to evaluate the potential of spectral measurements obtained from different spatial scales levels and machine learning approaches as a rapid tool for quantifying multi-ages oil palm N status. This study involved assessing the performance of discriminant analysis (DA) and support vector machine (SVM) classifiers for discriminating spectral bands sensitive to N sufficiency levels and comparing the predictive accuracy of DA and SVM of spectral data obtained from the leaf measurements for classifying oil palm N status. The experiment was conducted on immature Tenera seedlings (13 months old) and mature Tenera palm stands (9 and 12 years old) that were arranged in Randomised Complete Block Design (RCBD) with treatments varied from 0 to 2 kg N. Generally, the discriminant function of both classifiers were age-dependent. A clear trade-off between the classifiers’ number of spectral bands and their accuracies was observed; the DA with a larger number of optimal spectral bands could discriminate N sufficiency levels of all maturity classes with higher accuracies compared to the SVM, yet the latter could produce reasonable accuracies with a lesser number of spectral bands. Nitrogen status of all maturity classes could be classified satisfactorily with SVM (71 to 88%) via the satellite-simulated blue and green bands, signifying the possibility to develop spectral index or an N-sensitive sensor for oil palm.

Keywords: Nitrogen; machine learning; oil palm, nutrition status.

Abstract Id: 183
ACCURACY ASSESSMENT OF RADARGRAMMETRY DEM DERIVED FROM RADARSAT-2 WIDE MULTI-LOOK FINE MODE

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Digital Elevation Model (DEM) can be generated using terrestrial surveys, remote sensing technique, and digitizing of topographic maps. However, remote sensing methods are superior to conventional methods as they are faster and more economical especially for wide coverage area. The advantages of using stereo Radarsat-2 images to generate DEM are wider coverage, able to penetrate cloud and better resolution. The aim of this study is to generate medium resolution DEM from Radarsat-2 Wide Multi-Look Fine Mode stereo data by using radargrammetry method and evaluate the accuracy of the generated DEM. Stereo pair Wide Multi-Look Fine Mode images MF22W and MF5W over an area in Perak, Malaysia from ascending orbit, single polarization HH, in SGF format were used. The image pair were acquired dated on the 12th and 22nd February 2013 with view angle 31.3° to 36.6° and 44.3° to 48.3° at the near-far edges, respectively. Well distributed Ground Control Points (GCP) were observed to triangulate the stereo model for absolute orientation process. DEM elevation accuracy was evaluated by using Check Points (CP) and the root means square error (RMSE) of 8.9 metre. In addition, elevation profile analysis were also compared between Differential Global Positioning System (DGPS) road tracking points and the result showed closely match which is represent close disparity between the generated DEM and the DGPS tracking points.

Keywords: Radarsat-2; Radargrammetry; DEM

Abstract Id: 184
DAM SUBSIDENCE MONITORING USING THE REMOTE SENSING TECHNIQUE.

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In this study we have selected the Pong Dam, also known as the Beas Dam. This is an earth-fill embankment dam on the Beas River in the state of Himachal Pradesh, India, just upstream of Talwara. Construction on the dam completed in 1974. At the time of its completion, the Pong Dam was the tallest in India. We applied the satellite based PS-InSAR technique to monitor the subsidence at dam and surrounding area. PS-InSAR technique is well known for its various application across different field for monitoring the deformation on the surface. ENVISAT ASAR, a C-band SAR sensor’s data has been used to carry out this work. We have used 15 images acquired by the European Space Agency over the study area during the 2003 to 2008. Since the area is mainly urban with permanent structure we able to get the high density of the permanent scatter candidate. Our study shows the main body is fully stable. We could only record the seasonal deformation of around 5-6 mm at main body. This amount of the deformation can be caused by the pressure generated by the amount of water in the dam at given time. We also able to find a faster rate of deformation close the dam which need to be investigated fully. There are certain body which show a rate of 10-20 mm a year. Verification of the rate of deformation have also been carried out using the Sentinel-1 data. We have used the 20 images acquired by Sentinel-1 satellite. These images were acquired during 2015 to 2017 which again validated the result of ENVISAT data. A complete study with multiple sensor data will be able to provide the more insight of stability of the dam.

Keywords: PS-InSAR, dam, Sentinel-1, deformation

Abstract Id: 187
In this study, an Artificial Neural Network (ANN) based modelling has been done to estimate daily Sea Surface Temperature (SST) using Moderate Resolution Imaging Spectroradiometer (MODIS) Aqua datasets. A feed-forward Back-Propagation Artificial Neural Network (ANN-BP) model was implemented in this work. This ANN based SST model was then trained and tested over the Arabian Sea for 10 years using MODIS data and in-situ reference data collected by CERSAT from Coriolis data centre. The application of the tested model requires only the reflectance of bands 31 and 32 at 11 and 12 µm as inputs. The obtained results were compared and analysed with the standard MODIS SST product as well as the reference data. Preliminary analysis of the obtained results show that the proposed ANN based technique is in good correlation with the above two datasets. The obtained results suggests that the machine learning techniques such as ANN has good potential and should be explored in detail for estimation of SST at both near shore and offshore waters.

Keywords: MODIS, SST, ANN

Abstract Id: 188
SELECTING OPTIMAL PARAMETERS OF SLIC SUPERPIXELS BY USING DISCREPANCY MEASURES

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Superpixels are homogeneous image regions consisting of spatially associated pixels. They produce meaningful image objects (segments) and provide less computational time for image processing tasks. Recently, the use of superpixels has become a popular research agenda in computer vision studies. Nevertheless, the operation of superpixel segmentation appears to be at a limited level in object based image analysis (OBIA). Segmentation that aims to partition an image into homogenous regions is the first and most critical step of OBIA. There are many segmentation algorithms that utilize various parameters to control characteristics of output segments. However, selecting optimal parameter combination is a long-term and tedious process. In many studies, optimum parameter values are determined by discrepancy between a reference polygon and a corresponding segment as a segmentation evaluation criteria of image. In the ideal case, the expected situation is that over-segmentation and under-segmentation should be at a minimum level to achieve high-quality image segmentation. In this study, the effectiveness of Simple Linear Iterative Clustering (SLIC) superpixel segmentation algorithm was evaluated using varied parameter values for the generation of consistent image objects for land cover classes. Based on the discrepancy between reference polygons and corresponding image segments, the ideal combination of SLIC parameter values were determined. In this context, five segmentation discrepancy metrics namely under-segmentation, over-segmentation, potential segmentation error (PSE), number-of-segments ratio (NSR) and Euclidean distance 2 (ED2) were applied through the manually digitized reference polygons to evaluate the segmentation quality of SLIC superpixels. A Worldview-2 and Quickbird-2 images of Turkey were used in the case study and four superpixel sizes (5x5, 10x10, 15x15, 20x20) were evaluated. Results show that superpixel sizes of 10x10 pixels produced the highest accuracy to identify optimal combinations of parameter values.

Keywords: SLIC, Segmentation, Superpixel, OBIA, Discrepancy Measure

Abstract Id: 191
PRELIMINARY REPORT: AN INTERDISCIPLINARY APPROACH TO EVALUATING REGIONAL METHANE EMISSIONS FROM RICE PRODUCTION IN THE MEKONG DELTA

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Over one year, a substantial amount of rice straw was incorporated into paddy soils under continuously flooded conditions, encouraging a large amount of the greenhouse gas methane (CH₄) to emit from anaerobic soil bacteria in the triple rice-cropping system of the Mekong Delta. This study was conducted to establish a continuous spatiotemporal evaluation methodology for delta-wide emissions, which is essential to the scientific support for decision-making pertaining to sustainable delta-management policies. Six delta villages (one in Can Tho city, four in An Giang province and one in Soc Trang province), all residing on different soil types (alluvial, acid-sulfate and coastal regosol), were chosen for the study sites. At each study site, representative farmers’ paddy fields (6 to 18 in each village) that applied different water and straw management were monitored continuously for 1 to 5 years (2009 - 2017) to collect CH₄ flux field data (at least once a week), field water levels (at least once a day) and cropping information. With the field water level data and cropping calendars (e.g. sowing/planting dates and harvest dates), ALOS-2/PALSAR-2’s quadruple observation datasets (29 scenes; 20 November 2015 - 26 October 2016) were applied to supervise classification analysis for flooding and non-flooding paddies. After applying this field data to hierarchical Bayesian modeling, estimation models were built for daily/seasonal CH₄ emissions from remote sensory parameters (e.g. field water regime, days after sowing; logarithm values of daily fluxes: R²=0.34, n=16,551; seasonally cumulative values of the fluxes: R²=0.61, n=588). Support-vector-machine supervised classification with the field data and the three components computed by Freeman-Durden decomposition elucidates the hyperplane threshold of classified flooding and non-flooding paddies, irrespective of days after sowing (i.e. rice-growth stages). Sensor-fusion analysis of continuous long-term Advanced-Microwave-Scanning-Radiometer-2 datasets and higher temporal-resolution datasets from ALOS-2/PALSAR-2’s SCAN-SAR mode data is being analyzed in order to integrate these satellites’

Keywords: rice, methane, flux measurement, remote sensing, MRV

Abstract Id: 194
STUDY ON THE APPLICATION OF WINTER WHEAT INFORMATION EXTRACTION IN COUNTY SCALE BASED ON DOMESTIC HIGH SCORE IMAGES

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Satellite remote sensing technology can monitor the growth of crops in a rapid, accurate and large area. The monitoring of multi-temporal remote sensing can overcome the shortcomings of single-phase remote sensing monitoring, which can realize the dynamic monitoring of crop growth changes. Based on Gu'an County, Hebei Province, the two-stage satellite remote sensing images of tillering and heading dates in the same growth cycle were selected (November 2014, Resource No. 3 satellite imagery and April 2015 GF-2 satellite images) to study on spectral information recognition and planting area extraction. Firstly, based on the analysis of the spectral information of the two-satellite images, the normalized difference vegetation index (NDVI) images of the two images were extracted and the NDVI thresholds of the two images were statistically analyzed. The NDVI thresholds of wheat in two periods were obtained. Secondly, the NDVI threshold and random forest classification were used to extract the winter wheat areas from two original images, and two crude images were obtained. Because of the different growth of wheat, the threshold is not accurate, each period has some omission, therefore, making the two period planting areas transformed into vector graph and complement each other. That is, combining the vector information of the two periods into one. Then, using the field measurements information to correct the result, ensuring that eliminating the non-wheat area which is less than a certain area from the attribute table, and ultimately get more accurate wheat planting area and vector distribution. The results showed that the area of winter wheat was 652.80 hectares, and the actual measurement area of the scientific research unit is 686.91 hectares, with an accuracy of 93.58%. The results show that the planting area of winter wheat can be extracted more accurately by using the method of remote sensing data synthesis in different phases, which is better than that of single-phase remote sensing data, and the aim of extracting high-precision winter wheat area is realized.

Keywords: Multi temporal; winter wheat; RandomForest; area extraction

Abstract Id: 195
INTEGRATED APPROACH FOR IDENTIFICATION OF GROUNDWATER POTENTIAL ZONE IN HARD ROCK TERRAIN

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El Nino phenomenon in Malaysia prolonged dry seasons resulted the decrease of surface water resources. As an option, groundwater has been identified as an alternative to reduce the impact of the water shortage. The immediate of groundwater potential zone need to be identified. The advantages of Remote sensing and Geographical Information System (GIS) technology is proven to identify groundwater potential zone more accurate, faster and cost effective as compared to conventional method. Geologic feature such as lineament which related to occurrence of groundwater can be visually extracted from remote sensing images. The aim of this study is to identify the groundwater potential zone in hard rock terrain using remote sensing and GIS. The study area was selected in the state of Negeri Sembilan, Malaysia. Multi sensors remote sensing, Landsat-8 and SPOT 6/7 images were used to extract land use and geological information and analysed through GIS environment to produce groundwater potential zone. The groundwater potential map was compared with boreholes data, the results shows the yield of boreholes were match with groundwater zone. The groundwater potential map was categorised into three zone namely high, moderate and low based on the possibility of groundwater aquifer. As a result, 22% of the study area was categorised as high, 23% moderate and 55% low potential zone.

Keywords: Remote sensing; GIS; groundwater; lineament

Abstract Id: 197
Damage assessment is an important issue in emergency response and recovery after the occurrence of nature disasters. In this regard, satellite remote sensing is recognized as an effective tool for detecting and monitoring affected areas. Since SAR sensors can capture images not only at daytime but also at nighttime and under cloud-cover, we used multi-temporal high-resolution TerraSAR-X images to detect the changes of urban areas in Kathmandu, the capital city of Nepal, which was severely affected by the 2015 Gorkha, Nepal, earthquake on April 25, 2015 with Mw 7.8. It caused the collapse of many buildings including those in Kathmandu Durbar Square. TerraSAR-X images obtained before and after the earthquake were utilized for calculating the difference and correlation coefficient of the SAR backscatter, within the layover area of a large building in order to extract severely damaged buildings in the central Kathmandu. The affected areas were identified by high values of the difference and low values of the correlation coefficient. The pre- and post-event high-resolution optical satellite images were employed as ground truth data to verify our results. As the result, the correlation coefficient was found to be the most suitable index to identify severely affected buildings. So we used correlation coefficient in order to create rapid preliminary damage maps that can be used in emergency response times.

Keywords: TerraSAR-X, building damage assessment, rapid damage mapping, 2015 Gorkha earthquake

Abstract Id: 198
THE TOUZI DECOMPOSITION FOR A UNIQUE AND POLARIZATION BASIS INVARIANT DECOMPOSITION OF TARGET SCATTERING USING POLARIMETRIC SAR

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The objectives of target decomposition theory is to express the average scattering mechanism as the sum of independent elements and to associate a physical mechanism with each component. Two categories of incoherent target decomposition (ICTD) can be distinguished; the model-based decompositions (MBD) firstly introduced by Freeman and Durden in 1998, and the eigenvector based decomposition (EVBD) introduced by Cloude and Barnes in 1986. The Freeman MBD assumes that target scattering can be modeled as the linear sum of surface, double-bounce and volume scattering. Since that, many MBDS have been introduced as an extension of Freeman’s decomposition with various target scattering models. As a result, MBD cannot lead to a unique scattering decomposition, since the latter depends on the a-priori scattering model used as the basis of the MBD. Even though EGVB is supposed to lead to a unique scattering decomposition. Many EGVB decompositions have been popular; such as the Cloude-Pottier, Van Zyl, Touzi, and Palladini decomposition. In this study, the Touzi decomposition is presented as the synthesis of more than 50 years research in polarization optimization theory (Kennaugh-Huynen, Graves, Boerner, Cloude-Pottier, Barnes, Cameron, …). It is shown that the Touzi decomposition is the only EVBD that leads to a unique and polarization basis invariant scattering characterization. The multi-resolution Touzi decomposition, which permits a unified decomposition of both coherent and partially coherent target scattering, is also presented. Polarimetric C-band RADARSAT-2 and L-band ALOS are used to demonstrate the key information provided by the Touzi decomposition for various applications; urban mapping, peatland subsurface hydrology monitoring, and discontinuous subsurface permafrost mapping Northern Canada. It is shown that the excellent design of both SAR missions, with low noise floor, is important to fully exploit the added value of polarimetric SAR information in support of key applications of low HV backscattering.

Keywords: Polarimetry, Synthetic Aperture Radar, peatland, urban, permafrost

Abstract Id: 199
Tropical forests play important roles on global climate and biodiversity. The Moderate Resolution Imaging Spectroradiometer (MODIS), with high temporal resolution, provide a useful tool to study tropical forest dynamics, including seasonality and inter-annual variation. However, optical satellite data have cloud, aerosol and bidirectional reflectance distribution function (BRDF) effects, that create uncertainty in tropical forest studies. In the Amazon, some researchers demonstrated the difficulties in separating true forest dynamics from BRDF artefacts and seasonal cloud and aerosol influences. Lastly, optical reflectance saturation in dense tropical forests may restrict the retrieval of phenology information. In this study, we investigated the impact of BRDF effects on MODIS vegetation indices (VI) in Southeast Asia (SEA) tropical forests, the least studied area compared to other major tropical forests (South America and Central Africa). Moreover, unlike Amazon tropical forests, VI seasonality in SEA forests is not synchronous with sun-sensor geometries. We used 10-year data of daily MODIS BRDF (MCD43A1) collection 6 product, a kernel-driven model product that allows us to retrieve VI values for a range of fixed solar zenith angles (SZA). We compared these with the standard VI products (MOD13A1, MYD13A1) to analyse BRDF influences. The results show significant BRDF effects in all forest sites, including intact and disturbed forest sites. Generally, smaller SZA yielded higher VI signals in intact forests with mixed effects over disturbed forests. We found tradeoffs between VI robustness to BRDF effects and saturation that impacted upon the retrievals of phenology parameters as well as assessment of inter-annual variations and trends.

Keywords: MODIS, forest, BRDF, vegetation index

Abstract Id: 200
INVESTING IN DISASTER RESILIENCE: RISK TRANSFER THROUGH FLOOD INSURANCE IN SOUTH ASIA

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Protecting against floods and providing risk cover against losses due to floods has been a major area of concern for the governments around the world. Insurance is an important component in managing agricultural risks from these disaster events. In India, nearly 30 million smallholder farmers are affected by floods every year. For example, Bihar with a population of 100 million, 80% of whom living below the poverty line and mostly depended on agricultural sector lost between 0.5 to 120 million USD to floods every year. While in the agricultural sector, flood insurance is often included as a peril in Multi-Peril Crop Insurance (MPCI), flood insurance so far is not offered as a standalone insurance product in the agriculture sector anywhere in the world. Given the recent experience with designing and implementation of index based insurance products such as Weather Index Based Crop Insurance (WIBCI), an index based flood insurance (IBFI) product with similar features appears most appropriate for insuring crop losses due to floods. In 2016, IWMI launched its Index-Based Flood Insurance (IBFI) for India and Bangladesh, which is designed to safeguard farmers in locations at high risk of flooding. IBFI combines hydrological modelling and new and freely available high-resolution satellite images from ESA and USGS. Rainfall data for the relevant catchment is added to the model, which shows how runoff will travel and collect. If a trigger level is reached (calculated using 35 years of hydrological data), satellite images are used to verify the depth and duration of the flood. This accurately identifies the farmers that are eligible for compensation. We are testing a subsidized public-private partnership business model at micro level, where individual farmers buy the insurance, and also at meso level, where a group of farmers is insured jointly and receives subsidy support from the government.

Keywords: natural disasters, flooding, risk transfer, satellite images, IBFI, India

Abstract Id: 201
Terrestrial LiDAR systems (TLS) play a significant role in forest inventories to extract inventory parameters (e.g. tree position, diameter at breast height (DBH), tree height etc.), as they capture accurate 3D information at rapid speed. Though obtaining 3D point clouds over an area is relatively easy, extraction of parameters requires complex analytical solutions due to large data sizes and memory intensive computations. In the current study, we aim to design and develop a semi-automated method to isolate individual trees for parameter extraction and further 3D modelling studies using supervoxel based graph-cut segmentation. Multiple scans acquired over the study area have ensured less occultation for tree characterisation. Scans are co-registered and then normalised by automatically delineating digital elevation model (DEM). The co-registered scans are then sliced 1.3m with a width of 20m, to identify tree boles manually. At the each identified tree bole all points inside within the cylinder of 4m radius (found optimal for the study area) are extracted. The extracted point cloud is converted to supervoxels to reduce the processing time. Supervoxels centroids are used to detect foreground and background seeds of the interested tree bole for the graph-cut segmentation algorithm. An undirected weighted graph is used to segment the points into foreground (interested tree) and background by minimising the cost function based on spatial adjacency and distance of the supervoxels. Finally, the inventory parameters of the detected tree are extracted and validated with the field observations. Algorithm is tested over Central Indian Forests for both dry and green season to ensure the robustness due to interference of crown canopy. The results show that the method is efficient and robust for extracting individual trees from TLS point clouds with relatively higher accuracy (>90%).

Keywords: Forest Inventory, Terrestrial LiDAR, Individual Tree, Supervoxel
APPLICATION OF REMOTE SENSING TECHNIQUES IN GEOLOGICAL INTERPRETATION AND MAPPING OF ALTERATION ZONES BY USING ASTER L1T DATA: A CASE STUDY IN PARTS OF WESTERN BASTAR CRATON (WBC), CHANDRAPUR DISTRICT, MAHARASHTRA, INDIA

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The area under study area falls in the Western Bastar Craton (WBC) and is known for its basemetal mineralisation. This area exposes rocks of Archaean Supracrustals of Sukuma Group, Amgaon and Bengpal gneiss and Dongargarh granites. The Gondwanas are followed upward by the occurrence of Lametas made up of limestones, marls and clays. Near Thanewasana village basemetal mineralisation is confined to en echelon dilatational quartz-chlorite-barite veins in a brittle-ductile shear zone. The host granitoid also shows regional sodic alteration during the development of the shear zone. Mineralization occurs as disseminations, stringers and veins, with a structural control (along fracture and shear planes). Mineralization was further enriched due to remobilization during reactivation of faults. A convolution filtering involving directional filter of different kernel, in N-S, NE-SW, E-W and NW-SE direction was applied to enhance the lineaments of the study area. Most of lineaments corroborate with major crustal fractures of Central Indian Tectonic Zone (CITZ). Some of the lineament which manifests as quartz reef vis a vis N-S trending Aksapur lineament and NW-SE trending Ghot-Chamursi lineament were validated in the field and were found to contain minor sulphide mineralisation. The Composite Colour Map, PCA and Band ratio images, has brought out several interesting features and alteration zones in the area. The alteration zones are restricted mainly to NNW-SSE trending brittle-ductile shear zones. Sulphides and baryte in the area are associated with hydrothermal alteration dominated by K-Na alteration, chloritization, argillic alteration and silicification. Spectral signature of rocks (altered and unaltered) were collected in lab condition by the ASD Spectro-radiometer to record the diagnostic absorption features in the altered rocks/ minerals. In the present study it has been found that digital image processing techniques by using ASTER L1T data, serves as an effective tool in the identification of lineament fabrics and alteration zone.

Keywords: Thanewasna shear zone, band ratio, alteration zone, ASTER

Abstract Id: 206
AN IOT BASED REAL TIME LEAK DETECTION FOR WATER PIPELINE NETWORK BASED ON A GIS FRAMEWORK.

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Water is the basic need for all the humans. Most of the water pipeline networks are underground which leads to a lot of water leakage and difficult to detect leaks leading to deficiency of water. So there is an urgent need to detect leaks to avoid wastage of water. Recent times have witnessed an increased interest in the development of sensors including integration with GPS sensors. Advances in sensor technology have enabled to measure the flow parameters automatically without any manual work done by human. Sensors are used almost everywhere, and it can be used in our current problem of leak detection in water pipeline network. This paper presents a GIS based application for leakage detection using IOT. It is aimed at developing an application that constantly monitors the water network with the help of the electronic sensors. Smart water meters are a form of IoT, technology which can basically perform 3 tasks - to monitor the status of physical objects; to capture meaningful data; and lastly able to communicate that data over a wireless network to a computer for software/application to analyze in real time and help determine if there is any leak in the network. This represents an operational tool for water pipeline leak detection. The key approach to do this is to first calibrate all the parameters at equilibrium condition and then use the sensor to detect leak in the network given. It is a batch process where the sensor data is provided at frequent interval and at each interval the network is verified to find if there is any leak in the network. The application is tested on a water network with sensor data available at every 15 min to check accuracy of the algorithm to find leaks in the network and display it over GIS application.

Keywords: Water pipelines, IOT, GIS network, Leakage detection, Hardy Cross

Abstract Id: 207
DEVELOPMENT OF HYPERSPECTRAL IMAGING SYSTEM FOR COASTAL ZONE STUDIES

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Seagrass and seaweed beds play very important ecological roles such as spawning, nursery and feeding grounds for many marine organisms. Coastal zone monitoring of seagrass and seaweed beds is indispensable for their conservation. Although satellite data are used for coastal zone monitoring, atmospheric effects on the satellite data degrades classification of habitats. Low altitude observations using UAV can avoid such atmospheric effects. Hyperspectral image data are a powerful tool for detection of seagrass and seaweed beds. Thus, we develop a hyperspectral imaging sensor and a UAV as a platform of the hyperspectral sensor for habitat mapping in coastal areas, especially, mapping seagrass and seaweed species. The hyperspectral imaging sensor developed by this study is designed to be light weight for payload and low cost for wide use. The sensor scans an area and acquires data using optical fibers and swing mirror. Spectral data of a target ground or sea-surface are gathered at one side of optical fibers bundle. At the other side of optical fibers bundle, the spectral data are sequentially sent to optical fibers, which connected micro-spectrometer, by the swing mirror. The swing mirror is controlled by a stepping motor and the swing speed of the mirror is variable. Maximum eight micro-spectrometers manufactured by Hamamatsu Photonics are prepared. Each micro-spectrometer is connected optical fiber. One micro-spectrometer is used for sky light monitoring, and the other micro-spectrometers are used for spectral data of target earth surface. The total weight of the hyperspectral image sensor is less than 3kg. We are developing two types of UAV as the platform for the hyperspectral imaging sensor. One is an unmanned airplane with fixed wings and other is a multicopter type drone. We planed the unmanned airplane for the large area survey and the multicopter for the sea truth data at small area.

Keywords: Hyperspectral imaging sensor, UAV, Low altitude observation, Coastal zone studies

Abstract Id: 208
UAV PHOTOGRAMMETRY FOR 3D MAPPING - A CASE STUDY IN VIETNAM

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Digital Elevation Model (DEM) is a crucial input for many geography model and analysis, especially landscape metric assessment. UAV mapping started using in Vietnam recently deriving DEM and Digital Surface Model (DSM). However, it is still lack of technical study on fundamental of UAV photogrammetry and UAV photo processing. The flight parameters such as flight height, flight orientation, image overlapping, capture angle, image resolution are key factors effect on the derived outcome. In this study, the two UAV photo capturing approaches, object oriented and crossing grid attempts, will be compared and discussed. Results showed that each flight and capture mode has its own pros and cons. Object oriented flight is proper when a particular interested target is set in the field, while crossing grid flight is suitable for making DEM/DSM in a larger area with multi-landform. It is also indicated the possibility of deriving high accuracy orthophoto map with RMS less than 15cm. This is a worthwhile option allow using UAV photos in monitoring natural resource, agriculture crops, and assessment of landscape at finer scale.

Keywords: UAV photogrammetry, 3D mapping, remote sensing

Abstract Id: 209
A GIS-BASED LANDSLIDE SUSCEPTIBILITY ASSESSMENT USING ANALYTICAL HIERARCHY PROCESS IN TALOMO WATERSHED, DAVAO CITY, PHILIPPINES

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The main goal of the study was to produce a landslide susceptibility map for the Talomo Watershed located at Davao City, Philippines. Six different conditioning factors were considered, namely: aspect, elevation, slope, soil type, land cover, and rainfall. The Analytical Hierarchy Process (AHP) method was used to acquire weights of factors and their classes respectively. Three experts were consulted and acceptable consistency ratio (CR) value was achieved for each AHP matrix. Datasets were combined by Geographic Information System (GIS) spatial analysis techniques and a landslide susceptibility index map of the study area was created. Jenks natural break classifier was used to classify LSI map to low, moderate, high, and very high landslide susceptibility. Based on the produced landslide susceptibility map, very high susceptible zones cover about 10% of the total area while about 13% was classified as being highly susceptible, 9% as moderately susceptible and 69% of the study area was marked as low susceptible.

Keywords: Analytical Hierarchy Process (AHP), Geographical Information System (GIS), Land Susceptibility, Watershed, Philippines

Abstract Id: 211
MAPPING ALTERATION ZONES IN INACCESSIBLE REGIONS USING TARGET DETECTION ALGORITHMS TO SWIR BANDS OF ASTER REMOTE SENSING DATA

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In this study, the application of shortwave infrared (SWIR) bands of Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) data was investigated to extract geological information for alteration mineral mapping in inaccessible regions. The Oscar II coast area in the north-eastern Graham Land, Antarctic Peninsula (AP) was selected for this study to conduct a satellite-based remote sensing mapping technique. Target detection algorithms such as Constrained Energy Minimization (CEM), Orthogonal Subspace Projection (OSP) and Adaptive Coherence Estimator (ACE) were tested to ASTER shortwave infrared bands for detecting spectral features attributed to alteration mineral assemblages at district scale. Sub-pixels abundance of spectral features related to Al-O-H, Fe, Mg-O-H and CO3 mineral groups were detected using SWIR datasets of ASTER with little available geological data for poorly mapped regions and/or without prior geological information for unmapped regions in northern and southern sectors of Oscar II coast area, Graham Land. Fractional abundance of alteration minerals such as muscovite, kaolinite, illite, montmorillonite, epidote, chlorite and biotite were identified in alteration zones using CEM, OSP and ACE algorithms in poorly mapped and unmapped terrains at district scale. The results of this investigation demonstrated the applicability of SWIR bands of ASTER spectral data for alteration mineral mapping in inaccessible regions, particularly using the image processing algorithms that are capable to detect sub-pixel targets in the remotely sensed images, where no prior information is available.

Keywords: Remote sensing; Inaccessible regions; ASTER; Alteration mineral mapping, Target detection

Abstract Id: 212
The Bajestan is located in the north of the Lut block, the biggest structural block in the eastern Iran. ASTER data processing through Spectral Angle Mapper classification, band ratio, and band composition methods enhanced main the alteration zones, including Propylithic, Sericitic, Argillic and Fe-oxide alterations. Fractures map was prepared using SPOT-5 imagery and applying the enhanced spatial filters in order to recognize the role of fractures in controlling mineralization. Based on fracture map obtained by remote sensing and field studies, fractal pattern was examined through box-counting algorithm. The results showed that the maximum amount of the fractal dimension is observed in NW-SE orientation. Statistical parameters of fractures such as density, intensity, and fractures' intersection confirmed the results of previous fractal studies. Total data indicate that most alteration zones are related to lineaments, especially the main NW-SE faults. In addition, this study signifies the maximum probability of the occurrence of mineralization.

Keywords: Alteration, Fractal, Fractures map, Remote sensing, Bajestan, Iran

Abstract Id: 213
This study used a satellite-based remote sensing approach by application of Landsat-8 and ASTER datasets for regional geological mapping and alteration mineral detection in the NVL, Antarctica. The NVL consists of three major fault-bounded tectonostratigraphic Gondwana-derived terranes. Different association of ore mineral systems such as deposits of sediment-hosted/orogenic gold and granite-related minerals is discovered in collision and subduction zones of the Gondwana-derived terranes. They are associated with large-scale, terrane-bounding fault systems and broad areas of deformation. Mineralization mostly associated with structurally-controlled complex lodes, veins, sheeted veins and veinlets in diverse orientations, which are mostly associated with hydrothermal alteration zones. Satellite-based remote sensing approach could be used to detect geological structures and hydrothermal alteration zones associated with suture zones between Gondwana-derived terranes especially for large inaccessible regions where fieldwork is limited or nonexistent such in Antarctica. The Landsat-8 and the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) datasets were used to extract lithological-structural and mineralogical information. Several new spectral-band ratio indices were developed using Landsat-8 and ASTER bands and proposed for Antarctic environments to map spectral signatures of snow/ice, iron oxide/hydroxide minerals, Al-OH-bearing and Fe, Mg-O-H and CO\textsubscript{3} mineral zones, and quartz-rich felsic and mafic-to-ultramafic lithological units.

Keywords: Antarctica; ASTER; Landsat-8; Regional geology mapping

Abstract Id: 214
INVESTIGATION ON THE TERRAIN STABILITY AND LANDSLIDE HAZARD ALONG A HIGHWAY CORRIDOR IN KOHIMA, NAGALAND

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Infrastructural development such as roads are a necessity despite the fact that it exerts immense stress on the stability of a terrain particularly- the hilly terrain. Expansion or widening of road has caused drastic change on the slope stability triggering landslides. The area selected for the study consist a part of Asian Highway 1 under Kohima district. It is a study on the recent four lane road widening carried out in Nagaland. The present study was conducted to determine the impact of road cutting on the stability of land particularly in line with landslide triggering caused by slope cutting. Remote sensing and GIS based approach has been used for the study. Thematic layers such as slope, aspect, lineament etc. were integrated to generate the landslide hazard map. The hazard map depicts the area susceptible to landslide categorizing the area from low to high landslide susceptible area. High hazard zone was found in places where dumping of soil, steep slope, damming of drainage line etc. has been carried out. This study highlights the importance of a proper environmental impact assessment to be carried out before any major project commences for better sustainability and mitigation process.

Keywords: Landslide, Remote sensing, GIS, slope cut

Abstract Id: 215
ESTIMATING THE FOREST CANOPY LOSS USING SENTINEL-1 C BAND SAR IMAGES

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Deforestation could be identified as one of the main anthropogenic agent leading to an imbalance in the natural ecosystems triggering disasters in the form of landslides, floods and droughts. Recent studies show that Earth Observation (EO) data offer new opportunities for fast, reliable and accurate deforestation detection at smaller scales. Synthetic aperture radar (SAR) data has huge potential in terms of its scattering mechanism and all whether capabilities to estimate the forest canopy loss as an indirect measure of deforestation. A region that has been subjected to heavy deforestation during the past few years in North West region of Sri Lanka was focused for this experiment. Time series single polarized (VV) Sentinel-1C band SAR data was employed in this study. The low canopy penetration capabilities of C Band SAR systems were significantly utilized in the study. Two Sentinel-1VV polarization interferometric wide swath (IW) images from the year 2015 and 2016 covering the heaviest deforestation period of the study area were used. These images were carefully preprocessed in order to extract the backscatter intensity to perform the change detection. Coherence based change detection and Image rationing were performed to estimate the canopy loss primarily. Further analysis has been carried out in order to intensify the backscatter difference using radar texture. Second order texture measures, Homogeneity, Entropy and Angular Second Moment (ASM) were identified to give the highest correlation with the changes derived from complex coherence and image rationing. Both Coherence and Backscatter values for deforested regions are lower than those of regions with forest cover. Experimental results suggest that the Homogeneity texture has the advantage in delineating the difference between the forest and bare soil classes. The comparative results between the ground truth based referenced images generated from Google images and the SAR texture based interpretation suggests that an alarming area of 0.0207886km2 has been changed from forest to soil.

Keywords: Forest Canopy, C band SAR, Sentinel-1, Coherence, Backscatter, Texture

Abstract Id: 217
Flood risk assessment in low-lying coastal areas requires efficient spatial observations of land elevation for the implementation of protection, evacuation and safeguard plans of people and assets. Here we evaluated the potential of Digital Surface Model (DSM) derived from satellite observations to map flood prone areas with the objective of early warning on flood risk in the Cuddalore and Pondicherry region, southeast coast of India. Coastal zone management of this 100 km long coast is particularly challenging. Indeed, the whole region experiences at least two cyclonic storms accompanied with storm surge, heavy rains, flooding and beach erosion every year; the havocs wreaked by the 2004 tsunami, flash floods of 2005 and 2015, and the Thane cyclone in 2011 are still close memories.

We analyzed Sentinel-1 Synthetic Aperture Radar (SAR) and ALOS World 3D DSM satellite data, and Google Earth images. All these data are freely available and we compared them to the population census data acquired in 2011. Using Sentinel-1 SAR images, we discriminated flooded from non-flooded areas before comparing maps of low-lying areas derived from ALOS DSM data. The results suggest a good agreement between real flooded areas and low-lying areas. However, the micro-topography reflecting channels and drainage systems could not be captured with important issue for delineating areas with high risks of flooding. We explained that spatial resolution of about 2 m in X, Y and 10 cm in Z directions are necessary for identifying areas with high risk of flooding as demonstrated in many countries of the world. It is time to rethink national Indian spatial policy about high-resolution images in order to prepare safety plans of the property and the lives of populations of Tamil Nadu coasts.

Keywords: satellite remote sensing, environmental risk, coastal flooding, digital surface model, Tamil Nadu

Abstract Id: 219
A STUDY ON A REAL-TIME IMAGE PROVISION METHOD FOR EFFICIENT TRANSMISSION OF FLOOD SIMULATION IMAGES

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Recent increases in the frequency and scale of natural disasters due to changes in global climate and people's living environment have led to countermeasures prepared to protect the safety of citizens and property rights. However, studies for transmitting real-time disaster image information to the mobile environment, which can provide services to information providers, site decision-makers, and citizens, are insufficient. In addition, the data capacity is overloaded when large-capacity image information generated in the disaster response situation room is directly transmitted to the mobile environment. Therefore, in this study, research on image compression and format conversion was conducted to reduce the capacity of large-capacity image information generated in the situation room under the flood disaster situation among various disasters. Disaster image information generated in the situation room was captured as images at one second intervals, stored in the DB server, and compressed. 30 compressed images were converted into a video file format. In addition, various image and video file formats were used for compression and format conversion, and experiments on the capacity and transmission time of each result were conducted to analyze the optimal format. Based on this, efficient information sharing between disaster information providers and decision-makers will be possible and services for citizens will also be available. Further studies are required on improved image compression technology and image transmission means.

Keywords: Disaster Information Providing, Image Compression, Image Encoding, Image Decoding, Dynamic Expression Technic

Abstract Id: 221
Climate change causes changes in glacier dynamics leading to sea level rise. Glacier velocity is one of the parameters to observe glacier dynamics. Remote sensing technology makes easy to observe glacier dynamics because it is very difficult to access these areas manually. Differential SAR Interferometry (DInSAR) is the process of differencing two interferograms for measuring surface movement with an accuracy of millimeter range. The DInSAR process can be applied to observe glacier movement, earthquake deformations, volcanic activities and rate of subsidence or uplift caused due to the extraction of ground water and coal. By using single pass interferometry we can also generate accurate DEM. In this paper, we present the movement of a Chhota Shigri glacier in October month by using German Earth observation satellite TanDEM-X mission (X-band SAR sensor) with the help of two pass DInSAR technique. Chotta Shigri glacier is located in Chandra river basin, Himachal Pradesh and its length is approximately 9 km. Data used for this study is 10th Oct 2011 image as a master and 21st Oct 2011 as a slave. The Interferogram (deformation pair) generated consists of displacement along with topographic information and atmospheric errors. Therefore, we used SRTM DEM for removing topographic information from the Interferogram. Velocity map is generated after removal of topography effects. Effects of Ionosphere on velocity estimation are reduced by the use of X-band data. The maximum velocity of 1.8 cm/day is observed at the accumulation zone. The glacier velocity is found to be decreasing towards ablation zone. We also observed that DInSAR technique fails if the time difference between master and slave is more due to the low coherence.

Keywords: DInSAR, Glacier Velocity, Chhota Shigri Glacier

Abstract Id: 223
3D PROCESSING OF GOKTURK-2 IMAGERY

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Gokturk-2 is the third Earth Observation (EO) satellite of Turkey. It was launched in 2012 and operates at its orbit of 685 km altitude from earth. It has a pushbroom scanner which acquires images from panchromatic (2.5 m), RGB (5 m) and near infrared (5 m) bands. Gokturk-2 also has a long-track stereo imaging capability with the angles of ±30 degrees. Research and validation activities on Gokturk-2 images are so far somewhat limited in literature. This study aims at validating Gokturk-2 panchromatic (pan) images acquired in March 2015 and May 2017 in stereo mode over Bergama region near Izmir Province of Turkey. The validation mainly focuses on 3D point positioning and Digital Surface Model (DSM) generation accuracy from stereo pan images. The image orientation accuracy obtained using ground control points and trajectory modelling using higher order polynomials is around 1 pixel for the 2015 stereo pair, which is expected to be sufficient for DSM generation. Similar accuracy is assumed for the 2017 images. Radiometric quality analysis and improvements are performed prior to DSM generation. The DSMs generated from 2015 and 2017 images will be compared for a relative accuracy check. The absolute accuracy will be analyzed by comparing the DSMs with reference LiDAR data acquired in 2015 using two different airborne sensors from Optech and Riegl. In addition, ground control objects and Digital Terrain Model (DTM) extracted from the aerial images with 30 cm resolution, which were taken and processed by the Turkish General Directorate of Land Registry and Cadastre, will be used for further quality analysis. The results will be provided in this paper.

Keywords: Gokturk-2, stereo processing, validation, DSM

Abstract Id: 226
EFFICIENCY OF ECONOMIC INFRASTRUCTURE IN ENHANCING REGIONAL COMPETITIVENESS OF THE DISTRICTS OF INDO-GANGETIC PLAIN; A GIS BASED APPROACH

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In the current scenario of global economic slowdown, characterised by low investment and subdued level of external demand formulating the strategy for regional competitiveness is a complex task. Districts of middle and lower Indo-Gangetic plain are predominantly rural and agriculture based. Strategy of augmenting competitiveness of agriculture based Indo-Gangetic plain can be built around improvement in income. Improvement of Economic infrastructure can help in improvement of urban and rural farm & non-farm income in multiple ways. Strategy of augmenting competitiveness of this region can be- ‘efficiency in distribution of Economic Infrastructure in the region’. This efficiency in the distribution of infrastructure will reduce the burden of government institution and improve the relative output of the region with relative lesser investment. Judicious urban and rural planning for allocation of infrastructure provisions becomes very important for development of Indo-Gangetic plain. Data Envelopment Analysis (DEA) is the mathematical programming optimisation tool that measure technical efficiency of the multiple-input and/or multiple-output case by constructing a relative technical efficiency score. Present paper tries to utilise DEA to identify the efficiency at which present level of selected components of Infrastructure (Railway, Road, ICTs and Electricity) is utilised in order to build competitiveness of the region. This paper tries to identify a spatial pattern of efficiency of Infrastructure with the help of spatial auto-correlation and Hot-spot analysis in Arc GIS. Results show very high and significant spatial clustering of efficiency scores. Districts having large urban areas with high per capita GDP are the hot-spots of efficiency. This reveals the economic dependency of the region on large and developed urban areas. This dependency is highly prominent around Kolkata, Kanpur and Lucknow. Analysis also highlights the bottlenecks for each district and gives direct policy prescription for investment in the region.

Keywords: Infrastructure, Rural & Urban planning, Spatial auto-correlation, Hot-spot analysis, Moran’s I

Abstract Id: 227
ESTIMATION OF REFERENCE EVAPOTRANSPIRATION BASED ON AVHRR DATA USING HARGREAVES EQUATION

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The use of satellite data to estimate reference evapotranspiration (ET0) data has become an effective solution for large areas. The aim of this study is to investigate whether it is possible to reach reliable estimation of ET0 only on the basis of the remote sensing-based surface temperature (Ts) data by Hargreaves equation (HG) under an arid environment of Iran. This study has assumed that the daytime surface temperature at the cold pixel obtained from the AVHRR/NOAA sensor can be used instead of air temperature in the HG equation for ET0 estimation in irrigation network. For this purpose, 61 NOAA- AVHRR satellite images obtained between June and September in 2004 and 2005 and weather data measured at two weather stations located in two irrigation networks with sugar cane located in Khuzestan plain in the southwest of Iran were used to calibrate and test the HG equation. The FAO-56 Penman-Monteith model was used as a reference model for investigating the performance of the calibrated HG model. The results show that calibrated HG model provided close agreement with the reference values, with an average RMSE of 1.2 mm d⁻¹ and a R² of 0.90.

Keywords: Reference evapotranspiration; Hargreaves equation; NOAA Satellite; Iran

Abstract Id: 228
Polarimetric synthetic aperture radar (PolSAR) has become an important and useful technology for remote sensing. Development of target decomposition theorems is an important field of research which fundamentally aims at extracting scattering information of elementary targets from PolSAR data. The coherent target decomposition utilizes the 2x2 complex scattering matrix whereas the incoherent decompositions which are mainly categorized into two classes (viz. eigenanalysis decomposition and model-based decomposition) utilizes second-order statistics of stochastic polarimetric scattering given in terms of the 3x3 covariance or the coherency matrix (for a monostatic radar). The 4x4 real symmetric Kennaugh matrix in monostatic configured PolSAR conveys the information about the transformation of the incident and received Stokes vector. One way of measuring the similarity between two Kennaugh matrices utilizes the concept of a geodesic distance. The geodesic distance (GD) is a general notion of measuring distance along a geodesic. A geodesic is a smooth curve of minimum length joining two distinct points on a Riemannian manifold. In our case, the Riemannian manifold is a unit sphere. Moreover, the concept of a unit sphere and GD may be very easily extended to higher dimensions. This distance is ideal for characterizing target scattering mechanisms and is invariant under arbitrary scaling of Kennaugh matrices. While the use of a particular model-based decomposition restricts the number of canonical scattering mechanisms considered, the similarity approach using the GD allows for any number of desired canonical targets for comparison. Using this GD measure, multi-frequency and multi-polarized SAR datasets are analyzed for binary change detection in urban areas, scattering mechanism preserving classification, change analysis in agricultural crops and dynamics of snow cover changes. It can be appreciated that this GD measure which is simple to use can be appropriately used for complex scattering analysis for PolSAR data.

Keywords: PolSAR, multi-frequency, multi-polarized, target

Abstract Id: 229
PERFORMING VISUALISATION ANALYSIS USING REMOTE SENSING HIGH
RESOLUTION IMAGE TO RECOGNIZE MILITARY TARGETING

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Limitation to access the critical of geospatial information for security and defence purposes determine satellite images as extraordinary for essential assessment. By utilizing high resolution visualization derive time constrain turn valuable and efficient to perform information verification. Nowadays, imagery data is an important element to provide critical information about the situation or event in earth surface. By manipulating the combination of high resolution image, view angle (vertical and oblique), type and sensor capability, one would be able to enhance visualisation in order to perform analysis. Image characteristic and features theme such as shadow, shape, tone, colour and pattern indirectly has ability to guide visual analysis. High resolution imageries will provide better visualisation, but the knowledge of military discipline and experience should be in line to assist and guide commander’s decision for clear understanding of events occurred. In this paper, visualisation analysis is to predict possible strength of personnel in military garrison. The aim of this study is to evaluate the opportunities of high resolution imagery satellite in term to identify critical information to be manipulated into military decision process.

Keywords: Visualisation, High resolution, Recognize Military Targeting, Estimation, Image Feature, Shadow, Critical Geoinfo

Abstract Id: 231
DEFORESTATION OR REFORESTATION, A TIME SERIES REMOTE SENSING PERSPECTIVE OF WILPATTU NATIONAL PARK, SRI LANKA

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National parks and forest reserves by far could be considered as the heart of a country's ecological network. Both these geographical phenomena are subjected to decay. This decay is a vague entity called deforestation, and one of the challenging tasks to estimate using multispectral satellite data. Deforestation is mainly triggered by timber production and new settlements in Sri Lanka. This study attempts to identify and analyze the forest cover and its changes in the Wilpattu national park of Sri Lanka, which has grown into a national crisis. The rapid utilization of remote sensing satellites and techniques has provided reliable and near real-time possibilities to characterize terrestrial ecosystem properties. In this study, a series of Landsat imagery (Landsat 2, 5, and 8) ranging from the year 1975 to 2015 have been used for the analysis. Initially, Support Vector Machine (SVM) based land cover classification was performed for all the images and the changes in the forest class were determined. Secondly, Vegetation indices Normalize Difference Vegetation Index (NDVI), Normalize Difference Water Index (NDWI) Green Normalize Difference Vegetation Index (GNDVI) were used to separately extract the vegetation, surface water, and canopy conditions respectively. These results were compared with the SVM based classification results. Further, the social and environmental parameters (population, rainfall, temperature, and humidity) were used to develop a relationship with the deforestation to identify the main factors causing such effects. Finally, the Markov chains were used to predict and model the forest cover in another 30 years using time series SVM results. Deforestation rate was calculated based on definitions from FAO (Food and Agriculture Organization). The study found out that there is reforestation inside the national park (annual reforestation rate of 0.17%), while a deforestation outside close to the boundaries of it (annual deforestation rate of 0.29%).

Keywords: GNDVI, NDVI, NDWI, SVM, Markov Chains

Abstract Id: 232
APPLICATION OF INFRARED OBLIQUE THERMOGRAPHY TECHNIQUE IN THE WALL OF CITY BUILDINGS INSULATION EVALUATION

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City buildings wall insulating performance direct consequences its energy utilization. The quick and comprehensive evaluation method for the wall of city buildings insulation is imperative. A method based on infrared oblique thermography technique was proposed and its ability to evaluate rapid and pervasive insulation on the wall of city buildings was investigated. The oblique infrared images were captured by the drone spiraling up. And according to the black-body calibration files, the primitive image data transformed to the temperature image data. Three dimensional (3D) temperature modeling of the buildings was acquired. Combining the field-measured indoor and outdoor temperatures and the 3D temperature modeling of the buildings, the buildings insulation were evaluated precisely. The results showed the method has a strong ability to assess the city buildings insulation. Infrared oblique thermography technique also has excellent technical feasibility and practical value in the city buildings insulation evaluation.

Keywords: Buildings Insulation; Infrared Oblique Thermography; Evaluation

Abstract Id: 233
Flash floods can be identified as the most frequent and most damages natural hazard in Sri Lanka. Depending on the area of occurrence, urban flooding results in serious damages and stay as a complex phenomenon to map due to the land use heterogeneity it associates. Normally flooding most frequently occurs with the heavy rains, and hence the Multispectral satellite data fails to capture timely damages mainly due to dense cloud cover exists over the regions. Therefore SAR data which is independent of visible light, cloud cover, day-night capability and weak returns from water bodies is significantly useful in mapping floods over its Multispectral counterpart. SAR signals capability of clearly demarcating water and non-water on the base of smooth surface scattering makes it and unique tool for inundated area extraction. The objective of this study is to analyse the performance and the ability of the Sentinel-1 C band single co-polarized (VV) data to extract urban floods. Sentinel-1 single look complex, interferometric wide swath (IW) Level 1 C band Products were, utilized by covering the same area, one before (pre) and another during the flood event (post). In the context of floods to understand the backscatter behavior of various semantic classes a series of histograms representing the class backscatter coefficients were generated. These histograms were used to determine the backscatter threshold values between water and the non-water regions. The change detection was performed between the two images by using a contextual Mean Ratio Detector considering second order pixel neighboring system. The results were compared with the reference map generated by using field data, and the correlation coefficients for the sample area were in the range of 0.7 to 0.8 with high agreement. Further the visual interpretation suggests the level of details using the C band SAR data is significantly higher than the ground based interpretation.

Keywords: Floods, Sentinel-1, Single Polarization, C-band,SAR

Abstract Id: 235
NOVEL SINGLE DETECTOR POLARIZATION LIDAR

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The conventional dual polarization lidars use a polarization beam splitter unit in receiver to separate the incoming light into co and cross polarized components. Two independent receiver channels utilize the separated light in this system and provide an un-calibrated measure of atmospheric aerosol and cloud particles depolarization. For this reason, depolarization measurements using dual detector technique require frequent channel gain calibration and also need optical correction for residual polarization between channels. These problems can be eliminated in a single detector based polarization lidar technique. The single detector based polarization lidar system uses a rotating polarizer that polarizes the incoming light into co and cross polarized components during rotation. The rotation of polarizer is synchronized with the laser pulsing and the each pulse of laser processes only one polarization at any time. For the first-time, a single detector based polarization lidar was demonstrated at National Atmospheric Research Laboratory (NARL) site. The NARL is a unit of Department of Space located near Tirupati in Andhra Pradesh. The developed lidar output has been compared with the CALIPSO satellite pass data. The lidar signal comparisons and demonstration were made at the second harmonic wavelength of Nd:YAG laser. The new polarization lidar demonstration utilizes the single channel transient recorder system and has been operated at near zenith direction.

Keywords: Lidar, rotating polarizer, Glan Thompson prism, single detector, transient recorder

Abstract Id: 239
A SENSITIVITY STUDY ON THE IMPACT OF LAND SURFACE PARAMETERS ON THE ARPS MODEL SIMULATIONS OVER THUMBA COAST

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The performance of any numerical weather prediction (NWP) model depends on several factors such as: (1) the quality of initial and lateral boundary conditions; (2) types of parametrizations used within the model for representation of different physical and atmospheric process; and (3) numerical techniques adopted by model in solving the governing equations. In this regard, accurate representation of land surface parameters (such as - surface roughness, soil types, vegetation fraction, land use/land cover, NDVI etc.) through latest database is highly essential for a model to simulate the atmospheric boundary layer process with very high accuracy. In this paper, we make use of a mesoscale atmospheric model, namely - the ARPS (Advanced Regional Prediction System) for investigating the role of land surface parameters. The model is configured for Thumba coast of Trivandrum district of Kerala, and is initialized with a thermodynamic sounding profile, whereas nearly constant fields are extracted from two distinct data sets, namely - (1) USGS and (2) NRSC-BHUVAN. Results obtained from two set of simulations (USGS and NRSC) clearly indicate an improved performance of ARPS with fine resolution data of NRSC-BHUVAN. The study also indicate a larger dependence of the model on the initial conditions of atmospheric fields, compared to the land surface parameters. This study provide a sensitivity analysis of the ARPS model - simulated atmospheric fields on the land surface parameters.

Keywords: ARPS (Advanced Regional Prediction System), Atmospheric Model, NWP (Numerical Weather Prediction), Land surface parameters.

Abstract Id: 240
Ensuring a sound management of rivers is one way to improve the quality of our lives. In order to efficiently manage rivers, a platform capable of handling hydrophilic information reliably is required. Various types of river data in South Korea are stored in each database by type. In order to improve the accessibility of this information, it is necessary to combine these pieces of information in a manner that is easily accessible to users. River information is generally stored in various formats such as in GIS data (GeoTiff and Shapefile) and in text data. In this study, the author proposed a module that can churn out hydrophilic information as images by combining GIS data of various formats. This module was made using open source GDAL, and it is configured to read and receive the above-mentioned information. In addition, it was written in C++ language to enable link with various libraries. The module reads GeoTiff, Shapefile, which are GIS data, and various text data before reconstructing and outputting them as 2D GIS. This module was able to read GIS data in various formats, analyze the aforementioned read data, and output it as a 2D GIS. As it outputs various GIS hydrophilic information while functioning as a viewer, the user can easily view it. In future works, the author intends to develop this module as a 3D GIS module by combining it with a versatile 3D engine such as OpenGL.

Keywords: Data Convert, GIS, 2D GIS, GeoTiff, Shapefile, GDAL

Abstract Id: 241
LANDSLIDE SITE DETECTION IN GAYABARI REGION USING SENTINEL-1 DATA BY PERSISTENT SCATTERER INTERFEROMETRY

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Persistent Scatterer Interferometry (PSI) is a widely used remote sensing method for landslide detection and investigation. The availability of C-band Sentinel-1 data freely has given edge to usage of this. The revisit time of 12 days and smaller orbital tube increases the suitability of its data for landslide investigation. This paper investigated the spatial patterns of PSI point targets and landslide occurrences in the Gayabari region of Kurseong subdivision of the Darjeeling district in the state of West Bengal, India. Gayabari region is very prone to landslides which are more pronounced in monsoon season. In past a significant number of such event have occurred here. The main purpose is to analyze whether spatial patterns of Persistent Scatterers (PS) can be recognized as indicators of landslide. We have used 35 ascending and 32 descending images of Sentinel 1-A of the region for our analysis which was acquired between November 2014 to June 2017 and processed them in SARproz© software. Atmospheric Phase Screen has been estimated and removed using the same. A good number of Persistent Scatterers were identified in the region .In our study we have identified subsidence upto 80 mm and subsidence rate of around 30 mm per year.

Keywords: Persistent Scatterer Interferometry, Landslide, Gayabari, land subsidence

Abstract Id: 242
RESEARCH ON TIME AND SPATIAL CHARACTERISTICS BASED ON GIS AND THE BIG DATA OF CITY TRAFFIC ACCIDENT

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With the rapid growth of the national economy, the number of city motor vehicles and traffic accidents have been increasing. More and more people have paid attention to the road traffic safety. How to reduce the incidence of traffic accidents has become a serious problem which is the city traffic relevant departments urgently need to solve. This paper integrated the big traffic data with related multi-source data and constructed spatial correlation relationship by making use of the advantages of GIS based on multi-year traffic accidents' data of Suzhou Industrial Park. The paper improved the traffic accident black spot identification algorithm by machine learning methods, constructed the black spot model, and proposed improvement measures for different black spots. Then the paper made visual analysis for the traffic accidents’ distribution on time and space, the data structure and topological relationship. At the same time, the paper constructed the spatial evolution characteristics of road congestion and dissipation before and after the traffic accidents. The paper also revealed the implicit information from the traffic accidents’ data and constructed the system of road safety analysis and countermeasure library of the accident reasons. Finally, the paper developed analysis and management platform for the city traffic accidents based on GIS, which provided preventive and decision-making technical support for traffic accidents.

Keywords: GIS; Traffic accident; big data; black spot; time and space characteristics

Abstract Id: 245
INVENTORY OF RUBBER PLANTATIONS AND IDENTIFICATION OF POTENTIAL AREAS FOR ITS CULTIVATION IN ASSAM USING HIGH RESOLUTION IRS DATA

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To some extent climate, topography and soil of north-eastern states of India are fully or marginally favourable for natural rubber (NR) cultivation but exact geo-spatial locations of these areas under NR cultivation are unknown yet. Geo-spatial technology based identification of NR and potential areas for its cultivation are relevant to find these lands for further expansion of NR plantations to suitable agro-climatic regions to increase domestic NR production. Present study utilized temporal and multi-resolution satellite data (Cartosat merged LISS IV) of Indian Remote Sensing Satellites (IRS) for identification and estimation of spatial extent of NR and wastelands suitable for its cultivation in Assam state of India. Mapping of the wastelands was carried out without interfering areas under food crops, forests, steep valleys and lands which are more suitable for cultivation of food crops. Spatial extent of rubber plantation distribution of Assam was 16872 ha and additionally areas of about 24783 ha of wastelands suitable for NR cultivation have been estimated. Karimkhanj district of Assam has the highest extent of wastelands suitable for NR followed by Karbi Anglong, Kamrup and Goalpara districts. These four districts alone accounted for about 63.5 % of total rubber cultivation and 82.8 % of total wastelands estimated from the state. In general, spread and occurrences of NR and wastelands suitable for its cultivation are more in south-western and north-southern districts whereas north-eastern districts of the state are found less areas of wastelands. The study showed usefulness of high resolution satellite data for accurate mapping and estimation of rubber holdings and wastelands suitable for NR cultivation to increase the extent of NR in Assam without conversion of food crops, forests etc. Estimated wastelands can be prioritized in terms of pedo-climatic variables which can serve as a geo-spatial decision support system for planners in NR sector.

Keywords: Cartosat PAN, LISS IV, natural rubber, north-east, wasteland, spectral signature

Abstract Id: 247
AUTOMATED OBJECT DETECTION USING TELEOS-1’S IMAGERIES AND POTENTIAL APPLICATIONS

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Since its launch in December 2015 and completion of In-Orbit Test (IOT) in June 2016, TeLEOS-1 has been in operation for over one year. TeLEOS-1, with a 96-minutes orbital period at 15 degrees inclination, can deliver high responsiveness coverage to the equatorial belt. TeLEOS-1 is geared for applications such as maritime security and safety, environmental monitoring, humanitarian assistance and disaster relief, and infrastructure development planning and monitoring. Having a high resolution panchromatic camera with a ground sampling distance of 1 by 1 metre, TeLEOS-1 has collected a large imagery database since commencing operations. With a steadily growing database, we can employ image processing techniques to derive higher level information that can be used to improve our business performance and processes. This paper presents a framework which conducts automated object detection by utilising feature extraction techniques. Using TeLEOS-1 imagery, the object detection framework is applied to perform detection of aeroplanes and oil palms. With this framework supporting TeLEOS-1 operations, sophisticated analysis can be performed to generate comprehensive reports, such as estimating yield rates of agricultural farmlands, for decision making.

Keywords: TeLEOS-1, Near-Equatorial Orbit, Image Processing, Object Detection Algorithm, Imagery Applications

Abstract Id: 249
A VARIATIONAL MODEL WITH ADAPTIVE REGULARIZATION BASED DENSE STEREO MATCHING FOR REMOTELY SENSED STEREO IMAGES

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An adaptive regularization based variational method is presented in this work, for obtaining dense disparity map of remotely sensed non-rectified stereo images. To overcome the problems such as to estimate accurate disparities near object boundaries, in repetitive texture regions or texture-less regions and in occluded areas, we estimate disparity map by minimizing the global energy functional consists of data and regularizer terms, using variational model with coarse-to-fine pyramidal approach. The pyramidal approach is used to handle large disparities. To optimize the regularization in the energy functional, we use spatially varying regularization parameter instead of a fixed value for the entire image which is common to any variational framework but unsuitable to satellite images because of various image characteristics specific to satellite images. In this approach, we use the pixel wise image gradient and the estimated intermediate disparity gradient to initialize and update the regularization parameter at each pixel location. The initialization consists of K-means clustering in the image gradient space and assignment of a per-class value of regularization. This has impact on the required regularization factor for a group of pixels. Step wise updation is involved at all levels in the pyramid by calculating the disparity in scale space followed by computing the derivative of the disparity map. The proposed method is found to be effective in dealing with the limitation of fixed regularization of the core variational method for increasing the accuracy while estimating the dense disparity map. We evaluate the estimated disparity map quantitatively by finding the number of inliers using fundamental matrix, computed using best matches available from scale invariant feature transform (SIFT) feature matching technique which encodes the epipolar geometry between the stereo image pair. The fundamental matrix is estimated using random sample consensus (RANSAC) algorithm.

Keywords: Dense stereo image matching; variational method; adaptive regularization

Abstract Id: 251
AUTOMATIC WATER FEATURE EXTRACTION FROM MULTISPECTRAL IMAGERY WITH ADAPTIVE TRAINING SAMPLES AND ONE-CLASS CLASSIFIER

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Automatic feature delineation from satellite imagery is a challenging task due to the variability of sensors parameters, acquisition condition and geographical heterogeneity of scenes. Surface water is one of the vital natural resource, its change effects the climate and ecology. In optical remote sensing, cloud and atmospheric effects are the huge challenges to extract land cover information in a continuous manner. For the continual monitoring of water body, there is need of fully automatic technique that required the least amount of human intervene and performed robustly even the sensor and scene parameters have been changed. The spectral reflectance curve (SRC) of the feature is one of the primitive properties that retrieved from the multispectral imagery. In proposed technique, SRCs were used with the help of modulation codes. A particular modulation code is assigned to each category of SRCs with the help of comparative analysis between the reflectance values of spectral bands. The specific modulation codes that partially able to represent the water feature has chosen to collect positive training sample for the target class. Through the integration of adaptive and automatic training samples and one-class classifier (OCC), a fully automatic technique for surface water feature delineation from moderate resolution satellite imagery is proposed in this paper. In addition, OCC applied for extraction of surface water from the scene with above positive training samples and randomly collected unlabeled samples. The novelty of proposed approach is that it is applicable to several moderate resolution sensors having SWIR, NIR, Red, and Green spectral bands. The performance of method evaluated rigorously on three different multispectral Earth observation sensors (Landsat 8OLI, LISS III IRSP6, and Sentinel 2A) in various scene acquisition and geographical conditions. The overall accuracy achieved from various test sites ranges from 93.90 % to 97.27 %, and kappa statistics 0.7622 to 0.9453 respectively.

Keywords: Modulation code, One-class classification, Automatic extraction, adaptive training samples

Abstract Id: 256
AN ASSESSMENT OF THE SENSITIVITY AND UNCERTAINTY IN ESTIMATING VALUED REGULATORY AND SUPPORTING ECOSYSTEM SERVICES IN SUNDARBAN BIOSPHERE REGION USING VALUE TRANSFER APPROACH

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Ecosystem services are the direct and indirect benefits human gets from the natural ecosystem functions and contributing to human well-being by providing basic human needs. There are several approaches were introduced in the last few decades to quantify the spatially explicit regulatory and supporting ecosystem services. Among them, the value transfer, biophysical surrogate, contingent valuation are the most feasible and accurate methods to explicitly determine the monetary value of indirect ecosystem services. In this study, the ecosystem service value (ESV) of six major land units, namely, cropland, waterbodies, mangrove, urban built-up and sandy coast in the Sundarban Biosphere Region was quantified from 1973 to 2013 using various satellite remote sensing products, crop production, and crop yield/price database. Two major provision services (Food production, Raw material production), four regulation services (Gas regulation, Climate regulation, Freshwater regulation and supply, and Waste regulation), two supporting services (Soil conservation and control and Biodiversity and habitat conservation) and one cultural and recreational service (aesthetic provision service) were incorporated to quantify the Spatio-temporal changes of ESV over different land units. During 1973 - 2013, ESV (million US$ year) of mixed forest has been decreased by 20.73% (26.19 in 1973 to 20.76 in 2013) with -0.52% yearly decreasing rate, followed by water bodies (-7.87% (2882.52 in 1973 to 2655.63 in 2013) with -0.20% yearly decreasing rate), and cropland (-2.73% (65.08 in 1973 to 63.31 in 2013) with -0.07% yearly decreasing rate, respectively. In this period, the ESV of mangrove has been increased by 2.62% (2291.71 in 1973 to 2351.65 in 2013) with 0.07% yearly increasing rate. Waterbodies were found most sensitive (with higher coefficient of sensitivity (CS) value, 0.55, 0.56, 0.52 and 0.52 in 1973, 1988, 2002 and 2013), followed by mangrove (0.44, 0.49, 0.46 0.46), and cropland (0.01, 0.01, 0.01, 0.01), respectively.

Keywords: Ecosystem service, ecosystem service functions, value transfer, biophysical, climate regulation, gas regulation

Abstract Id: 257
TEMPORAL MAPPING OF BLUE ICE REGIONS OF THE POLAR RECORD GLACIER, EAST ANTARCTICA USING LANDSAT-8 SATELLITE DATA

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Blue ice regions (BIRs) cover about 1% of Antarctic continental surface of area. BIRs are zones of glacier where surface mass balance is negative, sublimation forms the major ablation process, and surface albedo is relatively small. The environmental sensitivity of BIRs to changing climatic conditions makes them interesting for glaciologists, environmentalists, climatologists, meteorologists, and geologists. BIRs are major source of drinking water to research stations and are utilized as runways for airplanes in Antarctica. The present study has been conducted on the Polar Record Glacier (PRG), Princess Elizabeth land, east Antarctica, where more than 30% of area is covered by BIRs. Area for BIRs was estimated using the albedo threshold value. Surface albedo and temperature was determined using Landsat-8 satellite data. The data was first calibrated to standard pixel value using multiplicative and additive rescaling factors for further processing. Two thermal bands on thermal infrared sensor (TIRS-1) and TIRS-2 from Landsat-8 with wavelength range of 10.60─12.51µm were used to estimate surface temperature. This study showed an overall increase in maximum and minimum surface temperatures from November 2013 to January 2016 by ~2°C. The analysis infers that the variation in surface temperature and albedo of the glacier causes significant variation in the surface area and spatial extent of BIRs. The study indicates that there is a high correlation in formation of BIRs with variation in surface temperature as well as albedo.

Keywords: Blue ice, surface temperature, Albedo, Landsat-8, Image processing

Abstract Id: 261
El Niño events are one of the most principal impacts that affect the global climate, especially in the Tropical oceans. Previous studies have suggested the interannual variations on the conventional El Niño. However recent studies show the interannual variability connected with two type of El Niño, namely the Central-Pacific (CP) type of El Niño and Eastern-Pacific (EP) type of El Niño. During the CP type of El Niño, the maximum sea surface temperature anomalies are confined in the central equatorial Pacific, in contrast with the maximum sea surface temperature anomalies are found in the eastern equatorial Pacific during the EP type of El Niño. In order to focus on the influences on the El Niño events in the South China Sea (SCS) thermal variability, we should consider various influences of the CP and EP types of El Niño. In the study, air temperature, surface wind, precipitation, sea level press, sea surface temperature and multiple datasets has been used to analyze the interannual variations in the SCS. We estimate various thermal variability and indentify how well the two types of El Niño are influences on climate changes in the SCS. The composite for the EP El Niño events indicates a strong increase in the sea surface temperature anomaly over the SCS region. During the EP El Niño, the strength of the SST anomalies increases by as much as 0.5°C. However the decrease SST can be found in most part of the SCS during the CP El Niño. We also examine characteristics of atmosphere-ocean interaction between the SCS and western Pacific warm pool with the CP and EP types of El Niño.

Keywords: South China Sea, thermal variability, EP El Niño, CP El Niño, ENSO

Abstract Id: 262
APPLICATION OF HEC-HMS MODEL FOR FLASH FLOOD IDENTIFICATION IN UPPER CIMANUK WATERSHED, GARUT REGENCY, WEST JAVA, INDONESIA

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Flooding is one of the most frequent disasters in Indonesia (besides landslide and windstorm). Meanwhile, the flash flood in Upper Cimanuk Watershed is the most devastating disaster that occurred in 2016. This incident caused 34 people died, 19 missing, and 9 injured. This research has aims to identify sub-basins priority and analyze the factors that caused a flash flood in this field area study. HEC-HMS modeling software is used to show sub-basins priority. Factors causing flash flood are explained by geomorphological approach and field observatory. The results showed that Upper Cimanuk Watershed in Mount Papandayan and Cikuray Volcanoes were the highest contributors to surface runoff (39.9 m³/s per square kilometer and 50.1 9 m³/s per square kilometer). Rainfalls, soil characteristics, and, watershed morphometry are factors causing a flash flood. The annual average rainfall of five years’ data shows a value of 2941-3154 mm. Soil permeability has a low value and classified as hydrological soil group type D. Drainage density and time concentration (Tc) have medium to high class. The combination of three factors is the main cause of flash flood in Upper Cimanuk Watershed.

Keywords: Flash flood, Upper Cimanuk Watershed, HEC HMS Modelling

Abstract Id: 263
Surface deformation impacts in urban areas are quite numerous and can be categorized into infrastructural, environmental, economic and social impacts. In order to investigate the surface deformation in Surabaya city, we implemented the Time Series Interferometric Synthetic Aperture Radar (InSAR) Small Baseline Subset (SBAS) analysis by using ALOS PALSAR images taken from 2007 until 2011. The method includes the process of focusing the SAR data, incorporating the precise orbit, coordinate transformation to radar systems, atmospheric correction, generating interferogram and phase unwrapping using SNAPHU algorithms. The result reveal surface deformation reach up 2 cm/year in northern part of Surabaya and 2,5 cm/year in eastern part. The deformation occurs in highly populated areas particularly vulnerable to flooding. This result suggest that mainly deformation caused by ground water extraction for residential and industrial purpose.

Keywords: Surface Deformation, Time Series, InSAR, SBAS, Surabaya

Abstract Id: 266
NATURAL DISASTER ALERT SYSTEM

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Sensor is widely used device in technology to measure any physical phenomenon from environment to convert into electrical data. It can be used as a early warning and analysis system for detection of Landslide or any other natural disaster / tragedy. It has been surveyed that landslides are frequently occurring natural hazards in hill or valley terrains, especially in Himalayas and Sahyadri mountains. GIS based remote sensors can play most important role to alert and analyze the landslide disaster to prevent millions of losses, if this technology can detect the pre-activity of such a natural disaster. To identify the earth surface movements and other activities, Remote sensing technology must be fulfill by dedicated Wireless Sensor network to gather all details of earth crust. The Implemented system properly indicates the type of natural disaster with Lat Long value where natural disaster is occurred. System is currently in operating mode in Nashik, India.

Keywords: GIS

Abstract Id: 267
COMPARISONS OF THE THREE-DIMENSIONAL MODEL RECONSTRUCTED USING MICMAC, PIX4DMAPPER AND PHOTOSCANPRO (SUB-TOPICS: OPEN SOURCE ON GEOSPATIAL TECHNOLOGY)

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Three-dimensional models derived from digital survey techniques are growing and focusing on many areas of application. The three-dimensional model has high geometric accuracy with rich spatial and spectral information, which is useful for many geospatial applications. In this study, we will utilize two types of software for three-dimensional models reconstruction, they are commercial software packages and open source tools. Their advantages and disadvantages will be investigated. The suggested commercial suites are PhotoscanPro and Pix4DMapper, whereas the open source one is the MicMac tools developed by IGN France. The images are taken by a Sony Alpha 6000 digital camera with 20mm focal length. In general, there are four steps to reconstruction a 3D model from 2D digital images. The first step is the initial processing for aerial triangulation with camera self-calibration. After initial processing, we can obtain the exterior and interior orientation parameters for all images. We setup a scale bar during image acquisition. Thus, after dense image matching, i.e. the second step, we can obtain dense point cloud with real dimension. For accuracy evaluation, we utilize Riegl VZ400 terrestrial laser scanner to collect reference point cloud. Then, we can compare their 3D discrepancy. The third and fourth steps are mesh and texture generation, respectively. The performance comparisons will consider geometric accuracy, completeness and the level of detail. After experiments, all three software provide satisfying results and we conclude that PhotoScanPro and Pix4DMapper are more straightforward to use with user-friendly interface. While the MicMac is recommended for experienced users, particularly it supports push-broom sensors, such as high-resolution satellite image.

Keywords: Close range photogrammetry, 3D model reconstruction, Image matching

Abstract Id: 268
Bali City Forecasting: Simulation for Citizen and Government

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Bali is most popular tourist destination in Indonesia which have rapid increasing number of population as well as tourist. The existing built-up area will expand to meet the demand and land cover change became a challenge. Using GIS is an option to analyse those development and applied in urban planning modeling to create simulation how the city will be in future. Urban planning modeling useful to understand city growth, support urban planning for government and provide important information of the citizen. Residential area, road network, infrastructure facilities and another build-up area will take into consideration for the city growth. By using existing base map, open source data, statistical data and GIS analysis we can simulate city growth in Bali. To deliver the information not only to government but also to citizen, it is needed to develop the application in web based. The result of this simulation show information of cities to citizens about their future environment and hopefully could satisfy their Quality of Life (QOL). The result consist of population number change based on age classification, budget and accessibility to facility in grid 500x500m.

Keywords: GIS, simulation, urban planning modeling, government, citizen

Abstract Id: 269
The coastal zones, is under increasing stress due to development of industries, trade and commerce, tourism and resultant human population growth and migration. Integrated coastal management is a dynamic process by which decisions are taken for the use, development, and protection of coastal/marine areas and resources. The works, aims to study the coastal areas in Syria, based on the use of space technology and geographic information systems (GIS). It includes:

1. Determine the natural resources in these areas and their current statement
2. Statement uses of land in the study areas and their effects
3. Determination of environmental degradation and causes in the study areas
4. Study of the interaction between ecosystems (sea - land)
5. Identification of pollutants and their effects on various environmental regulations
6. Types of human activities in the study areas and the positive, negative effects
7. Study affected areas or potentially affected by climate change and the impact of sea level rise, determine the extent of this vulnerability and treatments offered in each case
8. To identify areas most affected by geological or biological hazards and affected by disasters related to weather factors
9. Management and protection of natural resources and use them optimally
10. Integrated management of natural resources, tourism, environmental and archaeological sites, agricultural, Water Systems, Population, and interactive - Sea- land Systems

Our experience shows, If we compare traditional methods with Remote Sensing data, we find the cost will be low about 50%, some times more. So space Technology gave us more information, shorten Time, reduce efforts and save money

Keywords: Keywords: Management, Space data, GIS, sea- Land

Abstract Id: 270
EFFECTS OF HUMAN INDUCED CHANGES ON ECOSYSTEM SERVICES IN THE SUNDERBAN BIOSPHERE RESERVE REGION OF WEST BENGAL, INDIA

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Human appropriation, especially unusual changes in land-use and land cover, significantly affects ecosystem services and functions. Driven by the growth of the population and the economy, human demands on earth’s land surface have increased dramatically in the past 50 - 100 years. The area studied was divided into six major categories; cropland, mangrove forest, sparse vegetation, built-up urban area, water bodies and sandy coast, and the land coverage was calculated for the years 1973, 1988, 2002 and 2013. The spatial explicit value of the primary regulatory and supporting ecosystem services (climate regulation, raw material production, water regulation) was quantified through the indirect market valuation approach. A light use efficiency based ecosystem model, i.e. Carnegie- Ames-Stanford-Approach (CASA) was employed to estimate the carbon sequestration and oxygen production services of the ecosystem. The ArcGIS matrix transform approach calculated LULC dynamics among the classes. Investigation revealed that the built-up urban area increased from 42.9 sq. km in 1973 to 308 sq. km in 2013 with a 6.6 sq. km/year expansion rate. Similarly, water bodies (especially inland water bodies increased dramatically in the north central region) increased from 3392.1 sq.km in 1973 to 5420 sq.km in 2013 at the expense of semi-natural and natural land resulting in significant changes to ecological and ecosystem services. However, the area occupied by dense mangrove forest decreased substantially during the 40 years between 1973 and 2013; it was recorded to cover 2294 sq. km in 1973 and 1820 sq. km in 2013. The results showed that the estimated regulatory and supporting ecosystem services respond quite differently to human appropriation across the regions in both the economic and ecological dimensions. While evaluating the trade-off between human appropriation and ecosystem service changes, it has been estimated that the ecosystem service value of organic matter provision services decreased from 755 US$/ha in 2000 to 608 US$/ha in 2013.

Keywords: Human appropriation, ecosystem service value, land use transition, ecosystem, Value transfer

Abstract Id: 271
CHANGING DYNAMICS OF URBAN BIOPHYSICAL COMPOSITION AND ITS IMPACT ON URBAN HEAT ISLAND INTENSITY AND THERMAL CHARACTERISTICS: A STUDY ON HYDERABAD CITY, INDIA

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The biophysical composition; including the green surface cover and moisture dynamics substantially affects the thermal character and Surface Urban Heat Island Intensity (SUHII) of an urban area. Therefore, biophysical indices are highly sensitive to the changing process in land use and land cover (LULC). Remote sensing based Land Surface Temperature (LST) plays a significant role in estimating the thermal behavior of urban areas at any spatial domain moderate the urban heat island, adhere to mitigate the effects of major urban greenhouse gas emissions. In the present study, Greater Hyderabad Municipal Corporation (GHMC), is taken as a case study to assess biophysical controls on LST and UHI in an urban ecosystem by implementing biophysical indices. Therefore, the cluster of UHI and the proximity to the hotspot created from spatial statistics. The result shows that areal coverage of built-up was doubled from 1973 to 2015 with 5.03 sq.km/year expansion rate. It is found that LST hotspot (H-H) in 2002 observed in the central and the southeast portion of the region, ascribe to the presence of higher thermal anomalies, whereas, the mean LST (ºC) of the neighboring region is below than the average. The highest negative correlation between the estimated LST (ºC) and the biophysical indices was encountered in the areas occupied by aquatic vegetation cover, followed by urban green spaces and built-up urban area, respectively. The simple linear and polynomial regression models determined the complex and nonlinear behavior of the UHI and LST with the biophysical components. Therefore, the spatial coherence among the biophysical indices with LST ensembles the necessity of urban greenery and parks within the urban counterpart to mitigate the outdoor thermal discomfort to a reasonable extent.

Keywords: Biophysical, Vegetation indices, Spatial statistics, Auto correlation, urban, Ecosystem

Abstract Id: 272
Urbanization has a drastic impact on the natural process of storm water runoff; increasing both the peak flow and the volume of runoff, reducing infiltration, resulting in degrading waste water quality. Urban Storm Water Management is a compendium of all matters necessary for the design of efficient drainage and stormwater management systems. In this study, urban flood vulnerability of Guwahati Metropolitan Corporation (GMC) region has been assessed through Remote Sensing and Geographical Information System based Multi-Criteria Decision Modelling (MCDM) and Spatial Analytical Hierarchy Process (SAHP). The city receives substantial rainfall during the monsoon and faced severe inundation because of the absence of a planned drainage system. The existing natural drainage channels, which have played a major role in the discharging of storm water in the past have been made ineffective today by adopting unscientific development process and subsequent encroachments of outlet channels during non-monsoon period. The study helps to draw a vulnerable map output which is represented by a graduated scale indicating the flood vulnerable Index (FVI) range 1 - 8.8. There is no clear-cut boundary for classifying the vulnerability index hence the classification is based on the histogram of the generated vulnerable map. The map shows that the regions with very high to high FVI have highest population density, these are the areas affected through the process of avulsion which has taken up the path of Paleochannel. The region that includes the Moderate FVI range has lesser population density with most of the area associated with agricultural land which has been converted to the moist area due to water seepage from the river channel. River Road intersection points are mostly located in these areas which have increased the vulnerability of the area. Some of the areas having low to very low FVI index as the population density is least, there

Keywords: Urbanization, Storm water, Runoff, Vulnerability, AHP

Abstract Id: 274
DETERMINATION OF PLANTING CROPS USING SATELLITE DATA AT SHONAI PLAIN IN JAPAN

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GEOGLAM covers the four major cereals of wheat, soybean, corn and rice. Rice is producing and consuming in Asia about 90% of the whole world. The Asian Space Agency and Asian Agricultural Organizations built Asia-RiCE (Asia-Rice Crop Estimation and Monitoring initiative) at framework of GEOGLAM.

Shonai Plain was set up as a test field area in Japan. At beginning work, we try to determination of planted crops using satellite data. Recently, in Asian countries, GIS is spread widely and agricultural field polygon is commonly used. Crop determination using the polygon is becoming popular. Normally, fields are used without changing, but sometimes, one field is divided two or three fields, and two or three fields are integrated one field.

It is necessary to overlay satellite image and the polygon, and to check with fitting or not. In case of mismatch, field polygon must be corrected. Simultaneously with this confirmation work for each field polygon, the optical satellite data were classified as water surface ‘water’, vegetation as ‘vegetation’, bare soil as ‘soil’ and ‘cannot determination’. In the SAR image, we classify 4 degrees, as small scattering of the water surface ‘0’, scattering slightly larger than the water surface ‘1’, larger than the water surface ‘2’, and large scattering ‘3’. The crop determination is performed according to the following standard using to the time series data:

Rice: Almost water surface at rice planting time and following several weeks. In summer, there is large vegetation.

Wheat: There is large vegetation at rice planting time, and small vegetation at summer.

Soybean: There is small vegetation at rice planting time, and large vegetation in summer.

Grasses: There is large vegetation at rice planting time and at summer.

We can get the classified result more than 95% accuracy in this method at this area.

Keywords: GEOGLAM, Crop monitoring, Crop determination, Satellite data

Abstract Id: 276
THE PERFORMANCE OF ITERATIVELY REWEIGHTED MULTIVARIATE ALTERATION DETECTION (IRMAD) ON UNTRANSFORMED AND TRANSFORMED LANDSAT SURFACE REFLECTANCE

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The iteratively reweighted multivariate alteration detection (IRMAD) based on canonical correlation is a popular technique for bi-temporal change analysis. In this research, its potential to assist the investigation of historical change of land surfaces is demonstrated. Our particular interest was in how IRMAD performed using different data inputs to detect simultaneous historical change in a heterogeneous topographical region of West Java. This article investigates IRMAD’s performance with untransformed and transformed surface reflectance from LANDSAT 5 TM and LANDSAT 8 OLI. Two forms of transformation were studied: tasseled cap transformation, and a set of indices consists of Normalised Difference Vegetation Index (NDVI), Normalised Difference Water Index (NDWI) and brilliance index (BI) which are equivalent to the tasseled cap transformation. We found that canonical correlation stability seems to be reached quickly on transformed data, and consistently on both the tasseled cap transformation and the set of indices. The transformation appears to increase the proportion of variance at the first variate, where tasseled cap transformation resulted in better change detection compared to the original surface reflectance and the set of indices. We found that the generation of MAD variates was influenced by the type of sensor and transformations.

Keywords: Change detection, multivariate alteration detection, Landsat, surface reflectance, transformation

Abstract Id: 278
Wind patterns in Sri Lanka, being an island exposed to two main monsoon seasons, is complex. The dynamic changes in the topography also affect these patterns. Irregularly distributed wind measurements are the main source of information regarding this dynamic geographic phenomenon for the island nation. Sri Lanka is in need of accurate and timely wind maps in order to support wind energy resource planning and to empower weather prediction system's accuracy. Heavy and continuous winds in the southern part of the island encourage the wind harvesting for energy. Wind energy is arguably the most affordable per megawatt hour of the renewable energy source and it is growing nearly as quickly as conventional generation techniques. This study has used 23 diurnal wind measuring stations data in the form of wind speed and direction. These data were analyzed on the basis of morning and evening time periods and then aggregated on a weekly basis by using the mean wind speed and the mode of the wind direction. The spatial correlation of the wind speed and the direction was determined in the beginning by using the semi-Variograms. Spherical semi-variogram was fitted with the observations. Ordinary Kriging which uses the samples in the local neighborhood avoiding the mean estimation was used to perform the spatial interpolations. For each month of the year 2016, four weekly wind maps were generated, both for the direction and speed. These 48 wind maps were further analyzed for the wind patterns that exist within the island during the year 2016. The changes in the morning and evening wind patterns and the significant wind pattern changes along the coastal areas and the central highlands are extracted and presented in the study. The generated maps could be useful in identifying potential areas for wind farming.

Keywords: Wind Speed, Wind Direction, Variograms, Kriging, Wind Power

Abstract Id: 281
PROJECT FOR CREATING DIGITAL ELEVATION MODEL ENABLING DISASTER RESILIENCE IN SRI LANKA

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The Japan International Cooperation Agency (JICA) LiDAR project aimed to help the disaster risk reduction in the Democratic Socialist Republic of Sri Lanka (Sri Lanka). The Project provides the Digital Elevation Model (DEM) which becomes the source of creating topographic data in disaster prone areas in the Colombo, Gampaha, Nuwara Eliya, Kegalle, parts of Kandy, Budula, Kalutara districts and surrounding areas. The Project started in January 2015 and completed in December 2016. There are two areas depending on the density of LiDAR measurement points. The 1 x 1 meter mesh area has 2,400 km², and the 2 x 2 meter mesh area has 5,400 km². The 1 x 1 meter mesh areas and the low land areas are accurate of ±30 cm, and the 2 x 2 meter mesh areas have ±50 cm - 100 cm. Some part of the Nuwara Eliya was excluded from the LiDAR survey because of weak GPS signal reception. The data with high vertical accuracy are available for updating topographic maps and preparing disaster management plans for the districts and communities. The JICA Project Team accelerated processing the data and provided to the Survey Department; the data are already in use for analyzing the flood area along the Kelani River and the landslide in Aranayake caused by the tropical storm on May 15, 2016 in Sri Lanka.

Keywords: LiDAR, DEM, Disaster risk reduction, Sri Lanka

Abstract Id: 282
GROUND PENETRATING RADAR (GPR) VELOCITY DETERMINATION FOR DELINEATION OF MULTI LAYER AQUIFER: A CASE STUDY OF NIZAMPATNAM COASTAL AREA, GUNTUR DISTRICT, A.P, INDIA

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In near shore coastal areas, groundwater is the only source of drinking and irrigation water. But over the years, groundwater is getting polluted due to salt water intrusion caused by tidal action as well as overexploitation of the groundwater in coastal areas. Therefore, mapping and delineating fresh water aquifers is of vital importance to partly solve the drinking water scarcity in these regions. In this paper the multiple lithofacies in coastal area of the Nizampatnam were identified using Ground Penetrating Radar (GPR) for understanding the nature of aquifer present in the area. Fast and high resolution data collection capabilities of GPR is helpful in delineating the lithological layers of the coastal aquifers present in the shallow zones. The velocity analysis of the GPR signal in the study area showed the presence of clay, sand, silt layers. Signal velocity in the fresh water saturated areas were between 0.0320-0.0340 m/ns and for salt water it was around 0.01 m/ns. Based on this velocity analysis technique water table and salt water interface fluctuations were observed in pre-monsoon and post-monsoon period which was also verified on the ground. Interpretation of the GPR profiles showed the geometry of the subsurface layers present in the study area. It also helped in understanding the nature of aquifers present in the area. Thus, GPR (Non-invasive geophysical technique) is useful for better understanding of the changes occurring in shallow coastal aquifers

Keywords: Ground Penetrating Radar (GPR), Dielectric properties, Velocity analysis, Coastal aquifers

Abstract Id: 284
There is a growing interest in open source alternatives to expensive commercial packages for extracting information from remotely sensed images. The benefits of open source software go beyond cost savings on software licenses. For researchers, open source software provides the ability to explore existing algorithms as well as provide access to latest algorithms, by looking at the source code and making changes as required. Image Segmentation is a process of partitioning an image into homogeneous non-overlapping regions of related content. The segmentation algorithms are based on two basic properties: discontinuity and similarity. An attempt is made here to develop an open source tool for image segmentation using python. The Python language is particularly beneficial in allowing the system to be expanded as there are a large number of Python libraries already available. It also provides good interoperability with other programming languages allowing existing code to be incorporated as part of the workflow.

The tool is based on pull down menu driven graphical user interface. The tool provides basic file operations, filtering, segmentation, morphological operations and feature extraction routines. Laplacian edge detection, Gaussian smoothing, Canny, Gabor and Hough transform form a part of the filtering based segmentation. Erosion, Dilation, Opening and Closing are implemented under morphology. Segmentation menu includes Thresholding, Region Growing and Watershed segmentation techniques and work flow for road and building detection is implemented as feature extraction. The tool is particularly useful for feature extraction. One of the key advantages of the system proposed is that its modular nature allows other packages and routines to be incorporated alongside and to build new algorithms on top of the existing framework.

Keywords: Feature Extraction, Image Segmentation, Open Source tools, Region Growing, Watershed segmentation

Abstract Id: 285
IDENTIFICATION OF TALC AND ASSOCIATED MINERALS IN THE ASKOT CRYSTALLINE OF KUMAON HIMALAYA, INDIA USING HYPERSPECTRAL REMOTE SENSING DATA

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Hyperspectral data have been used to identify economic potential minerals. This study demonstrates the capability of EO-1 Hyperion hyperspectral remote sensing data to identify the talc and associated minerals occurred in the Askot crystallines near to the Ghattabagar village of Askot town of the Kumaon Himalaya. Identification of the talc was done using the Hyperion data and results were verified in the field as well as in the laboratory analysis viz. petrographic examination, X-ray diffraction, and reflectance spectroscopy. Though the SNR of the Hyperion data was very low (10:1), a careful processing of the hyperspectral data has given very good signals to detect minerals like talc and clinochlore in this study. A destripping tool has been developed using the Iterative data language (IDL) to compensate the stripes available in the Hyperion image. Mixture analyses of the mineral spectral signature were performed using The Spectral Geologist (TSG) and found suitable for the identification of minerals. VNIR and SWIR spectroscopy has been studied and used effectively for the identification and confirmation of minerals. The mineralogy identified through the Hyperion data stands in good confirmation with the established geology of the study area.

Keywords: Hyperion, hyperspectral data, Askot Crystallines, Mixture analysis, minerals identification

Abstract Id: 286
SPATIAL AND TEMPORAL VARIATIONS OF THE LIGHT-FISHERY IN THE SOUTH CHINA SEA BASED ON REMOTE SENSING LIGHT DATA

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Light-fishery is one of the main fishing gears in the South China Sea. The bright signals from fish attraction lights are easily seen from the night remote sensing visible image. The Visible Infrared Imaging Radiometer Suite Data from Suomi National Polar-orbiting Partnership from April 2012 to March 2017 were used to analyze variations of light-fishery in the South China Sea. Results showed that most of the light fishery boats accumulated in the waters with depths lower than 200 m. The locations of fishing regions changed from offshore to nearshore from January to May, and from nearshore to offshore from August to December. The highest number of light pixels emerged on August just ascribe to the Fishing Moratorium. The second light pixels number peak was in spring due to the high chlorophyll a concentration related to nutrient transport from coastal region by seaward current. The variations in light-fishery can be affected by both fishery policies and natural environment.

Keywords: Fishery; South China Sea; Remote sensing

Abstract Id: 287
DEVELOPMENT OF MACHINE ALGORITHM FOR AUTOMATIC THRESHOLD SELECTION IN OBJECT BASED CLASSIFICATION USING REGION-GROWING

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In remote sensing data classification, object-based approach offer advantage over traditional pixel-based approach in providing better classification results and overcoming noise. The most common approach used for building objects is image segmentation using region-growing methods. These methods require selecting suitable threshold values which affect the quality of the resulting segmentation. In this study, a machine-learning algorithm is proposed to automatically select suitable threshold values for region-growing. The algorithm is implemented in the Open Source GIS framework by integrating image processing libraries using the Python scripting for program development. Experiments of using moderate (Landsat-8) and high spatial (RapidEye) resolution satellite images are conducted to evaluate the efficacy of the proposed algorithm. The results suggest the potential of the automatic threshold selection machine algorithm to image segmentation achieved by using region-growing.

Keywords: Remote sensing, image segmentation, threshold, object based, automatic

Abstract Id: 288
Recently, indoor positioning technologies, such as Wireless Fidelity, Radio-Frequency Identification, Bluetooth, and, Indoor Messaging System can be combined with Global Navigation Satellite Systems (GNSS) to improve the availability of the entire positioning system and achieve indoor/outdoor seamless positioning. However, the indoor environment has a complicated radio wave propagation environment, so the problem is that the positioning result becomes unstable. In our research, we propose a methodology to combine iBeacon ranging-based Received Signal Strength Indication (RSSI) positioning with Angle of Arrival (AoA) base on QR code detection using an omni-directional camera. Although high precision positioning can be achieved by backward intersection methodology using a camera, it is aimed to explore whether it is possible to improve positioning accuracy and positioning stability of radio navigation. We placed eight transmitters at 45 degrees each around the receiver and acquire data for eight directions. In addition, we installed the omni-directional camera at the same position as the receiver, and acquired AoA data. We conducted the simulation experiment with 56 positioning patterns to evaluate our methodology based on triangulation. We confirmed that our proposed methodology can improve the accuracy and stability of positioning can be improved in our experiments.

Keywords: Indoor positioning, seamless positioning, iBeacon, QR code

Abstract Id: 289
This research proposes a robust methodology for carrying out the flood risk mapping task using Landsat image and Unity 3D engine. In the first step, the 2D land cover image was generated using the given Landsat image for acquiring the land cover information in the study area. The multiple machine learning techniques such as the ISODATA (Iterative Self-Organizing Data Analysis Technique), SVM (Support Vector Machine) and ANN (Artificial Neural Network) techniques were applied in this step to generate the 2D land cover image having high accuracy. Then, the elevation information such as the DEM (Digital Elevation Model) was added into the generated 2D land cover image for constructing the 3D land cover map. Next, the module for carrying out the flood simulation on the generated 3D land cover map was made by using the Unity 3D engine. Finally, the flood risk mapping task was completed by detecting the flooded land covers from the 3D land cover map by using the flood simulation module. This research contributes to detect the flooded land covers from the 3D land cover map by the flood simulation module generated using the Landsat image and the Unity 3D engine.

Keywords: Flood Risk Mapping, Landsat Image, 3D Land Cover Map, Flood Simulation, Unity 3D Engine

Abstract Id: 290
PARAMETER OPTIMIZATION WITH RESTARTING GENETIC ALGORITHM FOR THE FOREST TYPE CLASSIFICATION

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Data mining is the process to find the knowledge from the huge amount of stored information and use the discovered knowledge to predict or classify the new data item that its class label is unknown. Currently, genetic algorithm can find the best parameter for support vector machine. The genetic algorithm is the search algorithm for optimal answer with adaptive heuristic search based on the evolutionary characteristic of nature. But the problem of genetic algorithm is that sometime the algorithm cannot find the best parameter because the improper setting of a random initial value. In this research we propose the new technique to improve performance of genetic algorithm to find the best parameter with restarting concept. We show the performance of the proposed technique with application for image-based forest type classification over the forest area in Japan with the satellite image data from the ASTER satellite. The result show that the proposed technique can classify the forest type more than other technique with higher accuracy.

Keywords: Data mining, data classification, restarting genetic algorithm, support vector machine, forest type classification

Abstract Id: 291
Deep learning based approaches have gained an increasing attention in recent years in particular in remote sensing. Convolutional Neural Networks (CNNs) as one of the deep learning techniques, has demonstrated remarkable performance in visual recognition applications. However, using such algorithms in the area of hyperspectral image classification due to high dimensionality and insufficient training samples is challenging tasks. Besides, the CNNs are time consuming process and practically implementation on original hyperspectral image with more than one hundreds bands is not intractable. This paper proposed a subspace-based feature extraction method by calculating orthonormal basis of correlation matrix of each class to reduce the dimensionality of hyperspectral images. The proposed framework presents a fix CNN architecture for two real hyperspectral data sets and subspace reduction is compatible by nature of class based CNNs and logistic regression as a classifier in the last layer. Experimental results on two real and well-known hyperspectral images, Indian Pines and Pavia University scenes show that the proposed strategy leads to a performance improvement, as opposed to using original data and conventional feature extraction strategies which have been considered in recent approaches. The classification overall accuracy of ca. 98.1% and 98.3% are obtained in Indian Pine and Pavia University respectively.

Keywords: Hyperspectral Classification, Deep Learning, Convolutional Neural Network, Feature Extraction, Subspace-based Projection

Abstract Id: 293
A MULTI-CRITERION APPROACH FOR LANDSLIDE SUSCEPTIBILITY MAPPING USING ANALYTICAL HIERARCHY PROCESS: A CASE STUDY IN MANIPUR, INDIA.

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Landslides are one of the major natural hazards accounting each year for enormous economic loss and loss of life. The probability of landslides is highest along mountain roads that cause hurdles in traffics and also cause congestion. A landslide susceptibility map presents areas with the potential of landslides in the future by combining factors that contributed to the occurrences of past landslides. The aim of this study is to evaluate the susceptibility of landslide along a highway in Noney area, Manipur, India with respect to identified factors that influence the occurrence of landslides such as slope, land use land cover (LULC), Normalized Difference Vegetation Index (NDVI), Normalized Difference Mid Red (NDMIDR) Index, Normalized Difference Mid Infrared (NDMIDIR) index and Geology. Geographical Information System (GIS) based Analytical Hierarchy Process (AHP) is adopted for the landslide susceptibility mapping of the region. A landslide inventory of 30 landslides was created using past landslide records collected from field investigations. Analyzing the past landslides record and influencing factors, the importance of each parameter were determined and weightage were assigned based on AHP for generating the susceptibility zone map. The landslide susceptibility map was compared with the landslide occurrence locations as an approach to check the accuracy of the model output. The overlay of the known landslide locations with the susceptibility map revealed that the output maps are in good agreement with the landslide locations as 50% of the landslide locations falls under the very high susceptible zone and 26% falls under high susceptible zone.

Keywords: Landslide susceptibility, AHP, Normalized Difference Vegetation Index (NDVI), Normalized Difference Mid red (NDMIDR) index, Norm

Abstract Id: 294
MAPPING ECOLOGICAL PHASE SHIFTS USING COMMERCIAL DRONE ON THE CORAL REEFS OF SOUTHERN FAAFU ATOLL, REPUBLIC OF THE MALDIVES

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The Republic of the Maldives is an archipelago composed of more than 1100 islands surrounded by coral reefs, grouped into a chain of atolls in the Indian Ocean. The one-meter elevation of most of the atolls’ islands makes the Maldives one of the countries highly vulnerable to the impacts of climate change. Healthy coral reefs are thus essential for the survival of the Maldivian islands due to their capacity to keep up with the rising sea-level. Nevertheless, the Maldivian coral reefs are threatened by anthropic and climatic issues and during April-May 2016 they faced a massive coral bleaching followed by high rates of mortality. In our study, we collected high resolution images using a drone (DJI Phantom 4) along different sector of reefs surrounding islands of the Southern Faafu Atoll. The acquired data were processed in order to map the extension and the composition of shallow lagoons habitat, from the beach to the reef crest. Comparing these new results with habitat maps realized using satellite images databases from 2011 to 2016 (RapidEye and Sentinel) and field data (snorkelling and diving transects), we were able to realize habitat change maps and correlate these changes to environmental disturbances. In addition, high resolution images (1.5 cm/pixel) were collected in order to realize a 3D model of shallow reef communities using structure from motion photogrammetry technologies. These 3D optical models will be used as the first step of a 3 years monitoring campaign addressed to observe the 3D structural complexity changes of the reef after the 2016 bleaching event. The whole study will focus on the integration of multi-scale maps to investigate, on a multi-temporal scale, ecological and geomorphological shifts in the study area and to figure out relationships with human activities (agriculture, land reclamation, new infrastructure) and pressures related to global climate changes.

Keywords: Maldives, Remote Sensing, Drone

Abstract Id: 295
CLASSIFICATION AND ASSESSMENT OF LAND USE LAND COVER IN BARA TAHSIL OF ALLAHABAD DISTRICT USING SENTINEL-2 SATELLITE IMAGERY

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Regional development of any region depends upon the current Land use land cover (LULC) pattern. By providing raw data in the form of satellite images Geospatial technology is helpful for mapping and area estimation of Land cover on temporal and spatial basis. The present study has carried out in geospatial platform using Erdas Imagine 2014 and ArcGis 10.2.2 softwares. Multi-temporal Sentinel-2 satellite imagery is the primary data source for extracting thematic layers of LULC. LULC map of National Remote Sensing centre, topographic map and Google earth images along with field surveys are the ancillary database. In the present work, an attempt has been made to classify the Sentinel-2 satellite imagery (10 m resolution in VNIR band) into various land cover. Maximum Likelihood classifier, unsupervised classifier and Principal Component technique etc. has been used to extract pure classes of LULC i.e. water-bodies, fallow-land, wasteland, cropland and forestland. Built-up layer is extracted by digitization due to mixing of built-up classes with fallow-land and wasteland. Thus final map compares current LULC classes between the Jasra and Shankargarh block of study region.

Keywords: LULC; Sentinel-2; Maximum Likelihood Classifier; Unsupervised; Principal Component technique

Abstract Id: 296
ESTIMATION OF CRUSTAL MOVEMENT IN THE 2016 KUMAMOTO, JAPAN, EARTHQUAKE BY RELATIVE GNSS POSITIONING WITH LONG BASELINE

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The GNSS Earth Observation Network System (GEONET) was developed by the Geographical Survey Institute (GSI) of Japan. It is a construction of high-density and high-precision surveying network consisting of electronic base stations installed at approximately 1,300 locations nationwide. As one of its uses, there is a measurement of crustal movement during earthquake using continuous fixed point observation. Calculation of displacement amount with high accuracy can be performed by relative positioning using another base station. In order to perform high accurate positioning, it is desirable that the distance between the base station and the measurement point is less than 10 km approximately. However, if the base station is used near an epicenter, it is difficult to detect the accurate crustal movement since it shakes with the ground at the time of the earthquake. Therefore, the relative positioning of a long distance baseline using GEONET far from the epicenter as a base station is effective. In this study, more accurate estimation of the crustal movement in the Kumamoto earthquake that occurred in the April 14 and 16, 2016 was attempted to detect by relative positioning with reference to a GEONET site (950462), which is located more than 100 km north-west from the epicenter. Receiver Independent Exchange Format (RINEX) data with 30-s intervals of several GEONET sites near the epicenter released by the GSI and 1-Hz sampling data through a private distributor were used for analysis. Firstly, the dairy coordinates of the GEONET sites were plotted and the average coordinates before and after the earthquakes and the crustal movement were calculated. Then, in order to evaluate the variations in the permanent displacement in terms of the baseline, difference base stations were set as the base station. We study the relationship between the performance of displacement and the baseline.

Keywords: relative, GEONET, long baseline, Kumamoto earthquake, crustal movement

Abstract Id: 297
Polarized SAR images have been extensively used recently for monitoring urban and suburban areas. Since different polarizations represent different scattering coefficient of the same target, they can be used to prepare land cover maps which contain vital information for several fields, such as environmental science, seismic risk assessment, urban management and planning. The amplitude data have been used mostly in recent years for obtaining the ground surface information. Whereas, phase data sets could provide more information of ground objects. Therefore, in this research full polarized data of ALOS-2 PALSAR-2 with 5.13-m resolution in ascending path were used to classify the various land covers in Kumamoto, Japan. This area was severely affected by the April 14, 2016 (Mw6.2) earthquake and the April 16, 2016 (Mw7.0). Accordingly, Yamaguchi-4 decomposition was applied on polarimetric data set to be used for supervised classification of the study area. Since Yamaguchi-4 decomposition provides surface, volume, double bounce, and helix scattering, it can be effective for classifying not only the nature objects on the ground also for man-made structures with different orientations. The result of Yamaguchi-4 decomposition showed those parts of urban area which are not parallel to the satellite range direction were represented by surface scattering. Thus, angel orientation correction was applied on the Yamaguchi-4 decomposition result to solve this problem. Afterwards, Support Vector Machine (SVM) algorithm was used for supervised classification of two Yamaguchi-4 decomposition data without and with angel orientation correction. Confusion matrix including kappa coefficient, overall-, producer-, and user-accuracy were prepared for classification results to be compared with the truth data. This research aims to explore the potential of decomposition method for classifying various land covers of urban and suburban areas.

Keywords: Land cover, Polarimetric SAR imagery, Yamaguchi-4 decomposition, Support Vector Machine (SVM), Kumamoto

Abstract Id: 298
DETECTION OF BACTERIAL WILT DISEASE (*PSEUDOMONAS SOLANCEARUM*) IN BRINJAL USING HYPERSPECTRAL REMOTE SENSING

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Brinjal is a principal vegetable crop, grown throughout India. West Bengal is the leading producer of Brinjal with acreage of about 160 thousand hectares and production of approximately 3000 thousand tonnes. Bacterial wilt disease (pathogen: *Pseudomonas solancearum*) is a major problem affecting brinjal crop. Infected leaves show yellowing, loss in turgidity, drying and ultimately the entire plant collapses. The study aims to examine the potential of hyperspectral remote sensing for detection of biotic stress caused due to bacterial wilt disease and identify best spectral band widths and hyperspectral indices indicative of disease infestation. This study was conducted in Baruipur block, South 24 Pargana district, West Bengal. Biophysical parameters viz., canopy spectra (using ASD Fieldspec 2 Spectroradiometer), chlorophyll content (by Chlorophyll meter) and Leaf Area Index (LAI) (by plant canopy imager) were collected. The healthy plants had green and fully turgid leaves whereas diseased plants had lower chlorophyll content and LAI. The reduction in chlorophyll content lowered reflectance in green region (520-590 nm) and internal leaf damage in near-infrared region (770-860 nm). A correlation analysis was carried out between reflectance at specific bandwidths and hyperspectral indices with chlorophyll content and LAI of healthy and stressed plants. Bandwidths of 528-531 nm, 550-570 nm, 710-760 nm, and single bands such as 800 nm and 920 nm and indices viz. Greenness index, Modified Chlorophyll Absorption Reflectance Index (MCARI), Transformed Chlorophyll Absorption Reflectance Index (TCARI), Triangular Vegetation Index (TVI), Simple Ratio Pigment Index (SRPI), Photochemical Reflectance Index (PRI 2), Lichtenthaler Indices (LIC1, LIC2), Structure Intensive Pigment Index (SIPI) etc. were found to have strong positive correlation ($R^2 > 0.9$) with above biophysical parameters. These specific bandwidths and indices can be helpful in regional biophysical parameter estimation through corresponding satellite derived band data and early detection of crop stress, crop growth and disease monitoring.

Keywords: Brinjal Bacterial Wilt Hyperspectral Indices

Abstract Id: 299
There is a prominent impact of LUCC on dynamic of carbon storage and sequestration in ecosystem. The influence of LUCC on carbon storage via two contributors, one is land conversion, the other is land modification. Studies has focused on the former, while the exploring of latter is scarce. Located in hinterland of he Loess Plateau, the Loess Plateau is a kind of typical ecologically fragile and sensitive area. Dynamic of carbon storage in he Loess Plateau contribution from land conversion and carbon density change of land modification was analyzed in the period from 2001 to 2010 in the paper. With the Land cover data from MODIS MCD12Q1, the biomass density from CDIAC, the soil organic carbon density from JRC, the carbon storage and sequestration of he Loess Plateau was calculated by the InVEST, considering the four carbon pool including aboveground biomass, belowground biomass, dead wood, soil carbon. With quadrats data such as aboveground biomass, soil organic carbon we collected by field survey and in-lab analysis subsequently, the output of the model was calibrated. The main conclusion lies in: 1) The carbon storage increased 2.60×108t from 2000 to 2010 in Loess Plateau. 2) From 2000 to 2010, the land covers characterized with forest increased, cultivated land decreased. The overall trend of land cover has turned for the better but not obvious.3) The carbon storage in the Loess Plateau and the DEM, slope and other geographical factors are related, the slope and elevation and carbon density are significantly correlated. 4) The change of land use type and the change of carbon density have different effects on the carbon accumulation. The contribution rate of land use type change to carbon storage was -1.0%; the contribution of carbon density to carbon storage was 101.0%.

Keywords: carbon storage; Loess Plateau; InVEST; NDVI; carbon density

Abstract Id: 300
The field collection of reflectance spectra of materials (referred as ground truth data) is necessary for interpreting the unknown materials in multispectral as well as hyperspectral remote sensing data and validating the performance of the sensor. Since sample removal for lab study often eliminates the sample’s surface properties and because lab study is impractical for many large natural surfaces therefore, researchers need a reliable field device, in order to bridge the gap between field measurements, lab experimentation and readings gathered from satellite or aircraft sensor. Such devices can also provide data for atmospheric and radiometric correction of satellite images. As with the ground surfaces it is essential to measure the targets with viewing geometry and illumination equivalent to that of imaging sensor of interest. Spectroradiometers generate high quality field spectra at the required viewing geometry and illumination for precise correlation to satellite and aircraft sensor data. Spectroradiometers are available in multiple configurations and compatible with the image analysis software packages such as ENVI, ERDAS Imagine and MultiSpec allowing creation of complete spectral libraries as per applications. This paper highlights some of the spectra collection devices with their specifications and applications for different targets or objects.

Keywords: Spectroradiometers, Reflectance, Spectra, Sensor, Hyperspectral Remote Sensing

Abstract Id: 301
REMOTE MONITORING OF SURFACE FEATURES OF BADAIN JARDAN, TENGGER AND ULAN BUH DESERTS

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The stability and movement of sand dunes, the transport of sand grains and the outbreak of dust storms have become the focus of many scholars. Differences in surface characteristics have important implications for the above processes. This paper develops a new method for assessing surface features based on decision tree approach using the tasseled cap angle, tasseled cap disturbance index and topsoil grain size index derived from MODIS MCD43A4 data. The results showed that (1) this method can be used to analyze the surface features of desert at regional scale; (2) in 2015, there were obvious differences of surface characteristics among three deserts. In the Badain Jardan Desert, the topsoil grain size was relatively coarse, and sand dunes formed northeast-southwest pattern with the relative thin interdunes in the southern and northern parts, and northeast-southwest pattern with the relative wide interdunes in the middle of this region. In the Ulan Buh Desert, the topsoil grain size was also relatively coarse, and the topographic relief was relatively high, and sand dunes formed northwest-southeast pattern with the relative wide interdunes in the southern part, and not clear pattern in the north because of human activities. Except the northwestern corner was similar with the southern of the Ulan Buh Desert, the topsoil grain size of the Tengger Desert was fine, and the topographic relief was relatively short. (3) The Badain Jardan Desert provided the possible sand source to the northwestern corner of the Tengger Desert throughout the northeastern of the Yabrai Mountains and to the southwestern of the Ulan Buh Desert throughout the south of Zongnai Mountains. Future studies may take into account the dynamics of surface features over the last 2000-2015 years. If pay attention to pattern dynamics and surface features of smaller scale, the higher resolution remote sensing data must be used.

Keywords: Tasseled Cap transformation, MCD43A4, TGSi, desert

Abstract Id: 302
DEVELOPMENT OF DROUGHT INFORMATION CHANGE DETECTION MODULE USING SATELLITE IMAGERY AND UNITY 3D

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In this study, a drought information change detection module, which calculates the soil moisture through South Korea using MODIS images and provides change detection services by implementing the image calculation function, was developed. The land surface temperature (MOD11) and vegetation index products (MOD13) data of MODIS images were utilized to calculate the soil moisture index (SMI). In addition, the calculated moisture index data were converted into the base map and grid-based graphic image information capable of mash up to implement the change detection function capable of visual services, and a change detection module based on multiple image operation was developed using the Unity 3D platform and Google Open Map. The change detection module developed in this study can monitor changes in semi real time and quantitatively extract the changed information by retrieving the data of images at different times on the service interface and manipulating the sliding tool bar. This is an advanced function that can visually display the simple change detection results of the existing image analysis software, allowing the user to intuitively monitor and analyze the status. It is expected that the use of the change detection function developed in this study will contribute to quick and scientific decision-making through more effective monitoring of image-based climate change information.

Keywords: MODIS, Drought Information, Change Detection, User Interface, Unity 3D

Abstract Id: 303
CLIMATOLOGY AND TREND ANALYSIS OF GLOBAL TOTAL COLUMNAR OZONE USING OMI SATELLITE DATA DURING 2004 -2017

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The depletion of ozone layer in the stratosphere changes the Earth’s radiation budget and also causes human health effects. The ozone layer variation trend varies from location to location and drastic changes were found from equator to pole. In order to study the trend in the ozone layer OMI satellite L3 data on board Aqua has been utilized from 2004 to 2017 with 1° X 1° resolution data. The result shows the positive trend of 0.384 DU/year over the globe, whereas the Northern and Southern hemispheres are 0.499 DU/year, 0.383 DU/year. A highest positive recovery of 0.957 DU/year has been noticed over Antarctica region and an almost constant trend of 0.071 DU/year over Australia. A positive trend of 0.830 DU/year, 0.681 DU/year, 0.342 DU/year, 0.340 DU/year and 0.374 DU/year are noticed over North America, Asia, Europe, Africa and South America. Total Columnar Ozone (TCO) is high in the North Africa region. Highest depletion of ozone layer is found in 2007, 2012 and 2016 over Antarctica region and its depletion start at the end of the winter season. Nearly 300 DU TCO exists up to mid latitude and above 300 DU are in the high latitudes of Asia. Global mean value for the study period is 289.5 DU. The climatological values are 266.8 DU, 259.4 DU, 319.7 DU, 270 DU, 325 DU, 333.4 DU, 261.7 DU over Africa, Antarctica, Asia, Australia, Europe, North America and South America respectively. The climatological mean value over Northern hemisphere and Southern hemisphere are 294.4 DU and 275 DU respectively.

Keywords: Total Columnar Ozone, Ozone Monitoring Instrument, Climatology, Theilsen trend analysis

Abstract Id: 306
Universal Data Automatic Conversion System for GIS Services

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Current studies on data automatic conversion algorithms for GIS information services and related libraries are limited to certain platforms and thus provide low accessibility. To improve these shortcomings, the proposed universal data automatic conversion system for GIS services is applied to the server/client model and the first client transmits files in satellite image and shapefile (SHP) formats, which are GIS formats, to the server via communication protocol. The server processes the data of the files in satellite image and shapefile formats and transmits the generated results to the client via communication protocol. In other words, the universal data automatic conversion system for GIS services has the server/client-type system configuration in which the client transmits GIS file formats to the server and the server processes the file formats and transmits the results to the client via communication protocol. The system proposed in this study can be applied in various platform environments without being limited to certain platforms. Therefore, it can facilitate the development of programs related to GIS services and shorten the development time by strengthening the use and accessibility of libraries in the program development stage for GIS services.

Keywords: GIS, GEOTIFF, Shapefile, Multi-Platform

Abstract Id: 308
CHARACTERISTICS OF VEGETATION INDICES FROM VISIBLE IMAGES FOR GROUND-BASED PHENOLOGY OBSERVATION

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Ground-based phenology observations using digital cameras are being carried out to understand the effects of climate change on vegetation. They are useful because of their high temporal and spatial resolution compared to satellite observations, and because they can provide detailed information about individual species and ground truth data for satellite observations. When using commercial digital cameras in phenology observations, camera settings such as white balance and the difference of camera models and illumination conditions influence the RGB digital numbers of the images. Vegetation indices, which are indices used in phenology observations that are calculated from digital numbers of images, must also be put in issue. There are many vegetation indices developed, but their characteristics seem unclear. We first examined a method of correcting the color of the images. We took some images of a set of grayscales and leaf color scales in different weather conditions and corrected them by color correction, linear conversion, and gamma correction. We also calculated vegetation indices from images before and after correcting color. We then evaluated the correction and was shown to be effective for digital numbers and vegetation indices. We will then clarify the difference of characteristics between several vegetation indices and investigate what would be useful in phenology observations. We installed a digital camera on the roof of a building and took repeated images of trees. Using the images, we will compare the daily fluctuation of vegetation indices between sunny, cloudy, and partly cloudy days to examine the relationship between the vegetation indices and bidirectional reflectance and direct sunlight. We will also examine the effectiveness of the correction method we examined for vegetation indices in phenology observations.

Keywords: Digital camera, Phenology, Vegetation indices, Grayscale, Color correction

Abstract Id: 309
MODELLING CHLOROPHYLL FLUORESCENCE THROUGH SCOPE AND IN-SITU MEASUREMENTS- A CASE STUDY FOR MANGROVE VEGETATION

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Fluorescence observations add a new dimension in providing a means to detect vegetation stress before chlorophyll reductions happen. Typically, less than 5% of absorbed photons are re-emitted by plants as fluorescence. Various photosynthesis models are in vogue to simulate field and laboratory measurements of chlorophyll fluorescence at the leaf level. SCOPE (Soil Canopy Observation, Photochemistry and Energy fluxes model, Van der Tol et al, 2009a, 2014) which is a vertical (1-D), integrated radiative transfer and energy balance model, based on the existing theory of chlorophyll fluorescence and photosynthesis. In this paper, we have simulated fluorescence using in-situ measurements of biochemical parameters namely Chlorophyll concentration (Cab), Vcmax for summer season over Pichavaram, Tamilnadu. For Pichavaram, fluorescence ranged from 1.3 to 3.7 W m-2 µm-1 sr-1. We have also investigated the sensitivity of fluorescence to biochemical parameters like Vcmax, Cab, atmospheric temperature and vapour pressure, visible radiation and Leaf Area Index (LAI). Fluorescence increased with increase in LAI. However, it tends to saturate at LAI values i.e. greater than 4. LAI values ranging from 1 to 2, the respective fluorescence measured was 0.4 and 1.3 W m⁻² µm⁻¹ sr⁻¹ at Vcmax of 50 µmol m⁻² s⁻¹. We noticed that the fluorescence sensitivity is large for Vcmax less than 150 µmol m⁻² s⁻¹ above which the fluorescence remains almost saturated. Also Simulation of fluorescence for post monsoon and winter season is carried out. Fluorescence observations add a new dimension in providing a means to detect vegetation stress before chlorophyll reductions happen. Typically, less than 5% of absorbed photons are re-emitted by plants as fluorescence. Various photosynthesis models are in vogue to simulate field and laboratory measurements of chlorophyll fluorescence at the leaf level. SCOPE (Soil Canopy Observation, Photochemistry and Energy fluxes model, Van der Tol et al, 2009a, 2014) which is a vertical (1-D), integrated radiative transfer and energy balance model, based on the existing theory of chlorophyll fluorescence and photosynthesis. In this paper, we have simulated fluorescence using in-situ measurements of biochemical parameters namely Chlorophyll concentration (Cab), Vcmax for summer season over Pichavaram, Tamilnadu. For Pichavaram, fluorescence ranged from 1.3 to 3.7 W m⁻² µm⁻¹ sr⁻¹. We have also investigated the sensitivity of fluorescence to biochemical parameters like Vcmax, Cab, atmospheric temperature and vapour pressure, visible radiation and Leaf Area Index (LAI). Fluorescence increased with increase in LAI. However, it tends to saturate at LAI values i.e. greater than 4. LAI values ranging from 1 to 2, the respective fluorescence measured was 0.4 and 1.3 W m⁻² µm⁻¹ sr⁻¹ at Vcmax of 50 µmol m⁻² s⁻¹. We noticed that the fluorescence sensitivity is large for Vcmax less than 150 µmol m⁻² s⁻¹ above which the fluorescence remains almost saturated. Also Simulation of fluorescence for post monsoon and winter season is carried out.

Keywords: SCOPE, Mangrove, Chlorophyll fluorescence, Leaf Area Index

Abstract Id: 310
In the field of Polarimetric Synthetic Aperture Radar (PolSAR), decompositions are an important topic of research. There are a number of model based decompositions already in literature. One of the widely used model based decompositions is the Yamaguchi 4-component Decomposition (Y4O) which succeeded the 3-component Freeman-Durden Decomposition (FDD). Many new decompositions rely on the Y4O namely Yamaguchi 4-component Rotated Decomposition (Y4R), General 4-component Unitary Decomposition (G4U), Adaptive G4U (AG4U) etc, each one refining the preceding decomposition and in turn improving the classification accuracy. The two important indicators for judging the superiority of a decomposition are the reduction of the 1) volume power in areas dominated by buildings oriented at an angle to the radar line of sight (LOS) and 2) number of negative power pixels. Recently, Bhattacharya et. al proposed a method for target detection using the AGU transform intrinsic to AG4U and a criteria based on the evaluation of the novel effective degree of polarization (DoP) which they called AGU-DoP to obtain the optimized coherency matrix (\( T_{\text{opt}} \)). The resulting coherency matrix (\( T \)) was found to be closer to elementary targets conducive for detection of targets. Following which we proposed a new decomposition RDY4O which uses the AGU-DoP transform in sync with a statistical interpretation of off-diagonal elements of the observed coherency matrix through the correlation coefficients. The difference of which between \( T_{\text{opt}} \) and observed \( T \) is modulated with diagonal elements to form decorrelating factors in the final computation of scattering powers. In this work we present an analysis of the correlation coefficients, their independent interpretation and usability in RDY4O and future decompositions. Some applications of RDY4O are also presented. For analysis two full polarimetric data sets are considered : a) AIRSAR L-band PolSAR image of San Francisco Bay area, and b) ALOS-2 L-band PolSAR image of Kyoto city in Japan.

Keywords: PolSAR Scattering Powers, Degree of Polarization, Relative Decorrelation Measure
GIS BASED MORPHOMETRIC ANALYSIS OF AKRA HALLA, CHIKODI AND RAIBAG TALUK, BELAGAVI DISTRICT, KARNATAKA, INDIA

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An attempt has been made to study the drainage morphometric analysis of Akra Halla, Chikodi and Raibag taluk, Belagavi district, Karnataka. Geographic Information System has proved to be an efficient tool in the delineation of drainage pattern for water resource management and planning. Strahler's System classification has been used to classify the stream order. In the present study sixth is highest stream order and watershed shows dendritic drainage pattern. Morphometric parameter such as Linear, Aerial and Relief Aspect has been calculated. Drainage texture having 5.23 indicates the moderate texture. Drainage density is 2.95 indicates the dominance of the surface runoff process in the watershed. Elongation ratio is 0.8 means the watershed is in elongated shape. Relief of the present study area is 787m. Circularity ratio of the area is 0.39 indicating the elongated shape. The data generated from this work will help the researchers for further hydrological studies in this watershed.

Keywords: GIS, Morphometry, Akra Halla

Abstract Id: 315
DEVELOPMENT OF SOIL AND WATER RESOURCES THROUGH SUGGESTED ACTIONS USING REMOTE SENSING AND GIS-A CASE STUDY OF MUZAFFARNAGAR DISTRICT.

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The Socio-economic condition and development of any village/area is based on the potential of land and water resources. Now-a-days these resources are overstretched often leading to depletion due to increase in population and other factors. Therefore it is needed to prudently manage these delicate resources. Action plan preparation is emerging as a potential approach for the further development of soil and water resources of a village/area to usher in democratic decentralization, need based planning and empowerment of the rural region. It covers diverse activities of soil and water conservation, rainfed agriculture, afforestation, wasteland management, rural employment and possibly all other biotic and abiotic activities. Keeping this in mind, a study was carried out for preparation of parcel level Action Plan for the development of soil and water resources available in Muzaffarnagar district, using CARTOSAT-I and LISS IV merged satellite data. The basic objectives of the task were identification of suitable parameters for the development of soil and water resources and preparation of action plan at parcel level. To fulfill the above task, four Lohia villages (i.e. Jaitpur, Mohammadpur Rai Singh, Garhi Nawabad and Kurwa) cadastral maps were studied and other thematic maps were prepared to pace the scope of work. There after these maps were integrated to prepare the action plan map at parcel level for soil and water resources. After getting the outputs from the integration of thematic layers, different suitable actions viz. Desiltation, Agroforestry, Agro-horticulture, Check-Road-Bund (CRB), contour bund etc. were proposed. Results show CRB is a prominent action is required to be taken in all selected villages.

Keywords: Depletion, Desiltation, Check road bund Contour Bund, Agro-horticulture.

Abstract Id: 316
Flood is referred to as the most common disaster in human activities. The main factors are various such as the physical characteristics of the region and the degradation of recharge area due to development in the upstream area of the basin. Flood that occurred in Winongo river in 2016 led to the flooding of dozens of houses in Yogyakarta city and even to washed away a house and bridge in Tegalrejo district. The maximum discharge quantity in the basin should be known to evaluate the capacity of stream thus the flood hazard level can be reduced. This study aims to determine the flood discharge using rational method and unit hydrograph method in Winongo River with the return period for 5, 10, and 50 years and to analyze the flood factors and its characteristics. Flood discharge estimation using unit hydrograph measured by Automatic Water Level Recorder (AWLR) installed in the one of river segment in Tegalrejo District and two rain gauges around Winongo sub-basin. The estimation of flood discharge using rational method has done using cook method by overlaying spatial data such as land use, soils, drainage density, and slope. The result of the rational method has greater value than the unit hydrograph method with return period for 5, 10, and 50 years. The flood discharge estimation using unit hydrograph method averaged only 80% than the estimation using the rational method. The most severe factor in the calculation of rational method is the land use data. The larger amount of built up area increases the runoff. The flood in Winongo River has time to peak about 140 minutes so it relatively went fast. Rainfall has great influence since the baseflow only supplies 40% of the total runoff when the flood occurred.

Keywords: Maximum Discharge, Rational Method, Unit Hydrograph Model

Abstract Id: 318
ALOS-2, which was launched on the 24th of May 2014, is equipped with a fully polarimeric L-band SAR (PALSAR-2). Unlike ALOS-PALSAR, which used to collect polarimetric (PLR) data at one incidence angle (about 22º), PALSAR-2 offers the possibility of providing PLR measurements at various beams (5 beams, with incidence angle varying from 25º to 40º). Therefore, different calibration distortion matrices might be required for the extraction of pure HH, HV, VH, and VV from the PALSAR2 PLR measurements at the various beams.

In this study, PALSAR-2 distortion matrix is measured using CRs deployed in the Amazonian forest. The Freeman calibration technique, which symmetrizes the SAR system prior to the estimation of the distortion matrix elements, is adapted. The Van Zyl calibration algorithm is reconsidered for the optimum estimation of antenna cross-talks, at the presence of azimuthally symmetric reference target of low HV return with reference to HH, VV, and the HH-VV cross-correlation. Six images collected over the Amazonian forest, with Corner Reflectors deployed during the acquisitions, are used to assess ALOS-2 distortion matrix for the five beams. The application of the extended Freeman-Van Zyl calibration method leads to excellent news regarding the L-band ALOS2 system. The antenna is highly isolated with a cross talk lower than -40 dB. Diagonal distortion matrix with antenna cross-talk set up to zero can be used for accurate calibration of ALOS2. The added value of the excellent NESZ of ALOS2 is demonstrated for mapping subsurface permafrost in Northern Alberta peatlands. A key application of low HV backscattering, which can be fulfilled using the excellent ALOS2 NESZ capabilities, and the Touzi Decomposition for optimum polarimetric information extraction.

Keywords: SAR, calibration, polarimetry

Abstract Id: 319
APPLICATION OF MULTI FRAME SUPER RESOLUTION IN REMOTE SENSING DATA

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This research work addresses problem of generating a super resolution image from a set of low resolution, blurred and noisy remote sensing images. The central aim of super resolution is to generate a higher resolution image from lower resolution images. High resolution image offers a high pixel density and thereby more details about the original scene. The super resolution has two approaches - single frame and multi frame super resolution. 'Cartosat-2E' satellite recently launched by Indian Space Research Organization is an earth observational satellite. This has the feature of capturing videos also, therefore multi frame super resolution technique can be used on these videos to improve the spatial resolution of the remote sensing images captured by such satellites. The fast and robust Super Resolution algorithm loads the captured video, extracts the frames out of the video, registers all the frames onto one another and then finally high resolution image is obtained which provides with greater details of the scene. In this research work, L1 norm has been used, both for the regularization and the error terms. Whereas the former is responsible for edge preservation, the latter seeks robustness with respect to motion error, blur, outliers, and other kinds of errors in the fused images. Moreover, following, a robust regularizer is used, related to Total-Variation, called the bilateral filter, to get better performance. In this work L1 norm minimization based solutions has been used, as it is a superior method in dealing with outliers, and produces outstanding results even when there are no outliers present, and the noise is restricted to pure additive Gaussian. This method has been tested on terrestrial video file and around 50-60 percent improvement is observed, so further implementation of this method on remote sensing images or videos can be done.

Keywords: regularization and the error terms, low and high resolution frames, L1 norm.

Abstract Id: 320
Multi-temporal satellite images of the same area are difficult for undertaking change detection procedures because of continuous changes in the atmospheric condition. Therefore, radiometric normalization of these multi-temporal satellite images is inevitable for land cover change detection. Pseudo invariant features were used for radiometric normalization of multi-temporal images. These pseudo invariant features (PIF) were selected manually based on the assumption that reflectance properties of all the PIF’s remain constant. Landsat 8 OLI/TIRS data of February, 2016 and Landsat 5 Thematic Mapper satellite data from two different years (February, 1997 and March, 2009) of Gurugram district were taken for this study. A soft computing technique of Support vector machine (SVM) is used for the classification of radiometrically corrected multi-temporal images. Root mean square error (RMSE) has been calculated for accuracy assessment of these radiometrically normalized images. Land cover change detection was done based on difference map, classified images and class distribution statistics. Seven classes were identified and area statistics under various classes were computed for change detection analysis. The study reveals that there is 11.65% decrease in agricultural area whereas built-up land area was increased by 7.03%. The study successfully explores the potential of the radiometric normalization of multi-temporal satellite images using PIF normalization technique and shows a systematic approach for spatio-temporal changes of rapidly urbanizing Gurugram area. This type of study is very much useful for policy makers and environmental managers.

Keywords: Pseudo invariant feature; Radiometric normalization; Support vector machine; Spatiotemporal change

Abstract Id: 321
ESTIMATION OF ACREAGE UNDER MANGO INTEGRATING REMOTE SENSING AND SURVEY DATA IN WEST GODAVARI DISTRICT

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Horticulture which is fastest growing sector within agriculture is now contributing more to nations GDP thus needs utmost emphasis in terms of reliable agricultural statistics. In mango production, India ranks first in the world. Therefore, reliable and timely estimates of area under mango at national level is essential for policy makers and planners for market planning and export activity. Previously only survey methodologies were used for area estimation under horticultural crops which are time consuming, requires extensive ground survey and involves huge cost. Modern space technology i.e. satellite data can be used as auxiliary variable to improve estimates obtained by survey. An attempt has been made to estimate area under mango using survey data along with satellite data as an auxiliary variable in this study. Traditionally Maximum Likelihood Classifier (MLC) is used for satellite image classification. MLC along machine learning classifiers like Support Vector Machine (SVM) and Artificial Neural network (ANN) were used in this study for satellite image classification. Support Vector Machine using three different kernel functions namely Radial basis function, Sigmoid kernel and polynomial kernel were used to improve the classification accuracy for delineation of mango. The study was undertaken in West Godavari district of Andhra Pradesh using Sentinel 2 satellite data. Best classification method was selected on the basis of kappa coefficient and overall accuracy. SVMRBF outperformed over all the methods with overall accuracy of 94.44 and kappa coefficient 0.9218. The estimates of area under Mango were obtained from survey data and satellite image classification technique. These estimates were further improved by integrating survey data and satellite data as auxiliary variable using ratio and regression estimators. Regression estimator gave very low Standard Error (SE) 11% as compared to ratio estimator (14 % SE). Thus, the study concludes that by integrating survey data and remote sensing data as auxiliary variable improved estimates of area under mango can be obtained

Keywords: Artificial Neural Network (ANN), Maximum Likelihood Classifier (MLC), Support Vector Machine (SVM)

Abstract Id: 323
AUTOMATIC BUILDING DETECTION FROM SINGLE AERIAL PHOTO USING AN UNSUPERVISED PRE-TRAINED CONVOLUTIONAL NEURAL NETWORK

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Automatic building detection from aerial photos is of great practical interest for a number of applications. In this paper, a novel approach based on deep learning algorithms is proposed to detect buildings from a single aerial photo automatically using Convolutional Neural Networks (CNNs). Learning CNNs is commonly carried out by supervised schemes such as the stochastic gradient descent algorithm and for this, several million parameters in a CNN should be initialized with a well-chosen starting point, firstly. On the other hand, in order to train a CNN based on random initialization of parameters, it is necessary to have large amounts of training samples, a long enough training time and enough computational resources. Since the amount of labeled samples is limited in many applications including building detection, training a CNN from scratch it is not possible due to over fitting problem. Therefore, in order to improve the performance of CNN for converging to a good generalizing minimum, an unsupervised pre-training method based on stacked auto-encoders is employed for initializing the parameters. A two-class dataset is first generated including image patches of building and non-building objects extracted from aerial photos. Next, a deep structure of auto-encoders is created and pre-trained so that the first auto-encoder is trained on the raw data and used to initialize the parameters of another auto-encoder. After pre-training, all parameters are fine-tuned. Finally, the generated weights and biases are utilized as initial values for training a CNN. For evaluating the performance of the trained CNN, the candidates are extracted from a single photo using the selective search algorithm and are then fed into the CNN to classify the buildings and non-buildings image patches. The results show that unsupervised pre-training with an auto-encoder architecture can improve the generalization performance of a CNN-based object detection problem on a small dataset.

Keywords: Deep learning, Convolutional Neural Networks (CNNs), Auto-encoders, Building detection

Abstract Id: 326
QUALITY ASSESSMENT OF TIME SERIES MODIS DATA FOR LONG-TERM MONITORING

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The role of remote sensing for long-term monitoring is essential to support the understanding of land surfaces dynamic. Serial monitoring requires periodical and frequent observations to allow discrimination between short- and long-term phenomena. High temporal frequency observations depend upon optical sensors. Moderate Resolution Imaging Spectro-Radiometer (MODIS) offers a higher frequency of temporal observation compared to LANDSAT and a better spatial resolution than Advanced Very High Resolution Radiometer (AVHRR), so provides a good source of hypetemporal observations. The assessment of spatial, radiometric and atmospheric conditions is a prerequisite for consistent hypetemporal observation to inform limiting factors in detecting a given change phenomenon. Satellite and sensor properties, algorithms for data generation, climatic factors during image acquisition, are known factors dictating the quality of images. In tropical areas where the persistent cloud cover exists, the atmospheric condition may determine the quality. Therefore, careful examination of the reliability of data quality (i.e. the invalid pixels) is vital to reduce the likelihood of misleading interpretations of temporal change phenomena. Employing the Time Series Generator (TiSeG) and GeoDa to assess the distribution of time series quality of the MODIS land product, this article examines temporal and spatial reliability of the MODIS product for a 15-year period. This experiment was conducted in the Western part of Java, Indonesia, which is the most dynamic and topographically heterogeneous area in Indonesia. The distribution of invalid pixels of MODIS vegetation indices and its scientific data set (SDS) varied spatially and temporally. Seasonal patterns within the annual span were clearly observed, while some noise was successfully detected. Noise clusters that derive from climatic or instrumental issues were clearly detected by using local association statistical techniques. Correlation coefficients between invalid pixels and terrain factors noticeably highlighted the interrelation between those variables, while as expected, NDVI was insensitive to terrain attributes.

Keywords: reliability, scientific data set, MODIS, NDVI, time series

Abstract Id: 327
BUILDING THE INFORMATION SYSTEM FOR EVALUATING, ADAPTING, AND MINIMIZING THE IMPACT OF CLIMATE CHANGE TO PHU YEN PROVINCE, VIETNAM.

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For many years, the United Nations has recognized the crucial role of utilizing databases in studying climate change with the mindset that without databases, any quantitative evaluation as well as study about climate change is uncertain and unreliable. Programs, softwares, and electronic databases are the legal platform in researching about climate change. The information model and databases of the United Nations serve as the standard for applying such technologies in many countries. In Vietnam, climate change offices are opened at localities across the country. However, the usage of databases is still limited. Some offices have launch informative websites about climate change, yet there is no data sharing between these offices and other provincial and national organizations. In addition, the database designs of different organizations within a province still lack unity. Annual climate change managing work is still in need for modelization. Dealing with the exploding data stream about climate change requires complete comprehensiveness and synchronization between offices within a province as well as other governmental organizations, which, as a result, demands a platform capable of supporting integration and sharing of climate data. This paper reports the initial achievements in developing a database system and a data sharing and integrating model that assist the climate change office of Phu Yen province, Vietnam, in evaluating the impact of climate change on the area as well as developing and executing appropriate methods to reduce and adapt to any consequence that may come. This study includes the using of WebGIS and different mathematical models.

Keywords: Database, WebGIS, Climate change, Mathematical model, Integration

Abstract Id: 329
THE VARIATION OF WETLAND IN THE KAZIRANGA NATIONAL PARK USING FORMOSAT-2 IMAGES.

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The wetland is an important role in ecology, because it’s sensitive at environmental change and rich in species and creatures. And, the Kaziranga National Park (Kaziranga) which is famous for wetland ecology was one of the World Heritage Site for unique evolutionary development and biodiversity in 1985. The aim of this study was to inventory and analysis the variation of Kaziranga’s wetland. The FORMOSAT (FS-2) Database has a lot of worldwide images from 2004 to 2016. Considering the cloud and river flooding factor, the study selected 2 almost cloud-free and 6~9 month (dry season) images (2014.10.25 and 2009.11.07). These images were performed with the Atmospheric Correction by Dark object subtraction (DOS) and Geometric Correction. There are almost evergreen in the Kaziranga, and the Kaziranga are near by the forest and cultivated field. It is hard to distinguish the wetland-vegetation from vegetation using spectral features. This study uses hybrid classification method combining the spectral and texture feature to define wetland-vegetation. Firstly, the Tasseled Cap Transformation was applied in multispectral image (MS) to enhance the spectral feature of three components: soil, vegetation, and water. Then, we used the Grey-Level co-occurrence matrix (GLCM) to derive the texture features from Tasseled Cap layers. The Semivariogram was used to determine the size of moving window when we calculated the GLCM. Finally, a supervised classification -Maximum likelihood was applied to the combination of Tasseled Cap layers and texture features. The result shows that the area of wetland decreases in the past five years, and the factors are the erosion and flooding of river and the odd area turns out of the greenfield.

Keywords: Kaziranga, Tasseled Cap, GLCM, Maximum likelihood, Wetland

Abstract Id: 330
A COLOUR-TEMPERATURE-BASED METHOD TO RECOVER THE SPECTRAL INFORMATION OF THE SHADED OBJECTS

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As the high-resolution remote sensing has been widely applied in earth observation applications, it also encountered many challenges. One of the challenges is the removal of spectral heterogeneity, which is often caused by shadow, from the same object. The mutual shadowing effect between ground objects are more pronounced in the image as the resolution increases, meaning that the proportion of pure-shadow pixels has increased. How to recover the intrinsic spectral information of the ground objects from the shadow pixel is the essential to many remote sensing applications, such as image segmentation, object-oriented classification, and surface parameter inversion. This paper proposed a color-temperature based projection method in log-spectral space called Color-Temperature-based Mapping on Maximum Illuminated Objects (CTMMIO), which describe solar incident radiation as a function of color temperature to simplify the radiation transfer in atmosphere. The CTMMIO method is easy to operate and with high accuracy. Simulations of surface incident radiance and correlated black body radiation using MODTRAN (MODerate resolution atmospheric TRANsmission) software shows that CTMMIO can recover the light condition of shadowed object from the diffuse skylight into a direct illuminated situation. The experiment on the Chinese GaoFen-series(GF) high resolution image shows that in the shorter wavelength band, the reflectance difference brought by sky diffused radiation spectrum in shadow area is restored to the level of normal light condition at the cost of one band’s information. The normalized difference vegetation index (NDVI) of forest area is also enhanced, and then improve the accuracy of vegetation fractional cover estimation. Comparison between illuminated area and shadowed area shows that the vegetation cover estimated after CTMMIO increased about 0.23, close to its well-illuminated condition. As a result, this method could help enhance the homogeneity of the same ground objects, the precision of the ground parameter inversion such as vegetation cover could be improved remarkably

Keywords: Shadow recovery, colour temperature, diffuse radiation, high-resolution image processing, fractional vegetation cover

Abstract Id: 331
STATISTICAL DOWNSCALING OF GRACE DERIVED TERESSTRIAL WATER STORAGE (TWS) PRODUCT: CASE STUDY FOR SRI LANKA

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Water is a vital and finite resource for all living beings on earth, with only 3% of the total water budget coming from fresh water sources. Groundwater accounts for about 98% of the total freshwater budget on Earth, with the remaining 2% divided between rivers, lakes, freshwater wetlands, and moisture in the atmosphere. To support all living beings, it is very important to harness, conserve, and manage this resource effectively, especially in arid and semi-arid regions, where water is scarce. With the arrival of technology, humans have discovered new methods to detect, analyse and harness this vital resource. The conventional way of detecting underground water is on-site measurements which is both expensive and time consuming, and completely inefficient in larger areas. With the advent of remote sensing technologies, this vital resource can be monitored efficiently and inexpensively. Though optical and microwave remote sensing can detect underground water content to some extent, detection of the underground water storage change is unsuccessful. This is because optical remote sensing uses indirect methods (analyzing terrain features and land cover) and deviation in penetration of microwave pulses from different objects. On the other hand, gravity variations can answer the question by monitoring the terrestrial water storage change effectively. Gravity Recovery and Climate Experiment (GRACE) provides gravity variation data and products like Terrestrial Water Storage (TWS) change over a period of time which can be used to detect and analyse the terrestrial water storage change effectively. However, the very coarse spatial resolution (110 km by 110 km) in GRACE is not sensitive enough to cater to the demand of hydrological researches at smaller scales, and this is especially true for small lands like Sri Lanka. Hence the objective of this research was to investigate the feasibility of downscaling the GRACE derived TWS product using

Keywords: Ground Water, Gravity, GRACE, Downscaling, MODIS

Abstract Id: 332
SUBPIXEL EDGE DETECTION WITH QUALITY INDICATOR AIDED TO PRESERVING THE DEPTH DISCONTINUITIES

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The integrity of geometric edge is vital to the high-quality 3-D scene representation. Thus, under the task of automated as well as successful 3-D scene or object reconstruction by photogrammetric approaches, edge detection and matching become an indispensable essential. Various edge detection techniques can only provide the locations of edge up to one pixel level, which may still incur significant intersection error when dealing with acute depth discontinuities. It was aimed in this study to obtain the subpixel accuracy of edge position to support dense image matching by means of gradient interpolation through appropriate function and weighting. In addition, an indicator giving the reliability of detected edges was also proposed. It was demonstrated that the proposed work scheme can support subpixel edge location on one hand and identify those weak edges to be denied or cautiously employed for the follow-up tasks, on the other hand.

Keywords: Edge Detection, Subpixel, Depth Discontinuities

Abstract Id: 333
AERIAL IMAGE BASED QUANTIFICATION OF THE GRASSLAND ENCROACHMENT BY *RHODODENDRON ARBOREUM* WITHIN THE HORTON PLAINS NATIONAL PARK


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Forest and/or tree encroachment into grasslands has been reported from the Horton plains of the central highlands of Sri Lanka for a period over a decade. In this study three change detection methods were employed to identify and quantify the grassland encroachment by *Rhododendron arboreum* from the forest-grassland ecotone within the Horton Plains National Park using a time series (1956, 1972, and 1982) aerial photographs. Reference data from 2016 Google Earth image, together with ground truth in the field were collected to validate the results. Five areas as plots were subjected to the study. Change information of *Rhododendron arboreum* was preserved and stored in the first principle component image through principle component analysis (PCA). Visual interpretation clearly identifies the encroachment with the PCA results. Band rationing proved that 1982/1956 ratio image detects highest change between the two years in each plot, when compared with 1972/1956 ratio image. Even though many previous studies failed to detect changes through this method, three out of five plots in the present study proved encroachment of *Rhododendron arboreum* between 1956 and 1982. Using the results of the texture analysis, the highest rate of encroachment (22.6%) was shown during 1982-2016. Further, the plot 05 shows the overall highest rate of encroachment (41.12%) while the plot 04 recorded the lowest rate of encroachment (5.3%). Landscape and patch metrics were calculated for the time series to evaluate the temporal changes and spatial patterns of the grassland encroachment by *Rhododendron arboreum*. Results reveal larger patches are getting more connected over time, causing disappearance of grassland patches in between. Number of patches, mean patch size, and the radius of gyration metrics show significant increase in each plot over time, indicating that the spatial configuration of the landscape is changing and *Rhododendron arboreum* is highly capable of further encroachment if the...

Keywords: Horton Plains National Park, Aerial Photographs, Principal component analysis, Rhododendron arboreum, Texture classification

Abstract Id: 334
ASSESSMENT OF FLOOD RISK BY USING SATELLITE BASED RAINFALL DATA IN WATERSHED SCALE

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Flood is the major disaster in Asia. For some big rivers such as Mekong, Chaophraya and Ganges, the flood in the lower basin is caused by the intensive rainfall for long period on some parts in the catchment a few months before the event, whereas, the flash floods are caused by the heavy rainfall for about a few or several days before the event on the site. In this study, the risk of flood was assessed by using satellite based rainfall data such as GsMAP from the previous flood events reported to Sentinel Asia which works as the emergency response for disasters in Asia and Pacific by the space agencies in the region since 2006. The daily rainfall data from April 2000 to March 2017 of GsMAP was used for the analysis. A watershed model was applied to understand the accumulated rainfall in catchment areas for the study area. The assessment was conducted through statistical approach in order to detect the anomaly in accumulated rainfall based on areas and periods in various scale, and a flood risk index was proposed. The index has a potential to support early warning for some cases of previous flood events. To improve the reliability of the index, issues about the accuracy of rainfall data and feasibility of watershed model are discussed.

Keywords: Flood GsMAP Risk assessment

Abstract Id: 335
Flood is the major disaster in Asia. For some big rivers such as Mekong, Chaophraya and Ganges, the flood in the lower basin is caused by the intensive rainfall for long period on some parts in the catchment a few months before the event, whereas, the flash floods are caused by the heavy rainfall for about a few or several days before the event on the site. In this study, the risk of flood was assessed by using satellite based rainfall data such as GsMAP from the previous flood events reported to Sentinel Asia which works as the emergency response for disasters in Asia and Pacific by the space agencies in the region since 2006. The daily rainfall data from April 2000 to March 2017 of GsMAP was used for the analysis. A watershed model was applied to understand the accumulated rainfall in catchment areas for the study area. The assessment was conducted through statistical approach in order to detect the anomaly in accumulated rainfall based on areas and periods in various scale, and a flood risk index was proposed. The index has a potential to support early warning for some cases of previous flood events. To improve the reliability of the index, issues about the accuracy of rainfall data and feasibility of watershed model are discussed.

Keywords: Citizen Science, Swachh Bharat Abhiyan, Citizen Centric e-Governance
QUALITY AND EFFECTIVENESS OF GEOMETRIC APPROACH SOLVING WATER SURFACE AND UNDERWATER OBJECT POINTS

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To deal with photogrammetric intersection considering the refraction effect in the functional model, where the camera and the object of interest are not as usual in the same optical media, only by quality object-to-image correspondence could lead to the whole path of imaging ray being correctly established. That is, the multi-media geometry has to be incorporated into geometric models. Therefore, the extension of standard photogrammetric imaging models adding Snell's Law for refraction effects is absolutely required. Under the assumption of all involved media being both homogeneous and isotropic, this study adopts piercing points to play a role of supporting points of the image ray through the interfaces of the different media. Besides, this study also aims to determine the underwater object points and the water surface simultaneously in air-to-water photogrammetry. Subsequently, the pseudo-observations are drawn into the adjustment model to offer great flexibility in adopting priori information of parameters so that the uncertainties of orientation parameters, water surface, refractive index, and image point measurement can be individually or unitedly considered. This study is concluded by reporting the quality and the effectiveness of the proposed approach in determining underwater object points and water surface.

Keywords: Refraction, Water surface, Underwater object points, Influential factors

Abstract Id: 337
DETECTION OF CREEPS USING DIFFERENTIAL INTERFEROMETRIC SAR TECHNIQUE IN THE HIMALAYAS

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Landslides are one of the most significant geo-hazards in terms of socio-economic implications, threatening cultivated lands and human settlements. The Himalayan region due to its tectonic setup is highly prone to landslides. Landslides in the Himalayas are triggered by heavy rainfall and earthquakes. Due to the inaccessible nature of the terrain, remote sensing data can be effectively used to identify the location of the landslide and subsequent damage. While fast moving landslides such as rock fall or debris slides can be identified using optical remote sensing data, identification of slow moving landslides such as "creeps" is a challenging task. However, differential interferometric methods using microwave satellite data have been proved to identify slow movements with millimetre level accuracy. Space borne Synthetic Aperture Radar (SAR) such as Sentinel-1 acquires consistent and periodic radar images, which can be accurately used to estimate ground movement using DInSAR technique. In the present study, Sentinel-1 data in interferometric wide swath (IW) mode, acquired on 03 December 2016 and 01 June 2017 over a segment of the Himalayas in Himachal Pradesh, India along with SRTM 30m digital elevation model was used to attempt detection of "creeps" in the region. The Interferometric data are processed using Gamma Software©. The workflow involves are SAR co-registration, interferogram generation, phase unwrapping and displacement calculation. The study will assess the utility of Sentinel-1SAR images in detecting creep landslides over a large area. This will also help identification of boundaries of the actively moving landslide and updating landslide inventory for the Himalayan region.

Keywords: Creeps, Differential SAR Interferometry, Sentinel-1, Digital Elevation Model and Displacement

Abstract Id: 338
QUALIFICATION OF IMAGING OPTICS FOR FIRST INTERPLANETARY MARS ORBITER MISSION OF ISRO

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Mars Orbital Mission (MOM) is India’s first interplanetary mission launched by ISRO. The main objective of this mission was development of technologies for an interplanetary mission. MOM had well-defined scientific goals of exploration of Mars surface features, morphology, mineralogy and Martian atmosphere. The actual elliptical orbit of the mission is 421.7km × 76993.6 km around Mars. Three Electro-Optical Payloads Thermal Imaging Spectrometer (TIS), Methane Sensor for Mars (MSM) and Mars Colour Camera (MCC) were developed by Space Application Centre, ISRO (Ahmedabad). Several COTS (Commercial off the Shelf) optical components like Germanium lenses, ZnSe lenses, fused silica thermal filter, borosilicate IR cut-off filter aluminium field stop optics, silicon Etalon, aluminium reflection grating, N-BK7 band pass filter & beam splitter were used to realize these Electro-Optical (EO) payloads. As these are COTS components, it had undergone rigorous screening and qualification tests to assess and ensure their worthiness in space use in terms of important optical performance parameters - MTF, transmission or spectral response, diffraction efficiency, free spectral range, bandwidth etc. The overall qualification was conducted at three level; namely discrete optical component level, optical sub-assembly level and integrated optical payload level. This paper briefly describes the imaging optics qualification test plan, test procedure and important integrated payload test results of all the three optical payloads and finally conclusion is drawn.

Keywords: Mars, Germanium, Transmission, COTS, Qualification

Abstract Id: 339
Sri Lanka is famous for its rich tea cultivation. The main tea growing areas in Sri Lanka are the Central, Uva, Southern and Sabaragamuwa Province. Tea is hard to monitor for its health as it's a non-seasonal plant species. Spectral signatures can be used as a major parameter to monitor the health of tea bushes using multispectral or hyperspectral satellite images, because the class separability is insignificant. Yet the spectral libraries generated for healthy and unhealthy tea plants are at a vacuum. In this study, an attempt has been made with the help of Remote Sensing and GIS techniques to monitor the tea plant health by using the spectral responses in the visible and Near Infrared (NIR) regions of the Electromagnetic Spectrum. For this research Landsat-8 OLI\TIRS images of January, February, March, and September, 2016 were used. Atmospheric corrections were performed in order to convert the pixel DN values to the ground target reflectance. Prior to the spectral profile generation Supervised classification was performed using Support Vector Machine (SVM) to classify the image into eight land use classes namely tea, water, forest, urban, scrub, other vegetation and Soil. From the classified images Tea growing areas were identified. Then the spectral profiles for these tea patches were generated. Healthy tea patches show high reflectance in the Green and NIR regions. In contrast reflectance in RED and BLUE spectrum is low due to absorption of chlorophyll. Alongside the Grey Level Co-occurrence Matrix (GLCM) based texture variations and Normalized Difference Vegetation Index (NDVI) analysis have been used to verify the results. Typical reflectance values for the healthy and unhealthy tea for the month of September in the Green region was 0.078 and 0.066, NIR region 0.380 and 0.272. The profiles generated could be used in classifying tea health especially for the tropical regions.

Keywords: NDVI, Texture, GLCM, Healthy and Unhealthy, Plant Spectral profile, Regression analysis, GIS

Abstract Id: 341
URBAN SPRAWL ANALYSIS USING GEOSPATIAL APPROACH IN
YAMUNANAGAR REGION, HARYANA, INDIA

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Land use land cover change (LULCC) may influence many natural phenomena and ecological processes, including runoff, soil erosion and sedimentation and soil conditions. The Urban areas are changing due to various human activities, natural conditions and development activities. Information on urban sprawl is very vital for spatial planning, management, and utilization of land. The spatio-temporal analysis of land surface attributes indicates a complexity of land use land cover change. In this study an attempt has been made to determine the extent of urban area and urban growth in Yamunanagar, Haryana from 1973 to 2011 in eight different directions and Shannon's entropy approach was used to analyze and assess urban expansion trends in the study area. The results demonstrate that there has been an overall increase in the built-up area by 196% from 1973 to 2011 in a haphazard manner at the cost of agricultural lands. The highest values of the entropy are found on the eastern side along National and State Highways indicate that Yamunanagar city has overall high dispersed urban expansion. The population growth and the processes of industrial development in both urban and rural parts of the district may be seen as factors for land transformation in the given period. The study was carried out through Remote Sensing and GIS approach using Soil Toposheets and Landsat imageries of five-time points during 1973 to 2011.

Keywords: Urbanization, Urban sprawl, Shannon’s entropy, Remote sensing, Yamunanagar

Abstract Id: 346
DETECTION OF FOREST DISTURBANCES BY TIME SERIES ANALYSIS OF NDVI FROM MODIS SENSOR FOR MICHOACÁN STATE, MEXICO (2000 - 2014)

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Time-series vegetation index (NDVI) from MODIS product MOD13Q1 was used to detect forest disturbance for the period of 2000-2014 for Michoacán state, Mexico. The data were pre-processed by applying a quality layer to remove pixels with undesirable quality. Spline interpolation was applied to fill the gaps and afterwards Savitzky-Golay filter was applied to smooth the time-series data for change detection. We adopted the Breaks for Additive Seasonal and Trend (BFAST) method implemented in R for forest disturbance detection which was proposed by Verbesselt et al. (2010). By this method, data from 2000 - 2007 was used as reference period, and data 2007 - 2014 as detection period. This method decomposes the time series into harmonic function, trend and remainder (noise). The method detects break points and change magnitude; area of disturbance is defined by overlapping of map of break points and change magnitude. Three thresholds of change magnitude were adopted: 0, 0.05 and 0.1 and two types of changes were detected: forest gain and forest loss. The detected changes were compared with the changes derived from high spatial resolution land cover maps (10 m) from 2007 and 2014. The results show that for the change pixels that coincided, MODIS NDVI time-series analysis detected less changes than the reference data. With the change magnitude threshold varying from 0.1, to 0.05 and to 0, the detected changes vary from 19%, to 42%, and to 86% of the total reference data. By using higher spatial resolution images, many small-sized changes can be detected which are often omitted by coarse spatial resolution MODIS images. This is why the changes detected by MODIS are less than those by high spatial resolution images. On the other hand, by change magnitude, MODIS detects changes not only deforestation and recovery but degradation and regrowth as well.

Keywords: forest disturbance, NDVI, time-series, MODIS, BFAST

Abstract Id: 347
GENERATION OF VIIRS DNB CLOUD FREE TIME COMPOSITES TO IDENTIFY NEWLY ELECTRIFIED VILLAGES

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Time-series vegetation index (NDVI) from MODIS product MOD13Q1 was used to detect forest disturbance for the period of 2000-2014 for Michoacán state, Mexico. The data were pre-processed by applying a quality layer to remove pixels with undesirable quality. Spline interpolation was applied to fill the gaps and afterwards Savitzky-Golay filter was applied to smooth the time-series data for change detection. We adopted the Breaks for Additive Seasonal and Trend (BFAST) method implemented in R for forest disturbance detection which was proposed by Verbesselt et al. (2010). By this method, data from 2000 - 2007 was used as reference period, and data 2007 - 2014 as detection period. This method decomposes the time series into harmonic function, trend and remainder (noise). The method detects break points and change magnitude; area of disturbance is defined by overlapping of map of break points and change magnitude. Three thresholds of change magnitude were adopted: 0, 0.05 and 0.1 and two types of changes were detected: forest gain and forest loss. The detected changes were compared with the changes derived from high spatial resolution land cover maps (10 m) from 2007 and 2014. The results show that for the change pixels that coincided, MODIS NDVI time-series analysis detected less changes than the reference data. With the change magnitude threshold varying from 0.1, to 0.05 and to 0, the detected changes vary from 19%, to 42%, and to 86% of the total reference data. By using higher spatial resolution images, many small-sized changes can be detected which are often omitted by coarse spatial resolution MODIS images. This is why the changes detected by MODIS are less than those by high spatial resolution images. On the other hand, by change magnitude, MODIS detects changes not only deforestation and recovery but degradation and regrowth as well.

Keywords: DMSP,S-NPP,VIIRS,DNB,Cloudmask

Abstract Id: 348
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GEOMETRIC CORRECTION OF UAV-BASED PUSH-BROOM HYPERSPECTRAL SYSTEM

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Low-cost unmanned airborne vehicles (UAVs) are emerging as a promising platform for remote-sensing data acquisition to satisfy the needs of wide range of applications. However, the UAV platform will inevitably result in tilting, shaking which leads to rotation and projection deformation in the acquired image, especially, geometric correction is more difficult than other platform, and relatively few studies focuses on this field. This study proposes a set of comprehensive geometric processing procedure, and has three innovation points: ① The two axis stabilization technique was used to reduces the geometric distortion of the original data; ② For hardware system, the frame frequency of hyperspectral imager is synchronously obtained with POS/IMU data, which reduces the difficulty of data post-processing; ③ Mathematical method is used to obtain the pixel's longitude and latitude and attitude information of the original image, and then geometric correction is carried out. This paper compared two results of geometric correction methods according to different combinations of ancillary data sets: control points based and POS data based. The results show that the proposed method can effectively eliminate the error control points and improve the accuracy of geometric correction which guarantees the precision of the constructed control point database and provides strong support for automatic extraction of control point within this region; in the process of POS data based geometric correction, two fast search methods were proposed in the indirect method for determining the optimal scan lines, and according to the characteristics of the test data, best search strategy was selected to effectively improve the search efficiency and accuracy.

Keywords: UAV, geometric correction, push-broom hyperspectral system, remote sensing

Abstract Id: 349
CARBON SEQUESTRATION CAPACITY OF THE TIBETAN PLATEAU AND ITS ATTRIBUTION ANALYSIS

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Land use change is one of the reasons of the change of the ecosystem carbon accumulation. Affected by many factors together, the Qinghai-Tibet Plateau is the world’s highest, horizontal zonality and the vertical zonality closely with natural geographical units, study the land use/land cover change on the influence of carbon accumulation has great significance for tackling climate change. Using MCD12Q1 land classification data, including the aboveground biomass, belowground biomass, soil carbon and dead wood, with the data of sample to verify the parameters, in the InVEST model for simulating ecosystem carbon accumulation, and analyzed the 2001-2010 carbon accumulation dynamic changes of the Qinghai-Tibet Plateau and its impact factors, the main conclusions are:

1) From 2001 to 2010, carbon storage of the Qinghai-Tibet Plateau increased by 1.039 billion t. Carbon storage has a downward trend in southern and eastern Qinghai-Tibet Plateau where vegetation coverage is better, increased significantly in northwestern Qiang Tang area, the rest were stable increase.

2) The land covers characterized with high carbon density increased in area, such as grassland and forest; those with low carbon density decreased in area, for instance shrub and spare vegetation. The land conversion improve the capacity of carbon storage. Assuming the carbon density in each type of land cover being constant, only the land cover types caused carbon storage increased by 116 million t, accounting for 13.82% of the carbon storage dynamic.

3) 10 years, broad leaved forest, deciduous evergreen needle, such as carbon density of high class carbon density decreased, grassland, sparse vegetation carbon density of lower class carbon density increased significantly. Assuming the same land cover types, only consider carbon density changes cause the accumulation of carbon, 2001-2010, caused by the change of carbon density of the qinghai-tibet plateau volume increased 722 million tons of carbon, carbon density changes of carbon accumulation contribution rate is 86.18%

Keywords: carbon accumulation; Land use; The density of carbon; InVEST; NDVI

Abstract Id: 350
Temperature lapse rate (TLR), an essential parameter for snowmelt runoff analysis, was determined for the Beas River basin in the Western Himalayas. LANDSAT 8 (formerly the Landsat Data Continuity Mission, LDCM) data sets were used to determine the land surface temperature (LST) of the region using the Split-Window (SW) algorithm. The LST was correlated with the elevation values obtained from ASTER (Advanced Space borne Thermal Emission and Reflection Radiometer) Digital Elevation Model (DEM) data of US Geological Survey (USGS) of the same area and the trend showed an inverse relationship between LST and elevation. The TLRs for the study area for the time period 18 April, 2013 to 30 August, 2015 were in the range 0.47–0.93°C/100 m. The results obtained were compared with lapse rates determined using Moderate Resolution Imaging Spectroradiometer (MODIS) LST maps. TLR determination in the past was based on air temperature data available from meteorological stations that are sparsely located in rugged terrain such as the Himalayas. As these measurements were point data and had been measured manually, they may have led to erroneous results. Satellite data, however, provide continuous and potentially unbiased recording provided an accurate radiometric calibration and atmospheric correction can be achieved. A previous TLR calculation using air temperature from meteorological stations for the western Himalayan region was found to be 0.65°C/100 m. Air temperature and LST from LANDSAT 8 and MODIS-Terra data were found to be in good agreement. This type of study will be useful for snowmelt runoff modelling studies for the Himalayan region.

Keywords: Temperature lapse rate, LANDSAT 8, Split-Window, ASTER, DEM

Abstract Id: 351
GEO-SPATIAL INVESTIGATION IN TO THE RECENTLY AGGRAVATED URBANIZATION AND DROUGHT SITUATION IN KERALA, INDIA

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Kerala State is recently experiencing extensive change in its climatic scenario in the form of less rainfall, its erratic pattern and high summer temperature as per various reports. This study investigated the phenomena trying to analyze its spatio-temporal trend for the last 30 years from 1986 using space-based satellite images and in-situ climate data. One of the recently elevated municipality in high-range mountainous Western Ghat district of the State - Idukki viz. Kattappana is taken as a specific case of investigation for the driving factors. Though post-monsoon and winter season rainfall shows increasing trend; monsoonal and summer rainfall shows highly decreasing trend. 2016 was the driest year with highest percentage departure from the normal rainfall and highest brightness temperature with extremely high intensity coinciding with considerable increase in the non-vegetation area as per the NDVI and the failure of both south-west and north-east monsoon. Wayanad district recorded the highest percentage departure of annual total rainfall from the normal consistently throughout the study period. As per the occurrence of deviation in Standard Precipitation Index, highest frequency of Extremely Dry Occurrence recorded at Kozhikode (10) and Palakkad (8) and Severely Dry Occurrence in Idukki (5) and Kottayam (5) districts. In Kattappana Municipality alone, the extent of core urban and semi urban built-up increased from 12% of the total area to 35% during 2001 to 2016 matching with increase in urban population and the number of built-ups such as educational institutions, hospitals and commercial centers. Same may be the case with other municipalities and towns in the Ghat area of the State like Bathery in Wayanad, Nedumkandam in Idukki and Pala, Earattupetta in Kottayam districts. This has caused aggravated deviation from the long-term normal of the micro-climatic situation in terms of the total quantity and spatio-temporal distribution with serious socio-economic and environmental consequences.

Keywords: climate change, drought, urbanization, NDVI, BT

Abstract Id: 352
ONLINE 3D SIMULATION AND VIRTUAL REALITY OF DISASTER AFFECTED AREAS IN HILLY REGION

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High-elevated areas of Northern India suffer extreme rainfall events frequently, which cause huge damages to the lives and property. Therefore, it is important to study such disastrous events and reduce the damages associated with them as far as possible. Online 3D geo-visualization and simulation can be an effective tool to study such events for effective planning and decision making. The recent advancements in web application technology using HTML5 and WebGL can be useful for the development of an interoperable online 3D geo-visualization system. Various virtual globes such as WebGL Earth, Cesium Virtual Globe, and Open Web Globe have been developed by the researchers for 3D visualization. This study focuses on developing a web-based framework to analyze and visualize flood-inundated areas in real time using flood-modelling techniques in the spatial domain. This study uses high-resolution Cartosat DEM (10m) and Cartosat imagery (2.5m MSI) for effective analysis. The Height Above Nearest Drainage (HAND) hydrological model has been used in this study for generating a spatial layer of the inundated area. This study also includes the development of on-the-fly 3D analysis, performed directly by the client. A public participatory approach has been developed for the management of disaster in the hilly region. This study also integrates a mobile application with Cesium environment for the public participation in effective decision making and planning. The mobile application contains various functionalities such as Reporting system, Emergency call, Disaster alerts and Geo-visualization. It also focuses on studying the flash flood disaster and providing the requirements for creating a disaster-specific GIS data repository.

Keywords: 3D visualization, HAND, Web-GIS, 3D-GIS, GIS repository

Abstract Id: 353
This study focuses on applying remote sensing and structural equation modeling (SEM) to assess the effect between green space and net primary productivity (NPP) of urban forms. The study area is Greater Taipei area in Taiwan, which includes two urban forms. One is Taipei City and the other is Taipei metropolitan area (i.e., Taipei City, New Taipei, and Keelung). The research processes include the calculation and selection of landscape indices, the NPP estimation using remote sensing, and the assessment of green space on the NPP between urban forms using the SEM. The results indicate as follows. (1) The green space of Taipei City is 65.44% in 2006 and the annual NPP is 2.09 ton/ha/yr. The effect of green space on the NPP is 0.86 according to the SEM established by six landscape indices, that is, percentage of landscape (PLAND), patch density (PD), largest patch index (LPI), mean Euclidean nearest neighbor distance (ENN_MN), area-weighted mean shape index (SHAPE_AM), mean patch size (AREA_MN). (2) The green space of Taipei metropolitan area is 86.32% in 2006 and the annual NPP is 3.20 ton/ha/yr. The effect of green space on the NPP is 0.93 under the established SEM by six landscape indices [PLAND, PD, LPI, ENN_MN, SHAPE_MN (mean shape index), CONTIG_AM (area-weighted mean contiguity index)]. (3) Assessing the effect between green space and NPP of two urban forms, Taipei metropolitan area is higher than Taipei City although two selected indices are different. From the above result, obviously remote sensing is a timely, economic, effective, and large-scale approach for the NPP estimation. Meanwhile, structural equation modeling is feasible to assess the effect of green space on the NPP between urban forms. The result obtained from this study can be a reference for the sustainable urban planning of Greater Taipei area in Taiwan.

Keywords: Remote sensing, structural equation modeling, green space, net primary productivity

Abstract Id: 355
A DEEP LEARNING APPROACH FOR HYPERSPECTRAL, MULTISPECTRAL AND PANCHROMATIC IMAGE FUSION

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High spatial and spectral resolution satellite data play important role in research and studies in various applications of remote sensing. Pansharpened images have been used by researchers since long time to get resultant images having improved spatial and spectral information. Similarly, fusion of high resolution multispectral data with low spatial resolution hyperspectral data retaining spatial as well as spectral information in fused image are also used. In this paper, a method is proposed which fuses high spatial resolution panchromatic, medium spatial resolution multispectral and low spatial resolution hyperspectral image to get a resultant image of better spectral and spatial resolutions as compared to their respective panchromatic and hyperspectral images. Multispectral and hyperspectral images are fused using 2D convolution neural network of deep learning techniques by preserving spectral information of hyperspectral and then spatial resolution of intermediate image is further improved by pansharpening with an available panchromatic image using sparse stacked denoising autoencoders. The proposed method is compared with other state of the art methods using various quality parameters which shows promising results.

Keywords: Hyperspectral Data, Multispectral Data, Panchromatic Image, Convolutional Neural Network, Deep Learning

Abstract Id: 356
THERE HEIGHT DERIVED FROM POINT CLOUDS OF UAV COMPARED TO AIRBORNE LASER SCANNING AND ITS EFFECT ON ESTIMATING BIOMASS AND CARBON STOCK IN TROPICAL RAIN FOREST OF MALAYSIA

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Abstract: Forests occupy about one-third of the land area of the earth and have been playing a crucial role in regulating the adverse effect of increased emission of greenhouse gases. Tropical rain forests have higher capacity to sequester carbon dioxide and hence play a role in stabilization of the concentration of greenhouse gases in the atmosphere. Forest inventory parameters require accurate information for biomass and carbon stock estimation. However, acquiring of forest inventory parameter data especially tree height and DBH for estimation of biomass and carbon stock is often a major challenge in tropical forest. Tree height and Diameter at Breast height (DBH) are important parameters of the forest that used as input in the allometric equation for quantification of forest biomass and carbon stock. Tree height is one of essential variable in the quantitative assessment of forest biomass and carbon stocks. Literature revealed that in the inclusion of tree height in the model can significantly improve the accuracy of estimating biomass and carbon stock. There are several techniques, range from traditional field work using hypsometers to the more advanced approaches of using remote sensing, can be used to estimate biomass/carbon stock. Airborne laser scanner (ALS) has been used as a fundamental remote sensing technique to estimate biomass/carbon stock. Advances in photogrammetry image matching of UAV 3D point cloud extraction technology from very high-resolution images potentially offer a less expensive and flexible alternative of ALS. The main objective of this research is to investigate the accuracy of tree height extracted from 3D point clouds of photogrammetry image matching of UAV in comparison to tree height measured with ALS data and assessing its effect on estimation of biomass and carbon stock of tropical rain forest. The accuracy of photogrammetry image matching DTM of UAV and that of LiDAR was assessed by using height (z value) recorded by Differential Global Positioning System (DGPS) and it was revealed that RMSE of UAV DTM was 3.84 m or 7.96% and $R^2 = 0.96$. While the same measures for LiDAR RMSE, RMSE% and $R^2$ were 1.25 m, 2.75% and 0.99. Then the accuracy of the DTM of UAV was assessed by comparison to the DTM of ALS in all six flight of UAV, and the results revealed that RMSE, RMSE% and $R^2$ were 0.31 to 1.49 m, 1.57% to 8.34% and 0.53 to 0.82 respectively. The accuracy assessment went further and assessed DTM generated from photogrammetry image matching of UAV in the area which shows small difference between UAV and LiDAR DTM. In this case the RMSE was 0.19 m, RMSE% = 0.5%, $R^2$ was 0.99. While at the same area, estimated tree height of UAV images compared to tree height from airborne LiDAR showed RMSE of 1.56 m and RMSE% of 8.7 with $R^2$ of 0.8. The accuracy assessment revealed that 97% of field biomass was accurately modeled by ALS computed biomass, with RMSE of 0.11 Mg (24%). While 99% of calculated UAV biomass was accurately predicted by ALS computed biomass, with RMSE of 0.06 Mg and RMSE% of 13. The measured tree heights were later adjusted to reveal its influence on the calculated AGB and carbon stock. The field trees height was adjusted based on RMSE of 3m while tree height derived from photogrammetry image matching of UAV was adjusted by RMSE = 4m.

Keywords: Tree height, Point cloud, UAV, ALS, Carbon, Tropical forest Malaysia

Abstract Id: 358
CHARACTERISING URBAN HEAT ISLAND IMPACT IN TWO INDIA CITIES: POSSIBLE IMPACT ON SMART CITY PROJECT

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The study involves the comparison of Surface Urban Heat Island (SUHI) in Ahmedabad and Guwahati city using thermal remote sensing technique as they are situated in different climatic condition. These two cities are among the fastest growing cities of India in present. It is well understood that urbanization has led to the substantial growth of the Ahmedabad and Guwahati city, making it the largest in western and north eastern India respectively. This is causing the lateral expansion of the urban extents towards the surrounding rural area. In the current research, MODIS thermal remote sensing data is used to derive the land surface temperature (LST) over the cities for a period of 15 years. An urban heat island phenomenon is evident over the city with a gradual increase in its magnitude over the years from 2001 to 2015. A Gaussian fitting algorithm is performed to highlight the heat island signature with respect to the surrounding rural region and also the spatial extents of SUHI area. The study reveals the variability of SUHI over the cities during summer season. The night time LST shows an increasing trend in the UHI magnitude for a period of 15 years. An overall increase in the urban heat island magnitude and extent is profoundly visible over the region. The result reveal the overall increase of UHI during the summer season, from a minimum value of 4.9 °C in 2008 to a maximum value of 6.2 °C in 2014 in Ahmedabad and from a minimum value of 4.6 °C in 2005 to a maximum value of 5.8 °C in 2015 in Guwahati. The spatial extent of the urban area also increased from 70.1 km² in 2001 to 91.9 km² in 2015 in Ahmedabad and from 62.3 km² in 2001 to 66.2 km² in 2015 in Guwahati.

Keywords: Surface Urban Heat Island (SUHI), MODIS, LST, Gaussian fitting

Abstract Id: 359
AN INNOVATIVE APPROACH FOR MASS LEVEL CAPACITY BUILDING IN GEOSPATIAL TECHNOLOGY AND ITS APPLICATIONS USING ONLINE ACTIVE LEARNING PLATFORMS

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The capacity building and skill development for effective use of geospatial technologies and its applications in India is critical due to large number of users, distributed geographic locations, multi-lingual environment and multi-disciplinary nature of the domain. Indian Institute of Remote Sensing (IIRS), ISRO has started its outreach programme in year 2007 by connecting 12 universities through satellite based interactive terminals (EDUSAT and INSAT 4CR). The programme has grown with many folds with inclusion of various advanced ICT tools and mode of contents delivery. The IIRS outreach programme was extended to Internet domain to connect more users using interactive Learning Management System (LMS) in year 2012. IIRS has setup a network 630+ knowledge Institutions in the country under its outreach programme. The online live and interactive classrooms sessions are being conducted for connected knowledge institutions where 8000 to 10,000 participants are getting befitted in each live and interactive course. IIRS has also extend its outreach programme through e-learning based online training and education in multi-lingual environment with a concept of ‘learning anytime anywhere’ by targeting working professionals and researchers. The interactive e-learning contents as a SCROM package for 100+ e-learning hours are created with customized LMS using Moodle. During last ten years, the IIRS outreach programme is quite successful and popular among its users where till date 50,000+ participants are trained from various user departments, ministries and academia in India. The IIRS outreach programme is being further extended by developing digital contents for different target users at various levels. A web based knowledge repository has been developed for widespread knowledge disseminations using digital workflow and Learning Management System. This paper presents the experience of IIRS-ISRO in the field of online training and education for geospatial technologies and its applications and also technological implementation and challenges for online mass scale capacity building.

Keywords: Distance learning, e-learning, Knowledge Portal, live & interactive

Abstract Id: 360
In this paper we highlight the benefits of the recently greatly improved availability and processing capabilities of 10-30 m resolution data for land area monitoring in insular Southeast Asia. Having notoriously difficult climate conditions for optical remote sensing, large scale land area monitoring efforts in the region have been largely limited to coarse resolution products. But from mid-2017, Landsat 7+8 and Sentinel 2A+2B satellites are providing 10-30 m resolution optical data in matching wavelength bands in frequency of nearly 120 observations per year (i.e. around once in every three days). This high temporal frequency of observations allows, even in the difficult atmospheric conditions of insular Southeast Asia, creation of full coverage cloud free composite images in as short as semi-annual intervals. These data can be further supported by Sentinel 1A+1B and PALSAR-2 radar data. The dramatic rise in the amount of data calls for new data processing and classification approaches. Here we present a data processing and classification approach utilizing 1) Google Earth Engine to create yearly Landsat 7+8 composites followed by 2) a decision tree based classification approach to create yearly land cover maps in insular Southeast Asian conditions in fully automated manner. The mapping approach enables us to produce finely detailed regional land cover map, revealing a large amount of contextual information through visual evaluation. We are currently able to produce 11 land cover classes (~76% overall accuracy), including closed canopy oil palm plantation class (~90% accuracy) which is of high regional importance. The most serious remaining shortcoming of the mapping approach is the incapability to separate primary forests from other tree covered areas in an automated manner. However, we hope that the larger number of wavelength bands available in Sentinel-2 data will enable us to extract primary forest areas from other tree cover in the near future.

Keywords: Land cover, forest monitoring, Sentinel-1, Landsat

Abstract Id: 363
COMPARISON OF FOREST TREE PARAMETERS EXTRACTED FROM UAV OPTICAL AND TLS DATA IN BOTH TROPICAL RAIN AND TEMPERATE FORESTS

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Tropical and temperate forests play a major role in sequestering and storing large amounts of carbon which in turn plays a key role in the global carbon budget and is an important natural control of climate change. The carbon stored in the aboveground living biomass of trees is typically the largest pool and the most directly impacted by deforestation and forest degradation which are among of the drivers of climate change. To control the impact of climate change, REDD+ program and its MRV mechanism have been established under UNFCCC. There is a great need for a cost-effective and accurate method to assess the parameters for estimating above-ground biomass (AGB)/carbon stock, both in complex multi-layered tropical rain-forest and in temperate forests. The tree height and Diameter at Breast Height (DBH) are important forest parameters required as inputs for biomass estimation equation and can be obtained through various methods such as direct field measurement. However, measuring tree height and DBH by field surveying is time-consuming, limited to inaccessible areas and rather expensive. With the advancement of remote sensing technology, various datasets have been used to assess AGB including airborne LiDAR or sometimes called Airborne Laser Scanner (ALS) but this data is not always available and expensive to acquire for regular monitoring. The emergent of Unmanned Aerial Vehicle (UAV) and Terrestrial Laser Scanner (TLS) technologies, which operate from air and ground respectively, can provide accurate information of upper and lower canopy layers at a reasonable cost for regular monitoring of carbon stock. However, both are associated with the limitation of foliage coverage in the complex multi-layer tropical forest which can underestimate AGB when used separately. This study aimed at establishing a cost-effective method that ensures reasonable accuracy for regular assessment of tree parameters in tropical rain-forest and temperate forests for AGB/carbon estimation for REDD+ and its MRV system by complementing UAV imagery and TLS data. Furthermore, a comparison between the techniques and modeling approach in both the tropical and temperate forest are discussed. Moreover, a comparison is made of the effect of the structure and the condition of both tropical rain and temperate forests on the results extracted from UAV and TLS. Ayer Hitam Tropical Forest Reserve near Kuala Lumpur, Malaysia and a temperate forest plantation at Amtsvenn, close to the city of Gronau, Nordrhein-Westfalen, Germany are the test sites of this research. Phantom-4 UAV and RIEGL VZ-400- TLS were used in both tropical and temperate forests to collect the data.

Keywords: Forest tree parameters, UAV, TLS, Tropical forest, Temperate forest

Abstract Id: 364
IMAGE FEATURE-BASED SLAM FOR FLAT SURFACE MODELING IN INDOOR ENVIRONMENT

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Recently, there are various studies for Simultaneous Localization and Mapping (SLAM) and Iterative Closest Point (ICP) using geometrical features extracted from point cloud data. The SLAM simultaneously estimates an environment map, rotation data, and translation data using differences among point cloud data acquired from continuous viewpoints with a loop closure restriction. Moreover, the ICP is one of the most popular methodologies for a point cloud registration. The stability of SLAM and ICP depends on a feature extraction procedure from point cloud data. The SLAM requires geometrical features, such as corners and edges, in point cloud data. Thus, when measured scenes include no geometrical features, such as flat surfaces in indoor environments, it is not easy to estimate an environment map, rotation data, and translation data. Therefore, we focused on image features in point cloud data to improve robustness of SLAM for indoor mapping. We also focused on 3D area scanner, such as a time-of-flight (TOF) camera, to acquire point cloud data with reflection intensity images for image feature-based SLAM. Our methodology consists of five steps. First, point cloud data are acquired using a TOF camera from continuous viewpoints. Second, intensity images are generated from point cloud data. Third, the feature points are estimate from reflection intensity images with a feature descriptor, such as Speeded up Robust Features (SURF). Fourth, feature points in intensity images are matched to estimated camera rotation matrices. Finally, acquired point cloud data are registered using the estimated rotation matrices. We clarified that our methodology can integrate point cloud data successfully through our experiments in indoor environments.

Keywords: Simultaneous Localization and Mapping, Iterative Closest Point, Point clouds, Indoor mapping, Time-of-flight camera

Abstract Id: 365
The Korean Government has executed the research project named “The development of volcanic disaster response system”. The phase I of this project was completed at 2015. From the year 2015, phase II of the project has been executed. The goal of the phase II is advancing the system which was developed at phase I. This paper deals with the design of application architecture for spatial information based volcanic disaster response system. First, we analyzes application architecture of phase I system. Next, users’ requirements are analyzed. Main requirements are three. One is extending spatial scope for volcanos. Another is developing real-time processing model for direct disaster. The other is multi-scenarios based processing. User’s requirements are stepped down to variable levels to adjusted application architecture in the system. Finally, we design altered application architecture comparing with architecture of phase I system and users’ requirements. The results of this research could be used for detail design of technical architectures (DA/SA/HA/NA).

Keywords: volcanic disaster, spatial information based response system, application architecture

Abstract Id: 366
LAND USE/ LAND COVER CHANGE ANALYSIS AND ENVIRONMENTAL VULNERABILITY IN GUWAHATI MUNICIPAL AREA, INDIA

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The study area comprises of Guwahati city which is located in the north-eastern region of India and situated between 26˚0 5’ to 26˚0 13’ N latitude and 91˚0 35’ to 91˚0 52’ E longitude, on the southern bank of the river Brahmaputra. It is the largest city of Assam and North- East India, a major riverine port city and one of the fastest growing cities in India. The Guwahati Municipal Corporation (GMC), the city's local government, administers an area of 216 square kilometres (83 sq mi), while the Guwahati Metropolitan Development Authority (GMDA) is the planning and development body of greater Guwahati Metropolitan Area. As per provisional reports of Census India, population of Guwahati in 2011 is 957,352; of which male and female are 495,362 and 461,990 respectively. Although Guwahati city has population of 957,352; its urban / metropolitan population is 962,334 of which 498,450 are males and 463,884 are females (Guwahati City Census 2011 data). The study focuses on the Land- Use and Land- Cover (LULC) Change in the Guwahati Municipal Corporation (GMC). Land cover / use studies are multidisciplinary in nature. The study of land use/land cover (LU/LC) changes is very important to have proper planning and utilization of natural resources and to manage the natural resources. The LULC change analysis assists decision makers to ensure sustainable development and to understand the dynamics of our changing environment. In addition to facilitating sustainable management of the land, land cover and land use information may be used for planning, monitoring, and evaluation of development, industrial activity, vulnerability prediction or reclamation. The rapidly growing urbanisation in the city of Guwahati has been resulted into significant changes in LULC pattern. The growth of urban areas has a significant impact on land use by replacing areas of vegetation with residential and commercial areas and their related infrastructure. To attain that changes the secondary data are used viz. population data, multdate imageries of Landsat TM, ETM, OLI, LISS III etc. with the use of geospatial techniques such as remote sensing and Geographic Information System (GIS). The unsupervised classification was applied to classify the LULC of the study area.

Keywords: Land use/land cover, Guwahati Municipal Area, unsupervised classification, urbanization, Environmental Vulnerability

Abstract Id: 367
As the largest ecosystem in Mongolia, grassland, not only provides abundant natural resources for economic development, but also safeguards the environment of the country as it acts as an ecological protective screen. However, because of the arid and semi-arid regions, most rangelands are seriously limited by climate as changes in precipitation and temperature can affect the pasture biomass in grassland ecosystems.

Materials and Results
For pasture biomass estimation we have used both of Enhanced Vegetation Index, derived from MODIS satellite data and ground pasture biomass measurements of 323 sites and air temperature and precipitation data from 1960s to 2010 of 69 meteorological stations. The results of climate change estimation over Mongolia showed that, air temperature increased by 2.14 degrees and precipitation decreased by 7% in last several decades (L. Natsagdorj 2007). The biomass changes were different site to site, ranging from 0.244 g/m² to +0.479g/m² over Mongolia and generally in most of natural zones occurred decrease of biomass in each month during vegetation period (B. Bolortsetseg 2004). The air temperature has been increased at all stations between 0.4-2.9 degree Celsius and the annual precipitation has changed between -123.0 mm/year and +40.3 mm/year. As result of long term remote sensing data analysis (M. Erdenetuya, 2004), in 31% of the country NDVI values have increased and rest 69%, NDVI values have decreased within last 25 years.

Conclusions
Researching the response of grassland community to climate change not only pays attention to common meteorological factors, such as mean air temperature, annual precipitation, but also understands extreme climate factors, such as drought, desertification.

Keywords: climate change, biomass, vulnerable, drought

Abstract Id: 368
A GIS BASED STUDY OF BANK LINE SHIFT/MIGRATION, EROSION AND DEPOSITION OF THE BRAHMAPUTRA RIVER IN DIBRUGARH DISTRICT, ASSAM

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In a general sense, river bank erosion is breaking down or carrying away the bank of the river by itself and it affects the changes in river channel courses in alluvial plains (Fujita et al. 2000). Erosion and deposition of a particular river is driven by physical, geological and hydro meteorological parameters. Bank line shift or Bank line migration is a normal morphological behavior of a river. River banks can move away (erosion) or can advance (deposition) which can result in meandering migration, channel avulsion and change in channel width (Bartley et al. 2008). The humid monsoonal region of Asia provides a common playground for channel variations, channel diversions and frequent bank line shift resulting from bank erosion and deposition (Neog, 2017). Brahmaputra River located in the tectonically active zone in the Assam represents frequent bank line migration. The Brahmaputra River is one of the largest alluvial rivers in the world characterized by frequent bank erosion leading to channel pattern changes and shifting of bank line (Sarkar et al. 2012). Dibrugarh district located in the south bank of Brahmaputra experiences intensive flood induced bank erosion. The recurrent shift of the bank line southward promotes erosion, which bring havoc to the low-lying population of the district. Thus, the study emphasizes on quantitative assessment of the actual rates of bank erosion, bank line shift of the Brahmaputra river in Dibrugarh District and counter strategic measures. The study incorporates Multi dated Satellite data sets, such as Landsat MSS, Landsat-TM, Landsat ETM and Google satellite data along with Topographical sheets of 1:50000 scale of the respective area.

Keywords: GIS, Brahmaputra River, Bank erosion/deposition, Bank line shift, Flood

Abstract Id: 369
Land degradation is defined as the decreased in the quality of soil or land physically and chemically due to certain factors and phenomena. Manipur, one of the state of North east India, comes under the Purvachal ranges of Himalaya. The topography of the state is rugged and more than 90% of the total geographic area is hilly terrain. Land degradation assessments becomes a trending way to responds to the environmental concerns in the developing region as it effects significantly on their agriculture and food security. Degradation of the land resources in this part of North Eastern India is quite rapid and prevalent due to various anthropogenic, natural and climatic factors. According to the NRSC report on desertification and land degradation atlas, 2011, 25.74% of the total geographical area of the state comes under the category of vegetation degradation. This paper explore the applicability of the methodology which is based on Land Degradation Assessment in drylands (LADA) to delineate different type of degraded land in the region using remote sensing based derived indices and controlling factors that directly/indirectly triggers the degradation of land resources of the region. In this study, Normalized difference vegetation index (NDVI), Enhanced Vegetation index (EVI) and Drought index (DI) are considered as the controlling variables for mapping the region susceptible to land degradation. The satellite data product (having high spatial and temporal scale) employed in this study was generated or synthesize using Spatio-temporal image fusion model (STI-FM) of the Landsat-8 and Moderate Resolution Imaging Spectroradiometer (MODIS) reflectance. It is expected that this model will provide a mechanism to identify various hot spots degraded region and will help the policy makers to take an effective decision making for conservation of the land resources of the region.

Keywords: Land degradation, NDVI, EVI, DI, STI-FM

Abstract Id: 370
CONFLUENCE DYNAMICS OF THE GANGA’S TRIBUTARIES BETWEEN
CHUNAR AND SAIDPUR, INDIA

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Integration of satellite data, sedimentological details of measured alluvial profiles provides opportunity to understand the channel behavior of the Ganga River and its tributaries in response to changing tectonics. The Ganga River has four tributaries out of which three Assi-nala (river), Varuna River and Gomati River joining from north near Varanasi city and Jirgo River joins from south close to Chunar. Confluence point of the northern tributaries (Varuna and Gomati river) have shifted progressively southwards in discrete steps, where as confluences of southern river (Jirgo river) tend to shift towards north by relieving their meanders and leaving behind abandoned channel belts and oxbow lakes. Differential disposition of Craton-derived sediments are found along the Ramnagar cliff and deep into the subsurface in different boreholes within the Varanasi across the course of the river. The present contribution indicate that from Chunar to Saidpur the River Ganga might be flowing along a strike slip fault with a gravity component, where eastern side of the river (Ramnagar) is upthrown and western side of the river (Varanasi city) is downthrown block. The strike slip movement is evidenced by the shifting of the tributary confluences with the Ganga River

Keywords: Ganga River, Confluence point, strike slip fault

Abstract Id: 371
Height accuracy assessment of ALOS World 3D (AW3D30) DSM and its utility for identifying flood-prone areas in the coastal region of Myanmar

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The recent release of the “ALOS World 3D” digital surface model (DSM) of 30 m resolution (AW3D30) by the Japan Aerospace Exploration Agency (JAXA) was yet another addition to the globally available fine resolution DSM datasets for users of broad communities in various application fields. The uniqueness of this dataset is that it is made available free of charge not only for research and scientific use but also for commercial use in fields of geospatial information and application. In an effort to test the utility of the AW3D30 dataset in a flat, flood-prone delta region of Ayeyarwady river in Myanmar, the author evaluated its height accuracy in comparison with another freely available global DEM data of comparable resolution—ASTER GDEM version 2 (GDEM2). The accuracy was assessed using 985 well distributed spot heights from eight 1:50,000-scale topographic maps of Myanmar (published in 2014) encompassing approximately 6,000 km² with elevation ranging 0.1-300 m. The height accuracy for the AW3D30 resulted in 4.2 m (RMSE) and 3.5 m (Std. dev.) that met its target accuracy of 5 m (Std. dev.), consistent with other reported validation efforts being conducted worldwide. The height accuracy for the GDEM2 using the same spot heights resulted in 9.4 m (RMSE) and 8.6 m (Std. dev.), also in accordance with the final report by the ASTER GDEM Validation Team in 2011. The results signified the comparative advantage of the AW3D30 among the two datasets. However, preliminary hydrological analyses revealed systematic artifacts of AW3D30 originating in the number of stacks that had been used to generate the dataset and the AW3D30 proved short in identifying flood-prone areas in the delta region of interest.

Keywords: AW3D30, GDEM2, Ayeyarwady Delta

Abstract Id: 372
This research proposes a robust methodology for carrying out the flood risk mapping task using Landsat image and Unity 3D engine. In the first step, the 2D land cover image was generated using the given Landsat image for acquiring the land cover information in the study area. The multiple machine learning techniques such as the ISODATA (Iterative Self-Organizing Data Analysis Technique), SVM (Support Vector Machine) and ANN (Artificial Neural Network) techniques were applied in this step to generate the 2D land cover image having high accuracy. Then, the elevation information such as the DEM (Digital Elevation Model) was added into the generated 2D land cover image for constructing the 3D land cover map. Next, the module for carrying out the flood simulation on the generated 3D land cover map was made by using the Unity 3D engine. Finally, the flood risk mapping task was completed by detecting the flooded land covers from the 3D land cover map by using the flood simulation module generated using the Landsat image and the Unity 3D engine.

Keywords: Flood Risk Mapping, Landsat Image, 3D Land Cover Map, Flood Simulation, Unity 3D Engine

Abstract Id: 373
TRACING OF THE VEGETATION RECOVERY BY MODIS AND HIMAWARI8 AFTER THE FOREST FIRE IN NORTHERN MONGOLIA

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In recent years, large-scale forest fires occur frequently. So not only the detection of forest fire but also the recovery of vegetation after forest fire becomes the important problem. In this study, we traced the vegetation recovery of the southern limit of taiga, in northern Mongolia by using the satellite data. At first we got the ground truth data of forest fire damaged area, and checked the period of forest fire by using Landsat data. From Landsat data, we found that the area was damaged twice, 1998 and 2009, by fire. Then we calculated the three indexes, NDVI, NDSI, and NDWI by using MODIS data, to corresponding to the damaged area from 2000 to 2017. We compared the value of three indexes before and after the forest fire of 2009 and confirmed the change of these indexes. Also we calculated these indexes from AHI data and compared these indexes.

Keywords: NDVI, southern limit of taiga

Abstract Id: 374
DEVELOPMENT OF A WEB SYSTEM FOR PROVIDING EFFECTIVE SHELTER INFORMATION BY 3D SPATIAL INFORMATION AND FLOOD SCENARIO

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Rapid climate change is occurring due to global warming and environmental changes. The frequently occurring natural disasters such as unexpected large-scale typhoons are increasing global human and material damage. In particular, efforts have been continuously made to minimize human damage by utilizing shelters in accordance with prepared manuals in case of floods in urban areas among natural disasters. The existing manuals for shelter utilization, however, cannot reflect real-time flood information and most of them provide locations and paths in one direction. To address such problems, a system, which monitors evacuation paths as well as shelter information and can be effectively utilized in the control tower according to the flood situation, is developed in this study. This system provides the location and path information of valid shelters by performing spatial information-based 3D flood monitoring according to the flood occurrence scenarios. Therefore, the developed system is expected to significantly reduce damage in case of flood disasters by helping disaster control managers to make quick and accurate decisions.

Keywords: Risk Map, Disaster Information Providing, Dynamic Expression

Abstract Id: 376
A Study on the Application of LOD Technique to Unity-Based High-Resolution Arial Images for 3D GIS Services of Disaster Information

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Worldwide large-scale natural disasters such as typhoons or heavy rainfall have cause extensive human and material damage. To manage and prevent such disasters, studies for constructing 3D GIS systems, which provide multi-angle analysis on disasters and easy management, have been conducted. Among them, 3D game engines can construct 3D display systems with the GIS function according to the capabilities of developers. However, terrain and 3D building information produced with high-precision spatial information and high-resolution images is large in capacity and requires much time for system services. In addition, the method of loading all the information of images regardless of their scales causes overload to the image processing devices, making efficient image processing impossible. To overcome these limitations, this study aims to address loading delay problems which are obstacles to system operation by applying the level of detail (LOD) technique to the high-precision terrain information provided by systems based on the Unity 3D engine, which is a game engine. The LOD technique is a technique used to control large-capacity images and adjusts the details according to the scales of images. To apply the LOD technique to the 3D engine, images with various resolutions were stored and aerial images were segmented according to the zoom. In other words, the zoom far away from the terrain produced low-resolution images while the zoom close to the terrain produced high-resolution images. Based on this method, the loading delay time of the display system could be shortened. 3D disaster prevention GIS systems based on high-precision terrain and building information can be constructed using this method. In addition, it will be possible to apply effective system functions and information services in the future.

Keywords: High Resolution Arial Image, Game Engine, 3D GIS, LOD, 3D Visualization

Abstract Id: 380
ANNUAL ANALYSIS WITH UAV AUTOMATIC NAVIGATION FOR ONIGI RICE TERRACES IN HASAMI TOWN

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Life and livelihood of Onigi rice terraces declined by cultivation abandonment and crop conversion in Hasami town. As the rice terraces were developed on the slopes, the area in rice terraces is small and productivity is lower than flatland paddy fields. Therefore, understanding the conditions of the vegetation, water balance and land uses is important for Onigi rice terraces. Land cover maps are required in many places including rice terraces since 66% of Japan is covered with forests. On the other hand, in recent years, spread of UAV progressed rapidly. UAV was used in many fields. Images of UAV are higher resolution than aerial photographs of satellites, and the photographs could be repeated easily. Land cover classification of vegetation and water areas can be done from RGB and infrared images. UAV has automatic navigation functions, and the air dose rate was measured even in places where human intrusion was difficult. In this study, annual analysis of land covers was carried out with UAV automatic navigation for Onigi rice terraces in Hasami Town. First, a UAV route map of Onigi rice terraces was made with automatic navigation software. Next, since April of 2017, UAV has been flown over the rice terraces. 5-band images of visible range, near infrared, and short wavelength infrared were acquired with IR filters. 3D models and orthographic images were created from these 5-band aerial images. Spatial distributions of NDVI, NDWI and land covers were calculated with GIS software from the orthographic images. Their seasonal changes were examined from calculated NDVI, NDWI spatial distribution and land use maps. A land cover classification map was compared with another land cover classification map made by Nagasaki prefecture.

Keywords: GIS, Land cover, NDVI, NDWI, Photogrammetry

Abstract Id: 381
Cultural identity has a profound connect to human lives and social living, and when culture is protected through generations, it evolves into a heritage that creates an emotional affiliation among individuals while also having direct and indirect social, historical, and economic impact on the community. Cultural Resource Mapping (CRM) has various applications and societal benefits founded in the creation of a Cultural Resource Database (CRD). Creation of a visual database of cultural heritage sites through allied techniques which provide numerous benefits like attribute information about the history and its significance. This will help in digital archiving of history and heritage, tourism, community storytelling, preservation and restoration of cultural resources despite any damage to the original sites, city planning and decision-support, municipal governance, and creating virtual tours through the cultural resources. The current work aims at creating a CRD for the city of Warangal, which boasts a rich history and cultural heritage of nearly 1000 years. The amalgamation of cultural identities through the regime of various dynasties such as Kakatiyas, Bahamani Sultanate, Musunuri Nayaks, Golkonda Nawabs, and Mughals in the region has created distinctive cultural resources in and around the city. The project implementation creates a unified resource platform which can be accessible through a Web browser and/or a smartphone application. This project model is scalable to implement in any city to create a similar CRD and has additional significance in the age of Smart Cities.

Keywords: application, history, preservation, resource mapping

Abstract Id: 382
ANALYZING LAND SURFACE TEMPERATURE DISTRIBUTION FROM LAND USE LAND COVER CHANGES IN SUNDARBANS, INDIA

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The paper utilizes Landsat 5 TM and Landsat 8 OLI for analyzing land use/land cover change and its impact on land surface temperature in Sundarban Biosphere Reserve, India. Split window algorithm and spectral radiance model were used for determining land surface temperature from Landsat 8 OLI and Landsat 5 TM, respectively. The land use land cover change analysis has revealed a substantial increase in the waterlogged areas followed by settlement and agricultural area and a decrease in mangrove forests followed by mudflats and mangrove swamps. The distribution of average change in land surface temperature shows that water recorded highest increase in temperature followed by deposition, open forest and settlement. Overlay of the transect profiles drawn on land use/land cover change map over land surface temperature map revealed that the land surface temperature has increased in those areas which were transformed from open forest to paddy, open forest to settlement, paddy to settlement and deposition to settlement. The study demonstrated that increase in non-evaporating surfaces and decrease in vegetation has increased the land surface temperature of the study area. The albedo of the study area was also estimated and varying degree of changes have been identified. The study demarcates that the increase in the LST and Albedo in the study area is definite and this increase has brought about stress on the sundarban delta.

Keywords: Land surface temperature, Land use land cover, Sundarbans biosphere reserve, Landsat, Ecosystem

Abstract Id: 383
MODELLING AND SIMULATION OF URBAN GROWTH WITH GIS BASED CELLULAR AUTOMATA MODEL - A CASE STUDY OF SHIMLA CITY, INDIA.

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The potential of Cellular Automata (CA) model for predicting the spatial and temporal urban growth dynamics has been evaluated for rapidly urbanizing Shimla city of Himachal Pradesh, India. An attempt has been made for prototype of a simulation model based on Cellular Automata (CA), and Multi Criteria Evaluation (MCE), integrated with Geographic Information System (GIS) in the present case study. The growth of Shimla city is visualized MODELLING AND SIMULATION OF URBAN GROWTH WITH GIS BASED CELLULAR AUTOMATA MODEL - A CASE STUDY OF SHIMLA CITY, INDIA.

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Keywords: Spatial urban growth, Smart city, Cellular Automata, Multi-criteria evaluation, RS, GIS

Abstract Id: 385
CHANGES OF GLACIER, GLACIER-FED RIVERS AND LAKES IN ALTAI TAVAN BOGD NATIONAL PARK, WESTERN MONGOLIA, BASED ON MULTISPECTRAL SATELLITE DATA FROM 1990 TO 2017

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Impacts on glaciers and water resource management have been altering through climate changes in Mongolia territory characterized by dry and semi-arid climate with low precipitation. Melting glaciers are early indicators of climate change unlike the response of the forests which is slower and takes place over a long period of time. Mountain glaciers are important environmental components of local, regional, and global hydrological cycles. In this paper calculates an overview of changes for glacier, glacier-fed rivers and lakes in Altai Tavan Bogd National Park, Western Mongolia, based on the use of multispectral data and the methods typically applied in glacier studies. Were utilized an integrated approach of Normalized Difference Snow Index (NDSI) and Normalized Difference Water Index (NDWI) to combine Landsat, MODIS imagery and digital elevation model, to identify glacier size and quantify water storage change in lakes system, and compared that with and climate parameters including precipitation, land surface temperature, evaporation, moisture. Our results show that melts of glacier at high elevation of Altai Tavan Bogd Mountain has resulted in obvious increase of water storage of lakes in valley of National Park. There is hydrologic connection that lake basin is directly fed by glacier meltwater.

Keywords: glaciers, climate change, multispectral imagery, NDSI, NDWI

Abstract Id: 386
STUDYING SUPPLY AND DEMAND OF PRIMARY HEALTH CARE PHC CENTERS USING REMOTE SENSING AND GIS

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This paper focused on studying, monitoring, mapping, planning, distribution and locations of government primary health care centers in the selected study area. Also, the paper focuses on following-up supply and demand in primary health care centers PHC to manage various health care facilities according to the criteria and standards of ministry of health and population of Egypt, based on the integration of remotely sensed data and geographic information system GIS from geographic and health care view. The main objectives of this research is to study and analyze the distribution of government primary health care centers and population for the best treatment service taking into account the criteria and standards of ministry of health and population of Egypt. El-Salam medical region, Cairo, Egypt has been selected as a study area to perform this research. It is characterized with densely urban and populated area. The proposed methodology involved many procedures based mainly on using satellite images, GIS, demographic, health data and field data to calculate the supply and demand of primary health care PHC centers. The results of this research showed that there was shortage in PHC centers in the selected study area. This shortage is not actually but theoretical due to the study explored there are many other governorate and private health service should be studied details in the next research.

Keywords: Primary health care PHC centers - Population - Remotely sensed data - GIS

Abstract Id: 387
Rainfall is a dynamic natural process which constantly changes its intensity as it passes over an area. Rainfall is traditionally measured using rain gauges at ground stations but due to the advancement in Remote sensing technology rainfall data can be obtained using satellite data. The study was conducted to assess the spatiotemporal accuracy and reliability of remotely sensed gridded rainfall data with rain gauge data for the state of Meghalaya. The remotely sensed rainfall data was used from the archives of the Tropical Rainfall Measuring Mission (TRMM). The Rain gauge data were obtained from seven Rain gauge stations spread across the state and were used to assess and evaluate the TRMM gridded data. The representative area for each Rain gauge station was delineated using Thiessen polygon method and The TRMM rainfall data were extracted for each delineated area and compared with the respective area weighted rainfall from each rain gauge station. The correlation analysis was done using annual, seasonal and monthly data for last ten years. The results showed that TRMM data followed the trend of rainfall (highs and lows) as apparent in rain gauge data at the monthly time step for the state of Meghalaya, mostly for the years of analysis. The TRMM data can be a viable option to analyze rainfall trend for Meghalaya, particularly in those areas where the density of rain gauges are not good enough to capture the spatial variation in rainfall.

Keywords: Rainfall; TRMM; Thiessen polygon; Remote Sensing; Validation

Abstract Id: 391
SNOW GRAIN SIZE MAPPING IN UPPER HIMALAYAS USING HYPERION DATA

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Estimation of physical property of snow such as grain size through classification of hyperspectral images is very challenging task due to minute differences between the classes which is complicated by limited availability of field measurements (both spectra and physical property). To overcome this limitation, in this study a Support Vector Machine (SVM) based classification using Radial basis kernel has been tried to classify the snow cover data of Hyperion for Upper Himalayan regions. SVM defines the classification model by the concept of margin maximization using few training pixels. The generalization capability of SVM is due to the selection of hyperplane that maximizes the geometrical margin between the classes and with the hyperspectral data, this allows the full exploitation of the discrimination capability of the relatively few training samples available. Due to unavailability of field data, grain size map generated using Spectral Angle Mapper (SAM) from Negi et al., 2013 has been considered as reference map. Initially, a visual comparison made between the snow grain size maps obtained from the tested SVM method and Grain Size Index (GSI) method indicates that the former is able to capture the spatial distribution of different grain sizes such as coarse, medium, fine. Further, a detailed comparison of the estimated snow grain sizes map obtained from SVM method and Grain Size (GSI) method is being carried out done using matrix method.

Keywords: grain size, hyperspectral, Hyperion, SVM classifier, Upper Himalayas

Abstract Id: 392
ICE DETECTION IN SWISS LAKES FROM MODIS DATA

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In this research, we process low spatial resolution satellite images (MODIS) for integrated multi-temporal monitoring of ice in selected Swiss lakes. Lake ice detection is crucial thanks to its direct applicability in climate change research and is considered one of the Global Climate Observing System (GCOS) Essential Climate Variables (ECVs). The aim is to detect the extent of ice, the duration of lake ice and in particular the ice on/off dates. The seven target lakes are Sihlsee, Greinfensee, Pfäffikersee, Ägerisee, Silsersee, Silvaplanersee and St. Moritzsee, showing different characteristics regarding area, altitude, surrounding topography and freezing frequency, describing cases of medium to high difficulty. From the satellite sensor MODIS with daily temporal resolution, several spectral channels are used, both reflective and emissive. The lake outlines generated using Open Street Map are backprojected on to the image space after generalization. The low-resolution MODIS bands (500m, 1000m GSD) are super-resolved to 250m resolution and co-registered prior to the analysis. A correction for the absolute geolocation accuracy is done both in x and y directions as a pre-processing step doing a matching of the projected lake outlines with the images. Only the cloud-free pixels are analysed. The pixels containing the boundary of a lake are treated separately compared to the pixels lying completely inside the lakes. For the boundary pixels, as a first step, the respective percentages of lake component and surrounding topographic components are detected using linear spectral unmixing followed by ice detection in the lake endmember/component. For the interior pixels the analysis is easier. We formulate the lake ice detection as a two class (frozen, not-frozen, whereby the frozen case can be also divided to ice or snow on top of the ice) semantic segmentation problem. The proposed method is tested on MODIS data from the cold winters 2005-2006 and 2011-12.

Keywords: lake ice, spectral unmixing, super-resolution, semantic segmentation, climate change

Abstract Id: 395
Mangroves are salt tolerant woody plants that form highly productive intertidal ecosystems in tropical and subtropical regions. Mangroves play a disproportionately large role in carbon sequestration relative to other tropical forest ecosystems. The carbon emissions resulting from mangrove loss especially biomass are uncertain. The point to be noted that mangroves biomass towards carbon stock is needed because when the changes occurs, much of carbon stock in the ecosystem will release to the atmosphere which may result in global warming, pollution etc. In this context, remote sensing is a tool of choice to provide spatio-temporal information on mangrove ecosystem biomass and carbon studies through digital image processing and modeling. Remote sensing techniques have demonstrated a high potential to detect, identify, map and monitor mangrove conditions and changes. The Krishna mangroves in Andhra Pradesh are located in the coastal plains of Krishna delta. This study provides reviews and highlighting remotely sensed data applied for measuring Above Ground Biomass (AGB) in Krishna mangrove forest from remote sensing perspective. This study assessed tree above ground biomass using a Support vector machine regression model equation. The Above Ground Biomass estimated from the model was 198.47 Mg/ha and an Allometric equation for Avicennia marina mangrove species was used to cross validate the estimated AGB from remote sensing technique and the average AGB from the field measurement was 217.53 Mg/ha. Thus the study reveals that the remote sensing is an effective tool to estimate above ground biomass with a high accuracy.

Keywords: GIS, Remote Sensing, Mangroves, Biomass

Abstract Id: 396
Ocean Heat Content (OHC) and Ocean Mean Temperature (OMT) products at depths of 50, 100, 150, 200, 300, 500 and 700m along with Tropical Cyclone Heat Potential (TCHP) products (ocean heat integrated at the surface layer till the depth of 26°C isotherm) are generated at the National Remote Sensing Centre (NRSC). The products are hosted in the Bhuvan site for public utility through the National Information System for Climate and Environment Studies (NICES) program activity of the NRSC. These products have been used in weather and climate studies. They provide information on monsoon onset, rainfall and forecast cyclone track over the north Indian Ocean. The products are generated using a neural network approach with vertical profiles of temperature and salinity climatology along with satellite derived Sea Surface Temperature (SST) and Sea Surface Height Anomaly (SSHA) over the north Indian Ocean (40°-120°E and 0°-30°N). Initially, Tropical Rainfall Measuring Mission Microwave Imager (TMI) based SST and subsequently Advanced Microwave Scanning Radiometer 2 (AMSR2) derived SST are used to generate the OHC and related products. The AMSR2 derived products are found well related with TMI based estimations ($R^2 > 0.90$) at all the depth levels of 50, 100, 150, 200, 300, 500 and 700 m. We have also observed a good relationship for TCHP and OMT products. The Root Mean Square Error (RMSE) of 7.9 kJ/cm² has been observed for OHC at 700 m depth and low scatter index (<0.005) indicate consistency of OHC products generated with AMSR2 based SST. The products are available in the BHUVAN website of NRSC for their further use.

Keywords: OHC, TCHP, OMT, Indian Ocean, SST

Abstract Id: 398
ASSESSMENT OF LANDCOVER DYNAMICS AND SHORELINE CHANGES OF GULF OF MANNAR ISLANDS THROUGH REMOTE SENSING.

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LandUse /Landcover change and Shoreline movement caused by erosion and deposition is a major concern for managing the islands and Marine Biodiversity of Gulf of Mannar National Park. Dynamic changes in shoreline location, such as those identified along the Gulf of Mannar National park, poses considerable vulnerability for Marine Biodiversity. Rapid assessment techniques are required to update the shoreline maps of affected islands and monitor rates of change. The study has been carried out to assess the Landuse / Landcover Dynamics and shoreline changes of Gulf of Mannar Islands through Remote Sensing and Toposheet from 1920 to 2014. The Study reveals that two islands near Tutcorin harbor namely, Punnaiyadi islands (62.2 ha) and Pandyan Island (51.50ha) has been encroached by Harbour. It is observed that the Islands in the Tutcorin group is fastly shrinking. The Van Island is shrinking from 34.12 ha to 2.8 ha. Kasuwar Island is shrinking from 58.40 ha to 8.9ha Kariachalli Island is shrinking from 23.49ha to 7.03ha, Villanguchalli Island which was 17.9ha is recently sinked which is the alarming signal for the community. It is observed that the other groups of islands are also facing same threat; slowly the area is decreasing from 1920 to 2014. The shoreline and Landcover of the islands are drastically changing because of over harvesting of resources, drudging operations, improper trawling practices, global warming etc. which hampered algal beds, sea grass beds and coral communities. The coral reefs of reserve are fast deteriorating because of erosion and greater silt inflow from mainland, human activities such a lime stone quarrying, coral collections, industrialization, urbanization, pollution, etc.

Keywords: Islands, Climate change, Remote Sensing, sea level rise

Abstract Id: 400
The emergence of numerous new infrastructures, attributed to the constant promotion of urbanization, has increased the possibility of hidden “Urban Disease” related to structural safety. Being short of regular health monitoring, e.g., detection of abnormal structural deformation, the maintenance of those infrastructures is usually not well coordinated. These potential security issues could somehow threaten our public life and property safety. On the other hand, plenty data from SAR (Synthetic Aperture Radar) constellations, representatively the Sentinel-1 A/B and its subsequent launches, is nowadays free to the public for deformation monitoring using SAR Interferometry (InSAR). With detailed (up to 1m spatial resolution) and accurate (several millimeters or less) surface displacements monitoring capability, InSAR is becoming a powerful tool for safety scanning in man-made environments. Against such a backdrop, we presented a new method for infrastructural health monitoring based on the combination of PS (Persistent Scatterers) and DS (Distributed Scatterers) technologies. PS candidates were selected mostly on high coherent targets, e.g., buildings, based on the amplitude dispersion index (ADI). These reliable scatterers will be used as reference points in the DS network established in low correlation regions. Before the identification of distributed scatterers, we designed an adaptive homogeneous filter to improve the accuracy of homogeneity test in texture areas. The two sample Anderson-Darling test was used for homogeneous pixel clustering, with significance level 5%. By providing more complete motion details of low correlation territories, the proposed method is more effective for health monitoring, especially in semi-artificial zones. Sentinel-1A images covering the Hong Kong International Airport were used for case study.

Keywords: Health monitoring, Persistent Scatterers (PSs), Distributed Scatterers (DSs), Adaptive Homogeneous Filter

Abstract Id: 402
STRATEGIES FOR ESTIMATION ON THE SHORELINE CHANGES
BANGAMEORI BEACH IN KOREA

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Shoreline change data play an important role for investigating trend of coastal erosion and deposition, establishing setback regulation, estimating insurance rate of coastal land (Leatherman, 2003), conducting measure of restoring submerged land (Kim and Lee, 2009), and so on. They are highly required by coastal engineers and managers, but found to be rare in most coastal areas. Only U. S. and Netherlands show a good example of constructing shoreline change data sets on a national scale (US Army, 1971; Horn, 2002). Archive historical aerial photographs have been the most valuable data sets providing long-term shoreline changes. In Korea, National Geographic Information Institute has taken aerial photographs over the Korean territory every 5 years since the 1960s. However, a standard method for producing shoreline change data using aerial images has not been established yet (Moore, 2000). Also, definition of shoreline is various so that it is difficult to compile different data sources (Boak and Turner, 2005). In this study, we deal with 3-D shorelines, elevation of which is determined by tide observations. We present a case study for long-term shoreline changes on the Bangameori beach, west coast of Korea. Objectives are to analyse tendency of temporal and spatial change of shorelines and to estimate rate of shoreline changes using shoreline change data obtained from archive historical aerial images.

Keywords: Coastal Erosion, Aerial Images, Digital Photogrammetry, 3-D Shoreline,

Abstract Id: 404
LIDAR STUDIES ON ATMOSPHERIC AEROSOLS AT A SEMI-URBAN STATION CHEERYAL (17.51° N, 78.62° E) NEAR HYDERABAD, INDIA WITH RANGE DEPENDANT LIDAR RATIO

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Deriving the optical properties of aerosols and clouds from the experimentally obtained lidar data is one of the most interesting and challenging tasks. Various lidar methods have been developed so far, to obtain the quantitative profiles of extinction /backscattering coefficient of aerosols and clouds from the pulsed backscattering lidar measurements. In order to obtain an analytical solution to the lidar equation, it has been a common practice to assume that these parameters are related in the form of the extinction-to-backscatter ratio or Lidar Ratio (LR). The LR depends on the size distribution, shape and chemical composition of the aerosols. These properties of aerosols are highly variable and mainly depend on their sources and the local meteorological parameters. In order to enhance the accuracy of the derived extinction/backscatter profile, it is necessary to obtain the lidar ratio also along with the backscattered signal, called as Range Dependant Lidar Ratio (RDLR). In this study we derive the RDLR while carrying out investigations on aerosol characteristics in the Cheeryal Village (17.51° N, 78.62° E), which is located at a distance of about 20 Km in the suburbs of Hyderabad, India. For this study the Multi-wavelength laser radar which is developed in-house and made operational at this location is used. The Nd:YAG laser (M/S Bright Solutions, Italy) based multi-wavelength lidar operates at 532 nm and 1064 nm with a pulse energy of 50uJ at both the wavelengths. The two wavelengths are generated coaxially with a pulse width of 10ns and the laser operates up to a PRF of 4 KHz. The receiver system consists of a 360 mm Newtonian optical telescope, 10 nm of interference filters and the Licel Gmbh, Germany make 250 MHz Photon Counting recorder.

Keywords: Lidar, Remote sensing, Anthropogenic aerosols, Semi-urban region, transport of aerosols, Range Dependant Lidar Ratio

Abstract Id: 408
AN IMPROVED METHOD FOR ESTIMATING MINIMUM LAND SURFACE TEMPERATURE USING MODIS LST PRODUCT FOR THE HIMALAYAN REGION

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Surface temperature distribution is a governing meteorological factor for studies investigating the hydrological and climatic behaviour of a basin. In the Himalayan mountainous region, it is difficult to obtain the high-resolution spatial records of the surface temperature because of the scarce and widely scattered meteorological stations. In this study, the potential of retrieving high-resolution surface temperature estimates from MODIS LST products has been investigated over the Western Himalayan region. The main objective of this study is to evaluate and improve the 8-Day land surface temperature (LST) derived from both Terra and Aqua MODIS (Moderate Resolution Imaging Spectroradiometer), Collection 6 products for 8-Day minimum temperature estimation over the mountainous Himalayan region. The results of the statistical analysis show that the 8-day night MODIS LST data (MOD11A-night) from Terra satellite provides a good estimation of 8-Day minimum air temperature with RMSE = 4.2°C, and $R^2 = 0.82$. To further reduce the RMSE and improve $R^2$, we have employed adjusted R-squared and the principal component analysis (PCA) of 8 major variables (including: MODIS LST products (four variables: MOD11A2 and MYD11A2), elevation, latitude, longitude, and Julian day) and formulated regression models for 8-day minimum temperature estimation. Thus obtained results show that the regional topography and the time of the year explains most of the differences between the MODIS LST and the ground temperature records derived from the 8 climate stations in the Himalayan region. The best results for 8-day minimum temperature estimation are achieved when a combination of the night-time LST products of TERRA and AQUA and data from the topography analysis is employed.

Keywords: Land surface Temperature, MODIS LST, Western Himalayas

Abstract Id: 410
ESTIMATION OF REGIONAL SCALE CROP WATER DEMAND USING INDIAN GEOSTATIONARY SATELLITES OVER INDIAN AGRO CLIMATIC REGION

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The rapidly depleting water resources in agricultural sector threatening the sustenance of existing agricultural production. In this context, the present study was framed to optimize regional-scale water-use through spatially explicit and accurate estimates of crop water demand (CWD) over India using Indian geostationary satellites through crop evapotranspiration (ETc). ETc was estimated at periodic interval from crop co-efficient (Kc) and reference evapotranspiration (ET0). Ten-day composites of INSAT-3ACCD NDVI data (1km resolution) were used to generate fractional canopy cover (fc) for kharif (June-October) and rabi (November-April) seasons during 2009-2016 to generate composite Kc (Kccomp) model. Kccomp was determined as defined by Food and Agriculture Organization (FAO) from tabulated and adjusted Kc using local meteorological data from Weather Research and Forecasting (WRF) model and weighted by crop fraction in a given administrative unit for three growing stages i.e. initial, peak-vegetative and reproductive. A polynomial model was developed using Kccomp versus corresponding fc for each growing stage for representative sites. Using the season-specific model, distributed Kccomp generated at ten-day interval were averaged together to construct monthly Kccomp. Monthly ET0 was generated from daily ET0 using daily solar insolation (Kalpana VHRR at 8km resolution) and WRF variables through data fusion in FAO 56 framework. A significant spatiotemporal variation of CWD was observed over India due to variations in crop growth and climatic conditions with an average value of 0.022 km³ and 0.020 km³ for kharif and rabi seasons respectively. Highest CWD (kharif >0.064 km³; rabi>0.062 km³) was observed in Indo-gangetic plains representing major rice growing areas and lowest CWD was observed in Western himalayan region (kharif ≤0.013 km³; rabi≤0.01 km³). This study showed clear trend of variations in Kc, ET0 and ETc over Indian agro-ecosystems during crop growth period with an opportunity to optimize crop water-use at different locations leading to estimation of regional-scale green and blue water-use.

Keywords: Crop evapotranspiration, crop water demand, crop co-efficient, agriculture

Abstract Id: 412
AUTOMATED EXTRACTION OF ROAD MEDIAN FROM AIRBORNE LASER SCANNING DATA

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The applicability of laser scanning systems continues to prove their worth due to the rapid, continuous and cost effective 3D data acquisition capability. The information obtained through these systems contributes to the production of useful knowledge, which can be used to develop more efficient approaches for managing road infrastructures. Laser scanning system can facilitate reliable and accurate acquisition of 3D spatially referenced data about road median, which is a narrow strip of land that separates traffic on opposite sides of the road. The road median is one of the fundamental feature, whose correct identification is prerequisite to obtain precise information about road and other objects along it. The acquired 3D LiDAR data can be used to locate, measure and classify the road median in a timely cost-effective manner in order to facilitate their maintenance.

In this paper, we present an automated approach for extracting road median from airborne laser scanning data. We use the road vector polylines to reduce the search space in the LiDAR data, which enables a more efficient and accurate estimation of the road median. The LiDAR elevation values are used to distinguish the road sections at highway crossing points. We apply a multi-level Otsu thresholding function to the LiDAR elevation and intensity attributes to extract road median. The binary morphological operations and prior knowledge of the dimensions of the road median are used to complete the shape and remove any noise introduced through the use of thresholding. We tested our algorithm on two 1-km road sections consisting of distinct types of road median with concrete and grass-hedge barrier. The successful extraction of the road median along these two road sections demonstrates the robustness of our automated algorithm. These research findings provide valuable insight and prototype road median extraction tool-set for both national road authorities and survey companies.

Keywords: Laser Scanning, Airborne, Road Median, Automation, Extraction

Abstract Id: 413
SPECTRAL ANALYTICAL TOOL FOR REMOTE SENSING

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Spectral reflectance and its changing behaviour across the visible and near-infrared wavelengths provide us a very relevant means for determining the elemental association of samples and obtaining information on chemical composition both on qualitative and quantitative basis that can be used for resource mapping. These spectral behaviour based techniques provides us a lot of surface information about the physical and chemical associations and also their proportionality, allowing an indirect way of qualitative and quantitative way of doing geochemical analysis on the remote sensing datasets acquired at different platforms. A generic extension application tool is developed in IDL (Interactive Data Language), that can be embedded as graphical user interface in ENVI software and is based on linear and non-linear interpolation techniques and it is capable to process both multispectral and hyperspectral datasets acquired at space borne and air borne platforms. Since its a generic tool and can be applied to any remote sensing gridded dataset but for key information extraction, domain specific expertise is required for selectively and sensitively choosing the input parameters and for careful spectral examinations and interpretations. A sensitivity analysis of both linear and non-linear methods is performed by domain specific experts which shows acceptable good results for estimating the spectral behavioural parent and derived parameters.

Keywords: Spectral Analysis, Spectral Behaviour Tool

Abstract Id: 415
MULTISCALE ANALYSIS OF THE RELATIONSHIP BETWEEN SOCIO-ECONOMIC STATUS (SES) AND REMOTELY SENSED SPATIAL PATTERNS OF URBAN GREEN SPACES (UGS) IN MUMBAI, INDIA

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The lack of necessary policy interventions in the cities of developing countries result in the disproportionate distribution of Urban Green Spaces (UGS), a key component of the urban landscape. The socio-economically affluent neighbourhoods are known to possess a better share of UGS arranged in distinctive spatial patterns. Studies relating Socio-Economic Status (SES) and UGS often overlook the aspect of spatial arrangement of the UGS; this dearth in quality information on UGS can be addressed using remote sensing. With synoptic coverage at near-real time, remote sensing systems aid the computation of spatial metrics that capture the compositional and configurational aspects of UGS. However, as spatial metrics are scale-dependent, the relationship between SES and spatial metrics is susceptible to the spatial resolution of the satellite imagery chosen. In this study, the effects of the Modifiable Areal Unit Problem (MAUP) on the links between SES and the spatial metrics characterizing UGS are assessed using satellite images of multiple spatial resolutions, viz. 5m, 15m and 30m. SES of the neighbourhoods in Mumbai was assessed using a newly developed Socio-Economic Status Index (SESI), based on which the neighbourhoods were classified into different SES classes. UGS in Mumbai were extracted from the satellite images, and the aspects of density, shape complexity and aggregation of the UGS patches at the neighbourhood level were each quantified with a spatial metric. An ordered logistic regression (OLR) was used to assess the probabilistic association between SES and the spatial metrics. A resolution-wise comparison of OLR results reveals that the relationship between SES and the spatial metrics is indeed influenced by the spatial resolution of the satellite image chosen. The study results equip the urban planners with a tool in form of remote sensing-based spatial metrics of UGS to reliably predict the SES of a neighbourhood at near-real time.

Keywords: Urban green spaces, socio-economic status, remote sensing, spatial metrics, modifiable areal unit problem.

Abstract Id: 416
CORRELATING SATELLITE RAIN RATE WITH ACTUAL RAINFALL MEASUREMENT

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When rich farmers from developed countries adapted their agriculture methods from the climate change affected by applying advanced or smart agriculture, the conventional agriculture method is still using by poor farmers in developing countries. The reasons are poor, lack of knowledge on climate change affect, unpredictable weather using traditional experiences, etc. Though, satellite remote sensing data provides usable weather information, the technology looks far from reach out by ordinary farmers. This study will be proof the usability of rain rate data which generated from weather satellites. Satellite measured rain rate and actual measured rainfall will be compared in the study. The correlation parameters of these two datasets will be applied to generate rainfall data from satellite rain rate. It is demonstrated that the generated rainfall data are good information where actual rainfall are not available. These data will be very useful for the poor farmers in the developing countries.

Keywords: Climate change, Rain Rate, Rainfall, Measurement

Abstract Id: 417
Online WebGIS tools and services have become widely available in the recent past to visualize and query geospatial data. These are primarily the spatial visualization of aggregated attribute data across various spatial scales or geo-hierarchy levels. Most of these tools lack the temporal profile of the data. Also, these are server centric. In the era of big data, the user data has various attributes collected over time across geographic detail. Also, the user may like to do visual analysis across these attributes at various levels of aggregation. Such server centric approaches give limited maneuverability to explore the data and discover hidden patterns and insights in data. This paper presents a spatial-OLAP tool that has been developed over existing Open Source geospatial and database tools. It computes the data aggregation across user-defined geo-hierarchy with dynamic visualizations in a defined framework. Parameters in menu options are not pre-computed but added on the fly based on user-given data. The tool enriches the user experience by combining additional data-aggregation functions over spatial toolkits like OpenLayers and allowing the user to zoom to a set of temporal charts for a more extensive analysis of data across space and time. To show the utility of this tool, a GeoBI case study was done on a large online retail data of three products sold in different countries during January 2009. The tool helped quickly identify the top five countries with maximum sales and the payment options in decreasing order of popularity. Also, relationships between the quantity of product sold across the geographic regions were also extracted. As Online retailers need to draw insights from data to understand their customers across regions, we hope this tool can benefit them in finding such answers - what their popular products are, identifying regions where there is a demand for these, understanding regional preferences and many others.

Keywords: GeoBI, Interactive data visualization, Open source tools, SpatialOLAP

Abstract Id: 418
URBANIZATION AND CHANGE DETECTION OF LAND USE LAND COVER OF THE HOLY CITY UJJAIN

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The Ujjain city has its own importance in state of Madhya Pradesh as many of the religious places are situated within the city. Land use Land Cover of the city is nowadays a major concern for various aspects. As the city is having many temples with vital religious importance, the crowd comes forward at intense. A proper use of land is therefore very important to manage the space as well as the utilities in the city at time of religious occasions. A proper development plan for the urban area of the city is needed very much. Here in this study a try has been made to evaluate the changes in the land use land cover pattern of the city, mainly concerned over the urbanization of the city. The changes occurred in the urbanization of the city over a time period of one decade from the year 2005 up to the year 2015 have been tried to be evaluated. For the change detection, the land use land cover (LULC) maps are prepared separately for the year 2005 and 2015. Landsat imageries at a resolution of 30m have been used to prepare the LULC maps of the city for mentioned years. Erdas Imagine software used for extracting ground information from the satellite imageries. The changes occurred during 2005 to 2015 have been evaluated using the ArcMap software, using the tool Overlay Analysis the changes have been quantified. The city is surrounded by the Holy River Kshipra. The river also has many changes in its spread of flow path. A very intense increase has been observed in the urbanization of the city during a period of one decade. The results of the study may help the city action plan at a considerable state.

Keywords: LULC, Landsat, Overlay Analysis

Abstract Id: 419
AUTOMATIC DETECTION OF TURBULENT BOUNDARY FLOW IN RED SEA FROM FLOCK-1 SATELLITE DATA

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A multi-objective evolutionary algorithm is utilized for the automatic detection of hydrodynamic turbulent boundaries overlying coral reefs. The procedure is implemented using sequences of Flock-1 satellite data acquired in the Red Sea. The study demonstrates that implementing Pareto-optimal solutions allows for the generation of accurate coral reef-water interface patterns. This conclusion is confirmed by a Pareto-optimal front and the receiver-operating characteristic (ROC) curve. The Pareto-optimal front indicates a significant relationship between hydrodynamic turbulent boundaries, macroalgae, and coral reefs. The excellent performance of the algorithm is shown by the 90% area significance achieved in the receiver operating characteristic (ROC) curve for the detection of hydrodynamic turbulent boundaries caused by coral reefs. In conclusion, MOEA which is based on Pareto optimal solutions can be used as an automatic detection tool for turbulent flow in data from the Flock 1 satellites that are excellent sensors for studying shallow coral reef zones.

Keywords: Multi-objective evolutionary algorithm, Flock 1, hydrodynamic turbulent boundary, coral reefs Pareto-optimal solutions, automatic

Abstract Id: 420
FOUR-DIMENSIONAL OF TSUNAMI COASTAL DAMAGES USING COMPUTER GENERATING INCOHERENT HOLOGRAPHIC INTERFEROMETRY

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Recently, N-dimensional, is curious topic between mathematicians and physicians. This work aims at using incoherent hologram interferometric with 4-D phase unwrapping to reconstruct fourth-dimensional of tsunami impacts on coastline. The data are used that involved Quickbird and RapidEye images with implementation of 4-D phase unwrapping. The results show that the incoherent hologram Interferometric an excellent tool for reconstructing tsunami chaotic influences on land uses from Quickbird and RapidEye satellite data. The study shows coastline of is flooded by tsunami run-up of 6 m which totally damaged road network and urban structures. Incoherent Hologram interferometry can be used to reconstruct 4-D of coastal water turbulent flows. In conclusion, In conclusions, incoherent hologram interferometry hold a great promise for 4-D tsunami inundation using Quickbird and RapidEye satellite data.

Keywords: Tsunami, Quickbird satellite, RapidEye, Incoherent hologram interferometric, 4-D phase unwrapping, n-dimensional.

Abstract Id: 421
FOUR-DIMENSIONAL OF EARTHQUAKE DISPLACEMENT FROM SENTINEL-1A SATELLITE USING HOLOGRAPHIC INTERFEROMETRY

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Holographic interferometry is new topic for dealing with synthetic aperture radar interferometry (InSAR) issues. In addition to four-dimensional reconstruction from synthetic aperture radar interferometry. This study utilizes 4-D phase unwrapping for holographic interferometry technique to retrieve earthquake displacement due to Nepal earthquake, 2015. In doing so, the hybrid genetic algorithm is implemented to optimize 4-D phase unwrapping algorithm based on fourth-dimensional best-path avoiding singularity loops (4DBPASL) algorithm. The algorithm modification from 3-D to 4-D has implemented prior to hybrid genetic algorithm. The study shows 4DBPASL can present the holographic interferometry from 3-D to 4-D. The study also shows that the integration between holographic interferometry and 4DBPASL competent to reconstruct 2-D earthquake displacement into 4-D. In conclusion, 4DBPASL algorithm can be used to produce accurate 4-D quake deformation using Sentinel-1A satellite.

Keywords: Four-dimensional, Holographic interferometry, best-path avoiding singularity loops, Phase unwrapping, Genetic algorithm, Hybrid

Abstract Id: 422
This paper presents a multiresolution textural approach to change detection in multitemporal synthetic aperture radar images. Texture analysis is often discussed in image processing domain, but most methods do not exploit the fact that texture occurs at various spatial scales. Often used techniques such as the gray level co-occurrence statistics is limited to altering inter-neighbor spacing and hence does not capture the texture very well. This is particularly true in case of remotely sensed images and therefore it is necessary to adopt a proper model that can overcome the above limitation in order to extract features from remotely sensed images. Wavelet based MRA showed great effect when dealing with 1D and 2D signals with point singularity features. Wavelets can only capture limited directional information due to its poor orientation selectivity and might not capture enough directional information in remotely sensed images. In order to avoid this shortcoming and process images of high dimension more effectively, curvelet and contourlet transforms are used. The proposed approach exploits curvelet and contourlet based multiscale decomposition of Pauli RGB decomposed images from SAR data where textural information is extracted at various scales and in different directions in terms of statistical moments and energy to generate the feature map. The L1-norm is used in the proposed method to generate the difference image (DI), which is thresholded using the maximum entropy principle to obtain final change detection map. The results are compared with the changes detected by wavelet based textural features. Accuracy assessment is performed for change maps and comparative analysis is carried out in terms of missed changes, false-alarms and overall accuracies. It is found that the proposed method exhibits high change detection accuracy with better edge continuity.

Keywords: multiresolution, texture, change detection, Pauli RGB, SAR

Abstract Id: 424
COMPARISON BETWEEN MULTI-OBJECTIVE EVOLUTIONARY ALGORITHMS FOR OIL SPILL DETECTION FROM COSMO-SKYMED SATELLITE DATA

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This study has demonstrated work to optimize the oil spill footprint detection in synthetic aperture radar (SAR) data. Therefore, Entropy-based Multi-objective Evolutionary Algorithm (E-MMGA) and non-dominated sorting genetic algorithm-II (NSGA-II) have implemented with COSMO-SkyMed data during the oil spill event along the coastal water of along Koh Samet island, Thailand. Besides, Pareto optimal solution is implemented with both E-MMGA and NSGA-II to minimize the difficulties of oil spill footprint boundary detection caused by the existence of look-alike in SAR data. The study shows that the implementation of Pareto optimal solution and weight sum in E-MMGA and NSGA-II generated an accurate pattern of oil slick. Furthermore, thick oil spills have the highest value of 2.3 NSGA-II TEMP than thin and medium spills. NSGA-II has the highest performance as compared to E-MMGA, which is able to preserve the morphology of oil spill footprint boundaries i.e. thick, medium, and light. In conclusion, NSGA-II is considered as an excellent algorithm to discriminate oil spills from look-alikes and also to identify thick oil spills from thin ones within the shortest computing time.

Keywords: Multi-Objective Evolutionary Algorithm, Entropy-based Multi-Objective Evolutionary Algorithm, Non-dominated Sorting

Abstract Id: 425
This study has used optimization techniques of Genetic algorithm to investigate the impact of ocean surface current on flight MH370 debris. The southern Indian Ocean during the months of March-April has dominated by anticlockwise large gyre moving with maximum velocity of 0.5 m/s and slowly drifts westward. It means that flight MH370 debris can potentially travel up to 50 km/day with large eddies of a width of 100 km wide. The study shows that flight MH370 debris could not move to Africa within 24 months and with less than 2 months it would sink before washed up on Réunion Island. However, it can be said that the turbulent flow due to large Southern Indian gyre would make the debris submerged in deep water more than 2000 m across the Southern Indian Ocean. In conclusion, multi-objectives genetic algorithm suggests that fake and uncertainties information had been delivered by satellite data. In conclusion, MH370 could be never fly and crash in offshore of Perth, Australia.

Keywords: Multi-objective algorithm. Pareto optimization, Indian Ocean circulation, MH370 flight, debris.

Abstract Id: 426
GENETIC ALGORITHM FOR SIMULATION OF TSUNAMI IMPACTS ON WATER MASS VARIATIONS USING MODIS SATELLITE DATA

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This study has proposed and demonstrated a new approach to retrieve water mass pattern from remote sensing data. The MODIS satellite data are acquired during tsunami 2004. Then, these data are used as input parameters for Genetic Algorithm (GA). Therefore, GA produced a new formula to retrieve water mass pattern by optimizing errors due to cloud covers, and SST and SSS linear algorithm implementations. The study shows that genetic algorithm can reduce the error of retrieving sea surface density with ±3.4 kg/m³. Further, coastal water Aceh is dominated by maximum offshore value of 22.5 kg/m³. In conclusion, Genetic Algorithm can be used to retrieve water mass characteristics using MODIS satellite data during 2004 tsunami boxing day.

Keywords: Tsunami, Water mass, MODIS satellite data, Genetic algorithm, Sea surface temperature, Sea surface Salinity.

Abstract Id: 427
This study presents a new approach for the simulation of four-dimensional wave refraction pattern in Sentinel-1A data. In doing so, the non-linear velocity bunching algorithm exploited to model significant wave height based on the new advance of the 4-D B-spline algorithm. The study shows that wave refraction pattern can simulate from Sentinel-1A data with convergence and divergence spectra energy of 0.78 and 0.3 m² sec, respectively. The study shows that wave refraction pattern can simulate from Sentinel-1A data with convergence and divergence spectra energy. In conclusion, 4-D wave refraction pattern in spite of nonlinearity between actual ocean wave spectra and Sentinel-1A data can be simulated by 4-D B-spline algorithm based on Pareto optimization.

Keywords: 4-D B-spline algorithm, Sentinel-1A data, wave refraction, 4-D wave refraction pattern, Pareto optimization.

Abstract Id: 428
Upwelling phenomena are observed in the southern coastal waters of Sri Lanka during southwest monsoon period. Upwelling events are associated with changes in the magnitude and location of frontal structures, which can be detected by the satellite remote sensing. Sea surface temperature (SST) gradients usually be used to detect the upwelling. In this study, well-established 750m resolution Visible-Infrared Imager-Radiometer Suite (VIIRS) SST data were used to investigate the upwelling. For each image in the archive, our workflow determines the location of SST fronts based on the Cayula-Cornillon single image edge detection (SIED) algorithm and the Sobel gradient field. The seasonal variability of SST gradient was investigated. Relatively strong SST gradients were found in the south coast of Sri Lanka during southwest monsoon period. Such gradients have been shown to influence low-level divergence, clouds, and precipitation, particularly near strong SST gradients. So the observed thermal gradients in the SST image may be associated with the enhanced production. It is possible to locate fish-feeding grounds from SST images generated from satellite data through detection of thermal gradients.

Keywords: Variability; SST; upwelling; Fishery; Sri Lanka

Abstract Id: 429
IMPACT OF LAND USE AND LAND COVER CHANGES ON SOIL EROSION RATE: AN INTEGRATED APPROACH USING RUSLE MODEL, REMOTE SENSING AND GIS

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Emergence of remote sensing technique and Geographic Information System (GIS) platform have aided research community to bring a significant improvement in quantitative and qualitative assessment of soil erosion hazards. The erosion models integrated with GIS has been widely used nowadays for mapping erosion and estimating the sediment yield at the catchment outlet with better accuracy. In the present study, we analyzed the soil loss in the Nethravathi River basin, which basically is a tropical coastal area with a humid environment, located in the South Western part of India. The soil erosion model, Revised Universal Soil Loss Equation (RUSLE), integrated with GIS, is used for this purpose. Land Use Land Cover (LULC) mapping, conducted during 2003-2013, evaluated the impact of LULC changes in soil loss and estimated a significant reduction in the total agricultural area. On the contrary, the same study found out an improvement in plantation and forest areas. Thanks to the increased vegetation cover, the erosion rate has been decreased by 200 tons/ha. The studies validated a rather expected observation; the soil erosion risk is inversely proportional to the land cover. That is, reduction in the land cover increased the potential erosion risk. The erosion severity maps show that a greater portion of the study area comes under low severity zone and only a small portion comes under high and very high severity zones. Drastic losses are observed mainly in the regions with steeper slopes, mainly, where the mountains exist. The results can certainly help implementation of soil management and preservation practices to bring down the soil erosion losses in the Nethravathi River Basin.

Keywords: Soil erosion modelling, GIS, RUSLE, Nethravathi basin

Abstract Id: 430
CONNECTION BETWEEN FIRE ACTIVITY AND LAND COVER/USE CHANGE IN SUMATRAN PEATLANDS 2007-2015

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Vegetation fires occur in the humid equatorial Southeast Asia with varying annual severity, occasionally causing severe damage and transboundary haze pollution. In this study we investigate the connection between fire activity, peatlands and anthropogenic land cover/use changes in the provinces of Riau, Jambi and South Sumatra, Indonesia, from 2007 to 2015. We combine Moderate Resolution Imaging Spectroradiometer (MODIS) active fire detections with peatland land cover/use maps (2007 and 2015). Our results reveal that during the nine years studied, 54% of all detected active fires were located in peatland areas which cover only 27% of the study area. Within peatlands, areas that experienced land cover/use change during the study period had clearly the highest fire density with 421 fires/100km². In comparison, areas that remained as managed land cover types controlled by either small-holder farmers or industrial companies experienced moderate fire activity (116 fires/100km² and 159 fires/100km² respectively), while primary forests had hardly any fires (2 fires/100km²). However, in absolute fire numbers, unchanged peatland areas experienced nearly as much fire activity as the changed areas over the nine years study period (62494 and 67030 fire detections respectively). In conclusion, our results highlight 1) the increased fire occurrence in areas undergoing land cover/use changes and 2) the vulnerability of all deforested peatlands to fires. Regardless of the lower fire density in managed deforested peatland areas, their increasing area means that in absolute terms they are becoming an increasingly important source of the negative fire effects (e.g. haze). From fire prevention point of view, our results therefore advocate reforestation of degraded peatland areas (rather than conversion to managed land cover types) and further improvement in fire handling and management practices in and near all peatland areas.

Keywords: Land cover change, forest fires, peatland

Abstract Id: 431
INTERANNUAL VARIATION OF CHLOROPHYLL-A IN VIETNAM SEA AND ADJACENTS BY MODIS DATA DURING 2003-2015

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Ocean color remote sensing plays a vital role of observation and monitoring the environment in the ocean. Processing MODIS images to extract Chl-a (Chlorophyll-a) during a long-term period is very helpful for analyzing the interannual variation of Chl-a. Based on MODIS data combining with in-situ data in Southern Center of Vietnam Marines in the period of 2003-2007 and 2013-2015, the local empirical coefficients of algorithm OC3 to estimate Chl-a concentration at the surface have been determined. The result showed that three seasonal upwelling regions have been located at the southern center of Vietnamese and the northeastern of Hainan island in summer, and at the northwestern of Borneo in winter. For the whole study area, the annual average of Chl-a concentration reached the peaks in 2004, 2007, 2009 and 2011, and the monthly Chl-a were minimized in April and maximized in November. In addition, interannual variation of Chl-a data at the upwelling near Vietnam waters indicated that the peaks of Chl-a were found after the year of strongly El Nino events. These results can help to predict the variation of Chl-a concentration under impacts of ENSO events.

Keywords: MODIS, Vietnam Sea, Chlorophyll-a, OC3, Interannual variation

Abstract Id: 432
MODELLING OF GENERAL FLOWERINGS OF THE TROPICAL RAINFOREST BASED ON SATELLITE-DERIVED BIOPHYSICAL PARAMETERS

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The advent of remote sensing science and technology for forestry and related environments have created various high-level products (level 2) derived from orbiting various remote sensing satellite programs. These long-term data acquisition and the well-documented scientific derivation methods of these high level products apart of the systematic archiving system have benefited to various opportunities in various studies for better understanding of complex tropical rainforest environment changes over time. This article reports on study of modeling of general flowering (GF) tropical rainforest using long term related biophysical parameters derived various earth observation satellites. The GF occurrences are often, but are very crucial to ecology and biodiversity studies as amongst the triggering parameters were know associated to threatening the growth cycle, such as prolong drought, changes in solar radiation, temperature, etc. Higher level satellite sensor products of Moderate Resolution Imaging Spectroradiometer (MODIS), satellite precipitation products of Tropical Rainfall Measuring Mission (TRMM), are modeled against the long-term in-situ GF occurrences, where characterization of all relevant triggering biophysical parameters are first identified using ordinal logistic regression (OLR). The model was then formulated and validated using independently set of recent GF occurrence. Here, interaction between temperature and solar radiation was found to be plausibly critical in generating the unique flowering sequence besides precipitations.

Keywords: Remote Sensing, general flowerings, tropical rainforest, ecology, modeling

Abstract Id: 434
UTILIZING CHAOS EQUATIONS AND FRACTAL DIMENSIONS TO DIFFERENTIATE VARIOUS CROP TYPES

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Chaos theory is a method used in both qualitative and quantitative analysis for exploring the behavior of dynamic systems that can only be predicted using overall and continuous data relationships instead of single data relationships. Thus, chaos theory is suitable for predicting crop phenology. A chaotic algorithm requires entry of a series of data. Obtaining continuous data from current commercial satellites or aerial images is difficult because of climate conditions and budget constraints. However, hyperspectral ground images captured by portable devices exhibit numerous wavebands and narrow spectral ranges. Spectral ranges that are similar form continuous data. Spectral information in hyperspectral images is richer than that in ordinary multispectral images, rendering them useful for detecting minor spectral differences. Such differences overcome the insufficiency in multispectral images. Portable spectroradiometers can be used to measure the on-site reflectance curves of various land features at various times, locations, and statuses. Because crops change continuously and rapidly according to temporospatial conditions (e.g., etiolation, abscission, disease, unevenly distributed spatial density, and differences in planting times), a considerable number of variables are added to crop spectra, which is the primary cause of difficulty in classifying crops. Chaotic algorithms may be suitable for solving the crop classification problem and effectively identify various crop categories.

The research sample investigated in the present study comprised garlic, scallion, sweet potato, and carrots, most of which are planted in Yunlin County, Taiwan and are easy to sample. The chaotic image features of spectral reflectance of the various crops were captured at the same time and compared to discern any differences. MATLAB was used to conduct the chaos simulation and to calculate the fractal dimensions.

Keywords: chaos equation, fractal, hyperspectral

Abstract Id: 435
APPLYING UNMANNED AERIAL VEHICLE (UAV) IMAGES TO INTERPRET MIXTURE FRUIT TREES IN MOUNTAIN AREAS

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Agricultural farmland patterns are fragmented and diverse in Taiwan, different from the extensive farming countries such as the United States. Furthermore, since many varieties of fruit trees are mixed in mountain areas, field surveys of fruit tree planted areas add a lot of difficulties. This study aims to interpret the planted areas of various fruit trees using the aerial photographs acquired from the fixed-wing Unmanned aerial vehicle (UAV) in Miaoli County, Taiwan. Average 18 cm spatial resolution images are obtained for both RGB and NIR photos, covering plains and hillsides. Filming time is 3 days (April 6, 7, and 19, 2017). Two types of land units are used for manual interpretation. One is based on the cadastral maps, and another is using parcels derived from the eCongnition software. The results indicate that the land units using the eCongnition segmentation method can accurately calculate the actual planted acreages. However, the problem of level tiered planting of crops is still existed.

Keywords: Unmanned aerial vehicle, segmentation, cadastral

Abstract Id: 436
Changes of Sea Surface Temperature in Vietnam Seas in Last Four Decades

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SST (Sea Surface Temperature) is a basic factor of marine hydrodynamic and biogeochemical processes. Based on SST data collecting from reanalysis data during the period of 1979 - 2014 (from the National Centers for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR)) and MODIS images during 2002-2016, the result shows interannual variation and trends of SST in marine regions of Vietnam in 38 years. Mean SST varied from 22.23°C (in Jan 1984) to 29.26°C (in June 2010). The SST average of every 5-year was also the lowest in (1984-1988) and the highest in (1999-2003), whereas SST average of every 10-year increased from 26.14 to 26.43°C. The correlation of SST with ENSO indices as well as oceanographic systems in marine regions of Vietnam have been discussed. The SST peaks were recorded in 1987, 1998, 2010 and 2016 under the developing ENSO events. However, the extreme SST in the upwelling regions of northern center Vietnam was found some months later compared with ones in Nino-3.4 region. Therefore, it is possible to predict the abnormal SST based on the trend of SST in the Nino-3.4 region as well as ENSO events.

Keywords: SST, Vietnam Sea, ENSO, SST variation

Abstract Id: 437
The Philippine economy relies heavily on its natural resources for economic contribution. These same resources are relied upon by many Filipinos living below the poverty line. Conflicts often arise with regards to the best use of these natural resources. Therefore, the main concern of the country is how to promote a growth path that is both sustainable and inclusive. Ecosystem Accounting can be used to measure the country’s natural resources and evaluate how they can be used equitably and sustainably. The aim of this research is to develop a partial ecosystem account and map of key provisioning services and hydrological services. These ecosystem services maps help in securing the equitable and sustainable use of ecosystems in Pulot Watershed, one of the three priority watersheds of the Wealth Accounting and Valuation of Ecosystem Services Project in Southern Palawan. Ecosystem Accounts for coconuts, paddy rice and palm oil were developed using remote sensing, ArcGIS, ArcMap and ArcGeoprocessing tools. Meanwhile, InVEST’s Water Yield Model was used to estimate the water contribution from different parts of the landscape. The Systems of Environmental-Economic Accounting and the Experimental Ecosystem Accounting were used as a basis for the development of the ecosystems accounts. In conclusion, the use of ecosystem services accounting through spatial analysis and mapping can provide better insights for spatial planning, especially on land-use changes. Such accounting guides the expansion of palm oil plantations, mining conversion of land covers and Environmental Critical Area Network implementation. But most importantly, accounting can support policies to secure the people’s welfare to more efficient, inclusive and sustainable natural resource use.

Keywords: Ecosystem Services, ecosystem accounting, provisioning services, hydrological services, remote sensing, water yield models

Abstract Id: 439
STUDY ON THE INFLUENCE OF DONGJIAKOU HARBOR CONSTRUCTION ON SUSPENDED SEDIMENT CONCENTRATION

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High SSC related to Dongjiakou Harbor construction was observed during June 2010 to August 2013. The adjacent Mytilus edulis aquaculture waters with area of 11.13 km$^2$, 15.48 km$^2$, and 24.27 km$^2$ were affected by the high SSC retrieved from remote sensing SSC on 24 April 2011, 21 September 2011, and 10 January 2013. The aquaculture rope and Mytilus edulis were full of sediment during the in-situ survey on 5 March 2013.

Keywords: Coastal construction; Suspended sediment concentration; Dongjiakou harbor

Abstract Id: 443
MONITORING DROUGHT IN JOHOR RIVER BASIN USING SATELLITE-BASED APPROACH

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Malaysia’s water resources are currently under threat of depletion, pollution and climate change. Realizing the importance of water resources planning, a comprehensive study on drought was prepared, focused in Johor River Basin. Interpolated rainfall data from rain gauges are in a discrete point-based record which may not be sufficient to assess droughts from a spatiotemporal perspective. Considering this constraint, a fully satellite-based method for monitoring drought in Johor River Basin (JRB) was performed using a run-off model. This study is aimed to (i) compile all spatial data available from related authority and previous works of JRB and; (ii) create relevant spatial data layers from archive satellite remote sensing images for JRB. The run-off deficit was calculated based on per pixel spatial scale and allowed to produce the run-off maps regularly. The run-off model was tested and evaluated using rainfall data in a span of 10 years (2000-2010) and landuse map of 2002, 2006 and 2008 over nine catchments in JRB including Sg. Johor and Sg. Layang. The validation results show that (1) monthly water yield in the basin shows the decrement over the years at inconsistent rate; (2) satellite-based run-off data is not significantly correlate with actual steam flow and spatiotemporal variation of run-off in drought-affected forest catchments. The most severely area that experienced critical water shortage was Sg. Sayong and high water yield is within catchment area of Sg. Layang. The analysis shows that drought started in January 2002 and reached its peak in January 2010. Hence, these findings signify that fully satellite-based run-off model is as good as a conventional drought-monitoring indicator. It can provide not only flood distribution information, but it also can reflect the drought-induced impacts on stream flow, forest catchment and land-use.

Keywords: remote sensing, drought, run-off model, landuse, Johor River Basin

Abstract Id: 444
When characterizing seagrass ecosystem services (ES), the essential integration of ecological, social and earth observation (EO) knowledge-base has been emphasized in the recent researches. The ecological processes and functions, biodiversity components, different sources of ES providers and interactions among the components within a seagrass ecosystem, act as ecosystem drivers and influence ES supply/benefits to the society. The repeated measuring capability of advanced EO instruments has emerged for assessing ES of seagrasses, but often do not take into consideration the ecological functions, processes, and drivers that control magnitude of seagrass ESs over spatial and temporal scales. Rather, greatly rely on surrogate measures to map ES distribution. Such a mapping effort may generate incomplete representation of ES components, with missing but ecologically important biophysical parameters and linking seagrass ES, although many of those parameters are currently quantifiable using EO instruments. This paper presents a collaborative framework for the assessment of seagrass ES based on capabilities of EO system with the integration of environmental and remote sensing (RS) expertise. Incorporation of both the direct and indirect detection capabilities of RS methods can provide spatially explicit seagrass ES maps for informing species diversity, water quality variables, marine animal census that use seagrass as food, and hydrological variables, are some of the parameters more relevant to seagrass ES. Using some examples from the published researches, this paper has demonstrated how EO data collected by different remotely sensed instruments and measurements can be employed for integrating seagrass ES valuation to RS techniques. The increasing range of EO system and data sets, suitable for seagrass ES valuation, can in turn support developing a pragmatic marine spatial planning for the benefits of communities. This work is to sensitize discussion about need of holistic methodologies, challenges, and to motivate an enhanced use of EO technology and data where it would

Keywords: remote sensing, seagrass, ecosystem services, coastal

Abstract Id: 445
LAW ENFORCEMENT MONITORING FOR PROTECTED AREA MANAGEMENT USING GEO-SPATIAL TECHNOLOGY

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Spatial Monitoring and Reporting Tool (SMART) approach is specifically designed software and application for conservation areas, special protected areas, protection and law enforcement monitoring and management to halt illegal activities and poaching the area. Moreover, the SMART offers a suite of best practices designed to collect efficiently, analyze, and report on anti-poaching efforts, which allows a park manager to identify hotspots where attention is needed, empower staff, and provide useful feedback to ranger teams and national park management. The SMART is being piloted in the Small Gobi SPA in Southern Mongolia as a tool for measuring, evaluating and improving the effectiveness of wildlife law enforcement patrols and site-based conservation activities. The rangers of Small Gobi SPA have completed 103 patrols for 185 days and travelled over 24,000 km from September through December 2016. The 78 patrolling forms were completed. The Small Gobi SPA rangers have covered approximately 90% of their responsible areas for four months between September and December 2016 since started using a SMART tool. The rangers have recorded the carcasses of khulan and goitered gazelles at 71 locations including 7 fresh, 6 recent, 43 old and 15 very old carcasses. Out of 7 fresh and 6 recent carcasses recorded, one was in conservation zone, one was in limited use zone and two were in buffer zone of the Small Gobi SPA. Mortality causes of two carcasses were identified as poaching and collision with vehicle while mortality cause of the remaining carcasses were identified as either natural deaths or unknown.

Keywords: ranger, protected area, patrol, geo-spatial technology

Abstract Id: 446
Plants of arid region have climatic smart adaptation mechanism to survive and grow well against harsh conditions of desert biome. One such ecologically important and keystone species is threatened Salvadora oleoides (S. oleoides) Decne.. The shrinkage of native geographical range of distribution due to abiotic and biotic stress declines the individual trees of this population frequently. Therefore, eco-distribution mapping through Remote Sensing (RS) and conservation program via habitat suitability Maximum Entropy (Maxent) model were carried out in our research work. The 250 sample points were taken during field visit (2016-17) from Haryana and boundaries of area under S. oleoides is demarcated by Google earth. Maxent model were used for predicting suitable habitat for conserving this species by using Bioclimatic variables explored from United States Geological Survey (USGS). The distribution map prepared through LANDSAT-8 image showed that species is very well located in North-western Haryana particularly in Mahendragarh, Rewari, Jhajjur and Bhiwani. Although the canopy cover showed that forest is moderately dense to open with scatter trees are present mainly in roadside, bunds of farmlands and sacred groves. The predicted area by Maxent model is cross checked through ground verification. 85% of sample points fall in the area of S. oleoides dominance. The Maxent modeling depicted that Sirsa, Fatehgarh and Hissar would be the potential sites for ex situ conservation of S. oleoides through germplasm bank. Management of open and moderately dense forest is also done through geographical mapping of this species. Geographical corridor linking as well as by demarcating grazing lines against livestock animals in the forest and community land are some of the solution strategy for conserving already threatened germplasm of S. oleoides.

Keywords: Salvadora oleoides, Eco-distribution mapping, Maximum Entropy (Maxent) model, LANDSAT-8, Germplasm bank

Abstract Id: 447
WHERE DOES GEOSPATIAL-RELATED SUBJECTS FALL WITHIN THE SURVEYING/GEOMATICS PROFESSIONAL EDUCATION PROGRAM IN MALAYSIA WITH THE PERSPECTIVE OF WORLD UNIVERSITY RANKINGS?

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The world university ranking undoubtedly has impact on education programs of almost all universities worldwide at greater or lesser extent, without exception of the Surveying/Geomatic Professional Education in Malaysia. The 3 best-known rankings are: Quaquarell Symonds (QS) World University Rankings, Times Higher Education World University Rankings, and Academic Ranking of World Universities (ARWU). The most recent, the QS-subject University Rankings seems to be the most acceptable by the academia, government, industry as well as community at large quadra-helix level, since the approach is more focussed on subject-specific. Within this ranking, world university programs can be categorised as 5 broad subjects: (i) Arts and Humanity; (ii) Engineering and Technology; (iii) Life Sciences and Medicine, (iv) Natural Sciences, and (v) Social Sciences. Education decision makers are keen to streamline and strategize their programs in such a way that the subject-categories at national level may remain relevant and competitive at international level. The Surveying /Geomatics programs, once offered under sole Surveying/Geomatic-based faculty or school, have now being merged with either Civil or Built environment, and the trend is also observed in Malaysian Universities. As such, under the QS-subject university ranking, Surveying/Geomatic program can be categorised under specific subject of Civil Engineering or Built Environment under Engineering and Technology. Irrespective of acceptance of educators, particularly of Surveying/Geomatics programs, the trend is more likely because of realized universality and development of global knowledge in a coherent manner. This paper shades light on the subject-based ranking issues, with relevance to the Surveying/Geomatic education program, by comparing Malaysia Academia to selected similar Surveying/Geomatics programs in Australia, United Kingdom and USA. It is hoped that this paper will enlighten all Surveying professionals on the importance of positioning Surveying/Geomatics within the world university rankings.

Keywords: Remote sensing, World university rankings, Surveying, Geomatics, Professional Education

Abstract Id: 449
Lakes are an essential part of urban ecosystem which plays an important role in maintaining environmental balance in urban areas in the context of today’s urban growth. Large number of lakes in Bengaluru city have gradually disappeared due to rapid urbanization and the rest of the surviving lakes are presently reduced to cesspools due to direct discharge of industrial effluents, municipal sewage and spread of aquatic weeds. In order to understand the process of lake degradation and arrive at optimal management practices, there is a need to carry out a scientific study on the spatio-temporal dynamics of lakes and identify the hotspots for conservation strategies. The present investigation was carried out for mapping and monitoring of urban lakes and extent of weed infestation using a combination of optical and SAR data. Sentinel-2 optical data was used for mapping of different vegetation species of lakes while three date SAR data was used for mapping of seasonal water spread area. Object based classification using different band combinations of Sentinel-2 data was evaluated for its potential use in discrimination of lake vegetation species. The results indicated that the red edge bands centered at 705, 740 and 783 nm were found to be more useful for discrimination of major vegetation species such as *Eichornia crassipes*, *Alternanthera sessilis* and *Colocasia esculenta*. Temporal SAR data from ALOS PALSAR-1 (L-band) and RISAT / Sentinel-1 (C-band) were used for monitoring seasonal water spread area. The sigma naught values extracted from SAR data, after applying speckle filter, were used for determining threshold values of water bodies for extracting seasonal water spread area. The study revealed that cross polarization data is useful for mapping and monitoring seasonal water spread area of the lakes. Further study is in progress to characterize the lakes of Bengaluru city and its surroundings for prioritization and restoration of lakes.

Keywords: Urban lakes, Lake Vegetation, Water spread area, optical data, SAR

Abstract Id: 450
EXAMINING THE CONNECTIONS BETWEEN LAND USE AND AIR POLLUTION FOR A TIME SERIES USING AERIAL PHOTOGRAPHS

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Many studies on the impact of air pollution on land use development have neglected the existence of temporal variability and spatial instability. The scope of this study is to explore the relationships between the land use types and the concentration of air pollutants PM2.5 for a time series. The Shalu town of central Taiwan, which is affected by the PM2.5, is selected as the study area. Air pollutants data for the Shalu site is obtained from Environmental Protection Administration of Taiwan (EPA). The land use types are acquired by the manual interpretation of the aerial photographs dated 2007 and 2009. Based on the land use types in these two year, Markov chain model is used to estimate the land use types for the years of 2011, 2013, and 2015. Land use regression (LUR) models are utilized to examine the relations for these 5 years. Through observing the change trend of land use from one time point to another, and its influence of air pollution, the results of the study can serve as the reference basis for future land development.

Keywords: PM2.5, Land use regression, Markov chain

Abstract Id: 451
EVALUATING THE SCOPE AND THE LEVEL OF THE ECONOMICAL DAMAGE CAUSED BY THE OIL SPILL INCIDENT - THE CASE STUDY: DUNG QUAT BAY, QUANG NGAI PROVINCE, VIETNAM.

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Petroleum is the natural resource on the seashore of Vietnam that have enormous potential for exploitation. According to the statistics from the Agency for Environment, since 1987, there have been over one hundred oil spills, causing severe damage to the marine ecosystem and the economy of Vietnam. Despite of that, the current procedures for evaluating the environmental impact of oil spill are impractical and ineffective. The legislative sanction for misconducts that leads to serious environmental damage still lacks deterrent power. Compensation for people who endure the consequences of oil spill is not weighted and done properly. On-site reactions to oil spill is still inadequate. As a result, in order to assist evaluation and reaction to any oil spill incident that may happen in the future, the demand for a reliable mean of pollution modeling has never been so urgent. Such modeling tool also acts as an important foundation in accusing those responsible for causing oil spill. The purpose of this study is to promote an approach that integrate two models: one for analyzing an oil spill occurrence, and the other for calculating the environmental damage. The research method relies on applying module MIKE 21 and module MIKE 21/3 PA/SA to analyze oil spill with high reliability. The result of this analysis is then passed to the initial damage evaluation module BOCEM, which has been simplified to suit the conditions of Vietnam when calculating environmental and economical damage in a case of oil spill. This paper reports implementing this integrated tool for a case that took place at Dung Quat Bay, Quang Ngai province, Vietnam.

Keywords: Oil spill, Mike21, GIS, Damage, Database

Abstract Id: 452
EXPLORING THE RELATIONSHIPS BETWEEN LAND USE TYPES DERIVED FROM SATELLITE IMAGERY AND AIR POLLUTION

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In recent years, due to the vigorous development of industry and commerce, air pollution is becoming increasingly serious. Especially, PM2.5 pollution problems caused by the anthropogenic combustion process have caused wide attentions by the community. This study aimed to explore the relationships between the land use types and PM2.5 pollutants. The study area located in Taichung city of central Taiwan. Land use types interpreted from the three years of Formosat II images (2007, 2011, and 2015) and air pollutant concentration data of the corresponding years from 7 monitoring sites were used to develop land use regression (LUR) models. Air pollutants data is obtained from Environmental Protection Administration of Taiwan. Land use types that affect the quality of air include farmland, animal husbandry, forest, water conservancy, commercial, residential, industrial, temple, funeral, school, leisure, and military. SPSS regression analysis was performed to calculate the regression coefficient between land use types and pollutant concentration. The data of pollutant concentration under different land use scenarios were compared and the correlation between them was analyzed.

Keywords: air pollution, PM2.5, Formosat II, land use regression

Abstract Id: 453
REMOTE SENSING ASSESSMENT ON TIRUNELVELI COASTAL ZONE USING LANDSAT DATA FOR A PERIOD OF 45 YEARS

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Coastal zones are dynamic in nature, it’s spatially and temporarily changed by the physical process of erosion and accretion, tidal flooding, sea level change and anthropogenic activities. The present study was made a remote sensing assessment on Tirunelveli coast of Tamilnadu. The land cover of Tirunelveli cast changes between 2001 to 2017 and shoreline changes over 45 years were analyzed using of Landsat MSS, TM, ETM+ and OLI_TIRS datasets. Coastal land cover changes were studied up to 5 km from the shoreline. The coastal area was classified into 6 classes such as barren land, teriand, vegetation, sandy, buildup and water body. The coast is mostly dominant by barren land (32.98%), followed by teriand (27.11%), vegetation cover (26.18%), buildup area (8.10 %), sandy (3.46%) and water body (2.13%). The build up area was highly increased in the coastal zone about (69.14%), sandy (20.50%) and the vegetation (19.30%) cover was decreased over a period of 17 years. The normalized difference water index (NDWI) for Landsat imagery (1973 to 2017) were generated for shoreline extraction. The shorelines were extracted from the Landsat data and analyzing moving boundaries using R statistical package (AMBUR) were used for calculating the rate of change statistics. The maximum erosion was found in the Southwest region (4.14 m/yr). The maximum accretion was found in the Southeast region (27.4 m/yr). Overall, from the rate of change statistics, Tirunelveli coast exhibit a erosion stage. The predicted shoreline for 50 years shows that the tirunelveli shoreline in receded back to land.

Keywords: Tirunelveli coast, Landsat, AMBUR, Landuse, Shoreline change, NDWI

Abstract Id: 454
STUDY METHOD FOR TESTING IMAGE QUALITY OF OPTICAL REMOTE SENSING SATELLITE OF VIETNAM

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VNREDSat-1 satellite had been launch on 7th May 2013 with 5 years life time designed and it opens up new opportunities for natural resources and environment monitoring in Vietnam. Precise informations on the Earth surface which is extracted from remote sensing data including VNREDSat-1 depends on parameters such as spatial resolution, radiometric resolution, temporal resolution, and spectral resolution. Image quality is evaluated by spatial and radiometric resolution. MTF (Modulation Transfer Function) shows quality of spatial resolution and sharpness. Radiometric resolution is delineated through noise value characterized by signal to noise ratio (SNR). VNREDSat-1 is the first multi-spectral Vietnamese satellite that suitable image quality assessment methods should be built and possible applied for similar future satellites. MTF could be estimated by algorithms as general mathematical framework based on Wiener filter (1949), target based absolute MTF; or direct and indirect parametric models of MTF. SNR estimation could be performed by several methods which are single view for homogeneous and quasi-homogeneous area or synthetic landscape. Outputs of this work are methodology and algorithm for VNREDSat-1 image quality assessment and similar future satellites that is suitable with characteristics of Viet Nam site test.

Keywords: VNREDSat-1, Image quality, Validation

Abstract Id: 455
This research describes an approach to detecting Oil palm crown in Malaysia replantation site using Unmanned Aerial Vehicle (UAV) images. Malaysia is the world’s second largest palm oil producer. Oil palm expansion and replantation can contribute to deforestation, peat degradation, biodiversity loss, forest fires and a range of social issues. Oil palm is also a major driver of economic growth and a source of alternative fuel. Ensuring successful oil palm replantation requires an effective monitoring program to collect information regarding the status of young trees. Current field-based assessment methodology is costly and time-consuming therefore assessment frequency is low. Advances in computer vision and the parallel development of UAVs allow for the extensive use of UAV in forest inventory and in indirect measurements of tree features. UAV imagery is a low-cost alternative to field-based assessment, but require the development of methods to easily and accurately extract the required information. In this paper, regarding tree crown detection, template matching and object-based image analysis are presented. In the first step, the UAV images were prepared for analysis. Secondly, the corrected UAV image was segmented to create image objects using color information. Finally, a correlation image was generated based on a manually selected template from the corrected image. Finally, oil palm trees were detected by applying a threshold for average correlation value at each image object. The accuracy of assessment also is discussed.

Keywords: UAV, segmentation, oil palm

Abstract Id: 458
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DISASTER MANAGEMENT THROUGH IRS 1A LISS II IMAGES IN CONJUNCTION WITH ERS- 1 C-BAND SATELLITES REMOTE SENSING DATA FOR IDENTIFICATION OF NATURAL DISASTROUS ZONES IN SEMI-ARID ENVIRONMENT

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Gathering real Geoinformation through Indian Remote Sensing Satellite data (IRS-1LISS II) in Conjunction with & European Space Agency’s data (ERS-1, C-BAND, SAR) Satellite digital images have been interpreted visually and digitally, to access waterlogged information, Soil Moisture and associated thematic information for Natural Disaster Management (NDM). The Waterlogged is one of the disastrous areas in the Sikandra Rao Tehsil, Hathras district, State of Uttar Pradesh, India. The Natural Disaster Zones (NDZ) identified from IRS LISS II & ERS-1(ESA) SAR Images. After Field visit, Visual Interpretation & Digital Analysis and then compared with those extracted information from ERS-1 & IRS 1A LISS II as shown on Images. The Information shows that the accuracy of the visual identification varies greatly from 90 per cent for the ERS-1 to 81 per cent for the IRS 1A LISS II. The Remote Sensing Techniques applied to get information for mapping accuracy which incorporates and helped in delineating Disastrous zones locations affected by climatic fluctuations & Geo-dynamic variation. To demonstrate further the usefulness of the IRS 1A images for Geo-dynamic Environmental investigations on Waterlogged-soil moisture and associated features in the area have also been analyzed. The results show that the development of Natural Disastrous zones are due to excessive irrigation in areas with poor drainage network conditions causes water-logging and salinization/alkalinization of the soil. This study helped to mitigate future Geo-hazard Environmental condition in the area by adopting high resolution satellite data,LIDAR data & techniques of analysis with modern Softwares. Remote Sensing information (RSI) & Geographical Information System (GIS) techniques would helpful for Natural Disaster zones preparedness, forecasting & their management plan to cope during worse situation. Thus, Information sharing among disaster management & environment monitoring agencies/communities would be transparent for betterment of the country.

Keywords: Geoinformation Gathering, Remote Sensing Techniques, Digital Analysis, Geo-Environment,

Abstract Id: 462
DEVELOPING THE LANDSLIDE DISASTER RISK INDEX IN CENTRAL TAIWAN

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Taiwan is reported as the one of most hazard vulnerability island in the world according to Natural Disaster Hotspots- A Global Risk Analysis published by the World Bank in 2005. This island was affected by an average of 4-6 typhoons per year which triggered heavy rainfall frequently. Meanwhile, this island has a complex terrain shaped by the active tectonic collision and denudational processes. Therefore, the landslide disasters usually occur during a heavy rainfall on hillslopes. A useful landslide disaster risk index is essential for disaster mitigation in Taiwan. This study developed the Landslide Disaster Risk for central Taiwan by integrating the factors of landslide hazard, social vulnerability, and hazard exposure. The landslide hazard probability was evaluated by a statistical and rainfall-triggering landslide model. The social vulnerability was calculated by using the six multi-scale maps: number of disaster prevention training exercises, firepower/area ratio, distance from shelter, the dependency ratio, salary income, and number of low-middle income households. The hazard exposure data was calculated by demographics data and landuse map to consider both non-spatial and spatial factors. A multi-layer multi-class dasymetric model (MLMCD) was applied in this study to redistribute the human population and to improve the accuracy of exposure. This proposed approach is capable of integrating the natural and social data at different spatial scales to assess landslide disaster risk in an area with insufficient data.

Keywords: Landslide, Disaster Risk Index, Social Vulnerability, Hazard Exposure

Abstract Id: 463
DISCOVERING RELATION OF RAILWAY ROUTE AND NATIONAL ECONOMY USING STATISTICAL AND REMOTELY SENSED DATASET

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This study aims to find out the role of continental railways on national economy. Even though there are many kinds of transportation including railways, highways, and air transport, railway plays a significant role in freight transportation in many countries. Since the reason for constructing railways is to activate economy and improve our quality of life in total, using several quantitative indicators to reveal the effect of railways is important in that this is what railways were constructed for and looking into how it can affect national economy is also useful because there are many rail construction plan going on especially in South East Asia, and this tells us railway route they take can affect their future economy.

There are three parts in this study. Firstly, the role of freight railways is discovered. In this part, three indicators including population, income, and urban area were collected for targeted cities in Australia, India and China. Population and income data is collected from statistical dataset, while urban area is calculated from Landsat images using supervised classification. Using the statistical analysis of Instrumental Variables (IV), the effect of rail on cities is calculated. Secondly, the country’s economy (GDP) difference depending on the different economy focus on cities is studied. National support on different cities will lead to different economic outcome of the country. In order to know the components of GDP, statistical and remotely sensed dataset is prepared. The types of city on which railway is running is clustered and the relation between type of city on the railway and national economy is discovered using IV. Finally, using the result of previous parts, how important rail transportation is for the future economy of the country is mentioned.

Keywords: Landsat, freight railway economic impacts

Abstract Id: 464
POSSIBILISTIC BASED CLASSIFIER APPROACH FOR IDENTIFICATION OF PADDY FIELD USING INTEGRATED BI-SENSOR TEMPORAL DATA

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In remote sensing, discrimination between two classes which are spectrally similar mostly done using temporal data. But issues like clouds and atmospheric disturbances create gaps in optical temporal data acquisition. In this work, temporal microwave data incorporated with the temporal optical data to full fill the temporal gaps. Here, RISAT-1 and Formosat-2 temporal images integrated, for the identification of late transplant paddy and harvested paddy. The second challenge was handling of mixed pixel because the satellite images used in this research were of courser resolution. Possibilistic based classifiers were used with different similarity and dissimilarity measures for the identification of specific crop. First, three temporal dataset were generated for late transplant paddy and harvested paddy in chronological order which covers the phenology cycle of paddy crop. The temporal indices database given as an input for the possibilistic based classifiers which are Improved Possibilistic c-Means and Modified Possibilistic c-Means. Late transplant paddy fields were successfully found with these classifiers but for the harvested paddy results were not favourable. In the case of harvested paddy image segmentation with SVM classifier were used. The most favourable results obtained for late transplant paddy for Improved Possibilistic c-Means classifier were Normalized squared Euclidean norm at m=1.1, while for Modified Possibilistic c-Means classifier best norm were normalized square euclidean at m=1.1. In the case of harvested paddy upto November fraction output showed the most paddy fields. The best dataset achieved for the late transplant paddy and harvested paddy, single temporal RISAT-1 image and two temporal Formosat-2 image. Overall accuracy of late transplant paddy using Improved Possibilistic c-Means classifier were 90%, and with Modified Possibilistic c-Means were 85%. The accuracy of harvested paddy upto November were 85%.

Keywords: Temporal dataset, Possibilistic based fuzzy classifiers, Image classification, membership values

Abstract Id: 465
Flood inundation and retention are key hydrological characteristics of estuary wetlands. Mapping flooding patterns is critical for environmental flow management in terms of sustaining ecosystem function, biodiversity and habitat suitability. The goal of this study is to demonstrate the potential of intra-annual time series analyses at dense temporal for inundation characterization in the Yellow River Delta, China. We mapped inundation in the floodplain using time series Landsat 5 TM and Landsat 7 ETM+ images (2004-2014). An algorithm was developed for reconstructing the surface reflectance of any cell for any desired date based on all available Landsat data. Through analysis of the typical profile of each land cover, the inundation area can be identified at consecutive time in an annual cycle. Further analysis of the inundation time series provided additional information about the seasonal recurrence of water in estuary wetlands as well as their hydrological function. A map derived from a continuous time series assures the inclusion of temporary features, an obvious advantage compared to other datasets, which are based on several single date observations. An accuracy assessment has been carried out with a stratified random sampling approach and a one stage cluster analysis that relies on high-resolution satellite data to verify the detected flooded areas. The method presented here for monitoring the hydrological characteristics at high spatio-temporal resolution had much application value in wetlands habitat evaluation and restoration practice.

Keywords: Remote sensing, Time-series, Inundation, Wetlands, the Yellow River Delta

Abstract Id: 469
LAND COVER CHANGE DETECTION IN THE YELLOW RIVER DELTA, CHINA USING TIME-SERIES LANDSAT DATA

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Landsat data have been widely used in forest management, water resource management, change detection of land cover and use. Time series development are becoming increasingly available thanks to the launch of landsat4, 5, 7 and 8 satellite images and it's a promising way to detect the change of land cover in a real-time way. A new algorithm for change detection of land cover using time-series Landsat data was developed. First, the potential land cover change in a pixel on annual scale was selected out through comparison of annual NDVI curves between two adjacent years. Landsat Quality Assessment band was used to eliminate “noisy” observations when the pixel value is out of ordinary range, for example, the pixel contaminated by cloud or cloud shadow. The “clear” observations were combined to build a NDVI time series model. The NDVI curves in the adjacent time periods were compared using a dynamic time warping method to measure their similarity. If the similarity of the curves exceeded a threshold, the land cover was regarded to have changed in the period. Then a fitted model was developed to predict the temporal spectrum feature of a pixel, assuming no land cover changed in several consecutive years. The reflectance time series model can be updated dynamically when new observations are acquired. Compared the prediction value to the observation value, we can decide when and what happened, thus to monitor the spatio-temporal land cover change. In a case study in Yellow River delta, 300 random sample is used to assess the change detection accuracy, with the producer's accuracies, the user's accuracies and the overall accuracies were 76%, 80%, and 87%, respectively. The results showed the proposed method here was practicable in detecting land cover change both spatially and temporally.

Keywords: Land cover, Time series, Change detection, DTW

Abstract Id: 471
ATMOSPHERIC CORRECTION OF MULTI-SPECTRAL VNIR SPACE-BORNE REMOTE SENSING DATA

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Commercial optical imaging Earth observation satellite systems such as SPOT (Satellite Pour l’Observation de la Terre) and CARTOSAT provide multi spectral remote sensing data in visible and near-infrared (VNIR) wavelengths at high spatial resolution of the order of sub-meter to few-meters. These data-sets can be used in variety of applications particularly associated with precise mapping, monitoring and change detection of Earth’s surface, if top of the atmosphere measurements can be properly compensated for atmospheric absorption and scattering effects. Existing physics based atmospheric correction algorithms for multi/hyper-spectral remote sensing data over land involves simultaneous use of visible and short-wave infrared channels to derive aerosol information. Therefore, such algorithms cannot be used for atmospheric correction of data acquired by VNIR sensors to derive “surface reflectance”. In this paper, an algorithm for atmospheric correction of high resolution VNIR remote sensing data from space is described. The algorithm uses lookup tables generated with vector radiative transfer calculations. The algorithm uses near infrared, red and blue band measurements to derive aerosol information. Using derived aerosol information and ozone climatology data, pre-computed lookup tables are employed to derive surface reflectance. Quite reasonable surface reflectances have been obtained when our algorithm is applied on CARTOSAT data. It is found that our algorithm significantly removes the haze from the images making surface feature visible.

Keywords: Aerosol, Aerosol optical depth, Atmospheric correction, Surface reflectance, CARTOSAT

Abstract Id: 473
ANALYSIS OF BEIJING URBAN TRAFFIC CHARACTERISTICS BASED ON TAXI GPS DATA

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Taxi GPS data is a typical form of big data with the characteristic of high dimension, fast change and large amount. It can be used to not only track the trajectories in real time to analyze the traffic situation, but also mine the underlying information about the traffic behavior happening in the city. The study will take the taxi GPS data in Beijing for example, and will firstly make the statistical analysis of the data for traffic characteristics and the temporal-spatial distribution features, via which we can unfold the taxi traffic operational management. Next, it will construct an OD networks of different periods of time, based on the Origin-Destination pairs extracted from the GPS trajectories and the series of the city sub-regions. The OD network will take the sub-regions as nodes, and the flux across the regions as the weight of the edges. And then the paper will apply the complex-network-motivated method to study the temporal-spatial flow pattern of the city and the urban traffic characteristics through analysis of OD network and comparison the networks of different periods of time .Finally, there is very much time when taxies drive without any passenger in and at the same time many passenger have no chances to take a taxi, which leads to so high rate of free-passenger driving. Therefore the study will cluster the trajectories of taxies carrying passengers and find out the pick-up hot region so that drivers can choose better vehicle routing so as to help decrease the rate of free-passenger driving and increase the traffic flux within the city. In a word, the paper will employ the complex-network-motivated approach to help study the urban traffic pattern.

Keywords: Taxi GPS data, OD network, Hot spot, Urban traffic

Abstract Id: 474
MAPPING AND MODELLING OF URBAN SPRAWL PATTERN IN MORADABAD CITY USING MULTI TEMPORAL IMAGES AND SHANON’S ENTROPY APPROACH

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Moradabad City, being the U.P.'s industrial and cultural centre, has a problem of rapid urban sprawl. The city has an extremely high population density which is continuously increasing through informal settlements that grow by sprawling due to migration of villagers and the high population growth rates. The present study attempts to understand, detect and qualify the spatial pattern of Moradabad city's urban sprawl using Shannon's Entropy and multi-temporal LISS-III images and survey of India Topographical Sheets of 1971 and satellite data of 2008 and 2013 acquired for the period 1971 to 2013. Supervised classification was applied to extract the built-up areas and to measure the changes in urban sprawl, land-use class among the city. Shannon's entropy was Shannon's entropy was applied to model the city's urban sprawl, trend and spatial change. The entropy values for the city's area were modeled and used in an interpolation function to create an entropy surface (index) for each acquired temporal image. Such index indicates the spatial pattern of the urban sprawl and provides a visual comparison of the entropy phenomenon for study area. This study indicate that Shannon's entropy index increased from year 1971 to 2013 indicating dispersion of growth, a sign of urban sprawl. The maximum entropy values are found in the western parts of villages - Sikandarpur, Malakpur, Paikbara etc. Findings of the study help in understanding the sprawl patterns and dynamics among Moradabad city area and provide a visual comparison. The applied methodology provides explanation and facilities tracing and measuring the urban sprawl which is needed by decision makers and city planner's of mega cities.

Keywords: Urban Growth; Land use change; Shannon's Entropy Approach; Geographical Information system

Abstract Id: 475
SHIP POSITIONING USING UAV MULTI-SENSOR SYSTEM AT MARINE AREA

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Continuous surveillance of the marine area is necessary to deal with accidents, illegal activities and protection of national security in the ocean. In order to ensure safety and reduce social loss on the sea, it is important to monitor ships activities and determine their locations. The Unmanned Aerial Vehicle (UAV), which can be dispatched quickly in case of emergency and is inexpensive to maintain, has been adopted as a means to carry out marine surveillance. UAV multi-sensor system allows to collect high-resolution images at low cost. However, accuracy of obtained data has no confidence due to little number of GCP (e.g.: ships, land such as island) and the performance of mounted GPS/IMU sensors. In this study, we determine position of the ship using UAV images and GPS/IMU data, and verify the accuracy of the positioning results of the ship. This study consists of four following stages: 1) We determined the Exterior Orientation (EO) parameters of the images. Conducting the calibration of the UAV system to estimate the mounting parameters between GPS/IMU and the optical camera. 2) Through the ship detection stage, we obtained information which are manual ship detection location in Image Coordinate System (ICS). 3) Then, we calculated the position of the ships in the Geographic Coordinate System (GCS). 4) Finally, we analyzed of obtained results performed by comparing the determined position of the ship with the actual position of the same ship. Through this process, we verified the possibility of UAV multi-sensory data for marine surveillance. This study is expected to be useful in the future for ship surveillance based on the UAV.

Keywords: Ship positioning, UAV, Marine Surveillance, Multi-sensor, georeferencing

Abstract Id: 476
ON THE RECEPTION SITUATION OF SATELLITE SIGNALS FROM GNSS IN THE MOUNTAINS ~ HAKUSAN SHIRAKAWAGO WHITE LORD AS AN EXAMPLE ~

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The positioning technology based on GNSS is utilized in various places, from the familiar scene of life such as application of smartphone to civil engineering work, agricultural technology, cadastre examination. In addition, the satellite positioning system by the quasi-zenith satellite in Japan is planned to launch three aircraft in FY2009, and the operation is started with a total of four aircraft systems. From FY 2023 onwards, the aircraft will be equipped with seven aircraft systems and it will be possible to receive signals from multiple quasi-zenith satellites at elevated elevation all the time. In this study, Leica GPS 1200 + (Leica geosystems), JAVAD ALPHA G 3 T (JAVAD), SOKKIA GIR 1600 (TOPCON ) were installed in a mountainous area centered on a Hakusan Shirakawago White Lord with a height difference of about 800 m. We conducted a positioning experiment using GNSS logger and considered the reception situation of satellite signals in the mountainous region. In the experiment method, each receiver was installed at the zenith of the vehicle, and data of every second was received and analyzed. Furthermore, compared with the center of the road of the Geographical Survey Map where accuracy is guaranteed as public data relatively.

Keywords: GNSS QZSS

Abstract Id: 477
ASSESSING AGRICULTURAL DROUGHT OCCURRENCE BASED ON SATELLITE-DERIVED METEOROLOGICAL PARAMETERS

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Drought is one of the extreme events concerning the agricultural sector in the Philippines. It is generally characterized by the relatively low rainfall amount over a period of time that affects not only the agricultural sector but also the economic sector. In this study, different meteorological parameters, such as evapotranspiration, potential evapotranspiration, land surface temperature, and rainfall, were linked to the occurrence of agricultural drought in the Philippines during the two major seasons. Agricultural drought were assessed using the Standardized Vegetation-Temperature Ratio, an index based on satellite derived land surface temperature and vegetation. Logistic regression was applied to identify the individual influence of the different meteorological parameters in the occurrence of agricultural drought.

Results show positive correlations were found between evapotranspiration and rainfall to the agricultural drought, while negative correlations were found on land surface temperature and potential evapotranspiration. The effect of rainfall on the agricultural drought increases with time, until 3-months, which signifies lag effect of rainfall on development of agricultural drought. Over-all, evapotranspiration was found to have the greatest influence on the current status of agricultural drought. As the lag increases, the effect of rainfall on the occurrence of drought was increasing. Also, higher correspondence was found during the dry season than during wet season. The effect of rainfall deficiency on the occurrence of agricultural drought increases with time during the dry season. In general, higher agreement between meteorological parameters and agricultural drought was found during the dry season in the Philippines, and previous rainfall deficiency, as well as high evaporation, highly contributes to the development of agricultural drought.

Results of this study may be used as a guide for concerned sector in planning and mitigating the effects of drought.

Keywords: Drought, Meteorology

Abstract Id: 478
Hyperspectral remote sensing is a technique to detect and identify the spectral features in various disciplines such as mineral exploration, geology, agriculture, soil, forestry, ecology and marine sciences. Detection and identification of features depend on spectral and spatial resolution of hyperspectral image. For instance, in the case of minerals very minute differences in structure or composition of minerals provides distinct spectral features and spectral absorptions. Identification of materials or objects more precisely requires removal of artifacts and atmospheric correction. The goal of the study to evaluation and comparison of different algorithms and parameters such as DISORT, Scaled-DISORT and ISAACS on FLAASH and QUAC based atmospheric correction. Atmospheric corrections of an image have done in FLAASH, applied with different algorithms. Spectra of different features like as minerals, vegetation, water bodies of Jahajpur area, Bhilwara, Rajasthan, extracted from atmospheric corrected and raw image of AVIRIS NG. Evaluated more precise and accurate spectral feature result of objects, which is depending on the spectral curve of materials. These extracted spectra correlated and compared with spectra of USGS spectral library. Unwanted absorption features and spectral variation in curve lead to wrong interpretation but these effects are distinct in different algorithms and model. On the basis interpretation of spectral curve of various material and minerals with Scaled-DISORT in FLAASH provide more precise and accurate spectral result in comparison to DISORT and ISSACS. FLAASH also provides the better result than QUAC.

Keywords: AVIRIS-NG, atmospheric correction, FLAASH, QUAC, Scaled-DISORT.

Abstract Id: 479
Synthetic aperture radar (SAR) is useful for grasping the damage state of structures when a disaster occurs because it is able to observe the earth surface all day and under all weather conditions. Many highway bridges were damaged during the 2011 Tohoku earthquake and tsunami. Traffic networks were suspended due to the damage bridges and the delay of emergency operations was followed. Airborne SAR has more flexibility than satellite SAR since it can be dispatched to the affected area soon after a disaster strikes. However, it is difficult for airborne SAR to observe the same area in the same acquisition condition before and after a disaster. Therefore, it is important to extract the damage to bridges only from a post-event SAR image. Although Soergel (2006) decomposed airborne interferometric SAR images into layover, double-bounce and triple-bounce components according to the angle between the bridge-axis and the radar’s range-direction, there is still no established method to detect the bridge damage using a single SAR image. After the 2011 Tohoku earthquake and tsunami, the National Institute of Information and Communications Technology (NICT) carried out emergency observation of affected areas using airborne X-band SAR (Pi-SAR-X2). The Pi-SAR-X2 has 0.3-meters resolution and full-polarizations. Unlike a single polarization, full-polarimetric SAR enables us to extract and analyze detail information of a target. This study attempts to grasp backscattering characteristics of bridges in the central Tokyo from full-polarimetric Pi-SAR-X2 images. First, backscattering characteristics of bridges are examined using a color-composite of three polarizations. Then, the Pi-SAR-X2 images are decomposed by the Yamaguchi’s 4-component scattering model. From these results, backscattering characteristics of bridges are evaluated according the structural type, material and the shapes of superstructure, girder, and substructure. This kind of assessment is a first step to extract bridge damage from a single post-event full-polarimetric SAR image.

Keywords: Pi-SAR-X2, bridge, full-polarimetric, backscattering characteristics

Abstract Id: 480
APPLICATIONS OF SATELLITE DATA IN EXPLORING THE INTRICACIES OF RAINFALL AND TOPOGRAPHY OVER THE HIMALAYAN REGION

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Mountains control the precipitation distribution by modifying the moist wind flow and responding strongly to the solar insolation. In the northwestern Himalayan (NWH) region, the precipitation during Indian summer monsoon (ISM) results from a complex interaction between atmosphere-topography. Understanding the intricate interplay of rainfall-topography is a subject of ongoing research. Further, the influence of topography over the unpredictable short-lived extreme rainfall events occurring frequently in the region remains relatively unexplored. As Global Precipitation Mission based multi-satellite precipitation products offering high spatiotemporal resolution seem promising for the study of monsoon in orographic regions, we utilize Level 3 precipitation estimates derived using Integrated Multi-satellite Retrievals for GPM (IMERG) algorithm for our analyses. The paper aims to comprehend the monsoon precipitation and its extremes as functions of topographic factors like elevation, slope, aspect and relief over the states of Uttarakhand and Himachal Pradesh located in the NWH. The GPM IMERG data is available at 0.1° x 0.1° resolution with the half-hourly interval from March 2014 until present. The preliminary analyses suggest two-step topography from the longitudinal cross-section and a decline in average mountain height from the latitudinal cross-section. While the precipitation enhancement is rather continuous along the latitude, the mean seasonal precipitation seems to be related almost inversely with the mountain height along the longitude. However, this contrasting relation of precipitation with mountain height is not clearly evident in the case of frequency and intensity of rainfall extremes. The distribution of 1-day maxima displays little association with the underlying topography. Comprehension of poorly constrained precipitation patterns and driving processes in orographic regions is our ultimate objective.

Keywords: NWH, ISM, GPM, topography, rainfall extremes

Abstract Id: 481
USING FORMOSAT-2 TO ANALYZE THE RELATION BETWEEN THE WATER LEVEL AND THE WATER AREA OF ZENGWEN RESERVOIR

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Taiwan is located in the main path of typhoon passing in the pacific region and severe influenced by monsoon also. Most area of Taiwan territory is on slope land or mountain. The rapid river make the precipitation in this period cannot be preserved easily. The reservoir is an important facility to retain volume of water in the wet season and supply water for human activities in dry season. However, torrential rains have become more frequent in recent year because of extreme weather. This phenomenon causes that the river bring sand and soil from upstream and sediment accumulate in the bottom of reservoir increases rapidly. Consequently, the effective water storage capacity decreases significantly. It brings the severe influences to the operation of reservoir.

In this paper, Normalized Difference Water Index (NDWI) was derived from the FORMOSAT-2 satellite image in the Zengwen reservoir, using near-infrared and green spectral bands. By comparing the difference between two spectral data, we are able to discriminate waterbody from other geographical features. The boundary between water and land surface could be identified by making use of the edge detection and morphology then we can calculate the area of water body according to those results. Furthermore, with the help of long-term historical precipitation records in upstream catchments of reservoirs and water levels of reservoir, we are able to infer the utilization of water resources from 2010 to 2016 in this region.

Keywords: FORMOSAT-2, Water Resources Management, Edge Detection, NDWI

Abstract Id: 483
DEVELOPING REGIONAL WHEAT YIELD FORECASTING FRAMEWORK BY ASSIMILATING REMOTE SENSING DERIVED LAI AND WEATHER FORECAST INTO CROP MODEL

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The objective of the yield forecast is to give a precise, scientific sound and independent forecasts of crops’ yield as early as possible during the crops’ growing season by considering the effect of the weather and climate. Value of crop yield forecasting increases exponentially if it can be implemented spatially for a region in the form of yield maps. The present study attempted to develop a framework for regional wheat yield forecasting by assimilating remote sensing derived leaf area index (LAI) and weather forecast into crop simulation model InfoCrop-Wheat. The model was calibrated and validated using two year’s experiment at research farm of Indian Agricultural Research Institute, New Delhi as well as for farmers’ fields selected in Pataudi block of Haryana state. The framework consist of three modules, viz., (1) module to retrieve LAI from multi-spectral remote sensing images, (2) module to assimilate WRF based weather forecast and LAI into crop model, and (3) module to spatially run InforCrop model. The LAI is retrieved by inverting broad-band reflectances of Sentinel 2A MSI and Landsat-8 OLI using PROSAIL. Different PROSAIL inversion approachs like ANN and Look-Up tables were implemented. The results of LAI retrieval validated using in-situ LAI measurements taken from farmers’ fields. The best retrieved LAI was assimilated into crop model using two approache i.e. Forcing and Ensemble Kalman Filtering (EnKF). The reasonably good parameterized WRF-ARW model for Indian condition was used to generate weather forecast during the crop growing season. This weather forecast integrated into crop model along with assimilated LAI generated spatial crop growth and yield maps. The detailed analysis of accuracy of proposed framework will be presented.

Keywords: WRF, LAI, Forecasting, CSM

Abstract Id: 484
RADIOMETRIC NORMALIZATION OF MULTITEMPORAL OPTICAL SATELLITE IMAGES USING ITERATIVELY-REWEIGHTED MULTIVARIATE ALTERATION DETECTION

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Radiometric normalization is a fundamental process for multitemporal satellite images. The accuracy of relative normalization depends on the quality of selected Pseudo Invariant Features (PIFs). PIFs represent the ground objects whose reflectance are constant during a period of time. In previous study, an algorithm, called Multivariate Alteration Detection (MAD), was applied to statistically select no-changed pixels within bi-temporal satellite images. However, MAD is sensitive to cloud covers and some clouds may be misclassified as PIFs. For this reason, Iteratively Reweighted MAD (IR-MAD) was introduced to establish an increasingly better no-changed background using iterative scheme. Nonetheless, both MAD and IR-MAD only compute the linear combinations for bi-temporal images, and not applicable for multitemporal images with more than two images. In this study, a novel method called Weighted Generalized Canonical Correlation Analysis (WGCCA) is proposed for the selection of high-quality PIFs in multitemporal and multispectral images, which solves coefficients for the correlations of not only multivariable data but also multitemporal data. Specifically, the proposed method integrates the strengths of Generalized Canonical Correlation Analysis (GCCA) and IR-MAD, and PIFs extraction from a sequence of satellite images is performed at the same time, which leads to a consistent feature extraction. Furthermore, when the high-quality PIFs are determined by the proposed method, the digital numbers of PIFs from multitemporal images are transformed into a predefined radiometric reference level. With this approach, the radiometric resolution of multitemporal images can be preserved, and a better radiometric normalization can be obtained. In experiment, SPOT-5 imagery was tested. Compared with Canonical Correlation Analysis (CCA) which is used in MAD, the proposed method can discriminate no-changed pixels from changed more precisely.

Keywords: radiometric normalization, PIF, MAD, GCCA, multitemporal satellite images

Abstract Id: 485
AN ARTIFICIAL NEURAL NETWORK APPROACH FOR OPTICAL-SAR IMAGERY FUSION AND LANDSLIDE MAPPING

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In the mountainous areas of Taiwan, affected by active tectonics, frequent typhoons and human activities, landslides are commonly induced by heavy rainfall especially during typhoon seasons. This study focuses on the landslide detection over Laonong River watershed in southern Taiwan. Due to the incursion of Typhoon Morakot (2009), the heavy rainfall induced large-scale landslide and debris flow and caused 28 deaths in this area.

Image fusion can visually or statistically enhance the characteristics of land-objects. Usually, investigators only detect bare surface of landslides by obtaining optical images instead of using synthetic aperture radar (SAR) images to identify the erosion, transportation and deposition patterns, which can be critical to the landslide susceptibility assessment. Thus, this study aims to develop an Optical-SAR image fusion for an advanced landslide mapping task. SAR data is capable to detect the deformation of landslide surface by distinguishing different backscattering. A machine-learning method, artificial neural network (ANN), was operated for landslide pattern fusion and mapping practice. With applying image segmentation, Normalized Difference Sigma-naught Index (NDSI) from SAR images and Normalized Difference Vegetation Index difference (NDVI_diff) from optical images were calculated, including mean, standard deviation, contrast, entropy, homogeneity and dissimilarity values.

With applying the ANN algorithm, all images were fused and used for landslide detection which were assessed by overall accuracy and kappa coefficient. The details of the procedure and all results will be presented and discussed in the conference.

Keywords: landslide, image fusion, ANN, NDSI, NDVI

Abstract Id: 486
COTTON CROP MONITORING USING MULTISPECTRAL OPTICAL SATELLITE IMAGERY

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Cotton, as a globally cultivated crop, have had benefited greatly from present remote sensing research. However, due to its unique changing physical characteristics over growing seasons, traditional vegetation indices have proven largely inconsistent in their management capabilities. Building on this research gap and the prevalence of modern high-resolution, multispectral optical imagery, this paper proposes a series of multispectral-sensor-based indices that attempts to enhance the management of crops in general and cotton plantation in particular. The theoretical reasoning behind these hypothetical indices are discussed and their practical applications are demonstrated using the sub-meter multispectral imagery of TripleSat.

As crops mature, their surface spectral reflectance changes. This change is more significant when common crops like cotton and wheat grow closer to harvest. Thus, by tapping into the sensor bands along the visible spectrum, this index is able to monitor the degree of and changes in crop readiness in large areas simultaneously. This allows for stakeholders with large landholdings to pre-empt harvesting or crop-tending periods.

Looking beyond the crops, this paper goes a step further in extracting information from multispectral imagery to study sites for crop suitability. Cotton, for example, require specific environmental conditions to flourish, such as specific soil types, frost-free periods, and temperature ranges. A decision-tree based suitability index is proposed to extract regions with cotton-friendly environments for potential plantation establishment. This index also draws upon ancillary information such as temperature or rainfall distribution data to enhance the precision of the index’s results.

Keywords: plantation monitoring, crop prediction, NDVI, TripleSat

Abstract Id: 487
IKH TURGEN MOUNTAIN GLACIER CHANGE AND 3D SURFACE EXTENTS ESTIMATION USING LONG TERM LANDSAT DATA AND CLIMATE DATA

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The glacier is most important the freshwater resources and indicator of the climate change. The researchers noted that during last decades the glacier is melting due to global warming. The study calculates a spatial distribution of potential change of glacier coverage in the Ikh Turgen mountain of Western Mongolia, and it integrates long-term climate data and satellite datasets. Therefore, in this experiment has tried to estimation three-dimensional surface area of the glacier. For this purpose, Normalized difference snow index (NDSI) was applied decision tree approach, using Landsat MSS, TM, ETM+ and LC8 imagery for 1972-2016, a surface and slope for digital elevation model, precipitation and air temperature historical data of meteorological station. The potential volume area significantly changed glacier cover of the Ikh Turgen Mountain, and the area affected by highly variable precipitation and air temperature regimes. Between 1972 and 2016, a potential area of glacier decreased by 60% in Ikh Turgen mountain region.

Keywords: Glacier 3D area, Landsat Imagery

Abstract Id: 489
DEEP LEARNING TECHNIQUES FOR REMOTE SENSING STUDIES: A REVIEW

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Remote Sensing data provides valuable information that can be utilized for monitoring earth surface. Land use land cover classification (LULC) using RS data is a crucial task and occupies a significant place in this research domain. Numerous classification techniques have been designed and utilized, for last many decades, to distinguish LULC classes in satellite images. Machine learning (ML) approaches like artificial neural network, support vector machine, random forest are widely used methods for satellite image classification. One of the important aspect of machine learning models is representation of data. Extraction of prominent features using feature extraction techniques which provide better representation of data, enhances the accuracy manifold. However, it requires prior human knowledge related to the application. In this paper, a review of Deep Learning (DL) techniques commonly implemented for classification/pattern recognition in satellite images has been done. Recently proposed DL techniques are better at providing multiple level of representation without requiring any manual feature engineering. DL models have been extensively tested for general computer vision tasks like face recognition, digit/object identification and natural language processing, where it outperforms all other state of art ML techniques. However, its potential needs to be checked for remote sensing applications. In recent years, number of works published have been exponentially increasing in this field. Thus, this article presents a summary on the current state of the deep learning and provide a perspective that how it may evolve. Convolutional Neural Networks (CNNs), Auto-encoder (AEs) and Deep Belief Networks (DBNs) are discussed primarily as these techniques or their variations are primarily applied in most of the RS studies.

Keywords: Image Processing, Deep Learning, CNN, Random Forest, feature extraction

Abstract Id: 492
Penetration of light into the water column is depends on the water clarity where clear water tends to has high percentage of light absorption. Out of 6036.7km total Malaysian coastline, Peninsular Malaysia is surrounded by more than 1926km, from west coast, south to east coast of continental region. Seagrass density and habitat complexity is affected by the amount of light that able to penetrate into the water column to be received by submerged seagrass for growing process. Water along the west coast is generally more turbid compared to south and east coast of Peninsular Malaysia. Therefore, using spectral properties of visible band of satellite data, the variability of light penetration could be estimated where light attenuation is an important parameter to detect underwater seagrass occurrences from satellite. Blue band (450-510 nm) of Landsat 8 OLI which has strong penetrative power and red band (640-670 nm) which is sensitive to subtle changes on seafloor features is used to estimate variability of light penetration. A set of sampling point from sandy area was extracted from both spectral bands to be plotted with depth value. Hydrographical chart is the source of interpolated depth value, with the influence of tidal height obtained from tidal chart during the time of satellite passes. It is found that east coast that almost covered by high water clarity has 25% higher light penetration into the water column, in average compared to south and west coastal region. This condition is favorable for seagrass habitat to catalyst their growth rate. However, very deep sea bottom and strong wave from South China Sea are among limitations imposed by east coast seagrass community to survive in longer period of time.

Keywords: light, penetration, seagrass, satellite, attenuation

Abstract Id: 493
ASSIMILATION OF REMOTELY SENSED SOIL MOISTURE INTO HYDROLOGICAL MODEL: A CASE STUDY IN THE MAHANADI BASIN, INDIA

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Small-scale soil moisture conditions have a great impact on agriculture, ecology and hydrology. Data assimilation technique provides the best analysis estimators by merging the strengths of modelled state and satellite derived observations to achieve higher accuracy and continuous improvement in forecasts. In this study Kalman filtering data assimilation technique has been used to assimilate satellite observed soil moisture in the macroscale Variable Infiltration Capacity hydrological model at 25km grid size resolution for the Mahanadi Basin in India.

Primarily parameter sensitivity analysis is done for the meteorological forcing parameters considering four different scenarios. The deviation observed in runoff, evapotranspiration and discharge are +7.8%, +2.1% and +1.25% respectively with and without forcing wind speed. The fluxes obtained from VIC has been routed to simulate discharge for the time period of 1995-2010. IMD gridded daily rainfall, temperature, wind speed and cloud cover dataset at 0.25ox0.25o resolution has been used as meteorological forcings. NBSSLUP soil map and LULC map of ISRO-GBP LULC project for year 2005 were used for generating the soil and vegetation parameters respectively. Model calibration is done using observed discharge data at Tikarapara gauging station, validation of the calibrated model is done at Jhondra, Kantamal, Kotni and Rajim stations and the coefficient of determination, Nash-Sutcliffe model efficiency coefficient and relative error measured in the validation phase (1995-2010) are 0.95, 0.99 and 0.039 respectively.

Data Assimilation is done for August 2010 using observed AMSR-E soil moisture data. Updated soil moisture states are generated for 208 grids and assimilated soil moisture behaviour is compared to without assimilation case. Assimilated variable (soil moisture) is used to generate multilayer soil moisture regime. A data-set (maps) for different hydrological parameters has been developed on a daily basis which can be used as an important initialization variable for large-scale weather forecasts and climatic predictions in the basin.

Keywords: Data Assimilation, parameter sensitivity, Kalman Filter, VIC

Abstract Id: 494
A STUDY ON SATELLITE IMAGE APPLIED TO DISASTER PREVENTION MAP

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Taiwan is situated in Asia pacific region with risk for natural disaster especially the occurrence of the frequent typhoons in every year between July and October. People are under serious threat from different aspects of disasters such as flood, mudslide, devastated road and river floods due to the torrential rain. Integration of those disasters information becomes a critical issue in recently year.

With the advance of the modern spatial information technology, electronic map service is very mature, coupled with the popularity of mobile phones and personal computers. The masses can easily to share information on the internet.

The remotely sensed visible imagery has been used in various fields. The main characteristics of visible imagery are high spatial resolution, stable geometry, and rich information appropriate for human vision. It is also the most important reference for the disaster prevention and management applications.

In this study, we take advantage of web crawler technique to collect the data in the internet for the typhoon event happened on 2016 (including Meranti, Nepartak, Megi and Aere). Those structured data was scraped from the webpage and build an index in the database for search engine. On the other hand, orthorectification of FORMOSAT-2 and THEOS satellite image was published with WMTS TileServer to compare pre- and post-disaster conditions. That information is integrated in to a single geographic platform, using GOOGLE as system basemap to support disaster prevention.

Keywords: Formosat-2, Satellite Image, Map Tile

Abstract Id: 495
Extraction of 3D information from a stereo pair has its importance in many fields such as digital photogrammetry, computer vision, robotics, intelligent vehicle navigation, etc. Based on the legacy of the optical imaging, co-linearity condition is established between object and image space. It relates the image point in the image space, the optical centre common to both images and the object space and the object point in the object space. The relation developed is then used to convert the disparity in the position of the image feature on the ground in a stereo pair (conjugate points) to the 3D dimension of the object space using the parallax equation. The stereo matching process thus needs to establish the correspondence in the stereo pair. It is thus imperative that the accuracy and the quality of the 3D measurements depend on the density and accuracy of these conjugate points that result from the processes of stereo matching strategies used.

Due to the complexities in the definitions of the imaging geometry, the variability due to the radiometric and the spatial resolutions of the imaging sensors, a recent trend is to apply interest point operator on the images to identify key points to establish the geometric relationship of the image and the object space. However, one of the limitations here is the density of the interest points depend on the radiometric and textural properties of the input images. Another area of concern is the strategy used for matching of the interest points.

Present study is hence, aimed at improving the accuracy and the density of the conjugate points in a stereo pair thereby improving the accuracy and the quality of the 3D information and extending it to a tri-stereo imaging systems wherein occluded areas could be reduced by taking the advantage of

Keywords: Disparity Space Image, Tri-Stereo, Winner-Take-All, Watershed Transformation

Abstract Id: 496
WALKING ACCESSIBILITY TO URBAN FACILITIES IN THE BANGKOK METROPOLITAN REGION

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Walking is the most basic human physical activity. To create a walkable city, which helps promoting public health, it is necessary to have a good walking environment to encourage people to walk. In this case, we can divide environment into two issues: Are there attractions to push people to walk? Are walking spaces in good enough condition to support walking?

There is no study clarifying environmental issues of walking in the Bangkok Metropolitan Region. For the attraction issue, this study aimed to develop an "Index of Walking Accessibility" to urban facilities in the study area, in order to create indicators of a walkable neighborhood through quantitative analysis using spatial data contained in a Geographical Information System (GIS).

The results of this study can be divided into three parts. First, it has been defined that urban amenities accessed by foot should be divided into six categories, e.g., the workplace, educational institutions, commercial places, public service and financial institutions, recreational places and transit nodes.

Secondly, from generating a Walking Accessibility Map by category, it was found that the workplace is the widest city area that is walking accessible. After integration of categories, a GoodWalk Map was created, which shows the value of the Index of Walking Accessibility at arbitrary points. It was found that higher-scoring areas are only in the inner city, followed by suburban nodes, and also along the arterial roads and electric rail lines.

Lastly, higher-score areas cover only 2.5% of Bangkok Metropolitan Region, or 11% of the area of the Bangkok Metropolitan Administration. By contrast, they cover 60% of the inner-city area (17 districts).

The results of this study show areas of interest in order to improve the walking environment in the city and region. Therefore, higher-scoring areas should be focused on, and there should be further studies on physical infrastructure for walking.

Keywords: Walkable City, Walking Accessibility, GoodWalk

Abstract Id: 497
VALIDATION OF CHLOROPHYLL-A AND SEA SURFACE TEMPERATURE CONCENTRATION AND THEIR RELATIONSHIP WITH THE PARAMETERS-DIFFUSE ATTENUATION COEFFICIENT AND PHOTOSYNTHETIC ACTIVE RADIATION USING MODIS DATA: A CASE STUDY OF GUJARAT COASTAL REGION

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In situ data of chlorophyll-a concentrations (Chl-a) & sea surface temperature (SST) of the Gujarat region for the period, 2002-2009 were obtained from Indian National Centre for Ocean Information Services (INCOIS), Hyderabad. Out of nearly 100 sampling points, 22 & 67 points were qualified for the comparison with the satellite measurements of Chl-a and SST respectively. Chl-a concentrations were estimated from the MODIS satellite data (4 km resolution), with the existing global ocean color algorithms namely, OC2V4, OC4V4, and OC3M. SST was calculated with the help of bands 31 and 32 using MODIS-Aqua sensor long wave SST algorithm and ECMWF assimilation SST retrieval model (split window method). The satellite images were processed using global SeaWiFS Data Analysis System (SeaDAS) software v.10.2. Chl-a retrieved from OC3M algorithm had high coefficient of determination (R2=0.75) and less root mean square error (RMSE=1.24) as comparison to OC2V4 & OC4V4 (R2=0.541 & 0.542 and RMSE=0.94 & 1.83 respectively) with in situ data. The SST retrieved from MODIS - Aqua sensor long wave SST algorithm had a high coefficient of correlation as a comparison to ECMWF assimilation model (0.798 & 0.25 respectively) with in-situ data and RMSE were 0.84 and 3.25 respectively. SST and Chl-a showed an inverse correlation, with a coefficient of correlation (R) = 0.530. Daily retrieval of Chl-a & SST value had very high degree of correlation with remote sensed eight days composite & monthly composite value (0.958 & 0.876 respectively). Retrieval of the value of diffuse attenuation coefficient (Kd), photosynthetically active radiation (PAR) & vertical attenuation coefficient of PAR(Kd(PAR)) had been done and found that Kd & Kd(PAR) had very high degree of positive correlation (r=0.994). Also, it was found that PAR had a positive correlation with SST (R=0.512) and negative correlation with Chl-a (R=-0.445). The range of this parameter values supports the case-I water and fish assemblage area.

Keywords: MODIS, Chlorophyll-a, Sea surface temperature, validation, in-situ, algorithms

Abstract Id: 498
In Japan, many infrastructures were built in high economic growth period from 1950’s to 1970’s. Thus, in the current state, many infrastructures are required to be maintained. Actual maintenance works consist of a visual inspection, hammering test and paper based archiving. However, there are two technical issues. The first issue is that the maintenance works require high professional skills and costs for infrastructure evaluations. The second issue is a shortage of skilled engineers for infrastructure maintenance. Therefore, many engineers focus on photogrammetry, laser scanning, and, Geographical Information System (GIS) to improve the efficiency of infrastructure inspection and maintenance with a cloud data management approach. In this paper, we aimed to propose an inspection methodology for concrete structure maintenance with GIS. We also focused on a hammering test for flaking concrete detection for GIS attribute data acquisition and classification for infrastructure maintenance. The hammering inspection methodology can evaluate the state of concrete surface health with hammering sounds. The conventional approaches using a microphone require a professional knowledge to evaluate the health. Thus, the conventional approaches are not easy to be applied to infrastructure inspection for practical uses. In this research, we have developed a machine learning methodology with k-nearest neighbor (k-NN) algorithm for concrete hammering inspection works. Moreover, we evaluated our proposed methodology through our experiments using sounds hammering on flaking concrete surface.

Keywords: Infrastructure maintenance, concrete hammering inspection, flaking concrete, machine learning, k-nearest neighbor algorithm, GIS

Abstract Id: 499
Gangetic plains of north India have been afflicted with the problem of salinity since late nineteenth century. Incessant efforts have been made to estimate the area and reclaim these salt affected soils adopting latest methodologies in order to bring in more areas under crop production. Remote sensing data heralded the beginning of systematic and periodic surveys in estimating the spatial extent of barren sodic soils which helped to launch reclamation programs.

The farmers have made consistent efforts under various reclamation programs. The concentrated attempts for reclamation were initiated in 1992 through World Bank funded projects. In the present study, six sample areas covering barren sodic land, representing the alluvial plain from west to east in Uttar Pradesh, were selected to monitor the reduction in barren sodic area between 1986 and 2012/2013 using Landsat TM and IRS LISS-IV satellite data. The results revealed a reduction of sodic land by 62%, 68%, 73%, 88%, 88% and 92% in selected sample areas of Kannauj, Raebareli, Mainpuri, Sultanpur, Sant Ravidas Nagar and Pratapgarh respectively. Superimposition of village boundaries in GIS clearly indicate the reduction in sodic land in about 421 villages out of 451 partial or full villages covering six selected sample areas. Out of 15476.7 ha. barren sodic area in 1986, 12413.1 ha. has been converted into agricultural land in 2012/13 in the six sample areas. An average of 20% remaining barren sodic land was found spread over in 30 villages which did not show any remarkable changes. The remaining barren sodic areas are found in most cases, either with village community or with the forest department. Large scale reclamation of sodic soils where anoxic paddy is taken as the first crop, the methane (CH4) emission is creating a challenge to deal with.

Keywords: sodic soils, gangetic plains, reclamation, satellite data

Abstract Id: 500
PARALLEL IMPLEMENTATION FOR SURFACE EXTRACTION FROM HIGH RESOLUTION LIDAR SENSOR USING WEIGHT FUNCTION METHOD WITHIN VIRTUAL PROFILES

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With the advancement in high resolution LiDAR sensors, the ‘velocity’ and ‘volume’ of point cloud datasets also accelerated. For such a high ‘volume’ of point cloud datasets, most of the analysis/operations performed, are becoming a challenging task for commodity hardware. Increasing availability and competence of ‘processors’ based on multi-core architecture, can be exploited to speed up the computationally intensive tasks involved in point cloud processing.

The application of ‘how the earth surface is’ and ‘how it changes with time and space’ is growing day by day. Digital surface or DEM are directly or indirectly used in many kinds of scientific and engineering applications like hydrology, flood modeling, 3-D city modeling, designing structures, or even studying an archaeological site. In this work, ‘point cloud filtering for surface extraction’ is the considered use case for parallel implementation. A new ‘weight’ function is used in conjunction with the virtual profile approach. Multi-core implementation of the proposed algorithm was done and a convincing improvement was observed in terms of ‘computation time’ as compared to serial implementation. The usability of proposed algorithm was also expanded by adding customizable options for ‘filtering parameters’. Hence, for background and foreground surface extraction, it can process any dataset originated from any data source (Airborne LiDAR, Terrestrial LiDAR, or Structure from Motion).

Keywords: parallel processing, LIDAR, multi-core, DEM

Abstract Id: 501
EFFICIENCY IMPROVEMENT OF SFM USING IMAGE BLOCKS FOR INFRASTRUCTURE INSPECTION

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The Structure from Motion (SfM) is a methodology to reconstruct a scene and all camera poses simultaneously from all available relative motions through key point detection, feature matching, motion estimation, triangulation, and bundle adjustment. The SfM can be applied for various 3D modeling and mapping, such as an aerial drone survey, cultural heritage modeling, indoor mapping, and infrastructure modeling. Although the SfM is useful methodology, large-scale SfM typically requires a huge amount of computational time on pair-wise image matching and geometric verification to discover connected image components. Thus, many researchers have improved the efficiency of the SfM to deal with large image collections. The conventional researches are classified into three approaches. The first approach is a computational environment improvement, such as General-Purpose computing on Graphics Processing Units (GPGPU). The second approach is an image matching algorithm improvement based on feature descriptor, such as Speeded Up Robust Features (SURF) and Features from Accelerated Segment Test (FAST). The third approach is a camera network optimization, such as graph-based image matching using GNSS/IMU data. In this paper, we focused on the efficiency improvement of SfM for infrastructure inspection using close-range images and long-range images taken from various viewpoints. We also focused on the camera network optimization in a matching matrix using ordered image blocks. Our methodology consists of three steps. First, blocked images are prepared. The blocked images consist of a main block with long-range images and several sub blocks with close-range images. Second, feature point pairs between the main block and each sub block are extracted from key image pairs determined in a matching matrix using ordered image blocks. Finally, an outline and details of measured object and all camera poses are simultaneously reconstructed. We have confirmed that our proposed methodology can improve the efficiency of SfM through our experiments.

Keywords: Structure from Motion, Infrastructure inspection, Image matching, Multi-view stereo, Point cloud

Abstract Id: 502
APPLICATION OF GEO-INFORMATICS FOR ENVIRONMENTAL IMPACT ASSESSMENT (EIA) ON IRON-ORE MINES AREA, NOAMUNDI BLOCK, JHARKHAND, INDIA

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The impact of mining and mineral extraction activities is very significant on the surrounding land, air and water bodies in any operational area. Multispectral satellite data have demonstrated its ability to detect, monitoring of geo-environmental change based on remote sensing applications. The Noamundi iron-mine in the Paschim Singhbhum district of Jharkhand is one of the important mining areas since eighteenth century. The Principle iron-ore in this area is hematite. The use of Normalized Difference Vegetation Index (NDVI), measures the amount of greenery/vegetation in the area. At the present time, it has become obligatory to study and analyze the impacts of mining on its surrounding area with the use of remote sensing (RS) and geo-spatial information system (GIS) to generate maps for Environmental impact assessment (EIA) over the mining affected area. Therefore, it can be concluded that increase in mining activities is damaging the vegetation, land, and Environment. The present study can be useful to identify the degraded area due to mining activity and necessary environmental management plan (EMP) with their societal aspects can be taken up to mitigate the problem.

Keywords: Iron-Ore, NDVI, GIS, EIA, EMP.

Abstract Id: 507
The Philippines has embarked on an effort to develop a national rice mapping and monitoring system named the Philippine Rice Information System (PRISM). PRISM provides reliable, timely, detailed, location specific and sustainable rice-monitoring information for improving rice production in regions. PRISM uses data from high resolution multi-temporal Synthetic Aperture Radar (SAR) imagery and smartphone-based field data in generating planted rice area estimates, planting schedule, production and yield estimates, crop health and crop damage assessment.

Accessible seasonal forecasted information on area planted to rice and yield on a national scale is uncommon, untimely and sometimes incomplete. This delays the delivery of interventions from the national government’s decision-makers and planners.

PRISM utilizes the potentials of Information Technology (IT) infrastructure through the integration of smartphone applications, mapping software, RTK GNSS device, Unmanned Aerial Vehicle (AUV), Information System (IS), internet and cloud computing to deliver timely and accurate information on rice production situation in the Philippines.

The system uses these technology for field data collection and transmission to cloud-based services via the internet. Data control environment ensures accuracy and validity of ground information before processing. These generated outputs are then classified by a Sharing Policy to ensure that the system will only show information intended for the user.

To ensure the efficiency of the system infrastructure and security, modular implementation of web and database systems and services with multi-location redundancy will be implemented. To ensure the Information Systems availability at any given situation, a Risk Management Plan provide the management the information on how to efficiently manage and recover the system.

PRISM demonstrates the convergence of cutting-edge technologies to deliver actionable information on rice production at national and regional scale. This could help the national government make the necessary provision to address food security.

Keywords: Information System (IS), SAR, UAV, IT, RTK GNSS

Abstract Id: 509
MONITORING FOREST COVER IN GREAT HIMALAYAN NATIONAL PARK (GHNP) USING REMOTE SENSING AND GIS

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Forest cover and forest density change monitoring has become an effective tool in forest management and conservation. Present study deals with the analysis of spatial and temporal changes in forest density in Great Himalaya National Park (GHNP) in the Western part of the Himalayan Mountains in Kullu district. Great Himalayan National Park is UNESCO’s World Heritage Site and part of Himalaya biodiversity hotspot which includes twenty five forest types with rich faunal diversity. The major forest types in GHNP are Temperate broadleaf forest, Temperate conifer forest, Temperate Oak-conifer forest, Temperate Secondary scrub, Temperate grassy slopes, alpine scrub, alpine meadows etc.

In the present study, multi-temporal Landsat TM data covering GHNP from 1993 to 2017 was analyzed. The spectral plots of forest types were generated for forest type discrimination. The NDVI images of these multi-temporal Landsat TM data were generated and based on NDVI values, the forest cover was classified into dense, moderately dense and open forest. The changes in forest cover were monitored based on the NDVI differencing technique. The difference images (ΔNDVI) were then reclassified using the calculated threshold values. The result of this study on change in forest density during last 25 years (1993-2017) in different zones is as follows: In eco-development zone on the northern side of river at Bathad more changes have been taken place in terms of increase in area under plantation. Similarly in the south west of river area under plantation have increased. In northern part of eco-development zone north of Sainj river between Neuli and Shanshar the area under plantation have increased. In Sainj Wildlife Sanctuary in the northern part of Sainj river at Shagar and Shakti, forest density have decreased. The relative simplicity of NDVI differencing technique has demonstrated its utility in monitoring changes in forest cover in GHNP.

Keywords: Landsat TM, forest density, GHNP, NDVI differencing, change monitoring

Abstract Id: 511
Heavy industrialization and urbanization promote development of socio-economy but they unwittingly causes environmental problems when pollutants to enter soil, water and air yearly through various pathways. Land-use change always brings about the changes of other environmental parameters including water quality and richness of marine communities. Rapid alteration in coastal landscape, increasing density of residential area and intensive reclamation since early 2014 in Merambong coast area causes changes of water quality compared to 2009 where moderate coastal development. Aim of this study is to report and analyses water quality changes that cause intensive pollution and changes in water quality that lead to the gradual changes in seagrass biomass 5-year interval along the Straits of Johor. Water quality checker of Horiba U-50 model is used during field sampling to measure seven main water quality parameters. Using Landsat 8 OLI data, each water quality parameter is map and interpolation function using known point from collected water sampling in study area and assessed the accuracy. It is found that the increase of >30% in total dissolved sediment content, and turbidity level and dissolved oxygen is the most obvious changes in the reclamation area. The remaining parameters are stable and fluctuate with continuous daily variation. To conclude, water quality in Merambong area is reduced compared to 2009, mainly several critical parameters due to consecutive flow of pollutant as the consequence of coastal alteration for urbanization and industrial expansion. Heavy load of sediment in parallel with coastal development is the most potential threat to water quality maintenance.

Keywords: Merambong, water quality, interpolation, land-use, Landsat OLI

Abstract Id: 512
Malaysia has one of the richest biodiversity and extensive road networks throughout the country. One of the negative impacts emerges from this interaction, including wildlife-vehicle collisions (WVC), which may represent a significant source of non-natural mortality in several species. It is crucial to improve the safe co-existence between human needs and animal populations along the expressway. This study is to (a) evaluate the relative influence of land-cover patterns on the distribution of WVC, (b) assess whether WVCs are clustered forming hotspots of mortality along 70km of Senai-Desaru Expressway (SDE). Annual records of WVCs from 2009-2014 was collected, while Landsat images used to detect landuse changes. About 30 trapping camera were set-up at both sides of SDE to identify hotspots of mortality and record type of animal killed, landuse type, richness of wildlife species, sloppiness of terrain relief and logistic facilities which could stimulate the WVCs. Based on the result, a strong association between WVC probability and roadkill index for all focal species could explained the annual trend. Distance to riparian areas, tree cover, terrain ruggedness and poor unmaintained fencing system were important stimulator of WVCs. Twelve main hotspots of mortality was detected, yet with little spatial overlapping as only four road sections were classified as hotspot for more than one species. From 2009, the number of WVCs have decreased indicates the adaptability of wildlife to new invented habitats and effectiveness of mitigating action. Hotspots of mortality may provide important information to prioritize road sections for mitigation. The results support focusing on hotspots and habitat quality and landscape connectivity for a better assessment of road mortality. At local scale, a larger number of road passages with regular maintenance of exclusionary fencing with appropriate mesh size in riparian areas may provide safe crossings for many species and constitute a promising mitigation measure.

Keywords: remote sensing, wildlife-vehicle collisions, hotspots, road management, mitigation

Abstract Id: 514
DAMAGED EVALUATION OF TREES USING NEAR INFRARED AND THERMAL INFRARED

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In Japan, a large-scale afforestation policy was carried out for post-war reconstruction. After 70 years since then, trees have weakened, fallen accidents have occurred. Especially when the tree beside the road collapses it leads to a big accident. Tree doctors are currently conducting visual inspection and palpation of trees to investigate the state of trees. However, this method spends a lot of time and cost. Therefore, a simple and low cost tree evaluation method is required. In this research, we developed a method to evaluate the deterioration situation of trees using near infrared reflection and thermal infrared radiation that is highly effective in detecting stem cavities and corroded parts. As a research method, we shot trees about once a month using near-infrared cameras and thermography cameras. NDVI value change rate of leaves and stems calculated from photographed images. After that, we selected trees with a high risk of fallen trees. We found that NDVI value varies depending on the amount of solar radiation. Therefore, we developed a method to correct the NDVI value by the amount of solar radiation. The amount of solar radiation and NDVI value inversely correlated. Therefore, correction calculation was performed so that the NDVI value became constant. As results of the research, it was possible to correction of the NDVI value even when the sunlight incident amount is different. Image analysis enables the selection of highly dangerous trees and the detection of tree decay parts from pine trees. In the future, it is necessary to develop algorithms for correcting environmental noise of sunlight and outside temperature. In addition, it is necessary to increase the shooting frequency of trees and observe the seasonal change of trees.

Keywords: Image analysis, NDVI, near infrared, thermal infrared

Abstract Id: 515
DISCRIMINATION OF URBAN TARGETS USING SENTINEL-1 AND RADARSAT-2 C BAND DATA

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In the current study, an attempt has been made to identify and discriminate various urban features based on their backscatter values and scattering properties, using C band Sentinel-1 and Radarsat-2 SAR data. A part of the Vancouver city of Canada has been chosen as the study area, considering its dense urban structure, proximity to the coastal area and port activities, along with a lush green landscape. Some of the major urban features that were identified include high rise and low rise building clusters, roads and bridges based on difference in scattering behaviour, cultivated and non-cultivated agricultural land, forest areas on hilly terrain, ships, water body etc. Based on the difference in backscatter values (dB) and change in scattering behavior using Freeman Durden Decomposition and Volume Scattering Index, an attempt to generate a SAR polarimetric signature bank for urban features, using two time periods C-band SAR polarimetric data has been done.

Keywords: Urban Targets, SAR Polarimetry, Scattering behaviour, C-band SAR, Signature bank

Abstract Id: 516
MONITORING VERTICAL CLIFFS, EMBAYMENTS AND SHORE PLATFORM MORPHOLOGY IN PARTS OF NEIL ISLAND, SOUTH ANDAMAN USING SPATIAL INFORMATION TECHNOLOGY

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The southern shores of Neil Island are fringed with vertical cliffs, embayments and near horizontal platforms on the rocky coast of windward side dominated by limestones, calcareous siltstones and biocalcarenites. The uppermost shell limestones, massive limestones and coralline limestones (Neil formation) are unconformably lying over the calcareous siltstones and limestones with ash layers in this part of the sequence (Archipelago Group). Sequences of erosional landforms such as caves, notches, arches, stacks, geos, rockfalls and solution pits have been appeared to offer insight into the pattern of progressive change on the cliffed coastline of the island. The height of the cliffs ranges from 8 - 21 meters along the shoreline and they appear to represent successive stages of erosion that produced small embayments, bays and coves in between the resistant headlands. The wave attack on headlands, water layer weathering, successive wetting and drying and having presence with sufficient zones of weakness into the near vertical slopes of the cliff are the main causes for the gradual change in morphology. At the base of cliffs in entire parts of the island, near horizontal shore platforms are well developed within the intertidal zone ranging between 30 - 100 meters in width and extended seaward upto the margins of coral bank with descending slope. The rate of cliff retreat and its spatial diversity as well as the resultant shoreline types are estimated with the LANDSAT ETM+ images of 2005 and 2015 for the above study. However, the morphology of shore platforms and cliffs is studied with the delineation of features from satellite images and temporal field verifications over the period between 2014 and 2017. The study reveals the nature of shoreline morphodynamics of the cliffed.

Keywords: Vertical cliffs, Landsat, Spatial diversity, Shoreline morphodynamics and Limestones.

Abstract Id: 517
In this paper, we present a method which achieves accurate and robust co-registration of multi-temporal point cloud data in curved surface. One of the most popular methods for co-registration of multi-temporal point cloud data is Iterative Closest Point (ICP) algorithm. This method has both advantages and disadvantages in condition. We have proposed a method for Susaki and Deguchi (2016). Their method composes of two processing. In their first process, the walls are assumed to stand regularly that they have common and dominant normal, and they are robustly estimated in any condition. However, the method has a limitation that it is not applicable to the areas where planar surfaces are not available. Similarly, other existing researches using distributions of local surface’s normal are not robust against noise or data lacking. Therefore, in this research, we improved the Susaki and Deguchi’s method and aim to achieve robust co-registration.

The proposed method is divided into two processes. In the first process, we estimate the local and relatively global normals of point clouds. Then, by comparing the two histograms generated from two sets of point clouds, we estimate relative rotation angles even if occlusion is occurred. At this stage, a rough co-registration is completed by applying the relative rotation angle to the point cloud. In the latter process, we apply ICP method and the accurate co-registration is achieved. In the experiment, we used terrestrial light detection and ranging (LiDAR) and measured the point clouds with curved walls. The proposed method generated acceptable root mean square error (RMSE), and it was demonstrated that the proposed method is applicable to various types of urban areas. Consequently, it is concluded that the proposed method is capable of automatic and efficient for investigating road condition via co-registration of temporal point clouds.

Keywords: Point clouds, Co-registration, LiDAR, Curved surface

Abstract Id: 518
Unmanned Aerial Vehicle (UAV) Photogrammetry that provides meter to centimeter measurement accuracy can fill the gap between conventional airborne and very-high-resolution satellite imagery in mapping application. The availability of Digital Surface Model (DSM) and orthophoto at high spatial and temporal resolution and accuracy is important for all activities that require accurate topographic data sets. Accuracy assessment of DSM and orthophoto derived from UAV photogrammetry technique has been chosen as a main goal on this study. For this study, three data sets were carried out considering three flight altitudes (i.e., 200, 400 and 600 m). The UAV was a fixed-wing platform called eBee Plus SenseFly and the sensor was Sensor Optimized for Drone Application (S.O.D.A) camera by SenseFly company. Pix4Dmapper and Image Station Automatic Triangulation (ISAT) software were used to process aerial triangulation followed by DSM and orthophoto generation using 29 GCPs. Root mean square error (RMSE) analysis was used to assess the accuracy of the DSM and orthophoto. A conclusion will be conducted to explain the quality of DSM and orthophoto derived from UAV photogrammetry as a new technology in mapping application.

Keywords: UAV Photogrammetry, DSM, Orthophoto, RMSE

Abstract Id: 519
AN INTEGRATED RS&GIS BASED EVALUATION OF GROUND WATER QUALITY IN TELANGANA STATE, INDIA

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About 85% of drinking water needs in rural and 40% drinking water needs in urban areas are met from groundwater resources in Telangana state. There is a huge demand of ground water for different uses like agriculture, drinking and industrial purposes as the command area is very low in the state and it is evidenced by the fact that around 70% irrigation is dependent on ground water sources as compared to other surface sources like Tanks/Canals/Reservoirs etc. Climate change has affected the hydrological cycle with uncertain and increased variability in rainfall followed by with high rainfall in a short span of time resulting more surface runoff which ultimately decreases the recharge to groundwater. Decreased recharge to the groundwater and excess withdrawal of groundwater has accelerated the depletion of groundwater resources there by resulting in stress on groundwater regime in terms of quality as well as quantity. The groundwater quality evaluation of Telangana state is carried out by using legacy quality data (2012-14) collected from Rural Water Supply & Sanitation Department, Government of Telangana. Contamination spread of groundwater is one of the most important concerns that have received attention at regional, local and global levels because of their importance on public health and its further impact in ecosystems. The spatial distribution of chemical parameters like pH, Total Dissolved Solids (TDS), Total Hardness (TH), Total Alkalinity (TA), Fluoride (F), Chloride (Cl), Iron (Fe), Nitrate (NO3) and Sulfate (SO4) are examined with respect to its contamination level. The spatial distribution and concentration of chemical elements is carried out by using spatial interpolation technique namely Inverse Distance Weightage (IDW) method from the point source data. The distribution maps reveals important information to understand the hot spot areas of the groundwater systems and for identification of potential areas for providing safe drinking water supply.

Keywords: Chemical parameter, GIS, Ground Water, Irrigation, Legacy data, Quality, Rural, Source, Remote Sensing, Wells

Abstract Id: 522
Satellite technology is proving that the sky has no limits. Quick look of a Robotic Refueling mission. And robotic eyes into the sky leads up to the new start and for this concept of Robollite breaks the ground. Despite of all the success, satellite technology still facing some difficulties in space. Basket of Problems For the recent satellites such as Assisting, Repairing, Garbage reduction, Refueling and one orbit to other orbit satellite changing etc. To solve all troubles this new arrival will help us. The concept is a technology which can Assist other satellite, Repair them, reduce the garbage and the crux of the matter it will be useful to refueling the satellite to change one Planet's orbit to orbit of another planet. Moreover looking forward to the future there will be no need of human being at international space station to monitor satellite, adding in this a multi tasker Robollite can change the parts of satellite also. it will useful for mineral exploration too. To come out with robollite technology a powerful sensors and remote sensing technology can make path for human being. By the testing of various application of remote sensing robollite technology will not far from us. let's go extra mile.

Keywords: robollite, robotic refueling mission, satellite changing, mineral exploration, remote sensing sensors.

Abstract Id: 523
DEVELOPMENT OF LBS-BASED INDOOR AND OUTDOOR CAR PARKING GUIDING SYSTEM

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Location-Based Service (LBS) usually combines GNSS (Global Navigation Satellite systems), digital maps and mobile technologies so as to provide the spatial information of POIs (Point Of Interesting) such as restaurants, entertainment places, disaster locations, traffic conditions, and so on. The traditional way to visualize the spatial relationship between POIs and user’s locations is to overlap assorted related two-dimensional data layers. However, the 2D-based visualization is not intuitive for most users to understand and sometimes can be difficult to explain the scenarios of requirements. In many metropolitan areas car parking has become a frustrating task for most drivers as the number of cars increases much faster than available parking space. Combining the the wireless and related communication technology, this study develops a 3D LBS indoor and outdoor car parking guiding system. The developed system utilizes outdoor and indoor 3D building models and attributes in order to improve efficiency of parking space search. The example result demonstrates that the developed system integrated with the indoor building models and attributes can provide intuitive and realistic visualization for car parking assistance. It may be of interest for future research to apply the developed system and integrate with sensor networks in support of the car parking management.

Keywords: Location-based Service, Digital Map, Indoor/Outdoor Navigation

Abstract Id: 524
DETECTION AND ANALYSIS OF CEILOMETER FOG/LOW CLOUD BASE HEIGHT AND INSAT-3D FOG PRODUCT OVER DELHI EARTH STATION, NEW DELHI

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Fog/low cloud base height has been continuously monitored using ground based Ceilometer during the fog season of 2016-17 over Delhi Earth Station, New Delhi. The results have been validated with the INSAT-3D fog product. Fog/low cloud has been successfully detected by both Ceilometer and INSAT-3D during the existence of single layer cloud in most of the cases. However, fog/low cloud detection using INSAT-3D observed to be a difficult task in the presence of multi-layer clouds whereas both single and multi-layer clouds have been well captured by Ceilometer. Since fog is a near surface phenomena, ground based observation like Ceilometer could be the most effective approach for the detection of fog and on the other hand, to get information about the complete spatial coverage of fog, remote sensing technology provides better opportunity. Satellite remote sensing is an important tool in the detection and now casting of fog events. Therefore, an altogether approach which incorporate both ground based Ceilometer and space based INSAT-3D observations can provide better detection and monitoring of fog

Keywords: Fog, Ceilometer, Cloud base height, INSAT-3D, Visibility.

Abstract Id: 525
Soil moisture deficit (or SMD) is very important variable for many applications like flood and drought, which is now possible to estimate using the remote sensing data. This study is an attempt to evaluate the long term climate change initiative (CCI) soil moisture data for SMD estimation at a catchment scale. The SMD (Soil Moisture Deficit) estimated from the Probability Distribution Model by using the in situ station data is used as benchmark for all comparisons. Approaches based on generalized linear model, relevance vector machine and season based algorithms particularly for Kharif, Rabi and Summer seasons are provided for the estimation of SMD. The Kharif cropping season starts from July-October during the south-west monsoon and the Rabi cropping season is mainly from October-March. The crops grown between March and June are considered as Summer crops. The overall analysis reveals that CCI soil moisture is of reasonable quality in estimating the soil moisture deficit at a catchment level.

This study provides first time comprehensive evaluation of CCI soil moisture in Indian condition and the result provides supportive evidence of the potential value of this product for meso-scale studies and hydrological applications.

#Note: The Soil Moisture CCI project is part of the ESA Programme on Global Monitoring of Essential Climate Variables (ECV), better known as the Climate Change Initiative (CCI), initiated in 2010 for a period of 6 years. It is started to create a long-term consistent soil moisture time series, based on active and passive satellite data.

Keywords: Soil moisture deficit, Climate Change Initiative soil moisture, Linear and non-linear Modelling, Seasonal algorithms, Catchment

Abstract Id: 526
THE APPLICATION OF CHLOROPHYLL FLUORESCENCE IN PRECISION AGRICULTURE: POTENTIALS AND LIMITATIONS

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Solar-induced chlorophyll fluorescence (SIF) is emitted from the vegetation photosynthetic apparatus and has become established as an ideal probe for monitoring vegetation actual photosynthesis since its direct link with photosynthetic activity. Compared to traditional vegetation indices such as the well-known normalized difference vegetation index (NDVI), mainly measuring vegetation greenness and its potential photosynthetic capability, the SIF has been recently reported as a completely new solution to monitor vegetation vitality, which is often affected by various stresses such as disease, drought and nutrient deficiency. Therefore, the SIF maybe superior to the traditional vegetation indices in non-destructive early and accurate diagnosing of crop stresses by tracking crop actual photosynthesis that is highly demand for precision agriculture to assure crop quality and avoid a production loss. This study aims to investigate the SIF feasibility to measure the temporal and spatial variations of crop photosynthetic vitality through designing two novel field experiments using the automated SIF field measurement system and unmanned aerial vehicle (UAV) hyperspectral system separately. The crop SIFs were retrieved at O2-A band (760 nm) by the established Fraunhofer line discrimination methods. In order to provide a better understanding of SIF implications for crop actual photosynthesis, the widely used NDVI was also calculated. The SIF’s potentials and limitations for tracking crop photosynthesis were discussed with varied solar irradiances, different phenological periods and crop types. Results demonstrate that the SIF may capture both the temporal and spatial changes of crop actual photosynthesis. However, transitions of SIF to crop photosynthesis are not as straightforward as the mechanism, which may be affected by numerous factors including the SIF retrieval method, crop types, phenological period, canopy structure, sun-crop-sensor geometry and so on. This study may strengthen the understanding of crop SIF and photosynthesis, and thereby advance its applications in monitoring crop for precision agriculture.

Keywords: Hyperspectral remote sensing, Solar-induced chlorophyll fluorescence, Crop actual photosynthesis, Precision agriculture

Abstract Id: 528
TITLE: APPLICATION OF PHOTO-REALISTIC 3D MODEL IN WEB-BASED OPEN SOURCE GIS PLATFORM | TOPIC: OPEN SOURCE ON GEOSPATIAL TECHNOLOGY

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The advancement of web technology has caused a paradigm shift in the use of the website, especially for 3D contents. Web browsers have become an effective computation platform, as they are able to execute HTML5, JavaScript, WebGL, also OpenGL 3D graphics library that runs directly inside the browsers. With those elements, it allows the user to access in multi-platform such as mobile phone, notebook and PC. 3D Web GIS can give the user 3D visualization through internet. From this feature, it would be very useful if it combined with Photo-realistic 3D model. It can give information about the condition of some areas, buildings, even historical objects. For 3D reconstruction, acquisition of all 2D images in every part of the object are conducted, including UAV images or terrestrial images. Put all the acquired images together and perform structure from-motion by Bentley ContextCapture. After that, all the images interior and exterior orientation parameter will be obtained. Set the map projection output into WGS84. Then, dense point cloud, 3D Mesh, Texture model are created. In this research, CesiumJS will be used as a platform to build 3D Web GIS. It is an open-source JavaScript library for world-class 3D globes and maps. It can create 3D globe and map for static and time-dynamic content, with the best possible performance, precision, visual quality, platform support, and ease of use. It provides Hierarchical Level of Detail (HLOD) to adaptively load and refine 3D models. It allows the engine to render low resolution 3D model when they are far from screen and high resolution 3D model when they are near. CesiumJS also can load GIS data such as building information, road line, area segmentation and many others. Thus, it is useful for many 3D GIS applications, such as disaster modelling, heritage object, 3D city modelling.

Keywords: 3D Web GIS, JavaScript, Photo-realistic 3D

Abstract Id: 529
Forest fire often occurs in mountainous and agricultural areas as a result of a complex processes involving several factors in a particular location. Landscape, local weather and human interventions are the most important factors which influence the occurrence of forest fire. Ten Provinces in the upper north region of Thailand are identified as highly susceptible areas to reoccurring hotspots and smoke plumes during January to May. Identification of hotspots will significantly aid in forecasting forest fire in these areas. Using this, forest fire risk assessment may then be undertaken which can be utilize to evaluate its impacts on the society and economy.

This research focused on enhancing the application of basic concepts of forest fire risk assessment. A case study was undertaken which entailed forecasting the risk areas of forest fire in 2015 as compared to other years. Two main methodological approaches were applied, spatial modelling for susceptibility assessment and forest fire impact determination. The research generated a risk forecasting model based on major physical-spatial factors in GIS environment. Analysis Hierarchy Process (AHP) was used to define ranges of risk conditions for 7 day forecast. The risk mapping in 2015 was validated by accumulated hotspots in the same year wherein 74 % of hotspots were located in high risk zones for forest fire. Moreover, the forest fire risk forecasting was deployed by local agencies for preparedness and prevention of wildfire incidents in 2016 and 2017. Result shows that burnt areas classified from LANDSAT-8 decreased from 28,803 km² in 2015 to 16,588 and 13,658 km² in 2016 and 2017, respectively. The cross matching results between risk maps and burnt areas show better correlation percentage at 52 % in 2016 and 60 % in 2017. Thus, forest fire risk forecasting can efficiently support forest fire management implemented by government agencies and local communities.

Keywords: Forest fire, AHP, Risk maps

Abstract Id: 530
GROUNDWATER DRAFT ESTIMATION AND SUSTAINABLE SCENARIO DEVELOPMENT FOR GROUNDWATER MANAGEMENT IN JEDCHERLA WATERSHED, MAHBUBNAGAR DISTRICT DISTRICT, TELANGANA STATE

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In hard rock granitic terrains groundwater availability has become a major geo-environmental & socio-economic issue. In future it may result in further depletion & deterioration of available groundwater resources due to ever increasing dependence on groundwater with indiscriminate extraction in various parts of the country without due regard to the recharging capacities of aquifers. Groundwater recharge is key factor in water balancing study, especially in semi arid, granitic terrains of South India. Considering these issues and ever changing dynamics of groundwater resources, a micro level watershed wise Mapping, groundwater draft, recharge estimation & groundwater management studies has been taken by integrating both Geohydrological, surface and sub-surface components as input variables thus creating knowledge guided geo-mathematical model. The outputs obtained from the knowledge guided geo-mathematical model are used and validated with field conditions. It was observed that the estimated groundwater draft, recharge falls within the acceptable range. The results of the present study can serve as guidelines for planning future studies in similar geological provinces order to ensure dependable water supply and sustainable groundwater utilization on a long-term basis for sustainable scenario development

**Keywords:** Water balance, Recharge, Semi-arid environment, guided geo-mathematical model, Groundwater draft

Abstract Id: 531
ANALYZING THE EFFECTS OF LAND USE CHANGES FOR LANDSLIDE SUSCEPTIBILITY ASSESSMENT: A CASE STUDY OF LABLAE DISTRICT, UTTRADIT PROVINCE, THAILAND

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Landslide problem involves several factors, The significant ones include rainfall, slope, and land use. A plan to reduce landslide problem requires studying of landslide inventory on relevant types of land use in Laplae district, Uttaradit province from the past to the present. Such plan can also be applied for land use managing in steep areas and land administration that match conditions of the areas. This area was selected as the case study because it is a highly steep area and encountered two obvious landslides in 2006 and 2011 in nearly the same spot. Remote sensing technology can support this planning with wide-scale spatial data, and it can be used for monitoring land use change after a landslide. This study used multi-temporal satellite images to analyze land use change in a landslide area. The main objective aims to interpret land use from satellite images and examine land use changes induce in recurrence of the landslides that implemented image classification and GIS based analysis techniques. The results of analysis reveal that the 2006 and 2011 landslides occurred mostly in forest area, which accounted for 176 acre and 16 acre. Regarding the result of land use change occurred during 2006-2011 found that the forest area was changed mostly into fruit orchards about 53 acre, followed by fruit orchard area was changed into forest area about 9 acre. When the landslide inventories cross with the land use change data, it was found that the fruit orchard areas had the greatest rate of landslide recurrence, which accounted for 22.90% of landslide areas. The final analysis result classified fruit orchard as high susceptibility zone for landslide, so it should be considered other parameters such as slope and aspect for the further analysis.

Keywords: Land use change, Landslide, Susceptibility

Abstract Id: 533
FLOOD PRONE AREA IDENTIFICATION USING TOPOGRAPHIC INDICES IN PARTS OF HIMALAYA

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Topographic vulnerability to flood for an area goes beyond proximity from flood causing stream. Without going into the complexity of Hydrological and Hydrodynamic modelling flood prone area were identified in Beas River basin India by Topographic indices. The basic idea is to identify sudden morphological break using Remote Sensing and GIS in terrain surface differentiating floodplain from upland. Highly rugged terrain of Himalaya makes this task very challenging. Three topographic indices namely Topographic wetness index (TWI), Slope Position (SP) and Height above Nearest Drainage (HAND) were identified and worked out for floodplain delineation. All of these indices were derived from Digital Elevation Model (DEM). TWI considers draining area into a DEM cell, SP combines relative elevation in a neighborhood with local slope, and HAND accounts vertical drop for each cell from its draining cell to quantify flood vulnerability. All indices presents contrasting differentiation between floodplain and upland. The borderline to separate floodplain and upland was determined by conducting field surveys. Points collected by blending DGPS and Total Station surveys at multiple river cross sections were utilized to extract average values of topographic indices in genuine floodplain during field survey. DEM Data used was ALOS PALSAR with resolution of 12.5 m from Alaska Satellite facility. Results show TWI and HAND depicting floodplain effectively and SP performed relatively deficient for floodplain delineation in flat terrain. The presented methods can be incorporated for flood prone area identification in basins for which availability of hydro-meteorological data is still a long shot.

Keywords: DEM, TWI, SP, HAND, Floodplain

Abstract Id: 535
AN INTRODUCTION OF THE HYPERSPECTRAL NANO SATELLITE SPARK AND DATA FUSION

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On December 22, 2016, 3:22 am, the first commercial hyperspectral nano satellite (SPARK-01, SPARK-02) was launched at the Jiuquan Satellite Launch Center. Figure 1 shows the first scene of hyperspectral image product at level L1A acquired by SPARK-02 over the area near Zigetangcuo, Tibet. The hyperspectral team at the Institute of Remote Sensing and Digital Earth (RADI), Chinese Academy of Sciences (CAS), is responsible for data production system development corresponding to this hyperspectral satellite. Currently, the team has been qualified in automatic data production from level 0 to level 2 (systematically geometric calibration). On December 22, 2016, 3:22 am, the first commercial hyperspectral nano satellite (SPARK-01, SPARK-02) was launched at the Jiuquan Satellite Launch Center. Figure 1 shows the first scene of hyperspectral image product at level L1A acquired by SPARK-02 over the area near Zigetangcuo, Tibet. The hyperspectral team at the Institute of Remote Sensing and Digital Earth (RADI), Chinese Academy of Sciences (CAS), is responsible for data production system development corresponding to this hyperspectral satellite. Currently, the team has been qualified in automatic data production from level 0 to level 2 (systematically geometric calibration). In this paper, a spectral resolution enhancement method named SREM was used to fuse the SPARK hyperspectral image and GF-1 multispectral image, with the aim of generating hyperspectral image with higher spatial resolution. The results showed that SREM could enhance the spatial resolution of SPARK image by fusing with other high spatial resolution images, which is very useful for the data application of SPARK satellites.

Keywords: Nano satellite; SPARK; Data fusion

Abstract Id: 540
EVALUATION OF SCATTEROMETER DERIVED WINDS WITH ALTIMETER DERIVED WINDS IN INDIAN OCEAN

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Indian Ocean surface wind speeds from Oceansat-2 Scatterometer (OSCAT) for 8 months (Apr,2013-Dec,2013) and SCATSAT for 8 months (Oct,2016-May,2017) were compared with wind speeds estimated from SARAL-AltiKa and JASON altimeters for representative months to investigate the consistency in wind speeds between these sensors. The spatial window used for comparison with SARAL-AltiKa and JASON altimeters was 25 km for OSCAT and SCATSAT. The comparison was carried out through statistical analyses for low (0-5 m s⁻¹), medium (5-15 m s⁻¹), high (15-25 m s⁻¹), as well as for the total wind speed range (0-25 m s⁻¹). The results of the inter-comparison indicate that SCATSAT wind speeds are almost as consistent with SARAL-AltiKa and JASON as OSCAT wind speeds in almost all the ranges.

Keywords: SCATSAT, OSCAT, JASON, SARAL

Abstract Id: 541
MULTI-ANGULAR VEGETATION INDICES USING MISR DATA FOR WINTER CROP SEPARABILITY

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Multi-angle Imaging Spectro-Radiometer (MISR) bidirectional reflectance factor (BRF) data in the four spectral bands were used to study the angular anisotropy of four vegetation classes, in Punjab state. The NDVI of the nine-angle BRF data at nadir of selected vegetation classes was plotted to identify various dates where wheat is non-separable from other winter crops. Crop separability at nadir was found to be high from first week of February onwards, when the wheat was at ear-head emergence to flowering stage and potato was at maturity stage. However, wheat was not separable from potato and other winter crops during December and January, when wheat was at the early vegetative stage and potato was at the peak vegetative stage.

The results indicate that the NDVI variation with view angles is different for wheat and potato with larger variations in the back-scattering directions (-45.6° to -70.5°) as compared to forward scattering directions (45.6° to 70.5°). To quantify the separability of wheat from potato during early growth stages of wheat, an index, Relative Distance (RD) in NDVI was computed as (RD) = \[\frac{\text{NDVI (wheat)} - \text{NDVI (potato)}}{\text{NDVI (wheat)}}\] for nine angle BRF data acquired on 16-December and 07-January. It was observed that the Relative Distance (RD) increases from 11 to 55 per cent for the backward viewing directions (Af, Bf, Cf and Df) and reaching maximum (55 per cent) at backward 70.5° angle (Df camera). However, for the aft looking cameras the RD is comparatively small with a maximum reaching to 15 per cent at 70.50 angle camera (Da). These results imply that multi-angular data, especially in the back scattering directions (- 40° to -60°) can play an important role in discrimination of wheat from potato at the early growth stages.

Keywords: Multi-angle Imaging Spectro-Radiometer (MISR), Bidirectional Reflectance Factor (BRF), Vegetation indices

Abstract Id: 542
Dumping of municipal waste at landfill sites, in vicinity of urban centers, has become a common practice nowadays. Microclimate created in surrounding areas of the landfill site may have negative impact on Land Use Land Cover (LULC). In the present study, bio-thermal effect of landfill site on LULC has been investigated using Sentinel-2 and Landsat 8 OLI data. Higher resolution Sentinel-2 data (10 m) has been used for mapping of LULC. The variation of LULC may be represented by different vegetation indices, such as NDVI, SAVI, and MSARVI. Thermal band of Landsat 8 OLI data (30 m) has been used for estimation of Land Surface Temperature (LST), which represents microclimate of landfill site. For estimation of LST Mono-Window Algorithm using hydro-meteorological parameter has been applied. Spatio-temporal behavior of the vegetation indices and LST has been used to study the negative impacts of microclimate created near landfill site.

Keywords: Landfill, NDVI, SAVI, MSARVI, LST

Abstract Id: 543
ANTARCTICA is a store house to world's 90% of ice. The Antarctic ice sheet covers an area of 14 million sq, km of which about 10% consists of floating ice shelves. The study of iceberg calving is a major process in determining the ice mass loss from Antarctica which contributes to sea level change. Satellite sensors provide images of various major and minor iceberg calving events taking place along the coast of Antarctica. In this study, three Antarctic calving events are discussed. Two events have already occurred in past and one event will occur any time from now. These calving vents are studied using Landsat series of satellite data. The first event is reported in the Princess Ragnhild Coast and cumulatively these events calved ice mass of a total area of 105.46 km2. The second event took place along the Budd Coast and calving took place in year 2016, resulting into loss of area of 6.04 km2. The third event is a potential calving event that will take place in future along Princess Astrid coast. Various crevasses and rifts are observed on Landsat imageries which can be the first sign of a calving process. This study highlights on the exploitation of optical satellite data for studying calving events in Antarctica.

Keywords: Antarctica, calving, optical images

Abstract Id: 544
FOREST FIRE RISK ZONE MAPPING USING LANDSAT 8 DATA

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Forest fire has been regarded as one of the major reasons for the loss of biodiversity and degradation of environment. Global warming is increasing its intensity at an alarming rate. Thus one needs to understand the complex biophysical parameters, which are responsible for this disaster. As it is difficult to predict forest fire, fire risk zone map can be useful for combating the forest fire. Thus the main aim of this study is to generate a Fire risk zone map using Remote Sensing & GIS technique. Pauri Garhwal District, located in Uttarakhand, India, was selected for this study because it continually faces a forest fire problem. A multispectral image from the Landsat-8 was used for vegetation mapping. Slope and other coverage’s (roads and settlements) were derived from topographic maps and field information. For thematic and topographic information analysis ArcGIS and ERDAS Imagine software was used. Forest fire risk zones were delineated by assigning weights to the classes of all the layers according to their sensitivity to fire. Four categories of forest fire risk ranging from very high to low were derived. The evolved GIS-based forest fire risk model of the study area was found to be in strong agreement with actual fire-affected sites.

Keywords: Forest Fire, Risk Zonation, Remote sensing, Landsat 8,

Abstract Id: 545
GEO-STATISTICAL MODELLING AND ASSESSMENT OF SOIL FERTILITY STATUS OF RUBBER PLANTATIONS IN A TROPICAL REGION OF KERALA

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Geo-statistical modelling of rubber growing soils of Kottayam district in Kerala was carried out to assess soil fertility status of rubber plantations in order to develop a WebGIS enabled platform for soil fertility recommendation to rubber farmers. About two thousand and eighty two soil samples were collected from rubber growing areas of the district on a fifty hectare grid basis using satellite-derived rubber distribution maps. Soil samples were analysed for soil pH, organic carbon, primary, secondary and micronutrients following standard procedures. Geo-statistical modelling was performed to interpolate soil fertility parameters using ordinary kriging algorithm in GIS platform to generate soil fertility maps. Best fit semi-variogram models were used to interpolate soil fertility parameters and cross-validated with standard prediction error parameters. Nugget-to-sill ratios of the semi-variogram model revealed that degree of spatial autocorrelation of most of the soil fertility parameters were moderate in the study area. Spatial variability of soil fertility parameters indicated that major portion of NR growing soils in the study area exhibited acidic status of soil pH. Available organic carbon status was high to very high whereas status of available phosphorus and potassium were low. Secondary nutrients such as available calcium, magnesium and sulphur were also exhibited low status. Micronutrients status was sufficient but available boron and zinc showed deficient in some places of the district. A WebGIS enabled application called Rubber Soil Information System (RubSIS) was developed using the soil fertility variability maps and soil depth data of the study area. It gives location-specific and need-based recommendation for use of chemical fertilizers in one holding according to the age and the extent of the rubber plantation. Results of geo-statistical modelling of soil fertility parameters used to develop RubSIS are briefly discussed in the paper.

Keywords: Geo-statistical modelling, GIS, kriging, natural rubber, RubSIS, soil fertility, spatial variability

Abstract Id: 547
ESTIMATING GLOBAL CROP WATER REQUIREMENT TO IDENTIFY POTENTIAL AREAS FOR IRRIGATION DEVELOPMENT BY INTEGRATING REMOTE SENSING DATASETS

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Data from United Nation Environment Program (UNEP) shows that only 40% of global crop area is under irrigation system. In order to achieve high demand of food in the future, expanding irrigation area is needed to increase crop production. In this study, we generated index of potential irrigation development by combining four factors; crop water requirement (CWR) for non-irrigated area, global river network, global elevation data and annual precipitation model. We calculated CWR by combining crop coefficient product, crop specific evapotranspiration, and effective rainfall. Crop coefficient was developed by combining FAO-CROPWAT model with global crop sowing schedule and global crop intensity product. Two types of precipitation data were used in this study, that are WorldClim v.1 and GSMaP products. To observe the accuracy of CWR product, we compared CWR product in specific irrigated area with consumptive irrigation water use in 29 countries from FAO statistic data. The regression value for large irrigated area countries are 0.97 and 0.98, whereas for medium irrigated area countries, the regression values are 0.37 and 0.47 compared to WorldClim and GSMaP respectively. This potential irrigation development product can help global scale decision maker to create better planning of agriculture infrastructure development.

Keywords: Potential irrigation development area, crop water requirement, Remote sensing product integration, FAO-CROPWAT model

Abstract Id: 548
A QUANTITATIVE MODEL OF SOIL MOISTURE AND INSTANTANEOUS VARIATION OF LAND SURFACE TEMPERATURE AND APPLICATION ON DOWNSCALING SOIL MOISTURE FROM PASSIVE MICROWAVE DATA

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Surface soil moisture is a key variable in many hydrological, climatological and ecological processes. Different types of remote sensing systems are currently used to infer soil moisture at different spatial and temporal scales, each with its specific characteristics and limitations. Using AMSR-E soil moisture, MODIS land surface temperature (Ts) and vegetation index product, the authors discuss the relationship between the variation rate of land surface temperature and surface soil moisture. Selecting the plains region of central United States as the study area, the authors propose the distribution triangle of the variation rate of land surface temperature and soil moisture, which is learned from the Ts-NDVI feature space theory. The range of soil moisture narrows as the instantaneous variation rate of land surface temperature increases and the soil moisture value drops. In this paper, Temperature Variation and Vegetation Index (TVVI), a new index containing the information of temperature variation and vegetation, is introduced. The authors prove that TVVI and soil moisture show a steady relationship of exponential function; and build a quantitative model of soil moisture(SM) and instantaneous surface temperature variation(VTs). The authors later achieve downscaling of AMSR-E soil moisture data, through the above stated functional relationships and high-resolution MODIS data. Comparison of such against measured data on ground surface indicates that this method of downscaling is of high precision. Meanwhile, the authors propose the model of overlaying the same-day land surface temperature data across multiple calendar years, mitigating the drop in modeling precision caused by data deficiency.

Keywords: passive microwave; soil moisture; land surface temperature; power exponent function; downscaling

Abstract Id: 553
A GEOSPATIAL WEB RANKING ALGORITHM FOR GEOWEB RESOURCE DISCOVERY

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With the advance of World-Wide Web (WWW) technology, the volume of public-available geospatial resources on the web is rapidly increasing. The collection of geospatial resources was defined as the geospatial web (i.e., GeoWeb). With the growing number of GeoWeb resources, individuals face difficulties in searching for resources of their interest. Currently, users are finding geospatial data via data portals and spatial data infrastructures (SDIs). However, previous studies have identified that these solutions cannot provide complete set of GeoWeb resources to users. To solve this problem, a GeoWeb search engine that can index all the GeoWeb resources is necessary. In a previous study, we have proposed the GeoWeb Crawler to discover several kinds of GeoWeb resources. However, for users to find their target resources, the GeoWeb search engine requires a ranking mechanism that can rank the candidate resources based on users’ need. Hence, this research focuses on the ranking mechanism of a geospatial search engine.

To be specific, we propose two main modules, i.e., Analyzer and Ranker. An Analyzer extracts information from geospatial resources as ranking factors for the Ranker. We categorize the ranking factors into three categories, (1) attributes, (2) quality of service and (3) importance. The attributes are mainly for selecting resources according to users’ needs. The quality of service represents different performances of services, such as availability, response speed, correctness, etc. Furthermore, we evaluate the importance of geospatial resources according to the link structure of the web, which is the same idea as Google’s PageRank. Finally, the Ranker aggregates these ranking factors to estimate an overall ranking of resources, which consequently allows users to find their target data efficiently.

Keywords: GeoWeb, Search engine, Ranking algorithm

Abstract Id: 554
SOLAR PANELS DETECTION AND CLASSIFICATION USING FORMOSAT-2 IMAGES

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Due to the abrupt climate change in recent years, governments of all nations have finally realized that reducing fossil fuels and developing renewable energies are imperative. However, by year of 2014, Taiwan’s renewable energy accounts for only 5.1% of total electricity generation and therefore the government of Taiwan is anticipating the renewable energy generation ratio could be up to 20% by the year of 2025. Solar energy is one of the commonly used renewable energies these days, and the installations of solar panels on the farm land is also growing rapidly in central and southern Taiwan thanks to the promotion of the government, who encourages and funded people with severe land subsidence areas or polluted farms to plant solar panels instead of crops. Nevertheless, means of controlling and obtaining information of solar panels, such as surveys and utility filings, are limited in detailed spatial development and availability. In this research, we try to use support vector machine (SVM) to classified solar panels apart from farm lands, roads and other buildings, using Formosat-2 images which contains 2 meters of spatial resolutions. It may then be possible to use the detected solar panels in order to estimate power capacity, energy production and also, illegal installation. The aim of work is to test the possibilities and accurateness of detecting and classified solar panels in Formosat-2 satellite images using SVM approach. The results show it is possible to detect solar panels on the farm using SVM and yet, there is more improvement to it with further development.

Keywords: Formosat-2, Solar panels, Support Vector Machine, Classification

Abstract Id: 555
CANOPY HEIGHT ESTIMATION USING SATELLITE LASER ALTIMETRY IN TROPICAL FORESTS OF THE EASTERN GHATS, INDIA

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Forest height data are useful to monitor local, regional and global carbon cycle. Spaceborne light detection and ranging (LiDAR) has the capability to measure the vertical forest profile. The estimation of canopy heights from LiDAR waveforms is not straightforward, especially over a sloping terrain where vegetation and ground found at comparable heights. In this study, canopy height models were established for the forests of Eastern Ghats, India. Canopy height models are developed for two different slope ranges i.e., <10° and >10°, using Geoscience Laser Altimeter System (GLAS) waveform extent and terrain index, derived from ASTER digital elevation, to counter the effect of topographic relief effects in canopy height estimates over steep terrain. Tree heights collected by ground based surveys agrees well with modelled tree heights, with a coefficient of determination (R2) value of 0.70 and root mean square error (RMSE) of 4.3 m for <10° slope model; and R2 value of 0.72 and RMSE of 2.8 m for >10° slope. Tree height was calculated for six different forest types in the Eastern Ghats region using the model; and compared with canopy height calculated using two direct methods. The model developed for this study provided better result than the direct methods when accounted in terms of possible over and under estimation of tree canopy heights. This study shows the effectiveness of the model for canopy height estimation especially over steep slopes, accounting to pulse broadening effect as well.

Keywords: waveform extent; terrain index; pulse-broadening effect; canopy height model; spaceborne LiDAR

Abstract Id: 556
For the sustainable river sand mining practices, there is a requirement to ascertain the optimum mining sites, appropriate quantities that can be mined out and justified time periods for permitting extraction, so as to allow for the natural replenishment of sand. This study helps in utilizing the platform of remote sensing and GIS towards mining of river sand in a sustainable way. ISRO's Cartosat-1 satellite imagery stereo pairs of dates ranging over a decade are used here to study the successive changes in longitudinal- and cross-sectional profiles over a part of Luni River in western Rajasthan. The present study explores the possibilities of using satellite-based stereo imagery derived products like Digital Elevation Model (DEM), streams, contours and slopes for analyses related to river sand deposits. Attempt is made to identify the aggradation and deposition zones due to elevation changes across the seasons. The study may be carried further to help generate acceptable working plans towards sustainable river sand mining.

Keywords: River sand mining, Cartosat-1, DEM, GIS

Abstract Id: 550
Automatic image matching has been an essential task in the field of digital photogrammetry. Photogrammetric triangulation needs control points and tie points in the overlapped images to construct connections among images. Usually, we choose corners or some specific marks on images as tiepoints. On the other hand, SIFT (Scale Invariant feature transform) is known for image matching in computer vision, which extracts feature points in each image, and matches these images together according to their unique descriptors. This study decompose SIFT algorithm, in which contains octaves and levels, representing different spatial scales and image resolutions, to figure out the relationship hidden behind the algorithm. We first start from large scale images, step by step to match small scale ones, comparing accurate matches of different scale combinations to analyze the differences and accuracy. However, there could be some error matching, so we use RANSAC (Random Sample Consensus) to remove outliers for higher accuracy and precision. By affine transformation and solving relative orientations of each image pair, we can get the residuals of images that go through several different levels of image matching. This study is trying to analyze how different scales and image resolution affect image matching results.

Keywords: Image Matching, SIFT, Image Resolution

Abstract Id: 558
Planning for natural resources management (NRM) demands an integrated approach, considering numerous thematic inputs to be relatively studied in a GIS environment. In India, with a decentralized governance setup, the task of developmental planning in the rural areas is entitled to Panchayati Raj Institutions (PRIs) as per the 73rd Constitutional Amendment Act. In order to assist PRIs in making informed decisions with scientific justifications, a geospatial enabling platform is needed where NRM activities are planned based on logically-derived micro-zones of suitability. A platform with such an objective, named 'Bhuvan Panchayat' is developed and hosted under SIS-DP project of ISRO, which integrates the high resolution satellite imagery and associated spatial and non-spatial database in a web-GIS framework. This study attempts towards developing an operational methodology for generating land and water resources developmental plans (LRDP and WRDP), which dovetails with annual action plans of respective Gram Panchayats, using geospatial layers such as land cover, slope, drainage, soil, geomorphology and groundwater prospects. When examined with the existing NRM asset data, it will help in finding the gap areas where the new activities may be planned.

Keywords: NRM, Developmental Activity Planning, Multi-Criteria Analysis, Decision Support System

Abstract Id: 559
AN EFFICIENT SEA LEVEL MONITORING SOLUTION BY BLENDING HIMAWARI-8 AND LANDSAT IMAGERY

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High spatial and temporal resolutions of satellite imagery are necessary for improving the ability to monitor rapid environment changes at finer scales. However, no single satellite can produce images with both high spatial and temporal resolutions. To address this issue, spatio-temporal fusion algorithms, such as the Spatial and Temporal Adaptive Reflectance Fusion Model (STARFM) was proposed to synthesize high spatial and temporal resolution images.

On the other hand, water level monitoring is important to support natural hazard management, such as floods and tsunamis. However, continuously monitoring these hazards are challenging for a remote sensing satellite due to either its low spatial resolution or low temporal resolution. For example, Operational Land Imager (OLI) onboard Landsat 8 with a spatial resolution of 30 m has been applied on water level detection, but it cannot capture dynamic events due to its low temporal resolution. On the other hand, The Advanced Himawari Imager (AHI) 8 only needs 10 minutes to watch the hemisphere once, but its coarse resolution hampers the accurate mapping of sea level change.

This study, therefore, aims to blend Landsat OLI imagery with Himawari-8 imagery to monitor the dynamic behavior of sea level changes. To be specific, we first calculate the modified Normalized Difference Water Index (mNDWI) using Landsat and Himawari-8 images, and then fuse the index images using the STARFM algorithm. Finally, the water coverage is delineated by setting a threshold on the mNDWI index. By comparing the retrieved water coverage percentage with in-situ water level observations.

Keywords: Spatial-temporal image fusion, STARFM, Himawari-8, Landsat-8, water level monitoring

Abstract Id: 560
AUTOMATIC IMAGE MATCHING FOR SPACE INTERSECTION OF SPHERICAL PANORAMA IMAGES

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People are paying more attention to the use of Spherical Panorama Images (SPIs) for its main advantage of wide field of view (FOV). Provide accurate location and orientation can enhance more metric application using SPIs. While the exterior orientation parameters (EOPs) of image stations are known, the coordinates of interested points can be determined by space intersection of multiple SPIs. In this study, a special platform called portable panoramic image mapping system (PPIMS) is used to obtain SPIs, and applied for photogrammetric mapping. This system equips with eight single lens cameras and one GNSS receiver, capturing surrounding information simultaneously. The images captured with PPIMS are combined to be a SPI, and then used for mapping application instead of using original images. The EOPs of image stations can be calculated by the network adjustment with multiple SPIs. No matter in solving image station EOPs or space intersection process, conjugate points selection among overlapped images is a necessary task. Image matching is considered as an approach to obtain conjugate points much more efficient than manual measurement. In this study, an area-based image matching strategy for automatic conjugate point detection and point coordinate determination with multiple SPIs is proposed. The Sum of Normalized Cross-Correlation (SNCC) and Yet Another Reconstruction Dataprogram (YARD) index are used to check the similarity between images. To decrease the influence caused by scale variations and different FOV between images, the concept of matching in the object space is applied to enhance the matching accuracy. This research shows the feasibility of spatial positioning of interested points with PPIMS SPIs in cm level accuracy, the proposed image matching strategy with PPIMS SPIs is applied and validated. The problem of scale variations and different FOV which causes problem in matching with original images can be improved by object space matching.

Keywords: Spherical Panoramic Image, Portable Panoramic Image Mapping System, Matching in the Object Space

Abstract Id: 561
GIS-BASED GROUNDWATER POLLUTION HAZARD ASSESSMENT: A CRITICAL REVIEW OF THE DRASTIC MODEL

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Rapid urbanization and industrialization deteroi the groundwater quality which is an important issue confronting much of the world's people. Geographic information systems (GIS) have been shown to be useful tools for assessing groundwater pollution hazard. Many different methods have been developed for assessing this vulnerability. Hydrogeologists have failed to reach a consensus concerning the definitions of and reference terms for groundwater vulnerability assessment. New research challenges in vulnerability assessment are identified, especially the need for developing dynamic links between numerical models and overlay and index methods. Groundwater management can be effectively conducted by using groundwater contamination map assessment. A modified DRASTIC approach using geographic information system (GIS) was applied to evaluate groundwater vulnerability are discussed. In addition, the analytic hierarchy process (AHP) method was employed to evaluate the validity of the criteria and sub criteria of all the parameters of the DRASTIC model, which proposed as an alternative treatment of the imprecision demands. Efforts to use GIS in implementation of the DRASTIC groundwater vulnerability model and its derivatives are reviewed in the present paper. Problems related to data quality, model formulation, and model validation are discussed, and suggestions for augmentation and enhancement of the model are offered.

Keywords: DRASTIC, urbanization, vulnerability, index methods, hierarchy process

Abstract Id: 562
DEVELOPMENT OF GEOSPATIAL MODEL FOR PLANNING EDUCATION FACILITIES AT GRAM PANCHAYAT LEVEL IN INDIA

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Free and compulsory education to all children up to the age of fourteen years is the Constitutional commitment in India. Significant efforts have been made since independence, to universalize elementary education and impressive progress has been made in every sphere of elementary education. As per Right of children to free and Compulsory Education act, 2009 India it is the fundamental right of every child of India age between 6 to 14 years for free education and Primary school shall be established within a walking distance of 1km of the neighborhood. An attempt in the present study has been made for Dharmapuri block of Tamilnadu state, India to analyze the gap areas for identification of suitable sites for new primary school and optimization for the relocation of existing primary schools using geospatial techniques. The study has been carried out using Thematic & Asset database prepared under Space-based Information support for Decentralized Planning (SIS-DP) and Empowering Panchayati Raj Institution spatially (EPRIS) of NRSC, ISRO. Prioritization of gap areas has been obtained using the geospatial model developed in GIS Software. The area are prioritized on the basis of the distance between settlement to nearest primary school. The developed geospatial model can be generalized for district and state level for planning education facilities.

Keywords: GIS, Planning, Primary School, Geospatial Model

Abstract Id: 563
STATUS OF FOREST FIRE- A CASE STUDY FROM NORTHEAST INDIA

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Forest fire is a global concern and being considered as a proximate cause of land use/land cover change leading to loss of forests. This is a predominant phenomenon in several parts of Northeast India changing the vegetation structure and composition. Historical data analysis of fire counts in North Eastern Region (NER) of India shows approx. 10,000 fire incidents each year. This region being rich in biodiversity needs special attention in taking up measures for forest fire control. Therefore, using the historical data of forest fire occurrence from 2001 to 2010, the Forest Fire Vulnerability Zonation has been mapped for NER of India. Each of the NER states owing to its unique and varied forest types, topographic conditions and proximity to settlements has been considered independently to assess the proneness of the forests to fire hazard. The forest fire in this region is more anthropogenic in nature. The dependence of communities on the forest resource determines the fire incidents in this region. The region has most of the forest areas owned by the communities themselves. It is found that the forest fire incidents are occurring in almost all forest types particularly the moderate and the open forest. The spatial mapping using Remote Sensing (RS) & GIS technique may help to design adequate measures for controlling fire incidents in the region by planning and infrastructure development in different topographic setting in each NE state. The value added forest fire alerts sent to the different forest departments and NGOs every year is an initiative taken up to inform the officials about the locations and mitigate the fire spread. The technological interventions and adoption of alternative strategies by local communities can help to reduce the incidents. The study focuses on the forest fire scenario in the region by bringing out examples from different north eastern states.

Keywords: Northeast, forest fire, vulnerability, remote sensing, GIS

Abstract Id: 564
Leaf area index (LAI) is a key biophysical variable influencing land surface processes such as photosynthesis, transpiration, rain interception and energy balance and is a required input for various ecological models. Data on LAI from the tropics is sparse as compared to temperate and boreal environments. Teak and Sal are the two ecologically characteristic and economically important species of India dominated in south and north Indian forests respectively. In the present study monthly LAI of teak forest of Central India was collected using LaiPen LAI instrument and established statistical relationship with spectral vegetation indices derived from satellite data. Satellite remote sensing offers an excellent means of determining LAI on a regional, sub-continental and global scales. In teak forest of Central India, peak LAI is observed during September/October (5.01) followed by leaf-fall with lowest LAI in March and April (0.19). Monthly Landsat8 OLI data of 2016-2017 downloaded from USGS site were used to generate twelve vegetation indices along with radiance values of Red, Near Infrared (NIR) and Short-wave Infrared (SWIR) bands. MODIS LAI product of the study area was also downloaded for the comparison. The statistical relationship between LAI and spectral vegetation indices showed very good correlation of 0.98 for simple vegetation ratio followed by Enhanced Vegetation index (0.97) and Difference Vegetation index (0.97). Atmospherically Resistant Vegetation Index shows least correlation (0.68) among the vegetation indices. The statistical relationship between ground based LAI and spectral radiance of satellite bands shows good correlation between NIR band and inverse relation with red and Ratio Vegetation Index. SWIR band shows negative correlation with ground based LAI. MODIS LAI product registered a comparatively good correlation of 0.91. The temporal patterns of LAI resulted from this study are very useful indicators for detailed understanding of phenological sequence of teak forest in India.

Keywords: LAI, Teak forest and Vegetation Indices

Abstract Id: 565
Nowadays, rapid urbanization is destabilizing the environment and the economy of a place. For undertaking sustainable urbanization (to protect the environmental balance), we first need to model and predict the urban growth in the near future. In this study, Cellular Automata - Markov (CA-Markov) model has been used to predict the urban growth of Dehradun (planning area) in 2035. For this, the classified images of Dehradun (showing urban and non-urban classes), for the years 1995 and 2015, have been taken as input. Along with these two images, three more classified images of Dehradun (showing urban and non-urban classes), pertaining to the years 2000, 2003 and 2010, have been used to draw a percentage urban area vs. year graph to find out the trend of urban growth. The percentage urban area for the year 2035 has been calculated both from the output obtained from the CA-Markov model (≈38%) and from this graph (≈32%). The values are more or less similar. Now, five factors influencing urban growth, viz., distance from the roads, distance from the rivers, distance from the residential areas, distance from the city centre and slope of the area, have been considered. Maps representing these parameters are created and weighted overlay is performed with them to find out the suitable areas of growth. The map obtained from weighted overlay shows the central part of Dehradun as the most suitable area for growth. This result agrees well with the classified images and the output from CA-Markov model.

Keywords: Urban growth prediction, CA - Markov, Weighted overlay, Urban growth trend

Abstract Id: 567
Antarctic Sea-Ice variability: pre-2000 and post-2000 comparison

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Sea ice plays an important role in the state and variability of regional and global climate through thermodynamic and dynamic processes, and feedback mechanisms operating over a hierarchy of space and time scales. This study explores the trends and variability of Antarctic sea-ice in different sectors following literature: Weddell Sea (60°W to 20°E), Indian Ocean (20-90°E), Western Pacific Ocean (90-160°E), Ross Sea (160°E-130°W) and the Bellingshausen-Amundsen Sea (130-60°W). Using passive microwave sea ice concentrations derived from SMMR and SSM/I-SSMIS sensors for 1979-2015, we studied decadal and regional trends pre-2000 and post-2000. The results indicated that Weddell Sea, Indian Ocean and Pacific Ocean sectors are exhibiting an increasing sea ice trend at a higher pace post 2000, whereas, Ross sea sector experiences a slight decline. Sea ice in Bellingshausen-Amundsen sector has been decreasing since 1979, however post-2000 there is an increasing trend which contributes to an overall Antarctic sea-ice increase. Post-2000 Antarctica sea ice experiences higher rate of increase. On a seasonal time scale opposite anomaly is being observed pre-2000 and post-2000. Post-2000, Weddell Sea and Pacific sectors (Indian Ocean and Ross Sea sectors) experience a decreasing (increasing) trend. Monthly anomaly of Bellingshausen-Amundsen sector shows an increasing sea ice trend from a negative anomaly to a positive anomaly post-2000. Post 2000, total Antarctic sea ice indicate that the January and November months are contributing the most in decrease and increase of sea-ice, respectively. Prior to 2000, the monthly anomalies were negative with slight positive slope, whereas, post-2000 the anomalies are positive. The contributing factors such as ozone hole-Amundsen Sea Low system for this drastic changes post 2000 are addressed.

Keywords: Antarctica, sea-ice trend, climate-modes, climate change

Abstract Id: 568
SPATIAL ANALYSIS OF GROUNDWATER DISTRIBUTION AND QUALITY USING GIS AND REMOTE SENSING TECHNIQUES (CASE STUDY OF BOLGODA RIVER BASIN, SRI LANKA)


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Groundwater is an important natural resource for existence of life and environment. It provides higher quality, better protection from possible pollution, less subject to seasonal and perennial fluctuations and much more uniformly spread over large regions than surface water. The demand for groundwater in Sri Lanka is steadily increasing, particularly for urban/rural water supplies, irrigated agriculture and in industrial sector. This rapid increase in demand is exerting considerable pressure on available groundwater resources. This research aims to identify the Ground Water Quality and Distribution in Bolgoda River Basin.

Well water used as the easiest way to access the groundwater and 567 wells were observed. Data collection was done in dry season to identify the minimum water level and maximum water levels were obtained with peoples’ experiences. Digital Portable pH Meter was used to test quality parameters such as pH, Total Dissolved Solids (TDS), Electrical conductivity (EC) and temperature. Inverse Distance Weighting (IDW) and Weighted Overlay were main techniques that used for analysis.

Results show a conspicuous difference on spatial distribution of groundwater level and quality. pH level of the area was ranged between 3.6-7.8, EC between 10-900 and TDS between 0-440. Water quality was considered in 4 classes as very good, good, moderate and poor. 6.01Sqkm area was identified as very good in water quality and it represents the 1.3% of total land area. Largest portion of 235.3 was identified as good and 190.7 was in moderate quality. Poor quality land amount was 0.49. Maximum water level was identified as ground level in both seasons and minimum water level was the 14.63 meter below from ground level in dry season. Results of this research are very important as based data that can be used to ensure the protection of ground water from industrial and other non point source pollution activities as well as to identify the areas in water scarcity.

Keywords: Groundwater, TDS, water level, water quality

Abstract Id: 569
Urbanization process converts natural landscape into anthropogenic monotonous urban landscape in developing countries. Although it is a natural consequence of the present by providing opportunity for a better living, it also raises global concerns like rising temperature and rainfall variability due to environmental anomaly caused by human concentration at certain spots on earth. These global problems often require local actions to adapt, mitigate and moderate the consequential hazards. In order to do this, it is essential to analyze status and trends in land use-land cover (LULC) and prevalent bio-physical resource base of an urban area. Spatio-temporal change in LULC, ecosystem services and landscape characteristics could indicate if economic development of an urban region would be sustainable or current trajectory needs correction. The present paper attempts to understand spatio-temporal urban dynamics of a mid-sized Indian city - Khammam in Telangana, located in hinterland of Hyderabad metropolitan region, by carrying out LULC change analysis for assessing urban growth pattern. A set of twenty-three metrics in Landscape Analysis (LA) available to analyze growth pattern and broadly categorized into two sets - composition that are easy to analyze and configuration that are relatively challenging to analyze, were borrowed for the study. Lecos tool in Quantum GIS software was put to calculate them. PCA was used to identify three critical metrics from LA viz., landscape proportion, patch cohesion and splitting index while two additional metrics based on expert opinion - edge length and number of patches of LULC, were added to make the study amenable. City ecological status was assessed by adapting the Singapore City Biodiversity Index. Twenty-three indicators of the CBI broadly grouped into three core components viz., native biodiversity in city, ecosystem services provided and governance and management of CBI, were analyzed and five indicators that were amenable to digital interpretation of satellite data

Keywords: Urbanization, Spatio-temporal dynamics, Landscape Analysis, Ecosystem Services, City Biodiversity Index

Abstract Id: 571
MODELLING THE HYDROLOGY OF HIMALAYAN CATCHMENTS BASED ON WATERSHED AND CLIMATE CHARACTERISTICS

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Changes in the watershed characteristics (soils, topography, geology, and land use) and climate affecting hydrology at watershed scale might sometimes exacerbate flooding and other hydrological disasters with disastrous consequences to the human life and infrastructure. The present research is an effort to model the influences of the static and dynamic watershed characteristics including climate within the 5 watersheds of Upper Jhelum Basin (Kashmir valley, India) which conjointly drain at Sangam. The 5 watersheds include Liddar, Kuthar, Bringi, Sandran and Vishav. The area has heterogeneous land cover, lithology, soils, and topography with varied hydrological response. The datasets used in the research included: DEM, land use, soils, rainfall, evapotranspiration, discharge, census data, etc. Data from 3 rain gauge stations was used for simulation for 11 years at Sangam. The combined impact of all the influencing factors was studied using the HEC-HMS model. The model was run for the period of 2004-2014 and a good relation was found between the simulated and measured discharge. The results reveal that among the 5 watersheds, Vishav and Liddar watersheds are the major contributors of runoff. The reason may include the land cover, precipitous topography and more %area under impervious surfaces. The least runoff potential is of Bringi and Kuthar. Forests and infiltration-favoring geomorphological characteristics dominantly cover the two watersheds. Prioritization of watersheds based on their runoff potential, flood plain area and vulnerability was done using ‘vulnerability score’ approach. The method is based on the ranking of the contributory parameters, providing an insight into the combined impact of the three parameters. The findings are of practical use in planning water resource and flood management strategies by opting best management practices.

Keywords: Model, Jhelum, runoff, vulnerability score

Abstract Id: 572
Remote sensing technique has opened up new vistas of opportunities for geological mapping of lithology and alteration zones in inaccessible and unexplored terrain. With ground validation it helps to a greater to solve many unresolved issue of geological events. Mainly two types of satellite data are used for image analysis i.e. ETM+ and OLI using visible light, NIR and SWIR ranges of electromagnetic spectrum for mapping of silica, clay and iron oxides. Apart from these data, IRS LISS-III is also used for lineament analysis.

Geologically the study area is a part of Bastar craton comprising of Amgaon Group, Nanandgaon Group, Malanjkhand granite, Dongargarh granite and Sausar Group along with the Khairgarh Group, Chandrapur Group, Raipur Group, Amarkantak Group and Cenozoic laterite. A convolution filtering involving applied to enhance the lineaments of the study area. The lineament fabric map shows that majority of lineament trends in NNE-SSW and NE-SW direction. The cluster of lineaments west of Manegaon village are manifested by basic intrusives and rhyolite volcanic. Some linear basic bodies and rhyolite are well placed is shown remote sensing data. Petrological study of the dolerite and rhyolite has indicated the presence of minor basemetal sulphides. The lineament representing with N-S trending quartz with minor pegmatite bodies reef within Dongargarh granite and shows fluorite mineralization around Biritola Rajandandgaon district, Chhattisgarh. Samples from quartz reef were studied for fluid inclusion and indicated that hydrothermal activities possible lined to granite intrusive as a result of fluorite mineralization.

In the present work it has been found that the digital image processing techniques by using ETM+ and OLI data, serve as an effective tool in identification of lineament fabrics and alteration zones. The above interpretation were further verified and correlated with petrological and chemical analysis of samples collected from field.

Keywords: Geological Interpretation Remote Sensing Techniques

Abstract Id: 577
WATER BODY DETECTION USING SENTINEL 1 -SAR DATA

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Water Bodies Information System (WBIS) hosted in Bhuvan Platform of ISRO uses multi-sensors data from Resourcesat-2 LISS III, AWIFS & RISAT-1 which requires extraction of water bodies through automated algorithms for periodic monitoring of water bodies. Synthetic Aperture Radar (SAR) data has the advantage of monitoring the waterbodies especially during monsoon season (June-September) due to its capability to penetrate through the clouds. RISAT-1, the first indigenous radar imaging satellite of ISRO is a C-band SAR with 5.35GHz frequency. Medium Resolution ScanSAR mode (MRS) of RISAT-1 having systematic coverage of 25 days and resolution of 18m was used for extraction of water bodies. Algorithm was developed for automated extraction of waterbodies from RISAT-1 MRS mode HH/HV polarization data and was made operational in WBIS. Sentinel-1 is a constellation of two satellites S1A and S1B with C-band (5.405 GHz frequency) imaging capability, launched on 3rd April 2014 and 25th April 2016 respectively. The revisit time of a single satellite is 12 days .The Sentinel data along with Resourcesat-2 and RISAT-1 will improve the frequency of waterbodies monitoring. In this context an analysis has been carried out to develop an algorithm for automatic extraction of waterbodies from Sentinel-1A VV/VH polarization.

Studies have been carried out for Coastal region of Andhra Pradesh. Pre-processing of Sentinel-1 A imagery was performed with SNAP software. Radiometric calibration has been carried out to generate the sigma naught (σo) images. To remove speckle noise, Lee Sigma filtering method was adopted and Terrain corrections were carried out with the help of SRTM DEM. Terrain corrected Sigma naught images of VV and VH polarizations were used for further studies. This method was applied on entire study area and noise pixels were removed by applying the reference water body mask. The output obtained is validated by comparing with that derived from optical imagery.

Keywords: Sentinel 1A; WBIS ; Algorithm

Abstract Id: 579
ACCURACY ASSESSMENT ON DISTANCE MEASURED ON WEB MAPPING SERVICES - A CASE STUDY IN DOWNTOWN TAIPEI CITY

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Map distortion exists in every projected map. Mappers choose the most appropriate projection depending on the map's use. Google launched Google Maps based on the Web Mercator Projection (EPSG: 3857) in 2005. Now, most of web mapping services (WMS) follow this projection because it is a quick and convenient method of presenting the map to its user through the Internet. Compared to the traditional paper maps, more and more people like to use web maps. People have also used to learn geographic information, such as distance between two places, by measuring on the WMS. However, NGA and IOGP both suggest people not to measure on the WMS that is made by the Web Mercator Projection. Because the distortion is too large to ignore. The objective of this research is to assess the accuracy of the measurement on the WMS. Seven web mapping services are selected for the experimental platform: Google Earth Pro, Google Map, ESRI ArcGIS Earth, ESRI ArcGIS Online, NLSC Taiwan Electronic Map, NLSC Basic Topographic Map, and NLSC Taiwan Map Service. Two different direction roads in Taipei City are selected for distance experiments. One is Xinyi Road which is east-west direction and the other is Songjiang Road (Xinsheng South Road) which is north-south direction. First, the Web Mercator Projection formula is used to assess the theoretical accuracy of the 2 points’ coordinates between start and end points of each road. Second, distance of 2 points’ coordinates is accessed by user measured and calculated from Google Maps JavaScript API or ArcGIS API. Third, API calculates the GPX log of driving route. Finally, the measured or calculated distances are compared to the geodesic length to evaluate the experimental accuracy. The concluding results of this research could be served as a reference for people who want to measure on the WMS.

Keywords: Accuracy Assessment, Measurements, Web Mapping Service, Web Mercator Projection

Abstract Id: 580
EXAMINING THE SENSITIVITY BETWEEN URBAN BIOPHYSICAL COMPOSITION AND LAND SURFACE TEMPERATURE IN HYDERABAD CITY, INDIA

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The Greater Hyderabad Municipal Corporation (GHMC) has witnessed the drastic urbanization in the last decade and, is the sixth largest urban agglomeration of India. In the present study, the temporal dataset from Landsat Thematic Mapper (TM), Enhanced Thematic Mapper (ETM+) and L8 Operational Land Imager (OLI)/ Thermal Infrared Sensor (TIRS) are used to trace the LULC, and land surface temperature (LST) changes during the period of 2002-2015 and demarcate the fluctuation of different biophysical surfaces. Subsequently, four different indices viz. Normalized Difference Vegetation Index (NDVI), Land Surface Water Index (LSWI), Normalized Difference Built-up Index (NDBI), and Normalized Difference Bareness Index (NDBaI) explicitly employed to determine the collective response and sensitivity of the different LULC classes/biophysical surfaces to the changes of Land Surface Temperature (LST). Using simple linear regression between the biophysical surfaces and LST, the complex and nonlinear behaviour of Urban Heat Island (UHI) and LST over different land use units were examined. The spatial and temporal changes of the hot and cool objects were assessed through Global and local Moran’s I and Getis hot spot analysis. The spatiotemporal changes of land use and land cover, LST, and UHI of GHMC from 2002 to 2015 are quantified to evaluate the effects of biophysical indices on moderating or exaggerating LST. The areal coverage of urban land was increased from 31.2 % in 1973 to 62.87 % in 2015 with 5.03 sq.km year-1 expansion rate. The LST hotspot (H-H) in 2002 observed in the central and the southeast portion of the region, ascribe to the presence of higher thermal anomalies, whereas, the mean LST (°C) of the neighboring region is below than the average. The study outlines the effects of urbanization in the GHMC and the changing LULC pattern with the local climate and urban biophysical compositions.

Keywords: Land surface temperature, Surface urban heat island intensity, Physical composition, NDVI, NDBI

Abstract Id: 581
ROLE OF REMOTE SENSING AND GIS IN FLOOD DAMAGE ASSESSMENT AND MANAGEMENT - A CASE STUDY OF GORAKHPUR DISTRICT, UTTAR PRADESH, INDIA

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Gorakhpur District of Eastern Uttar Pradesh, a major flood prone area during monsoon season, is taken up for present study. The flooding in the said district occurs due to perennial Himalayan originating rivers flowing through the district. The capacity of rivers to carry water has been reduced due to siltation coming from the Himalayas and causes flood in the urban and rural areas of Gorakhpur district. Using the microwave data and other high resolution satellite imagery, flood affected villages and settlements have been observed. Shelter points, approach roads to shelters and hazard zonation area have also been mapped. In addition to this, existing embankments & spurs have been monitored and site for new embankment has been proposed. The conduit channels (linking of two arms of a meander of river) have been proposed on the meanders of rivers to reduce the pressure of water on adjacent embankment by speedily flowing river water.

There were 133 villages & 33 settlements, which were found affected by flood in Gorakhpur district. One site along Rapti river & nine sites along Ghaghra river are proposed for construction of embankment. Flood affected embankments along Rapti and Ghaghra rivers in the vicinity Gorakhpur district were observed as 42 and 25 respectively. In the year 2016, Rapti and Ghaghra rivers had eroded embankments from both the sides of rivers at 27 & 3 places respectively. A total number of 326 shelters were identified along Ami, Gaura, Manjhna, Rohini, Tura, Rapti and Ghaghra rivers to accommodate the affected people and for supply of relief materials during floods. A total number of 12 conduit channels were also proposed along Rapti river.

Keywords: Microwave Sensors, RADARSAT, RISAT, Remote Sensing, GIS, Embankment, Shelter, Conduit Channel

Abstract Id: 582
Problem of Urban Municipal solid waste disposal is a challenging task faced by civic bodies and planning authorities in almost all the cities of rapidly developing countries like India. Additionally, due to rapidly increasing population in the cities, the amount of solid waste generated has increased. This has caused the existing dumping sites to exceed their carrying capacity. A similar situation is being faced by Dehradun, the capital and the fastest growing city of Uttarakhand, India. Finding suitable sites for solid waste disposal requires studying and combining various physical, environmental, socio economic and accessibility factors. In the current study an attempt has been made to find out the suitable sites for waste disposal in area around Dehradun city using Geospatial Multi-criteria Decision Analysis (MCDA) techniques from remote sensing data. Two different decision rules of MCDA are used, namely Analytical Hierarchical Process based Weighted Linear Combination (AHP - WLC) and Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS). WLC has been used previously for similar studies for its ease and simplicity to apply in raster format but TOPSIS has an advantage over WLC, it orders a set of alternatives on the basis of their separation from the ideal point. It defines the best alternative as the one that is simultaneously closest to the ideal alternative and farthest from the negative ideal point. The study attempts the use of this technique in raster based site suitability analysis and the results obtained by the two methods are compared. Both the methods give identical results with minor differences identifying best suitable sites outside the eastern boundary of the city.

Keywords: Urban solid waste disposal, site suitability, Geospatial Techniques, MCDA, TOPSIS

Abstract Id: 585
COST EFFECTIVE CHLOROPHYLL METER DEVICE DEVELOPMENT USING 
RASPBERRY PI SYSTEM ON CHIP

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Chlorophyll meter is a device to measure chlorophyll concentration of green leaves as Chlorophyll Content Index (CCI), using the transmitted radiation through leaf. CCI values can be related to satellite reflectance data and thus, can be a very useful index / indicator in the assessment of the crop condition and health. CCI is measured in laboratory, using chemical analysis but the procedure is laborious, time- and cost-intensive and involves destructive sampling methods, which necessitates removal of leaf samples from the plant. Imported chlorophyll meters are very costly and sensitive to environmental conditions. Chlorophyll meter device can be very cost-effectively developed (ten times lesser) using Raspberry Pi SoC (System on Chip) along with the NIR camera which acts as a detector. Moreover it is a handheld device which makes it handy & user-friendly. An effort has been made to develop an indigenous device to measure the chlorophyll concentration of leaves in standing crops, using non-destructive sampling procedures. The hardware components have been procured from the local market and assembled. The software for calculating the CCI is developed using Python & Open source libraries like OpenCV. This device can be used as a field instrument for crop condition assessment studies. The device is being calibrated in field conditions.

Keywords: Chlorophyll, Device, Field, Crop, Health

Abstract Id: 587
Identification of Deforestation areas are critical for forest monitoring activities. In India, degraded forests constitute 41% of the total forest cover. Satellite data is a viable option to detect forest loss areas reliably at regular intervals at regional scales. In the current paper, we aim to develop a methodology for forest loss detection using temporal sequence of IRS Resourcesat-2 AWIFS & LISS-III at sub-annual time scales. For the current analysis, parts of Telangana and Maharashtra are chosen based on high activity of deforestation in the recent past. Monthly Images from Oct 2015 to May 2016 are used for generating time series profiles of each forest pixel. NDVI differencing method along with spatio-temporal normalisation was performed to identify change locations and detect time of change. Results are validated by corroborative evidence from high resolution satellite data. The current results shows that the method could be used in detection of forest loss at regular time intervals and could provide valuable inputs to forest monitoring.

Keywords: Forest-Loss; Resourcesat; AWIFS; LISS-3; Temporal analysis; NDVI.

Abstract Id: 588
Analysis of decomposition techniques using simulated hybrid-pol S band SAR data

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In this paper we compare the widely used hybrid-polarization m − χ decomposition technique with quad-polarization techniques for S band SAR (Synthetic Aperture Radar) data. To this end, we simulate the S-band hybrid-pol data from DLR F-SAR airborne full-pol data and then proceed to do a m − χ decomposition followed by a maximum-likelihood classification of prominent features. We show that a hybrid-pol decomposition technique gives almost comparable classification accuracy as compared to the full-pol technique. For most of the features, like all classes of Agriculture representing different growing conditions, urban(built up areas), smooth surfaces and forest, were classified with comparable accuracies in the simulated hybrid data based decomposition as well as the full-pol based decomposition. The almost at par performance of the hybrid datasets with full-pol data provides us with greater scope for doing classification of tropical agricultural land in India using upcoming RISAT-1A hybrid polarization data. Also this will prove to be an useful tool for detailed classification in the upcoming NASA-ISRO Synthetic Aperture Radar (NISAR) mission, and the ISRO L&S airborne SAR, which is a dual frequency SAR mission (L-band & S-band). Full-pol SAR imagery will be acquired in L-band and hybrid-pol imagery will be acquired in S-band over Indian subcontinent. ISRO L&S airborne campaigns are being conducted over the Indian subcontinent over different land classes and will be used for more experiments in the recent future. S-band SAR based results are limited in literature and our work provides some insight into this research area for similar applications.

Keywords: SAR Hybrid Polarimetry, Polarimetric Decompositions

Abstract ID: 589
DETECTION OF HIGH-POTENTIAL GOLD, COPPER AND IRON MINERAL ZONES USING ASTER IMAGERY AND GEOCHEMICAL DATA (CASE STUDY: ARDESTAN, IRAN)

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Image processing techniques in transform domain are useful tools for combining several correlated variables into a single variable. The process of decomposing the image into uncorrelated independent components increases the accuracy and reliability of producing surface sections of the area mineral alterations. Ardestan is located in NW-SE direction of central Iranian volcanic belt that hosts many well-known porphyry copper and gold deposits. In this paper, performance of independent component analysis (ICA) has been evaluated in the identification of the anomalies associated with Cu, Au and Fe mineralization using ASTER satellite imagery and geochemical data. First of all, multi-fractal inverse distance weighted (MIDW) was developed and applied to make raster maps related to Copper (Cu), Gold (Au) and Iron (Fe) that were combined later. ICA components were then used to identify Iron oxide and hydrothermal alteration zones in the visible and near infrared (VNIR) and shortwave infrared (SWIR) subsystems of ASTER data. For this purpose, this research investigated the major absorption wavelengths of the indicator minerals. The results show that the argillic alteration zone detected by applying ICA are mostly located near the Marbin Rengan and Kacho Mesqal-Gerian faults around the geochemical anomalies. The situations of identified hydrothermal alteration zones indicate that surface sections in the study area contain porphyry copper and gold deposits. According to geochemical anomalies obtained by MIDW method, detected promising areas of Iron oxide and hydrothermal alteration zones, match precisely with the locations of Intrusions of diorite and monzonite into the igneous lithological units between marbin rengan and Kacho Mesqal-Gerian faults.

Keywords: Independent Component Analysis (ICA), Multi-Fractal Inverse Distance Weighting (MIDW), ASTER, Remote Sensing, Geochemical Data

Abstract Id: 590
The extreme drought in Southwest China caused great damages to vegetation in that area. In this study, we analyze the relationship between remotely sensed drought monitoring and meteorological drought monitoring. Vegetation Health Index (VHI) was calculated using multitemporal Normalized Difference Vegetation Index and land surface temperature from 2001 to 2010. VHI was adopted to characterize vegetation responses to southwestern drought characterized by Standard Precipitation Index (SPI). At the beginning of drought, vegetation has little response (VHI > 50). As drought aggravates, VHI shows consistent and significant response (VHI < 30 in most areas). VHI and 3-month SPI have highest correlation for croplands, whereas VHI and 6-month SPI have highest correlation for forest. SPI and VHI have good spatiotemporal consistency during drought period in Southwest China. Our study proves meteorological drought index combined with remote sensing drought index can enhance our understanding of vegetation responses to drought threat.

Keywords: agriculture, drought, remote sensing

Abstract Id: 591
The remote sensing sensors represent the earth surface in terms of its geometric and radiometric characteristics. The degree of closeness with which the radiometry is recorded depends on the accuracy of sensor’s radiometric calibration. The prelaunch laboratory calibration—also called Light Transfer Characteristics (LTC) exercise—aims at establishing a relationship between input radiance intensity and the response of each detector element to the input intensity. Moon as a radiometric reference source has also been used with an added advantage of characterization bias in the system through deep space counts. The cross calibration of contemporary sensors with coincident imaging gives an opportunity to calibrate the target-sensor for larger part of its dynamic range.

This paper discusses an integrated calibration approach employed in the radiometric calibration of Resourcesat-2A Liss3 (RS2A-L3) sensor. The shortcomings of using each method individually in fully characterizing the sensor with 100% albedo capability has been eliminated through this integrated approach. The validation using moon and ground features show encouraging result for this novel approach.

Keywords: Radiometric, Calibration, Validation

Abstract Id: 592
AN OVERVIEW OF APPLICATION AND DEVELOPMENT OF REMOTE SENSING IN COUNTY-SCALE ECONOMIC DEVELOPMENT: CASE OF HEBEI PROVINCE, CHINA

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In pace of the launch of the Chinese “GF series satellites”, China is able to receive superb high-resolution remotely sensed images with high spatial, temporal, and spectral resolution. The GF series satellites data have been playing an important role in various fields related to regional economic development, such as agriculture, forestry, environmental monitoring, Urban/Rural Planning and so on. However, the applications of remote sensing at the country’s scale are still at the early-stage and difficult to popularize, due to some reasons involved data resources, technical matters, and the user’s cognition to remote sensing. In order to better serve the local economy and society using remote sensing technology, Collaborative Innovation Center of Aerospace Remote Sensing Information Processing and Application of Hebei Province (hereinafter referred to as the Center) has pioneered in applying space remote sensing technology to county-scale economic development in Langfang city, Hebei province, China since 2014. In the recent years, the Center has initially established a country-scale remote sensing service framework, developed a number of remote sensing thematic products providing information service for the Country Level Government, and applied the scientific researches to 11 countries. Next, the Center will further strengthen the cooperation with governments and enterprises, strive to form a fairly mature industrialization model to widely promote the application of remote sensing.

Keywords: country-scale, remote sensing, information service, industrialization model

Abstract Id: 593
Measurement of Soil Moisture (SM) through remote sensing is an important alternative owing to its multi-temporal observations and synoptic view. Several studies have attempted the estimation of SM using optical, thermal, active and passive microwave region of the Electro-Magnetic Spectrum (EMS). This study attempts to derive SM using a hybrid index called modified Vegetation Temperature Condition Index (mVTCI), which uses optical and thermal region of EMS. An investigation was carried out on the dynamics of Land Surface Temperature (LST) and Diurnal Land Surface Temperature (DLST) during 2012-13 summer and winter cropping seasons of 2012-13. Results showed that the DLST was able to capture the seasonal SM variations better when compared to LST. Hence, DSLT was used instead of LST along with Normalized Difference Vegetation Index (NDVI) in deriving the VTCI which is termed as the mVTCI. The mVTCI was derived using the seasonal maximum warm and minimum cold edges. Using mVTCI the SM was derived for the agricultural districts of Haryana state, India during summer and winter cropping seasons. The results show that the mVTCI SM was in close agreement with the SMOS SM. The correlation analysis between these two SMs revealed that there was very significant positive correlation (r=0.7858). The district average mVTCI SM also showed very strong positive linear relationship with the district average rainfall. However, in summer cropping season the retrieval of DLST was constrained due to the cloud and atmospheric water vapour contamination. Hence this methodology can be used to retrieve soil moisture during cloud free seasons.

Keywords: Soil moisture, LST, NDVI, VTCI

Abstract Id: 594
Air pollution is one of critical environmental issues in most of the urban regions generating numerous adverse impacts on all living beings. Being the largest commercial city of the country Colombo city is also under the threat of issues associated with air pollution. Monitoring air pollution is required to bring out sustainable solutions for this issue and traditional ground based measurements are being used to monitor air quality. Most of the countries in the world uses advance technologies in monitoring air pollution with the availability of the space born technology. This study aims to assess the spatial variation of air pollution in Colombo City using remote sensing techniques. Aerosol optical thickness is considered when determining the air pollution and difference of at-satellite temperature was used to estimate the absorption effect from the pollutants. Visible, near infrared and thermal infrared band of Landsat 7/ETM+ are used in this study whereas ground based data obtained by the National Building Research Organization was used to validate the results applying regression analysis. Accordingly particulate matter, black particles and carbon monoxide is detected and mapped using ArcGIS to derive spatial distribution. Linear regression was statistically significant between the space based measurements and ground based measurements ensuring the applicability of these emerging techniques in monitoring the air quality of the city in order to suggest sustainable solutions to mitigate issues and impacts of air pollution.

Keywords: Air pollution, Landsat, Aerosol optical thickness, spatial, Carbon Monoxide, Black particles

Abstract Id: 595
ANALYZING URBANIZATION PATTERN AROUND MAJOR WATER BODIES IN NAGPUR CITY, INDIA

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Urban water body means lakes and rivers, are important part of urban ecosystem. Though relatively small in size, lakes perform significant environmental, social and economic functions, ranging from being a source of drinking water, recharging groundwater, acting as sponges to control flooding, supporting biodiversity and providing livelihoods. Remote Sensing (RS) and Geographical information system (GIS) can be effectively used for generating of information related to water bodies and hence an attempt has been made to map the urbanization pattern around major water bodies of Nagpur Municipal Corporation (NMC) and its immediate vicinity. The study is carried out using the LISS-IV and Cartosat-2A data for the year of 2010 along with secondary data from Nagpur Municipal Corporation. NMC and its immediate vicinity accommodates ten major lakes, namely, Ambazari, Futala, Gandhisagar, Gorewada, Sonegaon, Naik, Lendi, Surobardi, Wadi, Mines of Wadi. There are mainly two rivers, namely, Nag and Pilli rivers. Nag River is main and important river in Nagpur City. This River is flowing middle parson in Nagpur City. Urbanisation pattern around 1 meter buffer of these water bodies have been studied through visual interpretation and on screen digitisation. Derived statistics highlights that approximate 28% to 78% area has built-up cover whereas, vegetation covers an area between 2% to 29% around 1 km buffer of different lakes. Futala lake, situated towards western outskirts of the NMC, is an exception with 17% of built-up and 49% of vegetation cover around immediate 1 km buffer. Gorewada Lake, located towards north-west direction, outside the NMC, also shows the reverse trend with 8% built-up and 82% vegetation cover within 1 km buffer area. The changes in the spatial extend of water bodies over different time of the year as well as water quality are potential areas for future research to maintain the urban ecosystem.

Keywords: Urbanisation pattern, water bodies, urban ecosystem and Nagpur City

Abstract Id: 596
Disasters are inevitable. It can happen anywhere at any time. Disasters hit instantaneously and cause widespread losses and human suffering such as earthquake, flood, tsunami, landslides, etc. Disasters are common in the countries like Nepal, which has the varying topographic and climatic features and the land between Indian and Eurasian plate. It is the most risky zone for the occurrence of earthquake, and we just had experienced a massive earthquake hit of 7.8 richter scale directing to physical, economical and human loss which greatly affect the country financially and psychologically. The proper monitoring of earthquakes, landslides, and floods is the most important and necessary task to be performed in the present context. Not only in Nepal it is clear that the world is facing the disaster events everyday and is proven by headline news in television channel and newspapers. So, it is important that we should monitor and make proper response towards such events and the proper management of victim areas are too prior. Remote Sensing (Earth observation) technique, a valuable source of spatial information, can be the most effective and economical solution to monitor such event. The remote sensing technique involves taking satellite imageries and making analysis through different bands which gives the reliable information about the affected areas. The paper will address a number of data sets and image processing techniques used to map and monitor earthquakes, landslides, floods, volcanos and the damages associated with it. Remote sensing techniques too facilitates the change detection over a period of time.

Keywords: Disaster, Nepal, earth observation, change detection

Abstract Id: 598
Iceberg calving is the sudden disintegration of large chunk of iceberg from ice sheet, glacier, ice shelf into an ocean. It is necessary to monitor these events, as they play a crucial role in knowing the current dynamics of the Western Antarctic Ice Sheet. The data sets have been acquired with the aid of LANDSAT (4-5, 7 and 8). The description of these events has been categorized into three major divisions: to be calved, calved- ice bergs and the potential locations which are vulnerable of getting calved. The four minor calving events have been discussed in this study. The first event has been reported near Dean Island. The calved off iceberg from the location is having a surface area of 2.98 sq km. The second event took place near Fletcher Island, where the rate at which the rift is growing is observed to be 0.53 km/year (2002-2009). Visual analysis has played a vital role to predict the shape (tabular) iceberg which is yet to be calved. The third event is reported and of global attention now is taking place nearby Larsen C. The major Larsen C crack is threatening, as it is on the verge of calving a huge iceberg; the difference between the lengths is calculated as 39.65 km and 53.42 km for the image dated 15-03-2005 and 08-03-2012 and 08-03-2012 and 02-02-2016 respectively; the rate in the growth of rift is 5.66 km/year till 2012 and 3.11 km/year till 2016. The study mainly focuses on usage of optical moderate resolution satellite data for monitoring and tracking iceberg calving events which can be used as an indicator of climate change.

Keywords: Calving, Antarctica, Optical data

Abstract Id: 599
Hybrid polarimetry offers several advantages over fully polarimetry in terms of lower data rate, wider swath, and low power consumption. The aim of proposed work is to compare the effect of different frequencies and incident angles on hybrid-pol descriptors. The test site selected for this study is San Francisco area. L-band (AIRSAR and ALOS-2/PALSAR-2) and C-band (RADARSAT-2 and RISAT-1) data is collected for the study. Hybrid-pol data can be simulated from any existing quad-pol data. In this study quad-pol datasets converted into hybrid-pol mode. However, RISAT-1 data itself is acquired in hybrid-pol mode and thus no conversion is needed. The descriptors such as degree of polarization (DoP), Relative phase (Delta) and ellipticity angle (Chi) have been extracted in this study. The analysis has been performed by taking around 10,000 pixels of urban and sea areas. These two classes are selected as their scattering response is closer to dihedral and trihedral targets. In AIRSAR L-band data, the distribution peak of DoP, Delta and Chi is around 0.98, +90 deg. and +40 deg. for sea area pixels. However, in urban areas, the distribution peak is around 0.80, -75 and -21 deg. In ideal case, the values for dihedral point target is 1.0, -90, -45. The reason for the difference is due inhomogeneity in the urban areas. Similar observations are seen in ALOS-2 data also. However, the peaks of histogram are deviated from AIRSAR results. The real hybrid-pol data from RISAT-1 satellite shows peak histogram for DoP, Delta and Chi around 0.65, -60, -50 deg. in Urban areas. The non-circularity of a transmitted wave may also be the cause of a shift in histogram peaks from in histogram peaks from ideal values. The results indicate that hybrid-pol descriptors are sensitive to the change in frequency and incidence angle of the transmitted.

Keywords: Hybrid polarimetry, RISAT-1, DoP, Delta

Abstract Id: 600
ASSESSMENT OF IMPACTS OF AGRO-CLIMATOLOGICAL DROUGHTS OVER VIDARBHA & MARATHWADA, INDIA, USING REMOTE SENSING TECHNOLOGIES

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Vidarbha and Marathwada meteorological subdivisions are one of the highest rainfall deficit regions of agricultural India, known for its severe droughts and incessant farmer suicides in the recent years. Over these areas, droughts and exceptionally dicey weather hinders rural development to a major extent. The present study sheds light on unseasonal and deficient rainfall over Vidarbha-Marathwada, and its battle with dismal droughts resulting this area as one of the most poorly developed region of the country. This study represents outcome of trend analysis for monsoonal precipitation over Marathwada for the period from 1951 to 2016. Monsoon rainfall variability reflects into drought scenarios in recurring months. Temperature Condition Index (TCI) and Vegetation Condition Index (VCI) were used to understand the spatio-temporal occurrences of droughts in the study area. The investigation of droughts includes use of remote sensing data acquired by Terra Moderate Resolution Imaging Spectroradiometer (MODIS) MOD11A2 and MOD13A2. Standard algorithms for Land Surface Temperature (LST) and Normalize Deferential Vegetation Index (NDVI) were used to estimate TCI and VCI respectively. Linear regressions, Mann-Kendal rank test, Sequential Mann-Kendal are the techniques used for analysis and to verify significant changing patterns in rainfall. The results obtained for overall monsoon rainfall series indicated negative rainfall trends over almost all parts of Marathwada and some parts of Vidarbha, in which significantly decreasing rainfall trend was noticed over the Latur district. Declining rainfall trends follows with the brutal drought situations in the post monsoon season. During the last decade more than half of the study area had moderate to severe drought conditions. Particularly the parts of the Beed and Osmanabad districts of Marathwada, constantly recorded highest drought severity. Negative rainfall trends, increasing drought frequency are threatening the Rabi crops and overall agriculture. The study indicates that, water scarcity and pertinent drought conditions may continue in coming years.

Keywords: Vidarbha, Marathwada, Drought, indices, MODIS

Abstract Id: 601
Urbanization is the process of rapid change in social structure of an area that is influenced by various natural factors. Geographic Information System and Digital Image Processing have rapidly emerged as an important tool in processing of geo data for scientific, commercial and operational applications. The study area is a part of Dehradun which lies in the foothills of Himalayas. For the present study Sitla Rao watershed has been taken up for detailed geological, geomorphological and hydrological studies using ASTER data for urban planning. On the basis of interpretation and field check major geological units identified in the study area are Lesser Himalayan Conglomerate, Middle Siwalik Sandstone, Upper Siwalik Boulder Bed and Valley fill with Doon Gravel of Holocene Age. Geomorphologically the study area is characterized by typical Himalayan topography with rugged terrain. ASTER false colour composite (FCC) (123) shows that the major land use category in the study area is agriculture while major land cover class is forest covered land. For present hydrological study ASTER DEM is used to generate physiographic information about the watershed such as configuration of the channel network, location of drainage divides, channel length and slope, sub-watershed geometric properties and a variety of topographic parameters (Tribe, 1992, Martz and Garbrecht, 1998). The present work is an integrated approach toward urban planning of Sitla Rao watershed, using digital topography, remotely sensed data and GIS. Remote sensing and GIS techniques have been used effectively for updating and monitoring the spatial analysis of the various parameters influencing planning polices of the inaccessible regions of the study area.

Keywords: Geomorphology, ASTER, DEM, Landuse/landcover and Urban planning

Abstract Id: 604
Using Unmanned Aerial Vehicles for Open Mining Areas: Current Applications and Future Potentials

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Unmanned Aerial Vehicles (UAVs) are preferred in a variety of applications such as forestry, precise agriculture and disaster management due to the good coverage of study area provided by high-resolution photographs in a short period of time. Due to its richness of natural and geographic features, Turkey has a real potential to use these instruments in many different application, especially in the cut and fill calculations of the open pit mines. The most important advantage of using UAV in open mines is to increase productivity in many aspects like time, cost, accuracy and safety without reducing work force. In this study, potential usage of unmanned aerial vehicles in open mines has been investigated. A marble mine located in the province of Antalya was selected as the study area. Related data was collected by means of a rotorcraft type UAV. The reason of preferring this type of UAV is its maneuverability during the monitoring for smaller areas with complex surfaces and no require large space for rotation at the end of the strips relative to the fixed-wing type. After the photographs were taken, 3D models were created and cut and fill (volume) calculations were done very quickly, to evaluate the daily changes occurred in the mining area. Another main advantage of using UAV for similar studies is to prevent any possible accidents that may cause serious injure or even death of the people who are trying to evaluate these changes by the help of new derivative data sets such as the terrain gradient created on the model and their interpretation. Depending on the location of the mine, it is possible to determine the effect of the studies carried out on the natural environment temporally, such as forestry area. Just the opposite, it is possible to determine the potential for influencing the mine by any flood of natural resource such as the basin, dam or stream bed which is located near the mine and is not adversely affected by the mine.

Keywords: Open Mine, Rotorcraft UAV, Unmanned Aerial Vehicle, Volumetric Calculation

Abstract Id: 605
DEVELOPMENT OF THRESHOLDING ALGORITHM FOR OPEN WATER DETECTION IN KOREAN MULTI-PURPOSE SATELLITE-5 IMAGERY

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Synthetic Aperture Radar (SAR) imagery represents an effective tool for detecting open water due to high resolution and resilience to weather conditions. However, various techniques and methods that have been developed produce ambiguity in detection and classification results. On this paper, a SAR-intensity based histogram algorithm method is applied in Korean Multi-purpose Satellite (KOMPSAT-5) image using a remote sensing and image processing software called PCI Geomatica. The thresholding algorithm detects and discriminates water from land, enhancing the contrast between the two classifications in the province of Pampanga, Philippines, and thus determining an optimal threshold value. The results of thresholding algorithm in SAR imagery effectively extracted water from occluded regions and demonstrated its precision and applicability in open water detection.

Keywords: thresholding, histogram, feature extraction, KOMPSAT-5, SAR

Abstract Id: 607
Speckle highly degrades the radiometric quality and corrupts accurate interpretation of Synthetic Aperture Radar (SAR) images. Different filtering methods were proposed since speckle reduction is a critical pre-processing step for SAR images. Adaptive filtering, an adaptive enhancement using a moving window to calculate the adjustment for each pixel value, is used to remove the high frequency noise while preserving high frequency features and degrades less the geometrical resolution of the image. This paper presents well-known SAR adaptive filtering techniques called: Enhanced Frost Filter, Enhanced Lee Filter, Touzi Filter, Laplacian Filter, Kuan Filter, and Standard Deviation Filter, that are applied to reduce the speckle noise in SAR images using a remote sensing and image processing software called PCI Geomatica. The aforementioned adaptive filtering algorithms were implemented on the Korean Multi-Purpose Satellite (KOMPSAT-5) image acquired in the province of Nueva Ecija, Philippines. The quality and performance of the filtered images are compared and evaluated by inspection for speckle reduction and using other parameters. Based on comprehensive evaluation, Enhanced Lee filter achieved the most reliable output which can suppress speckle effectively, and visually enhance the image while preserving radiometric information.

Keywords: speckle, noise reduction, adaptive filtering, KOMPSAT-5, SAR
In this study we performed pixel-based characterization of supraglacial debris on Schirmacher Oasis, Princess Astrid Coast, Queen Maud Land, East Antarctica, using high resolution WorldView-2 satellite imagery. Schirmacher Oasis is covered with blue ice, white ice, and snow. Debris being an important parameter in glacial melt and ablation, pixel-based methods were employed using MATLAB image processing routines. The results suggest that pixel-based methods yielded around 70% accuracy, while object-based methods yielded 95%, when compared to manual reference. Results with MATLAB looks promising with subdued over and under estimation when compared with the manual area (debris area). Accuracy assessment for the classification was done using manually digitized reference data with the help of confusion matrix. Future attempt includes analysing the distribution with respect to altitude, presence streams and temporal change in the distribution on different years.

Keywords: Supraglacial debris, optical satellite imagery, MATLAB

Abstract Id: 609
Mango varieties viz. Alphonso and Totapuri were selected for varietal discrimination in the present study. The leaf spectrum was collected in the field using ASD field spectroradiometer (350-1800nm) during October 2015 at Indian Institute of Horticultural Research (IIHR) farm, Hessaraghatta, Bengaluru. Sample size was 25 for each variety measured in three replications and each observation was an average of 5 spectral measurements. Spectral reflectance was used in generating hyperspectral two band vegetation indices (HVI) viz., Normalized Difference Index (NDI) and Simple ratio (SR). A mean matrix was created for each of the variety separately for every band combination. In order to find out which combination had maximum amount of separation a difference matrix was created. Further filter was applied specifying that average standard deviation of samples of two groups Alphonso & Totapuri for a particular index should not exceed the separation between the groups. The selected features were then classified. SR with support vector machine (SVM) classifier had the highest accuracy of 83 per cent due to the inherent capacity of the algorithm to transform non-linearly separable features to higher dimension, this accuracy further improved to 89 per cent by using a subset of selected band combinations adopting wrapper filter. NDI with SVM also gave similar results i.e., 83 per cent of the classification accuracy. Also the best subset could only increase that value to 85 per cent. The selected band combinations fell in the region of Red edge, NIR and SWIR, respectively. The significance of each band combination, i.e., each feature was found using one-way annova test. Bands at 1236, 1125, 940, 1530 nanometer were found to be significant in both the methods.

Keywords: Varietal Discrimination, Support vector machine, Mango, simple ratio, normalized difference index

Abstract Id: 610
UNDERSTANDING THE SURGING BEHAVIOR OF KARAKORUM GLACIERS: CASE STUDY OF HISPAR GLACIER

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Karakoram glacier surges are poorly understood. On Karakoram glaciers that surge, velocities increase rapidly to rates between one and two orders of magnitude greater than during quiescence. Peak velocities of around 2 km a-1 during summer months have been observed. The study presents a new data concerning glacier velocity and changes in the surface characteristics of a surge-type glacier Hispar Glacier located in the Karakoram mountains (Lat: 36.02 - 36.32 N; Lon: 75.02 - 75.55 E). This study analyses the behaviour of an actively surging glacier, Hispar glacier using remote sensing methods. We used 15 m panchromatic band from Landsat 8 OLI of September 2013 and September 2015 to assess the changes in glacier velocity, glacier geomorphology and supraglacial water bodies. For the velocity estimation, correlation image analysis (CIAS) was used, which is based on normalized cross-correlation (NCC) of satellite data. On-screen digitization was employed to quantify changes in the glacier geomorphology and dynamics of supraglacial water bodies on the glacier. Our velocity estimates indicate that the upper part of the glacier is presently undergoing an active surge which not only affects the debris distribution but also impacts the development of supraglacial water bodies. Velocities in the actively surging part, the main glacier trunk and its three tributaries, range from 30 to 112 m yr-1. The surge of Hispar also impacts the distribution of debris causing folding of the medial moraines features present on the glacier surface. During the analysis period the supraglacial lake and pond area decreased by ~71%. It was further demonstrated that the ice dynamics of the main glacier trunk is largely governed by the dynamics of the tributary glaciers.

Keywords: Glacier surge; Karakoram; Supraglacial water bodies; Glacier velocity

Abstract Id: 611
ASSESSMENT OF SILTATION OF UPPER GANGA CANAL FROM HARDIWAR TO MUZZAFARNAGAR DISTRICT IN UTTAR PRADESH USING MULTIBEAM SONAR SURVEY EQUIPMENT

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MBES (Multibeam Echo Sounder) is a compact equipment which easy to operate and provides accurate depth. An acoustic (SONAR) wave sent through equipment in form of pulses and analyses for the reflection. Bathymetric survey of a very shallow water (3-15 m) in canal (Upper Ganga Canal) was carried out by using a SONAR system. Bathyswath transducer is transmitting and receiving the sound waves. A motion sensor also known as attitude sensor used to reduced error of Roll, Pitch, Heave and Gyro. This type of error is generally due to motion of motorboat or marine vessels. DGPS (Differential Global Positioning System) has been used for coordination after establishment of a base station to reduce the errors of position. All system were fixed in a motorboat.

The canal has running from Haridwar (Uttrakhand) to Aligarh (Uttar Pradesh) however the surveyed area is from Dam Kothi (Haridwar) 29º56'31.14"N 78º9'20.33"E to Bhopa (Muzaffarnagar) 29º21'43.44"N 77º47'41.99"E. The survey has been carried out in the month of Dec.2016 and Jan.2017 at the time of running of canal for irrigation to Rabi crop. Whole length of Bathymetry survey in the Upper Ganga Canal is divided into 5 stretches which were further subdivided into sub stretches and the outcome generated after post processing. The final output were produced as map showing depth value of 10 cm at a regular interval. The depth of water in the Canal varies from 3m to 4.5m in general. The point showing depth of 11m and 12m at a few spot may be due to pot holes. The field identification of deepest spot of 15m is due to an abandoned well dug up in the past. Bathymetry survey is also very useful for assessment of silt load in canals by rapidly survey to solve major issue of irrigation department.

Keywords: Multibeam Echo Sounder, SONAR, Differential Global Positioning System, GIS, Contour

Abstract Id: 612
LAND SUBSIDENCE MONITORING BY USING PSI WITH ASCENDING- AND DESCENDING- ORBIT SATELLITE IMAGES

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The land subsidence has been a global serious problem due to climate change and ground water extraction, and the inexpensive land subsidence monitoring technique is highly required. Persistent Scatterers Interferometry (PSI) is the land subsidence measurement method by using multi-temporal synthetic aperture radar (SAR) images, and it can accurately measure wide range of land subsidence. However, the estimated displacement is obtained only along the radar line-of-sight (LOS) direction. Therefore, it is expected to develop a method for measuring three dimensional (3D) displacements by combining multi-directional observation.

In this work, we examine the fusion of the displacement results from SAR images observed on ascending- and descending-orbits. First, we estimate the displacement from the ascending- and descending-orbit SAR images, individually. Then, the vertical and horizontal land subsidence components are estimated from the two results. In experiments, we selected Kansai International Airport, located in the western Japan, as a study area because it is reported to show both vertical and horizontal displacements. We used 24 ALOS-PALSAR ascending images from 2006 to 2010 and 14 ALOS-PALSAR descending images from 2006 to 2010. We compared with the annual leveling data the vertical displacement estimated from the ascending-descending combination. The root mean squared error (RMSE) was 0.016 m/year. Further investigation is necessary to match pixels that represent the identical location among ascending- and descending- orbit SAR images, and to validate the estimated horizontal displacement.

Keywords: PSI, InSAR, surface deformation, ascending-descending combining, SAR

Abstract Id: 613
The hyperspectral satellite data always has the lower spatial resolution because of the limitation of signal-noise ratio. But the target can also be identified accurately by the feature information of spectrum, however, it becomes difficult in shadow area because of the weak signal and the increasing of noise. Many researchers focus on the study of hyperspectral target detection, but less was done on the study in shadow area.

In this study, we proposed to analyze the effect factor of target detectivity in shadow area using classical hyperspectral target detection algorithms. And we also try to remove the shadow using moment matching method, enhance the spectral information of target. Compared with original data, the results of shadow removed show that the detection accuracy is improved using Adaptive Coherence/Cosine Estimator (ACE) and Constrained Energy Minimization (CEM). The results of shadow removed or not removed are not changed too much using Orthogonal Subspace Projection (OSP). And a certain improvement is achieved by using spectral angle mapping (SAM), however, the separation of target and background is not quite good.

Keywords: hyperspectral image, target detection, shadow, CEM, OSP

Abstract Id: 614
PGIS Tool for Erosion susceptibility and Soil Conservation Planning in a Watershed of Nepal

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Stakeholders can be mobilized by several approaches in soil and water conservation activities. In this research, stakeholders were involved in Participatory Geographic Information System (PGIS) based Current Erosion Damage Assessment (CEDA) in some plots. This study aimed to find the soil erosion susceptibility by PGIS based CEDA tool. Tool was employed existing knowledge of stakeholders and expert knowledge by focus group discussion to erosion mapping and to select soil conservation measures for the benefit of conservation measures in watershed. The tool involved stakeholders to map soil erosion indicators and determine the soil erosion status in which they plan for soil conservation measures in sub watershed. Participatory tools showed that key stakeholders' knowledge of local ecology brings awareness of the status of soil erosion indicators and soil erosion status to community. Stakeholders identified the fields or hill slopes suffering from the severe soil problem with help of tools and make the common view of soil erosion impacts on soil productivity. The study showed that the farmers' evaluation of soil degradation scenario was accepted by the farmers than evaluation conducted by outsiders. Their idea during the soil erosion mapping tool was the source of runoff that damage down slope field could be identified the collective planning of SWC measurement in sub watershed. This tool helped to increase awareness among farmers and identification of fields that were severely eroded and causing run on down slope fields. Farmers approved the soil erosion status map with their own indicators and perceptions and export.

Keywords: Participatory Geographic Information System (PGIS), Current Erosion Damage Assessment (CEDA), erosion, stakeholders

Abstract Id: 617
MEASURING INEQUALITY IN THE LEVEL OF INFRASTRUCTURE AND AMENITIES PROVISION AMONG URBAN AREAS OF INDIA: A GIS-BASED APPROACH

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Urbanization is the process of increase in the share of the population living in urban area. The present study tries to identify various levels of which inequality in the provision of infrastructure and amenities in India exist. Indicator for major infrastructure and amenities (Railway, Highways, Road, Airport, Seaport, Electricity, ICT’s., Water Supply and Sanitation) were identified through literature. Gini’s coefficient, Coefficient of variation (CV) and Theil index were chosen as a static measure of inequality in this study. Census of India-2011 data for urban areas in India was utilized for the analysis. GIS-based spatial k- Means cluster analysis was performed in GeoDa to identify regions with the similar level of spatial association/disassociation infrastructure and amenities. Finally, these identified regions were utilized to measure inter and intra-regional inequality in India. The spatial interaction between clusters and outliers for infrastructure and amenities has been calculated through spatial auto-correlation (Global and local Moran’s I statistics) and Geary’s C index. The spatial variability and distribution of the inequality and CV have been assessed through Getis-Ord Gi* hotspot analysis. Additionally, the consistency of Global Moran’s I has been checked through Anselin Local Indicators of Spatial Association (LISA) statistics. Results show a very high level of inter-regional inequality among the regions. Intra-regional inequality is moderate to low. The Global Moran’s I varied between 0.2 to 0.8 throughout the study period, and the maximum value was observed in the developed western and southern India, and moderate to lower approximation was found over the Northern and Eastern part of India. Similarly, the observed and expected G values were found the maximum in the western and southern regions of India, and the minimum G was evident in the Northern and Eastern regions of India.

Keywords: Infrastructure, Inequality, spatial auto-correlation, Getis-Ord Gi, Global Moran’s I

Abstract Id: 618
EMISSION INVENTORY OF SRINAGAR CITY, KASHMIR, INDIA USING SATELLITE AND GROUND BASED MEASUREMENTS

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The study focuses on generating a high-resolution spatial emission inventory of major air pollutants and greenhouse gases (CO, CO$_2$, NO$_x$, BC and PM) for Srinagar City, India for the year 2013 using multi-source data. The bottom-up as well as top-down gridded emission inventory was prepared using the information about the land use/land cover, demography, biomass burning, coal burning, industries, vehicular traffic, brick kilns, and waste sectors. The assessment provides information on emissions of greenhouse gases emitted from various anthropogenic sources in the city like woody biomass burning, vehicular traffic and coal burning. The emissions vary sectorally and show spatial distribution patterns. Coal consumptions dominate CO$_2$ emissions, while as the vehicular traffic contributes to the NO$_x$ emissions. The inventory assessment made in this study is a pointer to the future emission pathways for Kashmir valley wherein local air pollutants and GHG emissions, and would therefore require alignment through well-crafted development and environment strategies. Emission estimates of NO$_x$, CO, CO$_2$, black carbon and organic carbon from fuel combustion and industrial sources for the year 2013 provide information about the role of fuel and coal burning annually and seasonally. Results show that CO$_2$ and CO emissions from woody biomass in Srinagar city is 6412.02 tons and 477.189 tons respectively and NO$_x$ and BC emission from wood biomass burning is 3.74 tons and 1.05 tons receptively for the year. The coal burning in Srinagar for heating and brick kilns generates 29989.5 tons of CO$_2$ annually. The emission trends were compared with EDGAR annual emissions. Further, MODIS AIRS satellite based data were validated with the observed data for Srinagar during the 2013 meteorological year. Results indicate a good agreement and therefore satellite-based data could be useful for monitoring air quality especially in the regions where ground data is not available.

Keywords: Air Quality, Air Quality Emission Inventory, Vehicle emissions, Greenhouse gases

Abstract Id: 621
EVALUATION OF ENORMITY OF RAVINE EXPANSION IN BHIND AND MORENA DISTRICT OF LOWER CHAMBAL VALLEY USING REMOTE SENSING AND GIS TECHNOLOGY

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Millions of hectares of agriculture land in the country degraded by ravines and gully erosion which is extending every year. Along the rivers ravines are formed because of their flow at lower level from surrounding table land, covered with thick, soft and unconsolidated alluvium. The land degradation from water-induced soil erosion appears to be a serious problem in India and only fragmentary information on the factors affecting soil erosion is available. The study area is a part of Bhind and Morena district of Madhya Pradesh included in the Survey of India toposheet number 54 J/9 and 54 J/10. Present study is carried out in Lower Chambal valley between the parallel of 260 15’ and 260 50’ north latitude and 780 30’ and 780 45’ occupying an area of 574 km². The study area is occupied by Chambal and Kunwari rivers which have carved out extensive ravine. The Chambal ravines seems to be originated from tectonic activity as there is no obvious relation has been established with climate till date, but continuous deforestation exposes the nutrient deficient soil, which exacerbates ravines expansion. Change detection study has been carried out in parts of Chambal river valley to analyze the effectiveness of remedial measures for soil conservation and reclamation of affected land for useful purpose. Various image processing techniques have been used for the identification and delineation of different geomorphological units, ravines and gullies land. Raw Pan images of CARTOSAT-1 of 5 meter resolution was digitally rectified and geo-referenced by taking LISS-III multispectral image as a reference image in Erdas Imagine 2011 through an image to image tie down by identifying ground control points (GCPs). The ravine in the district of Bhind and Morena show an increase of about 36% in ravine area during last 32 years (1975-2007). Ravines of Chambal and Kunwari rivers

Keywords: Ravines, Bhind, Chambal, CARTOSAT and LISS III

Abstract Id: 622
Climate change especially rising temperature in the urban areas has become a major focus of attention worldwide because of the impacts it is having on the human habitats, the biodiversity and on the urban ecosystem for the services they provide. In India, the level of urbanization has increased from 27.81% in 2001 to 31.16% in 2011. Urbanization has led to distinct landscape changes, which typically involve substantial replacement of natural cover with hard impervious materials resulting Urban Heat Island (UHI), which affects the lives of the inhabitants. Time series Landsat (TM and ETM+) and MODIS (MOD09A1, MOD11A2) satellite data products have been employed in this study to quantify the spatiotemporal LST and UHI intensity for the year of 2000, 2005, 2010 and 2015, respectively over the Nagpur Metropolitan Area (NMA). Biophysical characteristics of the urban area have been assessed through Normalize Difference Vegetation Index (NDVI), Normalize Difference Built-up Index (NDBI) and Normalize Difference Bareness Index (NDBaI). It was found that the thermal behavior around the city varied distinctly. The observation reveals that the temperature is very high within the city core area as compared to the surrounding areas of the city, especially towards the southern side. The temperature is low towards the northern part of the city which may be due to the presence of vegetation in Pench national park and in the areas occupied by active agricultural field. The temperature is comparatively lower on the western side of the city than the eastern region. Certain peripheral areas, however, show a higher temperature. This can be due to the development taking place in the peripheral areas of the city and destruction of vegetation in the outlying parts of the city. The mean land surface temperature recorded to be highest in ward 115, 116, 121, 1, 2, 30.

Keywords: Land surface temperature, urban heat island intensity, Satellite, Remote sensing, Normalize Difference Vegetation Index

Abstract Id: 623
MONITORING RICE CROP USING TIME SERIES SENTINEL-1 DATA IN GOOGLE EARTH ENGINE PLATFORM

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Rice is one of the major crops grown in Asian countries. Information on its temporal changes is a major concern with respect to food security and decision making. Synthetic Aperture Radar (SAR) data is highly suitable for monitoring rice crop, especially in tropical and subtropical areas, where pervasive cloud cover during the rainy seasons prevents the use of optical data. The SAR observations are sensitive to growth stages, LAI and biomass, crop height, soil moisture, and inundation frequency and duration. This makes SAR predominantly useful for mapping rice extent and monitoring rice growth. However, monitoring the rice dynamics requires an intensive multi-temporal data.

Dense time series Sentinel-1 C-band SAR data at high spatial resolution offers new opportunities for monitoring agriculture. However, in operational level several practical problems arises in agricultural monitoring using Sentinel-1 data. It requires processing and management of a large amount of satellite imagery that consequently leads to a ‘Big Data’ problem. In this present work, this problem is overcome with the Google Earth Engine which offers a cloud computing platform to access and seamlessly process a large amount of available satellite imagery. In this present research, time series Sentinel-1A Interferometric Wide (IW) Swath images are utilized to monitor rice crops across Bardhaman district of West Bengal, India. Time series phenological analysis of the Sentinel-1 data is then performed to assess rice information across the test site. The results indicate a low backscatter during transplanting stage due to the inundation. As rice crop grows from tillering to heading, the backscatter response increases proportionally with increase in biomass. After ripening and near harvesting stage, a decline in backscatter is observed. The results show strong ability of Sentinel-1 data to assess and monitor rice crop for better decision making.

Keywords: Google earth engine, SAR, Sentinel-1, rice, phenology

Abstract Id: 624
As one of the major challenges in land management is to generate an updated land use and land cover information. The European Space Agency (ESA) has recently launched and operated its earth observation satellites under the Copernicus program. Sentinel 2 is considered as super-spectral remote sensing data with 13 bands (including 3 red edge bands) for vegetation and land applications. Southern Leyte in the Philippines is a mountainous island and it is relatively near the Pacific Ocean. These are some of the many reasons why it is difficult to acquire a cloud-free image in the area making land use and land cover classification challenging. This research used Sentinel 2 Multi Spectral Imager with the least cloud for the year 2017 and implemented a machine learning based classification. This research implemented a pixel-based machine learning method with the inclusion of the spectral vegetation indices (e.g. LAI, fCover, NDRE, NDVI) as additional bands. ANN method is able to handle a non-linear and complex dynamic environment and is therefore suitable for land use and land cover classification of a large area with high class and spectral variability. Result showed that overall classification accuracy increased by 12% with the inclusion of vegetation indices in discriminating spectrally similar cover and class types as compared to using only the multi-spectral bands. Elevation and slope derived from IfSAR DEM were also included as additional bands and results showed improved class separability for upland and lowland vegetation cover types by 7%. This paper demonstrated that the increased spectral bands of Sentinel 2 (with observations in the red-edge) has enable better classification accuracies with the addition of spectral vegetation information and elevation data using single date image only. This method enables increased classification accuracy using single date Sentinel 2 data vital in areas where acquiring cloud-free image is limited.

Keywords: Sentinel 2 MSI, Land Use and Land Cover, Artificial Neural Network, Leyte-Philippines

Abstract Id: 625
HSV INDEX-BASED GENERIC TEXTURES MATCHING FOR EFFICIENT BUILDING MODEL VISUALIZATION

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Digital city is composed of DEM, building models, textures, cadastral data, etc. It is a powerful platform to demonstrate spatial relationship such as urban planning, disaster simulation, etc. Simultaneously, among the tasks, building façade texture is one of the most important and expensive works of digital city implementation. Model texturing methods can be divided into realistic images and generic textures. Realistic images give real look-and-feel but it is difficult to process them automatically and is usually inefficient in visualization. On the other hand, generic textures can solve these disadvantages; however, they are not real to human. This study analyzes realistic images and optimize generic textures by the developed image analysis algorithm and HSV index-based method. The procedure is separated into data preprocessing, opening extraction, texture classification and color replacement. Opening extraction detects opening such as window, balcony, etc. positions by grayscale gradient. Texture classification analyzes feature lines to classify the wall material. After classification, optimizing improved generic texture by HSV index-based method could minimize a generic texture database. The results demonstrate a better performance and realistic look-and-feel comparing to generic textures chose randomly.

Keywords: 3D GIS, digital city, realistic image, generic texture

Abstract Id: 626
CHALLENGES AND SOLUTIONS SATELLITE BIG DATA IN MONGOLIA

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Mongolia is a very special country; it has a total land area of 1,564 million sq. km and a population of 3 million people (NSO, 2015). Almost 60 percent of the population of Mongolia’s sprawling capital, Ulaanbaatar, lives in informal settlements, known as ger areas (NSO, 2015). There are million more people who are dependent on the natural environment as they move with their herds as pastoralists. These physical, social and economic conditions in contrasting human habitats are sharpened by strong cultural identities which define Mongolians’ rapidly changing requirements for productive livelihoods, human security and physical protection from disaster risks. The country is exposed to several types of serious natural hazards. Therefore, different time series satellite data from different source are very important for monitoring, management and research.

Since 1970s, Mongolian earth scientists have used satellite imagery for mapping activities and most of the thematic maps were produced with the support of remotely sensed data derived from former Soviet Union’s space vehicles. Nowadays, almost all national government organizations including institutes of Mongolian Academy of Sciences are actively using and developing remote sensing applications. There are also number of private and non-government organizations, which have started to use remote sensing data and ground positioning systems. Some specific targeted remote sensing laboratories and centers are available in Mongolia based on state universities.

In this research we will discuss about some challenges and their solutions on satellite big data in Mongolia

Keywords: satellite data sharing, satellite big data, Mongolia

Abstract Id: 627
AUTOMATIC EXTRACTION OF FAULTS USING BY REMOTE SENSING TECHNIQUES

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The geology of Mongolia is divided northern domain and southern domain by the Main Mongolian lineament. In the northern domain, it is mainly composed of pre-Cambrian and lower Paleozoic rocks, while the southern domain is composed of Lower to upper Paleozoic rocks.

Much of the territory of Mongolia is located in highly seismic areas of Central-Asian seismic belt and is subjected to frequent and large earthquakes. Its western half is particularly seismically dangerous. Only in twentieth century more than 60 earthquakes with M>5.5 (7 to 11-12 - intensity) occurred here, among which tens of earthquakes were responsible for severe destruction of the earth surface. Four earthquakes have been recorded in Mongolia since 1906 in the range of M7.4 to M8.1. A cluster of exceptionally large earthquakes in the interior of Asia occurred from 1905 to 1967: the 1905 M7.9 Tsetserleg and M8.4 Bolnai earthquakes, the 1931 M8.0 Fu Yun earthquake, the 1957 M8.1 Gobi-Altai earthquake, and the 1967 M7.1 Mogod earthquake (sequence). Each of the larger (M8) earthquakes involved strike-slip faulting averaging more than 5 m and rupture lengths of several hundred kilometers (Walker et al. 2008).

In this research we proposed methodology for the design of a knowledge-based lineament identification system provides quite satisfactory results for geological purposes. Due to its multi-scale feature detection and representation ability, this methodology might potentially be adopted for the identification of several features of geological

Keywords: fault, filter, tectonic lineaments

Abstract Id: 629
URBAN LAND USE CHANGE STUDY IN MONGOLIA USING RS AND GIS TECHNIQUES

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In recent years, because of the rapid increase in world population and the irreversible flow of people from rural to urban areas, the urbanization and urban sprawl have become the common problem of governments and decision-makers in both developed and developing countries. As it is known, the developed countries have a higher percentage of urban inhabitants than the developing countries. However, rapid urbanization process is mainly occurring in less developed countries, and it is expected that in future most urban expansions will occur in the developing world.

Mongolia, as many other developing countries, has problems with the urban expansion and the growth of population in the main cities. For example, within the last two decades, Ulaanbaatar, the capital city of Mongolia has been significantly expanded due to mainly enormous migration of people from rural areas as well as some development activities. To prevent from the rapid urban expansion, especially from the unplanned urbanization process, urban planners and decision-makers need to regularly evaluate the current development procedures using updated urban planning maps. One of the easy solutions could be the use of satellite images, because present remote sensing (RS) has the huge potential of providing accurate spatial information over a large area in a short time sequence.

The aim of this study is to analyze the urban land use changes of Central Ulaanbaatar, Mongolia using very high resolution RS and geographical information system (GIS) data sets. For the study, the changes that occurred before 1990 were compared with the changes that occurred after 1990 and the socio-economic reasons for the changes were described. For the development of the primary digital database, a large scale topographic map and historical description of the land use elements were used. To update the database and extract the reliable urban land use information, very high resolution panchromatic and multispectral Quickbird images of 2016 were fused. For the fusion, some advanced data fusion techniques are compared in terms of the enhancement of spatial and spectral variations of urban features. Overall, the study demonstrates that during the market economy the central part of the capital city is urbanized very rapidly.

Keywords: Urban, Land use, Change study

Abstract Id: 630
APPLICATIONS OF RS FOR FOREST CHANGE STUDY IN MONGOLIA


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Generally, forests are managed for an evolving constellation of objectives: timber and other commodities production; environmental stability, ecological balance, maintenance of wildlife habitat; water quality protection; wilderness and open space preservation; and, in the coming years, as a buffer against climatic change, and effective management of these resources, requires reliable and timely information about their status and trends. It has been found that much of the existing forests have been destroyed, mainly by shifting cultivation, timber preparation, legal and illegal logging, forest fires and increased number of people involved in agricultural activities.

Traditionally, optical RS images have been widely used for forest monitoring and management. Since the end of the last century, single polarization SAR data sets have been increasingly accessible for the forest specialists. As the present space science and technology are so advanced, very high resolution multichannel optical and polarimetric SAR images are available for different forest studies. The combined application of optical and radar data sets can provide unique information for different forest studies, because passive sensor images will represent spectral variations of the top layer of the forest classes, whereas microwave data with its penetrating capabilities can provide some additional information about forest canopy.

The aim of this research is to conduct a forest change study in the Bogdkhan Mountain, which is a nature reserve with protected status situated in Central Mongolia using optical and microwave images. For the analysis, multitemporal optical and SAR images as well as some other thematic maps have been used and different RS and GIS techniques were applied.

Keywords: Forest study, Optical and Microwave

Abstract Id: 633
EFFECTS OF DAMMING ON SEAGRASS DISTRIBUTION IN CON DAO ISLANDS, VIETNAM FROM 1970'S TO 2010'S

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In recent years, damming along Mekong river has led to many controversies over its environmental impacts. The 1990s and 2000s have witnessed a rapid increase of dams on Mekong river, noticeably in China and Laos. Despite rising concerns about adverse effects of dams on the environment, more dams are being constructed along the Mekong river. Besides reported impacts such as low water levels in the Lower Mekong River and changes in sediment flux, impacts on ecological systems in the coastal areas are also significant.

To investigate on effects of dams on the marine ecosystem, seagrass is chosen to be an indicator, because of its sensitivity to environmental changes and its significance in carbon sequestration, biodiversity, and coastal protection. Various seagrass beds in Vietnam have observed an alarming rate of decline. Con Dao islands, located 90km south from Mekong river mouths, were chosen as the study site due to its proximity to the Mekong River and diversity in seagrass species. Time series of seagrass distribution from the 1972 to 2017 in this area could be calculated from multispectral medium resolution Landsat images (from Landsat 1 to Landsat 8).

By comparing the trend in seagrass distribution in the coastal area of Con Dao islands and the construction of dams on Mekong River, this paper gives important insights on environmental impacts of damming and suggestions for dam management.

Keywords: Dam, Seagrass Distribution Mapping, Mekong River, Carbon sequestration

Abstract Id: 634
REGIONAL SURFACE MOTION STUDY OF MARITIME SILK ROAD BASED ON C-BAND SAR OBSERVATION

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21st century Maritime Silk Road (MSR) plays an important role in the development of Asia economy. There is a huge natural distinct along the belt and road and the type of disaster varies with a wide range and a high-frequency occurrence. With a background of global climate change, various ground surface hazards tend to be more active. In the meantime, MSR is facing great risk by involving a large number of cross-border and overseas transportation, energy and other infrastructure construction. As a consequence, regional deformation trend as well as infrastructure health in the key hubs along the MSR is a key issue.

The technical measures of deformation monitoring include geodetic survey, Global Positioning System and geological patrol monitoring methods. However, observation is discrete and limited by manpower, material resources and the terrain visibility conditions. In recent years, InSAR is regarded as the most promising deformation monitoring technology, which can achieve a large coverage and continuous observation. The measurement accuracy of InSAR arrives at a millimeter-level and the complementary between InSAR and other techniques can increase the reliability of the results of surface deformation monitoring. Therefore, deformation monitoring along the MSR based on InSAR techniques are of great importance, which may provide scientific basis for geo-hazard early warning.

In this study, we propose a framework combining Permanent Scatterer InSAR and Small Baseline Subset to conduct deformation monitoring along the MSR. C-band SAR observation is used to extract deformation velocity. A regional map covering 5 Provinces along the MSR is generated. Risk assessment and health diagnose will be done on the infrastructures including both sea port and airport. The significances of this study will benefit urban planning and risk management along MSR.

Keywords: Maritime Silk Road, surface deformation, InSAR, infrastructure diagnose

Abstract Id: 635
Multisensor Data Fusion is an emerging technology of current scenario. Requirements of Data fusion is increasing day by day in every field whether it's Department of Defense (DoD), Medical diagnosis, smart buildings or Subsurface analysis to determine the location and the sizing of an anomaly and many more. Pan-sharpening deals with a special type of data fusion in which a panchromatic image is fused with Multispectral (MS) image. Pan-Sharpening stands for “Panchromatic sharpening”. It means using a panchromatic (single band) image to “sharpen” a multispectral image. In this sense, to “sharpen” means to increase the spatial resolution of a multispectral image. This paper proposes a new method of Pan Sharpening with help of super curve and B-spline. The main novelty lies in forming the super curve out of the point to point mean of pixel value of all Bi cubic-Spline curve which is created by pixels of multispectral and panchromatic(PAN) images. The aim of this contribution is to retain a large extent of both, the high spatial component of PAN and high spectral resolution of MS data in local structure, i.e., the local information of MS data must sustain properly. In the experiment, the impact of this proposed method is analyzed in both way of quantitative and qualitative analysis. The performance shows that the better way of preservation of quantitative information is use of B-Spline with respect to weighted mean in PAN sharpening method.

Keywords: Pan-sharpening, B-spline, super curve

Abstract Id: 640
QUANTIFYING TROPICAL FOREST ABOVE-GROUND BIOMASS AND CARBON STOCK USING GEOGRAPHICALLY WEIGHTED REGRESSION (GWR) APPROACH

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Carbon dioxide (CO₂) believed to be one of the major greenhouse gases which impact the climate change. Tropical forests are well known as the world’s most complex trees which embraces a large stock of carbon in the global carbon cycle and contributes enormous amount of above-ground and below-ground biomass. Therefore, this study aims to estimates the carbon stocks for at Ayer Hitam Forest Reserve, Malaysia using geographically weighted regression (GWR). The variables used are the tree height derived from airborne light detection and ranging (LiDAR), HTL and crown projection area (CPA) derived from fusion of LiDAR and WorldView-3 (WV-3) images. This study contributes to the potential of linking the above-ground biomass and carbon stocks estimation and remotely-sensed data by using Geographically Weighted Regression (GWR) and ordinary least square (OLS) approach. The GWR models exhibited the substantial improvement in the above-ground biomass and carbon stocks estimation and beneficial for future development and strategic planning of the forest resources.

Keywords: Above-ground biomass, carbon stock, geographically weighted regression, ordinary least square, LiDAR.

Abstract Id: 641
HYBRID POLARIMETRIC DECOMPOSITION MODELLING OF LUNAR SURFACE FOR SCATTERING CHARACTERIZATION USING MINIRF DATA

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Planetary surface and subsurface exploration have made Radar Imaging a prominent tool in characterizing the spatial distribution of the physical properties of the regolith in a way to account for the detection of patchy ice deposits in the permanently shadowed polar regions. Deriving pseudo quad polarimetric information from dual polarized data explored the potential of hybrid polarimetry in mapping eccentric polar orbits. Some of the remarkable morphological features (viz. Shackleton, Erlanger, Rozhdestvenskiy, part of Cassini crater and near Apollo 15 landing site) in the lunar mid-latitude and polar regions are studied by analyzing their scattering characteristics using Mini-SAR (Chandrayaan-1) and Mini-RF (LRO) data. Polarimetric stokes child parameters such as CPR, relative phase ($\delta$), degree of polarization ($m$) of backscattered signal, Poincare ellipticity parameter ($\chi$), polarization angle ($\alpha$) and LPR are found to be significant in understanding the physical properties of the lunar surface and subsurface features. Hybrid decomposition techniques i.e. $m$-$\delta$ and $m$-$\chi$ have been used to characterize the backscatter and then compared with the Eigenvector analysis of hybrid-polarized data using $m$-$\alpha$ technique. All the features of lunar mid-latitude regions are characterized by low CPR values within the local crater surface which are found to have primarily odd and even bounce scattering as observed from $m$-$\chi$ decomposition images, which proved to be more dominant in these regions. The study also demonstrates that features in polar regions are distinguished by high CPR values with random scattering observed from more dominant $m$-$\delta$ decomposition. Shackleton crater proved to have more subsurface scattering as compared to others with maximum LPR value. The overall analysis concludes in characterizing different regions of the lunar surface on the basis of scattering mechanism.

Keywords: Radar Imaging, Regolith, Hybrid Polarimetry, CPR, Eigen-vector analysis

Abstract Id: 642
At present, the need for a global access to decentralized management of geographical information is driving the researchers to reorganize a system design and architecture that enable interoperability of data models and services. In this regard, a web-based geographic information system (WebGIS) defined as a GIS system that uses web technology to communicate between a server and a client, has been attracting more interest within the geoinformation community. There are some commercial and open-source-based WebGIS systems. The selection of any WebGIS system depends on many factors such as goals/objectives, functions and services of an organization, users/stakeholders, sustainability, available budget, and so on.

ArcGIS is one of the best commercial GIS systems existing in the world. It is used for creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic information in a range of applications; and managing geographic information in a database. The system provides an infrastructure for making maps and geographic information available throughout an organization, across a community, and openly on the Web. On the other hand, open source platforms are becoming more and more capable. One of such platforms is GeoMoose Open Source Web Framework. It has a number of strengths including modularity, configurability, and delivers a number of core functionalities in its packages. GeoMoose can be fully controllable and programmed by Javascript, XML, PHP and Map script. As an open source project, GeoMoose is also built upon other open source projects such as MapServer and OpenLayers.

The aims of this study are a) to compare already developed Web-GIS platforms based on the ArcGIS and open source software considering the needs of the stakeholders, and sustainability in terms of operational requirements, functionality and software/hardware improvement, and b) to propose how they could be updated by RS data. For this purpose, two WebGIS systems developed for geological and environmental applications in Mongolia have been compared.

Keywords: WebGIS, RS and Geological application

Abstract Id: 643
CHANGE DETECTION ANALYSIS WITH SPECIAL REFERENCE TO AQUACULTURE DEVELOPMENT IN WEST GODAVARI DELTA OF ANDHRA PRADESH, SOUTHERN INDIA USING GEOSPATIAL TECHNIQUES

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The present study is aimed to assess the landscape changes occurred in the delta region of West Godavari district, Andhra Pradesh state, India using a series of multi-temporal satellite data over a period of two decades between 1996 and 2016. Spatio-temporal changes were identified using Landsat-5TM, 7-ETM+ and 8 OLI imageries along with extensive field work data. The change detection results were examined particularly in focusing the development and consequences of aquaculture within the study area. The accuracy of image classification has found to be more than 90%. The data revealed that the agriculture land was enormously decreased due to its rapid conversion into aqua ponds. The study suggests that the integration of remote sensing and GIS was an effective approach for analyzing the land use and cover changes.

Keywords: Land use/land cover, Change detection, NDWI, Remote sensing & GIS, West Godavari delta

Abstract Id: 644
LANDSLIDE SUSCEPTIBILITY ANALYSIS USING AN ARTIFICIAL NEURAL NETWORK (ANN) MODEL: A CASE STUDY IN YUSHAN NATIONAL PARK, TAIWAN

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Landslide phenomenon continues to be one of the worst natural disasters around the world. The clear need for accurate landslide susceptibility mapping has led to multiple approaches. This study aims to perform landslide susceptibility analysis at Yushan National Park (YNP) in central Taiwan based on an Artificial Neural Network (ANN) Model using Remote Sensing data and Geographical Information System (GIS). In recent years, Machine Learning (Artificial Intelligence) and Data Mining techniques have been introduced as efficient tools in hazard and susceptibility analysis. ANN is one of the commonly used not only because it can deal with complex and non-linear relationships between slope stability and conditioning factors to predict landslide but also minimize subjectivity. Besides the static (predisposing) factors of landslide occurrence including topographic slope, aspect, curvature, elevation, topographic index, lithology, distance to geological lineament, some dynamic (triggering) ones have been selected in this study such as Normalized Difference Vegetation Index (NDVI) and precipitation (rainfall). All factors are analyzed with an ANN Model with back-propagation training method to generate the landslide susceptibility map for the YNP. A landslide inventory map available for this study is used to validate the model. The results show where landslide is more likely to occur and highlight the most important factors that can explain the behavior of the phenomenon under some environmental conditions. Finally, this work can be used as a basic data to assist slope failure, slope management and land use planning taking into account landslide occurrence in Taiwan every year.

Keywords: Remote Sensing, Landslide Susceptibility, ANN, GIS, Yushan National Park

Abstract Id: 645
The study aimed to determine tropical forest changes from year 1989 to 2016 and to determine the relationship between the changes of forest area and urban growth at central Peninsular Malaysia. The methods used for change detection analysis were matrix union and image differencing. The results showed that area of forest decreased gradually from the year 1989 until 2016 where the starting area was 4774.05 hectares had become 2583.09 hectares. Another land cover that seems change gradually increased was the urban area, which had 25.2 hectares in the year 1989, and 1420.09 hectares in the year 2016. The map showing the region where the changes of land cover occurred. The coefficient of determination between forest changes and urban growth was 0.74. The relationship between explanatory variable, urban and response variable, forest implies that when urban area increases, the forest area decreases with 0.74 of R-squared value.

Keywords: forest change, urban growth, remote sensing, image differencing

Abstract Id: 648
IDENTIFICATION OF SUITABLE SITES FOR RAINWATER HARVESTING IN A HARD ROCK TERRAIN USING REMOTE SENSING AND GIS

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Groundwater development through rainwater harvesting in the hard rock terrain from southeastern part of India was considered as a sample study to determine the main source of groundwater in the area. Most of the regions of India have become increasingly depend on groundwater for domestic, agriculture and industrial needs that resulted in the depletion of groundwater resources. Though, the development of groundwater in hard rock regions is very limited and is predominantly available in weathered mantle and lineament zones. Rainwater harvesting is one of the important structural component at watershed or local level as it is helpful to recharge the groundwater. This paper uses multi criteria decision analysis, conventional field methods, and geospatial techniques to identify suitable water harvesting structures in the area. Geospatial methods can assist for generating various models in a logical and scientific way towards groundwater development with the available data.

Keywords: Rainwater harvesting, hard rock, Watershed, Gosthani river, Eastern Ghats, Visakhapatnam, Tribal region

Abstract Id: 649
At present, China is facing major problems in environmental issues where the haze problem of air pollution is the most prominent. It seriously affects the sustainable development of China's cities and regions and the health of the people. The main reason for this problem is due to the accelerated process of urbanization in China and the influx of people around the big cities. Complete control of air pollution in the area of distribution and its variation is extremely important for environmental management and planning, and with the development of quantitative remote sensing technology, the use of remote sensing data for PM2.5 concentration monitoring is of great significance.

This article will use the Terra-MODIS satellite aerosol data, and select a sunny day image from 2014 to 2015, because the data is open for free and has good economic applicability. Using the modern system theory is more mature dark pixel algorithm and 6S radiation transmission mode, the aerosol optical thickness in the area of Hangzhou is inversed and according to the season for a case study. At the same time, I also obtained the corresponding time period Hangzhou monitoring point instant PM2.5 concentration monitoring value. The spatial and temporal dimensions of the PM2.5 concentration in Hangzhou were analyzed by using the principle of spatial statistical analysis. Finally, I select the best part of the aerosol optical thickness inversion results. The correlation between aerosol optical thickness and PM2.5 concentration obtained from the monitoring station was analyzed and regression analysis. Here is mainly to establish in a linear quadratic function, three function, index function regression model on the basis of logarithmic function and power function. The best fitting model is selected by comparing the regression model goodness $R^2$ and the model test precision. It is found that the fitting effect of unary three equation is the best, $R^2$ more than 0.5, This shows that the equation may have a good explanation.

Keywords: PM2.5; AOD; dark element method; MODIS; regression analysis; related analysis

Abstract Id: 650
DEVELOPMENT OF METADATABASE FOR MONGEOCAT SYSTEM IN MONGOLIA

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Digital geographic dataset is a representation of some model of the world for use in computer analysis and graphic display of information. The underlying model is an abstraction, requiring approximation, simplification, and omission of some aspects, and is always just one of many possible views. To ensure that the data are not misused, the assumptions and limitations affecting the creation of data must be fully documented. Generally, the data are used by many people from a wide range of disciplines. Proper documentation will provide those unfamiliar with the data with a better understanding, and enable them to use it properly. Good quality documentation will also provide data producers with a keener knowledge of their holdings and will allow them to better manage data production, storage, updating, and reuse.

Recent advances in computer software and hardware for managing and analysing data, particularly fusing with geographically referenced observations, has resulted in a vast increase in the use of digital information solutions worldwide. The resulting awareness of the importance of geography and how things relate spatially is impacting almost all aspects of society. Increasingly, individuals outside of geographic information science and information technology are producing, enhancing, and modifying digital geographic information. As the number, complexity, and diversity of geographic information resources grow, a method for providing an understanding of all aspects of these resources increases in importance.

The main objectives of this study are a) to define an approach for the metadata contents, including categories, spatial metadata for geoscience applications, and b) to describe workflows for metadata search and metadata entry and some examples. For this purpose, metadatabase that includes a set of mandatory, optional and conditional elements for the MONGEOCAT system has been developed based on the geographic information metadata standards of ISO19115, ISO19139 and MNS 5774.

Keywords: Metadatabase, MONGEOCAT System and Development

Abstract Id: 651
MINERAL MAPPING OF FeO AND TiO2 OF THE CASSINI CRATER USING MOON MINERALOGY MAPPER (M3) OF CHANDRAYAAN - 1

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An essential aspect of space exploration is the study of the geological makeup of any interplanetary body and the Moon has been a source of great fascination for scientific researchers in this field. Lunar surface mineralogy provides significant shreds of evidence for interpreting the composition and evolution of the planet’s crust. Spectral changes due to perpetuated exposure of the planetary surface to the space environment could be quantified using geological remote sensing. These optical properties depend on relative rates of surface modification processes. Assessment of the measure of lunar soil evolution may be denoted in terms of Optical Maturity (OMAT). Optical maturity parameter is an indicator of the maturity of lunar regolith and hence, its estimation is of great importance in studying the geological characterization of the lunar surface. Also, lunar mineral exploitation may be of significant importance in the near future. Synergetic use of spectral reflectance of lunar surface acquired by Moon Mineralogy Mapper (M3), onboard Chandrayaan - 1, with a hypothetically hyper matured optimized end member of the data, along with the standard weight percentages of FeO and TiO2 from lunar returned samples of Apollo and Luna landing sites, has been carried out using remote sensing based data interpolation techniques. The present work focusses on quantifying elemental concentration for characterizing lunar soil using hyperspectral data for Cassini crater, located at the eastern end of Mare Imbrium. Using local mosaic of M3 hyperspectral data and recalibrated element derivation algorithms, local modal abundance of FeO and TiO2 is found to be 6.88 wt% and 3.59 wt% respectively. The overall results establish that the crater is highly matured with a local modal maturity index of 0.064.

Keywords: Moon Mineralogy Mapper, Regolith, Optical Maturity, Optimized end member, Weight Percentage

Abstract Id: 652
QUANTIFYING THE TRENDS AND IMPACTS OF LONG TERM DESICCATION OF LARGE LAKES USING TIME SERIES OF HISTORICAL SATELLITE DATA

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The last three decades witnessed a wide scale desiccation of some of the largest lakes around the world. The most recent disappearance occurred when Lake Poopó in Bolivia with a surface area of around 3000 Sq.Km, completely dried up by the end of 2015. This study will focus on four large lakes - Lake Poopó, Aral Sea, Lake Chad and Lake Urmia which either completely disappeared or underwent massive shrinkage. Being a source for irrigation, fishing, tourism and other ecosystem services, large lakes often drive the socio-economic conditions of millions of people in the catchment area. This ecological disaster is mostly blamed on overexploitation and mismanagement of water resources for agriculture, aggravated by climate change. However, there is lack of detailed studies looking at long term drying and wetting patterns and processes associated with these ecological disasters.

The availability of high frequent temporal data from multiple satellites (~ 1 km spatial resolution) for the last three decades, offers a unique opportunity to study this phenomenon globally. However, many of the historical data from National Oceanic and Atmospheric Administration (NOAA) satellites has geometrical discrepancies due to well documented on board satellite issues. Here we present a novel approach to develop a corrected homogenised time series for thirty years since 1985 from multiple satellites representing geo-physical variables derivable from optical and thermal satellite data. We use these time series of land/water surface temperature, various land/water indices, evapotranspiration and reflectances to study the patterns and processes of desiccation of lakes and its impact on agriculture in the adjoining catchment area. Here we present the preliminary results from this study for the Lake Urmia in Iran. The current status of these lakes using latest high resolution satellite data will also be reported.

Keywords: Lakes, Desiccation, Remote sensing, Time series

Abstract Id: 653
APPLICATION OF HIGH RESOLUTION SATELLITE IMAGES FOR URBAN GREENNESS MONITORING: A CASE STUDY OF RIO DE JANEIRO CITY

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A very high-resolution WorldView-2 satellite data was used in our experimental application for mapping urban greenness. A normalized difference vegetation index (NDVI) and water index (NDWI) based techniques were used as indicators for environmental information extraction. Our attempt was focused on usage of high resolution satellite remote sensing and geographical information system (GIS) for assessing urban environmental health by mapping spatial extent of vegetation. Our experiment indicate that very high-resolution satellite data is a potential tool for temporal monitoring of closely spaced urban features, which interact closely with each other in an urban landscape. We suggest that this exercise should be validated for Indian cities for rapid extraction of information relevant to urban land covers, such as, vegetation, water bodies and man-made features to understand their interactions. Our attempt, in a broad way, focuses on rapid understanding of well-established classical phenomena, such as greenhouse effect, urban heat islands, energy scarcity, urban natural resources and endangered wildlife protection. It is concluded that cutting edge technologies such as GIS and remote sensing can be practiced to develop a natural urban ecosystem and to evolve new facets to environmental issues which may contribute to our better planning of urban resources in near future.

Keywords: Greenness, WorldView-2, NDWI, NDVI

Abstract Id: 654
LANDSLIDE ASSESSMENT USING GIS-BASED FREQUENCY RATIO METHOD: A CASE STUDY OF MAE PHUN SUB-DISTRICT, LAPLAE DISTRICT, UTTARADIT PROVINCE, THAILAND

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Advancement in Remote Sensing technology and improvement in spectral and spatial resolution is increasing day by day. Moreover, coverage and availability of the products are becoming easier, so it is possible to monitor landslide susceptibility, damages and landslide inventory mapping using different satellite data. The principle factors that trigger mass movement (Landslide, Debris flow, Mudflow) are 1) Intense prolonged rainfall and Earthquake 2) Anthropogenic factor (construction on steep slopes, deforestation, urbanization, overloading, and mining activities). The landslide inventory maps’ made by SPOT 5 satellite image. This study utilized the causative factors i.e. Slope, Elevation, Aspect, Plan and Profile Curvature, Land use/Land cover, proximity to streams and proximity to the road, using geospatial software to make a landslide susceptibility map. The correlation between the landslide and thematic layers has been analyzed in GIS environment, so it calculates the frequency ratio score for each class of thematic layers. The summation of frequency ratio was calculated for each parameter and consequently get the landslide susceptibility indices. Eventually, the study area was divided into five classes landslide susceptibility classes ranges very low (8.93%), low (24.21%), moderate (28.91%), high (23.92), and very high (17.02%). The results were also validated using success rate curve method, so the prediction accuracy found to be 60% which are acceptable results.

Keywords: Remote Sensing & GIS, Statistical Model, Susceptibility Assessment, Rainfall, Accuracy Assessment

Abstract Id: 655
APPLICATION OF RS FOR URBAN LAND COVER CHANGE STUDY

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The aim of this study is to compare the changes that occurred in the main urban land cover classes of Ulaanbaatar, the capital city of Mongolia during centralized economy with the changes occurred during market-based economy and describe the socio-economic reasons for the changes. For the analysis, multitemporal high resolution optical and microwave remote sensing (RS) images as well as geographical information system (GIS) and census data sets are used. To extract the reliable urban land cover information from the available RS data sets, a refined maximum likelihood classification (MLC) algorithm that uses spatial thresholds defined from the local knowledge is constructed. Before applying the classification decision rule, some ordinary and advanced image fusion techniques are applied to the selected RS data sets, in order to define the most efficient fusion method that can create the best color image to be used for training sample selection as well as for defining the contextual knowledge. Overall the research indicates that during the periods of both centralized and market-based economies Ulaanbaatar city is urbanized very rapidly and significant changes occur in the ger area of the capital city.

Keywords: Urban land cover, Change analysis, RS, Classification

Abstract Id: 656
A STEREO SELECTING METHOD OF MULTI-VIEW MATCHING MODELS BASED ON MULTIPLE CRITERIA

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For correctly matched image feature points, the vector of locally aggregated descriptors (VLAD) is generated for each image, and the imaging condition and local consistency is also analyzed for each image. Applying VLAD Criteria, imaging condition Criteria and local consistency Criteria, a matching quality analyzing method of multi-view images is given by matching measure robustness analysis. And based on the method, a stereo selecting matching method for multi-view images is proposed, of which the principles, algorithms and matching process are given. Experiments are done on both spatial and aerial multi-view images, and the experimental results prove that the proposed method could select images of great matching quality to obtain more correct matching results, and thus, to some extent, is more effective than traditional multi-view matching methods.

Keywords: VLAD; Multi-view Image; Matching Quality; Matching Measure; Stereo Selecting Matching

Abstract Id: 658
AN EFFICIENT REGRESSION STRATEGY FOR EXTRACTING FOREST BIOMASS INFORMATION FROM SENTINEL-2A AND FIELD INVENTORY DATA AT SARISKA TIGER RESERVE

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Forest inventory data often provide the required base data to enable the large area mapping of biomass over a range of scales. Biomass and leaf area index (LAI) are important variables in many ecological and environmental applications. However, spatially explicit estimates of above-ground biomass (AGB) over large areas may be limited by the spatial extent of the forest inventory relative to the area of interest (i.e., inventories not spatially exhaustive), or by the omission of inventory attributes required for biomass estimation. The continuous synoptic coverage of remotely sensed data have led to their increased application for AGB estimation over large areas, although the use of these data remains challenging in complex forest environments. In this paper, two approaches have used to spatially estimate biomass of Sariska Tiger Reserve. The traditional method for calculating biomass based field inventory measurement, such as; Diameter at breast height, tree height and basal area etc. and lab analyzed data such as; dry weight, volume and specific gravity. But the modern method used in this study is based on the remote sensing data i.e. Sentinel-2A (10m), which acquired data through satellite. Indices like, Normalized Vegetation Differential Index (NDVI), Ratio Vegetation Index (RVI) and Differential Vegetation Index (DVI) etc. has been calculated using the near infrared and Red wavelength for calculating AGB. The indices shows high relationship with the ground observed biomass (for NDVI $r^2 = 0.74$, for RVI $r^2 = 0.50$, and for DVI $r^2 = 0.40$). Biomass has been calculated using the index NDVI, as it shows highest relationship. The proposed method shows appreciating result with an RMSE= 0.69, which means this method can be used as a guideline for study in other area for predictions the above ground biomass using sentinel data.

Keywords: Biomass, NDVI, regression model, spectral response modeling, tropical forest.

Abstract Id: 659
PREDICTING BORO RICE YIELD USING MODIS VEGETATION INDICES AND MACHINE LEARNING TECHNIQUES IN HAOR REGION OF BANGLADESH


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Bangladesh is an agricultural country where rice is the most important crop that contributes to the maximum amount of cultivation throughout the country. Efficient monitoring of rice crop is vital for better planning of food security for Bangladesh and many other Asian countries. Current monitoring techniques of rice and other food crops in Bangladesh mostly rely on the conventional ways of gathering manually estimated data from fields to generate regional and national yield and production statistics. Remote sensing image analyses have been recognized as reliable methods for predicting rice and other field-crops yield well ahead of harvesting, however yet to be adopted in the mainstream national crop monitoring system in Bangladesh. Cultivation of Boro rice is crucial in the Haor Region distributed over eight (8) districts in North-Eastern part of Bangladesh as it is the only crop that can be grown in the area. This study has been devised to develop a simple and efficient method for Boro rice yield forecasting from MODIS vegetation indices and ancillary statistical data, which can be adopted to develop and employ an operational rice yield monitoring system for Bangladesh. The current study will add some new attributes in an attempt to improve the accuracy of the previously reported studies. These attributes are weather conditions and sub-district wise data of the previously recorded productivity. In order to make the forecasting technique faster, machine learning algorithms will be used to make the predictions by an intelligent forecasting system.

Keywords: Remote Sensing; Satellite Imagery; NDVI Index; Intelligent System

Abstract Id: 660
MODELING TEMPERATURE-VEGETATION INDEX (TVX) SPACE & QUALITY OF LIFE (QoL) FOR ENHANCED CHANGE DETECTION ANALYSIS: A CASE STUDY OF AHMEDABAD CITY

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The current study analyzes the relationship between most common environmental parameters such as vegetation cover and temperature for assessment of best possible sites to have a better Quality of Life (QoL). Temperature-vegetation index space (TVX) have been widely used across the globe for studying the relationship between these two phenomena. In urban areas, TVX can be used to assess the loss of vegetation, finding out drought prone areas and urban environmental quality (UEQ) etc. Landsat series data from Thematic Mapper (TM), Enhanced Thematic Mapper plus (ETM+) and Operational Land Imager (OLI) sensors was used for calculation of spectral index ratios such as Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), Normalized Difference Bareness Index (NDBI), and Normalized Difference Built-up Index (NDBI) over the span of 14 years for Ahmedabad City area. TVX space was built based on NDVI and Land Surface Temperature (LST) values, which brought about the spatial correlation between them.

This relationship between was assessed for the specified timeline to assess the trend of TVX space. Change in areal extent of built up was also correlated with the change in the NDVI for the Ahmedabad City. Going further, comparison between the classes extracted from SIR and classes extracted from unsupervised classification was also attempted. Results showed that, SIR performed better in feature extraction over traditional classification methods. For the timeline considered, the detected change showed Northward trend in TVX space. Anomaly like drought was also detected and confirmed.

Keywords: TVX, QoL, Spectral Index Ratios, Enhanced Change Detection

Abstract Id: 661
SYNTHETIC APERTURE RADAR AND OPTICAL REMOTE SENSING BASED LAND USE LAND COVER CLASSIFICATION OF SHIVAMOGGA, KARNATAKA

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Synthetic Aperture Radar (SAR) due to its penetration capability through clouds, soil and vegetation cover has been used for the retrieval of bio geophysical and structural parameters. Therefore, SAR data is an alternative option to provide information of earth surface. Size, shape, configuration and electrical properties of the surface can be obtained from backscattered electromagnetic radiation. Study area is Shivamogga district, Karnataka. Pre-processing of radar data which includes calibration, slant to ground range conversion and multi-looking was performed. To minimise presence of speckles from SAR data refined lee filter was applied. Textural changes in SAR data is analyzed using Gray level Dependency Matrix. Urban settlement showed high backscatter value, forest vegetation showed moderate backscatter and very less amount of backscattering was received from waterbodies which appeared darkest feature in SAR imagery. Spectral property of feature is utilized in optical data while SAR backscattering property is used to get structural information. This study aims to utilize Sentinel 1A, C-band data, Sentinel 2 (optical) data which is 10m in spatial resolution and has 12 spectral bands. To fuse the Sentinel 2 dataset band 8 (0.84 µm), 4 (0.66 µm), 3 (0.56 µm) were used and backscatter of Vertically transmitted Horizontally received (VH) was used in this study. VH has sensitivity to the vegetation information and so it is considered in image fusion. Both SAR and optical data are brought to the same projection before the image fusion. Supervised classification is applied to optical and fused image to identify different classes such as agriculture crop, agriculture fallow, deciduous forest, evergreen forest, water, and built up. The overall accuracy of supervised classification for optical is 82.5% and fused data is 88% with kappa statistics 0.74 and 0.83 respectively. Unsupervised classification performed in optical and radar data is visually interpreted.

Keywords: Synthetic Aperture Radar, Land Use Land Cover, Gray Level Dependency Matrix, Image Fusion

Abstract Id: 664
Synthetic Aperture Radar (SAR) remote sensing has been widely used for archaeological features which include cultural and natural heritage sites. SAR Interferometry has the potential to measure displacement and elevation of objects appearing on earth surface. Prime focus of present study is to evaluate potential of C-band SAR interferometry for subsidence mapping of cultural heritage site. For this study Rohtasgarh fort was selected as study site as it had been a major political and cultural center of sixteenth century, and used by various ruling dynasties due to its strategic location. C-band interferometric pairs were used which were acquired in March and April 2017. Interferometric processing for interferogram generation, coherence and phase unwrapping was performed to generate a displacement map. Modified Goldstein Filter was used to minimize the noise of interferogram. High value of coherence was observed on the fort boundaries because these behave as stable scatterers which wasn’t changed during second acquisition and low value of coherence was recorded for vegetation both inside and outside the fort. Displacement map was generated from unwrapped interferogram with 0.3 threshold value of coherence. A comparision was also made between displacement maps with and without filtering approaches. Most areas in and around the fort hadn’t shown any displacement but upliftment of 10mm was seen inside the fort premises. Upliftment observed in displacement map in fort area may be possible either due to increase in moisture or dust storm. A few areas outside the fort premises showed subsidence due to loose debris washed off by rain.

Keywords: Interferometry, coherence, phase unwrapping, Modified Goldstein Filter, displacement map

Abstract Id: 665
MONITORING SELECTED ICEBERG CALVING EVENTS IN EASTERN ANTARCTICA USING OPTICAL REMOTE SENSING DATA

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Antarctica, which holds the largest ice sheet on the Earth, is one of the most sensitive part of our planet to the climate change. Calving of ice shelves and glaciers contributes to major mass loss along the coast of Antarctica. In the present study, the ice dynamics along the Eastern coast of Antarctica using iceberg calving as an indicator has been studied. Using moderate resolution satellite data of LANDSAT 4,5,7 & 8, we monitored calving events that occurred in the past and icebergs likely to be calved in future, and identify potential zones where major calving could take place along the eastern Antarctica region. The present study focuses on 3 such events from Prince Astrid Coast. In this region, as on 04-12-1989, there was a crevasse of 45.15 km which had grown up to 77.84 km by 19-11-2001. Also, as on 16-03-2016, an iceberg of an area 29.88 sq.km which is about to calve can be observed. Here the rifts can be seen which are orthogonal in orientation relative to the calving front. In the third case, there is presence of 12 widening rifts and around 48 physical structures, as observed on 16-03-2016. The total length of the 12 rifts is around 215.68 km with minimum 1.24 km and maximum 40.55 km in length. This study shows that temporal monitoring of iceberg calving is necessary for deciphering climate change signals.

Keywords: icebergs, Antarctica, Multispectral data

Abstract Id: 667
Iceberg calving is sudden release and breaking away of a mass of ice from ice shelves, glaciers or ice fronts. It starts with formation of crevasses and rifts. In Antarctica, various ice shelves are witnessing major and minor iceberg calving at the coast. Calving is the major cause of ice mass loss in Antarctic ice shelves. These calving events can give an idea about what is going on in ice shelves and what could be the factors triggering the increase rate of rifts. Remote Sensing technique has been playing a significant role in tracking these calving events. In this study, three calving events have been studied. Two of them have already been calved and one event is about to calve in future. The first event is reported in the Leopold & Astrid Coast and calved an iceberg of area 6.09 km$^2$. The second event took place along Sabrina Coast and calved a total area of 33.06 km$^2$. The third event is along Luitpoid Coast and various rifts are going to calve an iceberg. The study tracks the calving events through optical remote sensing along the coast of Antarctica.

Keywords: Antarctica, Iceberg calving, Remote Sensing

Abstract Id: 669
COMPARATIVE ASSESSMENT OF IMAGE FUSION ALGORITHMS IN SYNTHETIC APERTURE RADAR IMAGERY

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The All-weather, all-time nature of Synthetic Aperture Radar (SAR) imageries makes it more suitable for object detection, disaster management, military and environmental surveillances applications. The availability of multi-frequency SAR space-borne/airborne imageries (C, X, L, S band etc.) gives a new dimension in Microwave Remote Sensing imagery Research. The operating frequency is a key factor in the penetration depth to see the effects on extracting information in SAR imagery. The combine use of diverse sensors is of major interest in Remote Sensing field. Fusion of remote sensing images with different spatial and spectral resolutions plays a key role for extracting information. Image fusion is an application for making use of two or more complementary images/spectral bands of the same or different sensors for the same area to get more information and to enhance the quality of image interpretation. This paper comparative assess the various existing image fusion techniques (IHS, DWT, PCA etc.), with an objective of analysing the algorithms and procedures followed by them and their utility in object detection in SAR imagery.

Keywords: SAR, Image Fusion, Object Detection, PCA,

Abstract Id: 670
Precise mathematical representation of spectral response functions (SRF) of Earth Observation sensors plays a key role in calibration exercises and also for out-of-band signal compensation in the operational phase of these sensors. With narrow spectral bandwidths and high radiometric resolutions built with ocean colour sensors (Moderate resolution imaging spectrometer-MODIS, Medium resolution imaging spectrometer-MERIS, Sea viewing wide field of view sensor-SeaWIFS, Ocean colour monitor-OCM) in order to extract small signal from the ocean upwelling radiance in the high background atmospheric scattering, more accurate representation of the SRF assumes significant importance. The SRF measurements are typically carried out at about 1nm intervals in the in-band spectral region and at about 10nm intervals in out of band regions. In this paper we investigated a detailed interpolation analysis of the SRF of Ocean Colour Monitor flown in Indian Oceansat-2 mission. Several methods have been reported in the literature. Of these, it is found that the OCM SRF data is best fitted with B-spline interpolation method, and hence was adopted in the present study. Criteria for re-sampling rate was worked out and spectral interpolation covering all the spectral regions was carried out. The interpolated data was analyzed in detail for bands specific parameters (peak wavelength, centre wavelength and full width half maximum). We found that cubic B-spline based interpolation function is the optimal method for representing the SRF covering all the spectral regions in terms of arriving at a smooth function to compensate noise in the laboratory recording process, and also providing accurate interpolated values in the gaps between samples.

Keywords: Ocean Colour Monitor, spectral response function, cost function, peak error, smoothness control

Abstract Id: 671
This study aims at analysing morphological changes of glaciers of Sikkim. Two important morphological parameters such as area and length of three high altitude glaciers, having three different (large, medium and small) sizes have been considered to analyse and understand the trends of change over the years 2000 and 2015. LANDSAT 5 TM (Thematic Mapper) and LANDSAT 8 OLI (Operational Land Imager) images were used in conjunction with Shuttle Radar Topography Mission Digital Elevation Model. Significant changes in terms of area and length have been observed in the sample glaciers of this region. Analysis of meteorological data pertaining to weather parameters such as maximum, minimum and average temperature as well as rainfall over the period of 1969 and 2016 exhibited an increasing pattern of minimum temperature, which in turn causes increment in average ambient temperature. These can relate to the causes of shrinkage of these glaciers. Whereas, throughout the entire observation period, the maximum temperature exhibits decreasing trend. Statistical techniques like Pearson's correlation coefficient, Two - tailed, Student's t-test value at p <0.05 significance level confirms these observations. Alteration in the amount of snow-melt or change in atmospheric temperature can lead to shrinkage of glaciers, which would have negative impact on water supply downstream as well as other concurrent impacts in future.

Keywords: Sikkim Himalaya, Glacier morphology, Climate, Glacier recession

Abstract Id: 672
In recent years the use of UAV has increased in assessment and monitoring of forest. Developments in remote sensing methods have made it possible to extract forest boundaries from satellite and UAV images. By means of high spatial resolution of UAV images, forest and tree species can be extracted with high precision. Due to the improvements in high spatial resolution of satellite and UAV images, new image classification methods have been developed. One of those image classification techniques is object based classification method which extracts data with high accuracy from high spatial resolution images.

In this study, Camburnu Natural Park in Surmene District of Trabzon Province located in the Black Sea Region was selected as the study area. This area is unique in the world where yellow pine forests can land at sea level. An unpredicted forest fire realized on January, 8 2017 and around 20 hectares were destroyed. To determine agriculture area, current high resolution UAV images of study area were obtained and image pre-processing steps was employed. Object based classification is applied in two part as segmentation and classification. Firstly, multiresolution segmentation is processed for optimum parameters (scale, shape, colour, compactness and smoothness) and segments are assigned proper classes by rule based. In this way images are classified by using object-based classification method. As a result, optimum parameter is determined for segments. The boundaries of forest and burned forest in the study area have been handled with high precision in vector format without salt and pepper effect.

Keywords: Object Base Classification, Forest Fire, High Resolution Image, Agricultural, Unmanned Aerial Vehicle,

Abstract Id: 673
The geometry of simple impact craters reflects the properties of the target materials, and the diverse range of fluidized morphologies observed in Martian ejecta blankets are controlled by the near-surface composition and the climate at the time of impact. Using the Mars Orbiter Laser Altimeter (MOLA) data set, quantitative information about the strength of the upper crust and the dynamics of Martian ejecta blankets may be derived from crater geometry measurements. Here we present the results from geometrical measurements of fresh craters 3-50 km in rim diameter in selected highland. We find large, resolved differences between the geometrical properties of the freshest highland and lowland craters. Simple lowland craters are 1.5-2.0 times deeper (=5σ difference) with >50% larger cavities (=2σ) compared to highland craters of the same diameter. Rim heights and the volume of material above the preimpact surface are slightly greater in the lowlands over most of the size range studied. The different shapes of simple highland and lowland craters indicate that the upper ~6.5 km of the lowland study regions are significantly stronger than the upper crust of the highland plateaus. Lowland craters collapse to final volumes of 45-70% of their transient cavity volumes, while highland craters preserve only 25-50%. The measured volumes of continuous ejecta blankets and uplifted surface materials exceed the predictions from standard crater scaling relationships and Maxwell’s Z model of crater excavation by a factor of 3. The excess volume of fluidized ejecta blankets on Mars cannot be explained by concentration of ejecta through no ballistic emplacement processes and/or bulking. The observations require a modification of the scaling laws and are well fit using a scaling factor of ~1.4 between the transient crater surface diameter to the final crater rim diameter. The refined excavation model provides the first observationally constrained set of initial parameters for study.

Keywords: Mars Crater, Mars Orbiter Laser Altimeter (MOLA), Martian ejecta blankets, Diameter Rim, Crater Volume

Abstract Id: 674
Indira Gandhi Canal Project has enhanced considerable food production in desert area of Rajasthan. It also brought problems such as waterlogging and secondary salinisation. Perched water table is developed at low-lying interdunal flats and depressions due to presence of subsurface fine textured/ mixed kankar/ gypsum impermeable layer and absence of natural surface drainage. Continuous application of surface irrigation at higher frequencies and seepage from unlined canals has resulted into a steady rise of water table causing waterlogging/ salinisation. One of the significant advantages of SAR is penetrating dry soil and detect subsurface geological and fluvial features. This paper presents the results of identifying subsurface canal seepage areas in the inter dunal areas of Hanumangarh district, Rajasthan. Multi-date dual polarisation (HH, HV) MRS RISAT-1 SAR data acquired from 31st May, 2014 to 23rd June, 2015 were analysed to study the temporal variations of canal seepage. SAR amplitude images were extracted and converted to sigma nought values using calibration coefficients. Signature of buried water bearing structures i.e. water accumulated in the depressions below the sand dunes were analysed and identified. Landsat-8 images and field soil moisture data were used as complementary information to find the surface, subsurface soil moisture, crop and vegetation condition of the area. Subsurface moisture was identified with higher sensitivity in the cross polarizations (HV) images due to high volume scattering caused by the moisture bearing structures. Cross polarization ratio (CPR) observed was higher in case of subsurface soil moisture than surface moisture signature. Significant depletion in soil moisture was observed in the images acquired during the month of June, 2015.

Keywords: Dual polarisation, MRS RISAT-1 SAR, Multi-date images, subsurface soil moisture

Abstract Id: 675
GEOSPATIAL ANALYSIS OF COASTAL VULNERABILITY ALONG THIRUVANANTHAPURAM COAST, KERALA

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Coastal areas of Kerala State in the southern part of the Indian are potentially vulnerable to accelerated erosion hazard. Along the 72-km coastline, most of the coastal areas, including tourist resorts, hotels, fishing villages, and towns, are already threatened by recurring storm flood events and severe coastal erosion. The present study is an attempt to develop a coastal vulnerability index (CVI) for the maritime state of Kerala using nine relative risk variables. Most of these parameters are dynamic in nature and require a large amount of data from different sources. In some cases, the base data is from remote sensing satellites; for others it is either from long-term in situ measurements or from numerical models. Zones of vulnerability to coastal natural hazards of different magnitude (very high, high, medium, low and very low) are identified. In earlier studies, tidal range was assumed to include both permanent and relative sea level. However, the mean of the long-term tidal records tends to dampen the effect of episodic inundation hazards such as tsunamis. For this reason, in the present study, tidal range has been considered as an additional physical process parameter to calculate the CVI. Coastal regional elevation has also been considered as an additional important variable. The map prepared for the Thiruvananthapuram coast under this study can be used by the state and district administration involved in the disaster mitigation and management plan.

Keywords: Coastal vulnerability index, Remote sensing, Geoprocessing model, Relative sea level rise, tidal range and coastal management

Abstract Id: 678
IDENTIFICATION OF URBAN GROWTH DRIVING FACTORS IN PUNE USING REMOTE SENSING AND LOGISTIC REGRESSION

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Urban growth of Indian cities has recently received wide attention since the announcement of the smart city initiative by the Government of India. Understanding the spatial extent of urban growth along with the driving factors is crucial to plan and make a city more livable, sustainable or smart. Many Indian and international scholars have used remote sensing to quantify the urban sprawl of Indian cities, while paying less attention to understand the driving factors responsible for urban growth.

In this study we employed remotely sensed data to study the temporal dynamics of urban growth of Pune city and we analyzed the process of urban growth based upon driving factors identified and derived from remote sensing data utilizing a multiple logistic regression technique. Fifteen driving factors were considered for the analysis pertaining to physical, proximal, socio-economic and legal characteristics. Physical as well as proximal characteristics (e.g. elevation, slope, distance) can be easily derived from remote sensing. As the nighttime light intensity is related to the economic status of a region, the change in stable light intensity derived from the DMSP OLS sensor was used as a proxy for a socio-economic variable. Using these driving factors as independent variables, a series of multiple logistic regression models were fitted to model the urban growth of Pune. All models were further carefully scrutinised to identify the best model based on the Akaike Information Criterion (AIC) value.

The results reveal that the proximal characteristics (esp., distance to built-up, highways and industries) are the most important driving factors. The proxy socio-economic variable derived from DMSP OLS sensor showed a positive relationship to urban growth. Legal constraints such as reserved forest, red zone (buffer zone around deference establishment) and protected areas around water bodies showed the expected suppressive effect on urban development.

Keywords: Urban growth, Driving factors, Remote sensing, Logistic regression, Pune.

Abstract Id: 679
Increase of natural disasters in Sri Lanka with unbearable damages on human life in recent decades are becoming greater in both number and the volume. Analysis of disaster census proves that most the cases are man made disasters, which could be prevented in long run planning of formalized human settlement and systematic industrializing. However, minimizing of disaster damages can be observed at pre-disaster preparation with exercising of disaster prevention programs.

This technical paper elaborates successful efforts experienced in very recent two huge disasters in the vicinity of Colombo. Flood inundation in Kelani Ganga River basin and Landslide at Meethotamulla garbage dump made unbearable damage to human life. Disaster management authorities faced with critical issues in collecting information of human life and property damage. In this context, the Survey Department as the geospatial base data producer, activated a just in time technical group to produce disaster intelligent map as quick production. Very recent LiDAR point cloud and 1:10,000 topographical feature dataset were readily available in the specific area. The most critical issue was to capture the ground reality before and after disaster occurrence. Sentinel Asia quick activated satellite images made extremely invaluable service to detect the pre ground features in the affected areas while images captured with UAV camera were used to trace ground reality after the disaster. The experience gained, firstly in Landslide at Meethotamulla garbage dump on 16th April, 2017 was immensely useful in subsequent exercise of flood mapping in May. Multi accuracy level spatial data integration and processing steps adapted to elaborate intelligent maps and dynamic geospatial models will be discussed in this technical publication. Further, Survey Department drafted Disaster Mapping Policy Document to regularize future proceedings will also be discussed.

Keywords: Disaster, Earth slide, Flooding, LiDAR, UAV

Abstract Id: 681
MULTI-CRITERIA BASED SUGARCANE CROP SUITABILITY ANALYSIS USING GEO-INFORMATICS TECHNOLOGY IN SURAT DISTRICT, GUJARAT STATE

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Although primarily an industrial economy, Gujarat's large sections of the population are dependent on climate sensitive sectors such as Agriculture. To improve sustainable agricultural growth, the Food and Agricultural Organization (FAO, 1976) recommended an approach for land suitability evaluation for crops in terms of suitability ratings ranging from highly suitable to not suitable based on climatic and terrain data and soil properties.

In the present study, Sentinel-2 (10-m spatial resolution) data covering Surat District of 24-March-2017 was analyzed in this study. Field data on crops grown, crop growth stage, Crop variety, GPS location, field size, soil moisture status etc. was collected. The Normalized Difference Vegetation Index (NDVI) image was generated using the NIR and RED channel data. The NDVI thresholding method was attempted to classify Sugarcane into three categories, namely Excellent, Medium and Good based on the NDVI values of these classes.

The second part of this study is a qualitative evaluation of land to determine sugarcane crop suitability in Surat district based on four pedological variables, which are soil Nitrogen-Phosphorus-Potassium (NPK) status, soil reaction (pH), Organic Carbon (OC), NDVI classes based on Sentinel-2 data of Sugarcane, soil type, etc. were considered for sugarcane crop suitability using weighted multi-criteria evaluation (MCE) technique in a Geographic Information System (GIS) environment. The suitability analysis was carried out by overlaying all thematic maps in terms of the weighted overlay method using the spatial tools. Each parameter from the various thematic maps was ranked by assigning weights according to its importance for sugarcane cultivation. The areas were categorised as most suitable, moderately suitable, suitable and not suitable. The suitability-wise villages were also tabulated by overlaying the village boundary map. The results indicate that Remote Sensing and GIS technology is very useful for conducting crop suitability analysis based on multi-criteria approaches.

Keywords: NDVI, GIS, GPS, Crop suitability, Multi-criteria evaluation

Abstract Id: 682
MAPPING OF ALTERATION MINERALS USING WORLDVIEW-3 DATASET: A CASE STUDY FROM PART OF SOUTH PURULIA SHEAR ZONE (SPSZ), EASTERN INDIA

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NIR_SWIR spectroscopy has the potential to identify the important alteration minerals Viz. white micas, Fe-oxide/hydroxide, Sulfates, Clay, and Chlorite group of minerals. In the present study, multispectral Worldview-3 data are used for mineral identification in part of SPSZ. The (SPSZ) is the ~ 4-5km wide semi arcuate zone hosting highly sheared and deformed rock masses having an extent of 120km in length. It demarcates the boundary between Proterozoic Chhotanagpur Granite Gneissic Complex (CGGC) in North and Paleoproterozoic North Singhbhum Fold Belt (NSFB) in South. SPSZ has ore potentiality similar to Singhbhum Shear Zone that lies to the south of SPSZ is well known for U and polymetallic Cu deposits. Previously, SPSZ has been explored for U, REE, Clay, Fe, Mn along with some Au and other polymetallic deposits of low concentration in some specific location like Beldih, Tamar, Tamakhun, Kutni, Mednitanar, etc. The area for this study encircles the eastern extremity of the shear zone, located in Purulia (West Bengal; India). To identify and demarcate the alteration mineral assemblage sprawling different mapping techniques e.g. SAM (Spectral Angel Mapper), LSU (Linear Spectral Unmixing) and MTMF (Mixture Tuned Matched Filtering) were applied with the image derived spectra as end member, which are further compared with the library for mineral identification. The results reveal that the zone of alteration minerals assemblages such as Kaolinite, Montmorillonite, Pyrophyllite, White Mica, Goethite, Hematite, and Quartz occur parallel to the shear zone. These minerals assemblage indicates the presence of low-temperature hydrothermal alteration. The correlation between occurrence and drainage using digital elevation model (DEM) also evident the hydrothermal origin.

Keywords: Alteration, Worldview-3, SPSZ

Abstract Id: 684
SPATIO-TEMPORAL ANALYSIS OF CROPPING PATTERNS IN SOUTH INDIA

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Study of cropping practices and changes occurring in it over time for a region is critical to the field of agronomics. The increase of temporal resolution of Earth Observation Satellite platforms has resulted in easier monitoring of the Earth’s surfaces. The need for large scale and structured analysis of satellite data is growing. One of the challenges in understanding agricultural practices is to built a history of land use outcomes and extracting the local phenological responses. Also, identification of change in crop practice described here as change event can provide valuable insights about the possible factors that were responsible for such an event be it biological, physical, hydrological or climatic. This paper attempts to built a spatiotemporal library of crop practices based on the vegetation responses recorded by satellite imagery. Our paper presents an approach to process the raw data obtained from the satellite images into representative phenological growth curves. With vast data spanning across multiple regions in hand, we can extract phenological parameters from these time dependent sequences and use these features to study changes occurring in agricultural practices and to discover regions that are spatially correlated or to find out crop practices that are prevalent across similarly endowed regions. The study covers the district of West Godavari, in south of India. The approach presented here shows that the effect of 2009 drought year on the agricultural practices vary spatially depending on the access to resources and the time-lag that manifests itself in such processes. In this study, we also find that nearly 80% of the region is well endowed and hence resilient to the climatic vagaries. The statistics provided by the proposed method is critical in understanding and assessing the changes in cropping practices over time.

Keywords: MODIS, vegetation index, time-series data, change-event detection.

Abstract Id: 686
PARTICLE SWARM ALGORITHM FOR AUTOMATIC DETECTION OF INTERNAL WAVE FROM ENVISAT DATA DURING 2004 TSUNAMI

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This work presents a new approach for automatic detection of internal wave due to tsunami impact. In doing so, such optimization algorithm of Particle Swarm is implemented with involving of ENVISAT satellite data. The Particle Swarm Optimization algorithm is designed for automatic detection of internal wave from ENVISAT data. The study shows that Particle automatically detect the shows the ENVISAT SAR radar image (Orbit 148) was acquired on 28 December 2004, two days after the tsunami hit Asia. It shows the Indian Andaman Islands and the Ritches Archipelago. The normalized radar cross section is ranged between -24 to -4 dB. The lowest normalized radar cross section of -28dB is described the low window zone shelter along the Andaman and Nicobar Islands. However, the highest backscatter of -4 dB is described the occurrence of whirlpool in east of the Andaman Sea. This whirlpool is located between latitude of 14° N to 15° N and longitude of 94° E and 96°E. The whirlpool has radius of 1.9 km and located above of water depth gradient of 1000 m. In conclusion, the Particle Swarm Optimization has automatically detect internal wave. It can be said that 2004 tsunami generated internal wave along the Andaman sea.

Keywords: Internal wave, automatic detection, the ENVISAT SAR radar image, Particle Swarm Optimization algorithm.

Abstract Id: 687
GENETIC ALGORITHM FOR SIMULATION OF TSUNAMI IMPACTS ON WATER MASS VARIATIONS USING MODIS SATELLITE DATA

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This study has proposed and demonstrated a new approach to retrieve water mass pattern from remote sensing data. The MODIS satellite data are acquired during tsunami 2004. Then, these data are used as input parameters for Genetic Algorithm (GA). Therefore, GA produced a new formula to retrieve water mass pattern by optimizing errors due to cloud covers, and SST and SSS linear algorithm implementations. The study shows that genetic algorithm can reduce the error of retrieving sea surface density with ±3.4 kg/m³. Further, coastal water Aceh is dominated by maximum offshore value of 22.5 kg/m³. In conclusion, Genetic Algorithm can be used to retrieve water mass characteristics using MODIS satellite data during 2004 tsunami boxing day.

Keywords: Tsunami, Water mass, MODIS satellite data, Genetic algorithm, Sea surface temperature, Sea surface Salinity.

Abstract Id: 688
SIMULATION OF SEA SURFACE CURRENT FROM TANDEM-X DATA SATELLITE DATA

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This first work is done on application of TanDEM-X data satellite data to Malaysian coastal waters. This aims at utilizing an optimization of Hopfield neural network to retrieve variation of sea surface current along Malaysian coastal waters. In doing so, multi-objective evolutionary algorithm based on Pareto front is used to minimize the error has produced due to non-linearity between TanDEM-X data data and sea surface movements. This work aimed at retrieving sea surface current from TanDEM-X data along the coastal water of Malaysia. Two approaches have been implemented Hopfield neural network algorithm and Pareto optimal solution. The study shows that the Pareto optimal solution has highest performance than Hopfield neural network algorithm with lowest RMSE of ±0.09. Further, Pareto optimal solution can determine the sea surface current pattern variation along coastal water from TanDEM-X data. In conclusion, TanDEM-X data data shows an excellent promises for retrieving sea surface.

Keywords: TANDEM-X satellite, Multi-objective evolutionary algorithm, Hopfield neural network, ocean current, Pareto front.

Abstract Id: 689
The paper has demonstrated InSAR phase unwrapping using Pareto ant colony algorithm (PACA). The four-dimensional phase unwrapping is performed using four-dimensional best-path avoiding singularity loops (4DBPASL) algorithm. Further, the combination between PACA and 4DBPASL is used to eliminate the phase decorrelation impact from the interferograms. The study shows that InSAR produces discontinues interferogram pattern because of the high decorrelation. On the contrary, Pareto ant colony algorithm (PACA) generated 4-D coastline deformation with 0.008±0.03 m) with 90% confidence intervals and lowest cross entropy value of 1.3. In conclusion, PACA algorithm can be used to solve the problem of decorrelation and produced accurate 4-D coastline deformation using ENVISAT ASAR data.

Keywords: Pareto ant colony algorithm, Four-dimensional best-path avoiding singularity loops, decorrelation, interferogram, coastal volume

Abstract Id: 690
This work presented findings related to aboveground biomass (AGB) of oil palm using integration between PALSAR data and harvesting and remote sensing techniques. Such studies are essential to enhance our understanding of the role of oil palm in the global carbon cycle and future climate change. Harvesting and non-destructive techniques provided AGB at smaller spatial (plot) scale and these estimates were up-scaled over a larger region with remote sensing data. AGB information over regional scale have the potential to inform decision makers to impose better land management in oil palm for alleviating climate change.

Results of dry biomass show that matured trees contain greater AGB compared to the intermediate and young oil palm trees. Stem biomass consists of 62% of the total AGB in matured trees whereas stem biomass is only 21% of the total AGB in the young oil palm trees. Meanwhile, the frond biomass is highest in young palm (46%) but decreased to 31% in intermediate trees and only 23% in matured trees. Approximately of 31% - 62% of the AGB is found to be contained in the stem because older trees contain less water thus, higher biomass content.

Keywords: PALSAR, Oil Palm, Aboveground, Biomass

Abstract Id: 691
The weakening state of glaciers, polar ice caps, snowfall, oceans, and lakes in the Arctic, Antarctic, Himalayas and other mountainous regions of our planet are at the very core of many environmental and climatic conditions being monitored. Snow, glacier and ice remote sensing allow modeling by researchers for observing and trending changes in the Earth’s Cryosphere. The present study explores the usage of high resolution imageries captured by WorldView-2 and Landsat series of satellites for mapping glacier surfaces in Ny-Ålesund and environ. The broad objective of this study is to understand the usage of multispectral satellite image classifications for characterization of the glacier surfaces to infer and quantify climate change in Arctic regions. Multispectral images have been extensively used to classify and study cryospheric surfaces. This study uses limited-spectrum surface reflectance data from WorldView-2 for the Ny-Ålesund region to explore glacier surface classification. Such simulation of satellite data would lead to new semiautomatic and rapid method for multi-temporal Arctic observations, and comparisons can be drawn with existing techniques.

Keywords: glacier facies, Arctic, WorldView-2

Abstract Id: 692
THE ROLE OF SEASONS IN INTERFEROMETRIC DECORRELATION OVER TROPICAL WOODY VEGETATED AREAS

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Applications of Interferometric Synthetic Aperture Radar (InSAR) are often plagued by decorrelation effects, especially over forested areas. While this research domain has been progressed, boreal forests have often been used as the reference. Conversely, there has been a paucity of similar research conducted in tropical regions, which host various types of woody vegetation. In this article, the level of decorrelation is assessed for several types of plantations, including rubber, oil palm, and tea plantations, in comparison to intact tropical forest. Our primary goal is to investigate decorrelation due to seasonal dataset configuration, which may lead to a better understanding of InSAR pair selection. To demonstrate the impact of seasons, two pairs of Phased Array L-band SAR 2 (PALSAR 2) data were acquired. July-August 2015 data were used to represent dry conditions, while wet season analysis employed February-March 2016 datasets. In general, forest and almost all plantation types displayed low InSAR correlation, which conforms with our previous understanding. The wet season was found to be an important factor in this study, which significantly reduced correlation in all types of land cover. Tea plantations, however, maintained strong correlation; hence, it is concluded that decorrelation due to seasonality was fairly low in this case. The high correlation of tea plantations was likely due to stable wetness of leaves with minimum impact of wind on the canopy. Although mature rubber trees exhibited high decorrelation effects in the dry season, the class of young rubber plantation revealed a different outcome with its fairly high correlation. The research demonstrated that seasonality plays a role in the selection of suitable InSAR datasets in tropical regions. Hence, users should focus not only on satellite parameters such as baseline and temporal lag, but also consider the impact of seasons.

Keywords: decorrelation, forest, interferometry, rubber, season, tea

Abstract Id: 693
AUTOMATIC BUILDING EXTRACTION FROM LIDAR DATA USING SHAPE BASED PLANE CLUSTERING

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Current methods of building segmentation from LiDAR depends on extraction of roof planes to segment the buildings. In our work, we propose a new method to extract buildings using the wall facades. The motivation of using wall facades is based on the rise of terrestrial LiDAR compared to aerial LiDAR. The shape property is the most important information obtained from a LiDAR file. We try to use this shape property from the LiDAR file to segment buildings from the given scene.

In the algorithm, the non-ground return points parallel to a facade of the potential building are combined to form multiple slices. These slices are parallel to the facade of a potential building. These slices are then merged based on the shape similarity and proximity to generate the footprint of the building. Thus, exploiting this shape property and it's similarity over a building is used to formulate the algorithm. After generating the footprint of the building, we can also reconstruct the 3D model of the given building. The algorithm was tested both on simulated synthetic data containing different buildings and real world benchmark datasets. The results show complete segmentation of buildings from the synthetic datasets and promissory results from the real world datasets.

The algorithm proposed is versatile in nature and can be easily adapted to different datasets with minimal modifications and tweaking. Existing works involve the use of secondary datasets like satellite images, orthophotos etc in order to aid in segmentation. Our work uses only the LiDAR data and no other secondary data to identify the buildings from the scene. Thus, the novelty of the proposed work is non-dependence on any other form of data required except LiDAR. The applications of segmenting buildings from a given lidar scene can be used in urban planning, resource management and monitoring tasks.

Keywords: Building Extraction, Footprint Extraction, LiDAR, Object Detection, Point Cloud

Abstract Id: 695
PORTABLE, UAV FRIENDLY INFRARED CAMERA SYSTEM BASED ON RASPBERRY PI

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A portable infrared scanner is a valuable tool in household application & small business, ranging from product integrity check to housing infrastructure maintenance. We want to extend the usability of portable infrared scanners and introduce remote sensing techniques to the products listed on the market. A possibility made only possible by recent development in consumer UAV and open source hardware like Raspberry Pi. Compared with the multi-thousand, if not million, dollar UAV drones with infrared scanning capability, our purpose is to introduce the insights from Remote Sensing to the daily life of the general population, helping manage small scale agricultural and forestry activities.

Keywords: Infrared Sensor, UAV, Raspberry Pi

Abstract Id: 696
In recent years, quantitative measurements of significant wave height (SWH) by the use synthetic aperture radar (SAR) and radar cross section (RCS) methods have been proven effective in different approaches without prior knowledge of wind information. An update of an existing simple semi-empirical algorithm, aided by parameterized filtering of RCS, is presented in this study to address the issue of how the RCS values depend on empirical algorithms in different systems, using the wavelength value of the dominant wave peak and the relationship function of RCS to incidence angle derived from the SAR image. To determine the wavelength of dominant wave peaks, we implement a contrast limited adaptive histogram equalization (CLAHE) method, based on a parameterized image texture analysis. An adaptive filtering method ensures a statistically robust determination of the filtering parameter, resulting in a higher contrast SAR image that allows more efficient dominant wave peak identification, as clearer wave patterns can be revealed by higher image contrast level. We also propose a preliminary empirical update for the backscatter cross-section to incidence angle function for vertical polarization in a 5.405 GHz SAR system. Standard meteorological buoy data from National Buoy Data Center (NDBC) is used in development of the empirical model through validation. This research employs Level-1 GRD Sentinel-1 SAR images from 2016 to early 2017 that look at Hawaii and the central part of the west coast of the United States of America, selected to represent deep to shallow water depth and river influenced estuaries. However, extreme sea states are not considered due to the limitation of the image repository and buoy data availability. Beside the two analysis methods described above, additional detailed analyses are conducted on the sea state relation to the velocity bunching mechanism, showing SWH dependency with wind speed, wave direction, and coastal dynamics influence.

Keywords: Significant Wave Height, Sentinel-1 SAR, Bragg Scattering, Velocity Bunching

Abstract Id: 697
Runoff is a main reason for soil loss and a continuous ecological problem in Seremban, Malaysia. Information on soil loss is essential to support agricultural productivity and natural resource management. Thus, this study was aimed to estimate and map the mean annual soil loss by using GIS and Remote sensing techniques. The soil loss was estimated by using Revised Universal Soil Equation. Topographic map of 1:50,000 scale, Aster Digital Elevation Model (DEM) of 20 m spatial resolution, digital soil map of 1:250,000 scale, ten years rainfall records of twelve stations, was used to derive RUSLE’s soil loss variables. The RUSLE parameters were analyzed and integrated using raster calculator in ArcGIS 10.3 environment to estimate and map the annual soil loss of state of Seremban. The result revealed that the annual soil loss of Seremban extends from none in the forest area (language - Panti - Ampangan - Seremban) to >100 t ha1 year in the open area (Labu-rengam-languge). The total annual soil loss in the Seremban was 883 tones/hectare/year, this is was 198 tones from agriculture area, 39 tones from forest area, 20.45 from rural area, 610 tones from open area, 12 tones from urban area, 1.3 tones in water area of land.

Keywords: soil erosion, seremban, enviroment change, malaysia

Abstract Id: 698
DEVELOPMENT OF CLOUD MASK PRODUCT USING HIMAWARI-8/AHI DATA

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Himawari-8 is the new Japanese geostationary satellite, which was launched on October 7th, 2014. Then the operation started on July 7th, 2015. Himawari-8 carries the Advanced Himawari Imager (AHI). Since the sensor specifications of AHI have been improved, Himawari-8/AHI can expect to be utilized not only for the meteorological monitoring, but also the environmental monitoring of land surface. In order to obtain accurate land surface parameters using satellite data, the discrimination of the cloud-contaminated pixels from cloud-free pixels is required.

This study demonstrates the cloud mask production method for Himawari-8/AHI “Full Disk” data in summer and winter season. This method is based on multiple threshold tests and refers to a neutral cloud detection algorithm, which is not biased to either clear or cloudy. The algorithm is based on CLoud and Aerosol Unbiased Decision Intellectual Algorithm (CLOUDIA), which is the cloud screening algorithm for Greenhouse gases Observing SATellite (GOSAT) / Cloud Aerosol Imager (CAI), and it is mainly composed of three parts; Reflectance tests, Brightness Temperature Test, and Integration of these tests. The cloud mask products were validated using the cloud cover data of Japan Meteorological Agency and is compared with MODIS cloud mask product.

Keywords: threshold tests, cloud detection, geostationary satellite

Abstract Id: 700
DATA QUALITY EVALUATION OF SCATSAT-1 LEVEL-1B SCAN MODE DATA

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This paper discusses the data quality of Level-1B data of SCATSAT-1. SCATSAT-1, a follow-on mission of OSCAT carries a dual pencil beam scatterometer in Ku band (13.5 GHz), launched in September 2016 to study the ocean winds and associated phenomenon. Level-1B data of scatsat-1 is in scan mode, formed by using sensor, orbit and attitude information for every half orbit (ascending/descending) at slice and footprint level. It is very significant to assess, evaluate and monitor the quality of this data as it forms the basic input to the cell grid sigma-0, which in turn results to wind formation. The key objective of Data Quality Evaluation (DQE) system is to ensure best quality of data to be disseminated to end user. For this, DQE is carried out in near real time and alarms/alerts are raised if any anomaly is observed.

A set of quality metrics is generated using Level-1B data into static parameters such as Doppler frequency, X-factor etc. and dynamic parameters as sigma-0 (σ0), Brightness Temperature (BT) etc. Behavior of each parameter is monitored with respect to specifications. The dynamic parameters are assessed based on the sigma-naught quality flag (part of data product) which categories every parameter in terms of land/sea, inner/outer, fore/aft, etc. The data quality is evaluated from eight months of data starting from 12th October 2016 using in-house developed DQE Software. The statistics of each of the quality parameter is discussed. Also, σ0 and BT over the invariant sites have been monitored. Observation of σ0 and SNR shows the linear relation with in the specified range. Standard deviation in σ0 over the Amazon rainforest is less than 0.4 which is as expected. Results from trend analysis ensures that parameters are behaving well within the specifications and assures stability and consistency of the system.

Keywords: Scatsat-1, sigma-0, Amazon, Brightness Temperature

Abstract Id: 701
MANAGEMENT PLAN FOR INVASIVE LANTANA CAMARA USING UAV BASED PHOTOGRAMMETRY IN BRT TIGER RESERVE, KARNATAKA

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Lantana camara has been known as an invasive species with exceptionally heavy impacts on forests. This species shows adaptability to a wide range of ecosystems and allelopathic traits which cause loss of vigour in surrounding forest. BRT Tiger Reserve in Karnataka has been affected by lantana, with a dramatic increase in the invasion in the last 20 years. This invasion has known to cause harm to biodiversity as well as the indigenous inhabitants of the forest. This reserve of 575 sq km shows six different types of forest, ranging from scrub, dry deciduous, evergreen and shola. The terrain is hilly and lantana is concealed under tree canopy, which affects the accuracy of mapping of lantana using satellite imagery. This study was conducted using UAVs equipped with a plain optical camera, capturing aerial images over the forest. Over 1200 flights were conducted over the entire 150000 acres. 3D mesh was made from these images using raycloud photogrammetry. Orthoimagery, Digital Terrain Model, Canopy Height Model were extracted at 10cm resolution. The fine resolution of the imagery combined with height value from ground aided the process of lantana mapping. Fine resolution land cover maps with lantana density information were made. Other outputs include high resolution drainage network and hydrology maps for water conservation, fire intensity and regrowth status maps, individual tree shapefile with species and height information. These maps were used for testing the removal of lantana after assessing the density, access routes, slope and tribal colonies in GIS software. A detailed lantana removal program has been initiated where tribals are employed for manual uprooting of lantana, and the crushed lantana is pressed into briquettes for industrial use, making it a self sustaining venture. This venture will generate income for tribals as well as reduce pressure on Non Timber Forest Products.

Keywords: Invasive species, UAV, under-canopy, forest, 3D photogrammetry

Abstract Id: 703
The decline in land quality caused by degradation due to the human activities has been a major global issue since the 20th century. The immediate causes of land degradation are inappropriate land use that leads to degradation of soil, water and vegetative cover and the loss of both soil and vegetative biological diversity, affecting ecosystem structure and functions. The purpose of this paper is to evaluate the impacts of varying spatial resolution on mapping the indicators of land degradation in watersheds of the Pir Panjal Himalaya, Kashmir valley, India. The availability of varied space-based sensors with different spatial resolutions necessitates the evaluation of the use differential spatial resolution for classification accuracy in mapping land degradation. A total of eight different indicators of land degradation, viz., vegetal degradation, water erosion, water logged area, man-made etc with different severity levels were delineated from AWifs (56m), LISS-III (23.5m), and Google Earth (GE) (1-5m) satellite data using onscreen digitization. The results were validated in the field and showed accuracies of 95% for GE, 89% for LISS-III, and 82% for AWifs respectively. Mapping accuracies were found to be influenced by the image spatial resolution and the spatial structure within and between the land degradation categories. Uncertainties in mapping the indicators were found to be 61.23 m and for area under different indicators 6.85 m2 (AWifs, 56 m resolution) and 2.87 m2 (LISS-III 23.5m). It was seen that there was a considerable increase in the mapping accuracy from the coarse resolution AWifs to High resolution GE. The value of Moran's Index I (VMI) of the land degradation indicators for three resolutions was also calculated and it was found to be considerably affected by different resolutions. With the increase in spatial resolution, Moran Index value showed significant decrease from high to low resolution.

Keywords: Water erosion, land degradation, indicators, water logging.

Abstract Id: 705
ANALYZING THE SPATIAL AUTOCORRELATION OF SYNTHETIC APERTURE RADAR (SAR) IMAGERY FOR EVENT LANDSLIDE DETECTION

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In Taiwan, three quarters of the island comprises hilly and mountainous areas, with small drainage basins and steep stream gradients. Affected by active tectonics, frequent typhoons and storms, and human activities over mountainous ranges, landslides are frequently induced during typhoon seasons. To detect landslide hazards for a wide region, remotely sensed data has been applied due to its efficiency and low cost. However, the cloudy condition during a typhoon may limit the application of optical data. For an emergent monitoring task, Synthetic Aperture Radar (SAR) is therefore a suitable tool for detecting landslides in cloudy and rainy weather. This paper proposes a method to analyze the spatial autocorrelation of Normalized Difference Sigma-0 Index (NDSI) image to identify the clustering of landslides induced by typhoon rainfall. NDSI can be calculated by using SAR images before and after a landslide event. Extreme NDSI values may indicate significant changes of land surface, such as erosions and depositions. In this study ALOS SAR images before and after Morakot typhoon in August 2009, which induced thousands of landslides and caused serious damages in southern Taiwan, were collected to perform the analysis. Morans’ I and G-statistics were applied to estimate the hot-spot of extreme NDSI values and detect landslides. Preliminary results will be presented in the conference.

Keywords: Spatial Autocorrelation, SAR, Landslide, NDSI

Abstract Id: 706
EFFECTS OF URBAN DEVELOPMENT ON FLASH FLOODS A CASE STUDY FROM KESBAWA-COLOMBO DISTRICT - SRI LANKA

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Over the past decades, the Sri Lanka has become an increasingly urban society. These changes are significantly observed from the rapid conversion of rural area to peri-urban or urban areas. The changes in land use associated with urban development affect flooding in many ways. The increase in artificial surfaces due to urbanization causes an increase in flash flooding frequency due to poor infiltration and reduction of flow resistance.

Kesbewa Located at 20 km from Colombo, Kesbewa Urban Council with its 152,657 inhabitants is rapidly being developed and urbanized. Historically, Kesbewa has been an agricultural area endowed with the excess water resources of the bordering Bolgoda Lake. A relatively large area of paddy lands can still be found in its lower-lying zones. However, as a result of the continuous growth of Colombo and expansion of the urban boundaries of Colombo Metropolitan Region, Kesbewa Urban Council became an attractive residential area for commuters, now hosting over 244,000 inhabitants (2012 census). Many of the agricultural areas were gradually converted to non-agricultural areas, resulting in about 60% of the land now being used for residential purposes.

Emerging technologies of remote sensing and GIS were integrated to estimate runoff for Kesbewa Urban Council from year 1980 - 2015. The temporal variability of runoff coefficient modeled with rainfall and flood frequency. It is found that variability of runoff coefficient, inversely proportionate to variability impermeable surfaces in KUC area. The results show that flood frequency is highly correlated with runoff coefficient at 0.95 confidence level.

Increasing trend and unplanned urbanization in the region leads to flash flood risk in the future. Therefore it is recommended to that consider the infiltration capacity in further development projects.

Keywords: urbanization, urban vegetation cover, urban flood frequency, runoff coefficient impermeable surfaces

Abstract Id: 708
ASSESSING THE GLACIER CHANGES IN JHELUM BASIN, KASHMIR HIMALAYA, INDIA

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Glaciers are widely recognized as sensitive indicators for regional climate change. Very few studies have been conducted to investigate the longterm deglaciation status in the Himalaya. This study investigates the glacier area changes at different time scales in the Jhelum basin, Kashmir Himalaya, based on various Landsat satellite images such as MSS (1980), TM (1992), ETM (2000), OLI (2013) and Advanced Spaceborne Thermal Emission Radiometer (ASTER). We examined the area change of glaciers of the Jhelum basin over the period of 1980-2013 and its dependency on the glacier topography (elevation, slope, aspect, percent debris cover) and climate (temperature, precipitation). In total, we mapped 147 glaciers from 2013 Landsat OLI having an area of 74.71 km². Large proportion of the glaciated area is covered by small (>1<=3 km²) glaciers, while glaciers less than 1 km² were highest in number. The results revealed that the glaciers changed from 101.73 km² in 1980 to 74.71 km² in 2013, i.e. reduction of 27.02 km² or 26.55% of the area between 1980-2013. The estimated average glacier area loss (1980-2013) was 0.80 % yr⁻¹. The percentage change in the average glacial length observed from 1980 to 2013 was 18% (32.27 km). The recession showed strong dependency on aspect and to a smaller extent on elevation and slope. Climatically, we found strong correlation of glacier area change with the significant increasing trends of seasonal and annual Tmax and Tmin. It was observed that mean annual temperature showed significant increase accompanied with a significant fall in snow precipitation at 95% confidence level. The glaciers in the Jhelum basin are shrinking at higher rates compared to the reported changes in other parts of the Himalaya. So, these drastic changes in the Jhelum basin cryosphere could be ascribed to the increasing temperatures and declining snow precipitation in the basin.

Keywords: Western Himalayas, Glacial recession, Jhelum basin, Climate change, Landsat

Abstract Id: 710
CHANGES IN EVAPOTRANSPIRATION, RUNOFF AND BASEFLOW WITH LULC OVER EASTERN INDIAN RIVER BASINS USING VARIABLE INFILTRATION CAPACITY APPROACH

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Modification in land use land cover (LULC) affects the catchment hydrology by altering the hydrological parameters as evapotranspiration (ET), runoff, baseflow and subsequently influences the local to regional scale hydrological cycle. We have analyzed the changes in hydrological parameters with reference to LULC changes using macroscale hydrologic model Variable Infiltration Capacity (VIC) during 1985, 1995 and 2005, and possible changes by 2025 in five River basins as Subarnarekha, Brahmani, Baitarani, Mahanadi and Nagavali River of Eastern India. These rain-fed river basins are densely populated and cropland dominated landscapes; experienced the total increase of built-up, cropland and water body by 1401 km² during 1985-1995 and 373 km² during 1995-2005 with corresponding loss of forest and scrubland cover by 1343 km² and 384 km². With these major LULC modifications, the model simulation showed decrease in ET with 0.0276% during 1985-1995; with a slight increase by 0.0097% during 1995-2005. Conversely, runoff and baseflow showed an overall increase with 0.0319% and 0.0041% respectively during 1985-1995; and decrease with 0.0018% and 0.0282% during 1995-2005. In response to the predicted LULC in 2025, with total increase of 1813 km² in built-up, cropland and water body with loss of forest and scrubland cover by 1752 km², the VIC model simulation estimated reduction of ET with 0.0851% with an increase of runoff and baseflow by 0.051% and 0.0828% respectively. Among the vegetation parameters, leaf area index (LAI) appeared the most sensitive to alter the water balance. Cropland expansion, urbanization via loss of forest and scrubland covers lead to reduction in canopy cover for interception and transpiration that in turn contributed to overall decrease in ET and increase in runoff and baseflow. This study reiterates changes in the hydrology due to LULC changes, thereby providing useful inputs for integrated water resources management in the principle of sustainable ecology.

Keywords: VIC model, Land use, River basin, Hydrograph, Dyna-CLUE

Abstract Id: 712
MINERAL MAPPING OF HYDERABAD AREA USING HYPERSPECTRAL DATA

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Minerals are the composition of certain chemicals which emit specific spectral variations throughout the Electromagnetic spectrum that facilitates mapping of their chemical characteristics and relative regions in abundance. Hyderabad is rich in rocks and minerals and it is proposed to map these using Hyperspectral data. 134 bands of EO-1 Hyperion data is used and processed for evaluation of mineral compositions. Various atmospheric correction models are compared for choosing the best model for reducing the effect. The minerals explored are then compared with the actual geographical map of Hyderabad obtained from the Geological Survey of India.

Keywords: Mineral mapping, Hyperspectral data, Atmospheric correction models, Hyperspectral data classification

Abstract Id: 713
ANALYSIS OF THE EFFECTS OF PERVERIOUS SURFACE DISTRIBUTIONS ON AIR TEMPERATURES USING FIELD MEASUREMENT RESULTS AND SOCIAL MEDIA DATA

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Pervious surfaces such as green spaces distributed in urban areas are expected to contribute to air temperature reduction against an urban heat island (UHI) phenomenon. The pervious surfaces have the effect of reducing the air temperatures and it is pointed out that their effect is further enhanced on the condition that the distributions of isolated pervious surfaces are spatially continuous. We have developed the method of detecting the spatial continuity of the pervious surface distributions using remotely sensed data. Furthermore, through verification using air temperature data derived from in-situ observations, it was suggested that the air temperatures dropped around the detected areas. In order to analyze the details of the UHI phenomenon, meteorological observation stations should be arranged more densely. By using the air temperature data observed more densely, the effects of the pervious surface distributions on the air temperature would be clarified. Moreover, there is a possibility that information related to the hot environments for humans would be included in the observed data because they are obtained along the daily movement of people. On the other hand, with the widespread use of social media, people began to share contents: circumstances, events, emotions and thoughts on social network structure. Social media data with location information shows human mobility and activity, which are also affected by the hot environments. In this study, we examine the effects of pervious surface distributions on the air temperatures using high densely observed air temperature data. In addition, we apply social media data to the spatial analysis of the relationship between the effect of pervious surface distributions and the human interest in the air temperatures.

Keywords: pervious surface, field measurement, tweet data, hot environment

Abstract Id: 715
IDENTIFICATION OF SOLID WASTE DISPOSAL SITE FOR HILLY AND UNDULATING TERRAIN USING MULTI-CRITERIA DECISION ANALYSIS: A CASE STUDY OF GREATER SHILLONG PLANNING AREA, MEGHALAYA

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Managing of solid waste by urban authorities has become a very serious problem in recent time due to rapid urbanization. Finding suitable solid waste disposal (SWD) site in hilly areas is very difficult because of its varying topography. Unscientific dumping of municipal solid waste (MSW) in open places may pollute the riverine systems and valley portions. The Shillong city is situated at an average altitude of 1400 meters above mean sea level on Shillong Plateau and surrounded by hills. The Greater Shillong Planning Area (GSPA) having 78% of the total urban population of Meghalaya state. In GSPA per day, 159 metric tons of solid waste is getting generated with a rate of 400 grams per day per capita. Because of the high amount of solid waste getting generated from GSPA present landfill site will not serve for next 30-40 years. The main objective of the present study is to find a suitable site for SWD using Remote Sensing (RS) and Geographic Information Systems (GIS) for GSPA, Meghalaya, India. In the present study, GIS-based linear membership fuzzy overlay analysis has been carried out for suitable site identification for SWD based on ratings and weights assigned with expertise and field knowledge. The final suitability map was represented in three classes such as not-suitable, moderate and high suitable for waste disposal. Existing landfill site was observed in moderate suitable area and it can't serve for long period because of rapid urbanization and increase in solid waste generation from GSPA. High suitable areas have been observed towards the northeast of Shillong city, and sites are away from settlements and water bodies and easily accessible by roads.

Keywords: Solid Waste Management, Site suitability, Disposal site, Fuzzy overlay, Greater Shillong Planning Area

Abstract Id: 716
The surface velocity of glaciers is important for the estimation of ice discharge, to understand glacier dynamics and its response to climate change. However, the glacier surface velocity data collected using conventional field measurements is spatially insufficient. Therefore, remote sensing based techniques are being used extensively in glaciological studies as they offer a comprehensive and repetitive monitoring in a cost effective manner. Recently, Co-registration of Optically Sensed Images and Correlation (COSI-Corr) tool (Leprince et al., 2008) which is based on image matching method of optical images has gained popularity for the estimation of glacier surface velocity owing to its robust and consistent results. For de-noising the glacier surface velocity estimates, Non-Local Means filter has been incorporated in COSI-Corr. Further, to discard/replace erroneous values, user has to manually define the threshold to discard/replace erroneous values. Although the filters in COSI-Corr give smooth estimates, but it has been observed that the filtered values deviate from the original ones. Therefore, the main purpose of this study has been to find an optimal filter for obtaining smooth estimates while preserving the original spatial velocity patterns. Various spatial domain filters such as mean filter, low-pass filter, adaptive filter and statistical filters have been applied and evaluated in this study to obtain smooth glacier surface velocity estimates. The comparative evaluation of these filters showed that the application of statistical filter with multipliers 1, 2 and 4 in sequential order followed by 3 x 3 mean filter, provided close match with the original estimates.

Keywords: COSI-Corr, Filter, Velocity

Abstract Id: 717
A CASE STUDY SPATIO-TEMPORAL ANALYSIS OF CRIME OF HISAR CITY USING GEOINFORMATICS

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Due to unemployment, unequal distribution of wealth and societal status, the rate of crime is increasing in developing countries. The present study attempts to identify and explore the rate and spatial variation of crime in Hisar city for a period from 2011 to 2015. Indices such as attempt to murder, chain snatching, kidnapping, rape and robbery were determined to understand the complexity of crime hot spot analysis. The improved computer based technologies like GIS and availability of Geographic data make it possible for law enforcement agencies to create analytical maps and various analyses to identify the crime hotspot area. Different data sources pertaining to crime such as murder, attempt to murder, rape, robbery, kidnapping and chain snatching for 2011 - 2015 time period were collected from the City Thana and Civil Lines Police stations of Hisar and analyzed in the GIS environment. The crime hotspot analysis uses vectors to identify the locations of statistically significant crime hotspots and cold spots. The results reveal that crime rate is higher within residential areas while the rate has increased from time to time especially in the year 2011. Ward no. 2 and 14 were identified with highest percentage of crime during the year. The crime percentage was found to vary among the wards over the succeeding years. The highest crime was found in ward no. 07 and 2 for the years 2012 and 2013 respectively. However, ward no 1, 12 & 14 were zones of highest crime in 2014 and highest crime was recorded in ward no. 2 and 14 for 2015. With the variation in occurrence of crime and shift in location over the years, we conclude that ward no. 14 and 15 are crime sensitive areas and ward no.18 and 19 are crime safe zone of the city over the

Keywords: Remote sensing, Geographical Information System, land use, hotspots, Crime mapping.

Abstract Id: 718
UTILITY OF ORTHO RECTIFIED WORLDVIEW - II DATA FOR FOREST INFORMATION SYSTEM AT CADASTRAL LEVEL - A CASE STUDY IN RANGALA VILLAGE (MEWAT DISTRICT), INDIA

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Cadastral mapping of forest lands mentioned in revenue records incorporates the demarcation of forest boundary with associated attributes for proper management of forest lands. The present study deals with generation of forest information system at cadastral level using the ortho rectified Worldview-II satellite data. To demonstrate the capability of the ortho data at village level mapping of forest lands, a study area has been selected in Mewat District, Haryana (India). The village Rangala is situated at 28°13'43"N and 76°52'53"E coordinates and occupies an area of 470.21 ha. A procedure has been followed for generation of Digital Elevation Model (DEM) and elevation correction in steep areas was performed to achieve the better accuracy of DEM. The final output was in the form of orthorectified image, which was used as the base image for digitizing the forest boundaries. The forest notification details such as rectangular number, khasara / killa numbers were superimposed on the orthorectified satellite data so as to map various forest lands such as Reserved Forest (RF), Aravalli Plantations, area closed under Section 4 and/or 5 of Punjab Land Preservation Act. The vector area for RF was found to be 11.23 acres against 11.73 acres notified forests, Aravalli Plantation of 200.95 acres against 207.69 acres in forest list, while for Sec. 4 and/or 5 of PLPA area it was found to be 126.22 acres against 111 acres in forest notification. The above results show very close values of GIS generated data to the notified revenue data.

Keywords: Remote Sensing, DEM, Orthorectification, Cadastral Data

Abstract Id: 719
DECADAL LAND USE/LAND COVER CHANGE AND ITS IMPACT ON THE NATURAL RESOURCES OF MAHESHWARAM WATERSHED AREA, TELEGANA

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A study was undertaken to assess the decadal Land use/Land cover (LULC) change of Maheswaram watershed between 2002-2003 and 2016-2017. Knowledge based on screen digitisation of LISS IV (IRS Resourcesat2) February and October 2016 data was attempted for LULC classification. The 54 class (Level 3) of NRC_LULC 50k adopted for the study. Spatio-temporal analysis was done and statistics generated for the area. Field data was collected and around 250 points were generated and showed an overall accuracy of more than 90 percent. Further the Land surface Temperature (LST) and NDVI for five different months (Feb, Mar, May, Oct and Dec) 2016 were calculated using Landsat OLI 8. A negative correlation was noticed between NDVI and LST for the different months under study for the area. The result showed higher LST and lower NDVI for built up compared to other land use classes, but there was no significant difference noticed among the different land use classes. The result showed that there was drastic reduction in kharif (19.7%) and increase in built up layout (11.5%), and industrial area. The area is characterised by a network of tanks in 2003 and the tank is almost dry in present scenario and hence the cultivated area drastically reduced especially kharif. Dominant plantations in 2003 like grapes totally disappeared. The only source of perennial water source kotwalcheruvu is under threat as that tank and adjacent area is under SEZ.

Keywords: LULC, NDVI, LST, Maheshewaram, SEZ

Abstract Id: 720
This study examines two approaches which are satellite image analysis and on-board sensor measurement for monitoring of track condition of Yangon Circular Railway Train. The number of population of Yangon City is 5.1 million and will be reached 9.5 million by 2035. Most residents use own cars and buses as means of transportation, and a modal share of railway is approximately one percent. Therefore, road congestion is becoming more severe and a modal shift from cars to public transportation is needed. Yangon Circular Line has 38 stations and double-truck and its total length is approximately 46 km. This line has some problems such as slow speeds, delays and derailments caused by deterioration of facilities and equipment. Myanmar Railways which operates this line plans improve of track for safety and comfort. This study aims to detect damage at an early stage to make maintenance works more efficiently and economically and to make passenger safety and comfort high level. To monitor a truck condition and detect fault parts, firstly, PALSAR-2 images are analyzed with interferometric technique. Railway subsidence will be detected by analyzing SAR images which are acquired periodically. Secondly, car body vertical and lateral acceleration are measured by accelerometer in a smartphone. Cabin vibration on section of track irregularity will be larger than ones on normal section. These results will show that a rail condition can be estimated effectively.

Keywords: Railway track, Condition monitoring, Yangon Circular Train, Synthetic Aperture Radar, On-board sensing system

Abstract Id: 724
SUPER RESOLUTION FOR TARGET DETECTION AND IDENTIFICATION IN HYPERSPECTRAL DATA

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Many small targets of interest in hyperspectral images; such as those found in military are often too small to occupy only the full pixels. Usually, these targets either occupy some pixels fully and simultaneously also occupy several other surrounding pixels only partially. This reduces the number of pixels of the target and thus the recovery of all the pixels (both full and partially occupied) becomes challenging. The target detection process involves various steps: discrimination, classification, detection, identification and quantification. Most target detection algorithms (as found in literature) can detect/identify only the full pixels thereby limiting the applicability of these algorithms for target identification in hyperspectral images unless recovery of the subpixel components of the target is possible. Spectral unmixing does provide the end members (including the target) and their corresponding proportions within a pixel; however, it does not give the spatial distribution of target and other end members within the pixel. Super resolution mapping is the process of obtaining this spatial distribution and leads to obtaining fine resolution data from coarse resolution data. For locating small military targets, super resolution may aid detection and identification. Also, the temporal data acquired over a time gap may be different in resolution and super resolution mapping may assist the analysis of multi scale and multi resolution data. The work in this paper aims for a comparative assessment, and validation of some of the super resolution algorithms selected from literature viz; Pixel swapping, particle swarm optimization, inverse Euclidean distance, and Hopfield neural network using hyperspectral data set.

Keywords: Hyperspectral image processing, spectral unmixing, target detection & identification, superresolution mapping, subpixel detection

Abstract Id: 725
GENERATION OF SURFACE REFLECTANCE PRODUCTS FROM RESOURCESAT-2 SENSOR DATA AND VALIDATION USING GROUND AND LANDSAT- 8 OLI SURFACE REFLECTANCE

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Surface Reflectance (SR) products are fundamental inputs for any remote sensing based application. We have implemented an atmospheric correction procedure based on Second Simulation of a Satellite Signal in the Solar Spectrum (6S) radiative transfer code for the retrieval of SR products from Resourcesat-2 (RS-2) advanced wide field sensor (AWIFS) and linear imaging self scanner (LISS-3) sensor data. The correction is based on lambertian assumption and corrects for aerosol and molecular absorption and scattering effects. The atmospheric characterization parameters are retrieved from MODIS and INSAT climatology products. Coefficients that are required for atmospheric correction are delivered by the 6S code using the above inputs, which are then used to correct RS-2 imagery on a per pixel basis. The validation is undertaken in this work by cross comparison with contemporaneous Landsat-8 (L8) Operational Land Imager (OLI) SR products and also ground measured spectral reflectances. Temporal validation over a wide range of target reflectances showed a good correlation between SR retrieved from Landsat-8 and the RS-2 SR product in every band, with R2 higher than 0.95. Retrieved SR values were also found to be consistent with ground based spectroradiometer measurements. Intra-sensor comparison of surface reflectance values were also carried out to further ensure the accuracy of the SR products

Keywords: atmospheric correction; 6S Code; L8-OLI; spectroradiometer

Abstract Id: 727
MODELING OF THE ATMOSPHERIC CO2 CONCENTRATION USING RANDOM FOREST MODEL

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In this research, we were modeling the relationship among of atmospheric CO2 concentration with environmental variables in April and August of 2015 in Iran. For this goal, we used CO2 concentration data gathered from OCO-2 satellite and LST, NDVI, LAI and NPP data collected from MODIS products. Temperature, wind direction and wind speed data were downloaded from ECMWF database. We utilized three layers of Organic carbon stocks data in two available depths of 5-15 cm and 15-30 cm which comes from Soil Grids1km - Global Soil Information and mean of two layers were resulting a layer with depth of 5-30 cm. We also extracted land cover information from Google Earth and fossil fuel data of the N.I.O.P.D.C for whole of Iran. Random Forest model was applied for this research. To probe the model validation, we used the cross validation for April and August that resulted R2=0.59, RMSE=1.38 and R2=0.45, RMSE=1.01, respectively. Among 12 variables used at this model in April, three variables of temperature, wind speed and fossil fuel were recognized as prominent parameters, where NPP has been recognized as less important one. In August, those prominent parameters, following the order of importance, were wind speed, fossil fuel, temperature and LST, where the result revealed that the NPP and land cover were less important parameters. The results of this research revealed that the most effective and important variables in atmospheric CO2 concentration are temperature, wind speed, and fossil fuel consumption in Iran which is useful for sustainable management.

Keywords: IRAN, OCO-2, Random Forest, Remote sensing, Climate change

Abstract Id: 728
OBJECT-BASED CLASSIFICATION OF VERY HIGH RESOLUTION REMOTE SENSING IMAGE

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An accurate land use and land cover information is essential to document the current state of urban environment. The aim of this investigation is to examine the different object-based classification for urban area and to find suitable one. The study utilizes object-based classification for a urban sub-area in Ulaanbaatar city, using QuickBird imagery. Two segmentation approaches, spectral difference and multiresolution segmentation, were applied to create image objects and implemented in eCognition Developer. The classification results were compared to classification based on individual and integrated segmentation types. The results implied that threshold classification based on integrated segmentation showed better performance compare to other methods. The detailed research outcome will be presented in main paper.

Keywords: multiresolution segmentation, object-based, QuickBird, spectral difference segmentation

Abstract Id: 729
MAXENT MODELING OF MYRICA ESCULENTA FOR ESTIMATING GEOGRAPHICAL DISTRIBUTION IN KUMAON HIMALAYAS, UTTARAKHAND

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The forest of Uttarakhand has sub-temperate species of medical and economic importance known as Myrica esculenta (M. esculenta) (Vern. Kafal). The evergreen small tree found in mid-Himalayas with elevation range from 1500-2100 m. The enormous anthropogenic pressure along with habitat degradation & habitat fragmentation causes declining in population of this species. Under Forest Genetics Resource (FGR) conservation aspect, geographical mapping is very important for M. esculenta.

The Remote Sensing and Geographical Information System (RS&GIS) study was carried out in Nainital, Bageshwar, Champawat and Pithhoragarh districts of Kumaon Himalayas using Maximum Entropy Modeling with a set of 19-Bioclimatic variables explored from USGS. Apart from Hyperspectral RS, other traditional techniques of optical RS are not found suitable for mapping because M. esculenta occurs under the canopy covers of Pinus roxburghii, Quercus leucotrichophora, Rhododendron arboreum and Lyonia ovalifolia in a scatter manner. Therefore, geo-spatial data were collected from field using GARMIN GPS and prepared forest cover map based on LANDSAT-8.

We use 60% well distributed GPS points for estimating distribution of M. esculenta. Out of 400 sample points, 240 were used in the Maxent model for predicting distribution of M. esculenta. Remaining 40% GPS points were used validation of model. It has been found that 125 GPS points (78.125%) falls on the actual area of occurrence of M. esculenta. According to Jackknife test environmental variables: Temperature Seasonality (18.4%) and Altitude (17.6%) showed highest contribution for Maxent modeling to predict the distribution of M. esculenta in Kumaon Himalayas. It could be concluded that Maxent model is highly suitable for habitat distribution and prediction of M. esculenta in Kumaon Himalayas.

Keywords: Forest Genetics Resource, Kumaon Himalayas, Maximum Entropy Modeling

Abstract Id: 730
INTEGRATED APPROACH FOR MAPPING DEBRIS-COVERED GLACIER USING OPTICAL, THERMAL AND TOPOGRAPHIC INFORMATION-A CASE STUDY ON BARA SHIGRI GLACIER, WESTERN HIMALAYA, INDIA

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Supraglacial debris strongly influences the rate of ablation of the glacier and thereby affecting the health and the contribution of the glacier towards surface runoff. Moreover, debris cover over the ablation zone of the glaciers hampers automated and semi-automated mapping of glacier boundaries in different parts of the Himalayan region. Therefore considering the immense significance of accurate mapping of debris-covered glaciers in glacial retreat analysis, snowmelt runoff studies, glacial lake outburst flood (GLOF) assessment, glacier volume estimation, mass-balance estimation, glacier health monitoring, the present study propose an integrated approach for delineation of glacier boundaries and supraglacial cover mapping of debris-covered glaciers using Landsat-8 OLI (Operational Land Imager) and TIRS (Thermal Infrared Sensor) image and Digital elevation model (DEM). In this study, spectral indices have been designed by utilizing the spectral properties of supraglacial covers. Those indices brightness temperature calculated from TIRS data and slope extracted from DEM of the glaciated surface facilitated sequential discrimination of supraglacial covers and thereby delineation of the boundary of Bara Shigri Glacier, an extensively debris-covered glacier of Himachal Pradesh. Especially, the brightness temperature is proved as an important parameter for segregating supraglacial debris from periglacial debris and other non-glacier areas, which is the most challenging task in hard classification technique. Brightness temperature computed from thermal band exhibits spatial variability starting from the terminus to the upper ablation zone of the glacier over the supraglacial debris. Results obtained using the proposed approach corresponded well with manually demarcated glacier boundaries on high-resolution LISS-IV image. The proposed classification technique is observed faster than the manual delineation and proved effective for delineating the boundaries and systematic mapping of supraglacial covers of debris-covered glacier compared to hard classification techniques.

Keywords: Supraglacial debris, Spectral Indices, thermal information, Slope, Landsat-8 Himalaya, Remote Sensing

Abstract Id: 731
GIS-BASED ASSESSMENT AND CHARACTERIZATION OF GROUNDWATER QUALITY IN A INDUSTRIAL CITY OF CENTRAL PUNJAB, INDIA

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The quality of groundwater may be affected by natural processes as well as by the activities directly attributable to human interventions in different environs. The complex biodiversity, physio-graphic setup coupled with prevailing hydro-geological set up attribute to water pollution in various parts of the State. Ludhiana district falls in central part of Punjab, India and it is well known for small and large scale industry hub in India. Different types of industry are set up in the Ludhiana that can adversely affect the ground water quality. To analyse the effect of pollutants to in ground water, the areas adjoining Ludhiana City are taken into consideration in which thirty two points are selected for ground water quality mapping. In the present study, the spatial variations in physico-chemical quality parameters and heavy metals in groundwater of three blocks were analysed. To determine its suitability through development of Water Quality Index (WQI) and Heavy Metal Pollution Index (HPI). The spatial variations maps are generated with the help of Geospatial analyst tool in ESRI Arc GIS. The suitability for drinking purpose was evaluated by comparing the physico-chemical parameters of groundwater with drinking water standards prescribed by BIS. All the physico-chemical parameters of groundwater, except iron, were found to be within permissible limits and the heavy metals such as Fluoride, Lead, Aluminium and Selenium were found to be almost not suitable for drinking purpose. WQI and HPI maps show that the groundwater qualities of these three blocks (Dehlon, Doraha and Khanna) are in above permissible limits. The probable reason for the poor quality of water found in HPI due to heavy metals comes from industrial effluents and excess use of fertilizers. It is also further suggested to study the ground water quality with different aquifer depth for better idea about the cause of the pollution.

Keywords: Groundwater, WQI, HPI, GIS, Punjab

Abstract Id: 735
REGIONAL IMBALANCES IN WATER RESOURCES MANAGEMENT IN HARYANA

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Haryana State was carved out of the Indian State of Punjab on 1st November, 1966. It extends between 27°03′I to 30°05′I N latitude and 74°27′I to 77°36′I E longitudes. It covers a total geographical area of 44,212 km2. There were 7 districts viz. Ambala, Karnal, Rohtak, Gurgaon, Hisar, Mahendragarh and Jind in 1966. The present day Haryana State comprises of 22 districts in 2017 and projected population 2.77 crore. The northeaster portion of the state in parts of Ambala and Yamunanagar districts are having stagnant water table condition due to the presence of hills in the north and continuously recharged due to the hills the seepage from perennial rivers draining these regions. In these area the amount of ground water extracted is balanced due to ground water recharge. Some districts of north west part of Haryana show decrease in water table by a maximum of 10 metres due to excessive use of ground water for irrigation in agricultural fields. The southern parts of the state surrounding Aravalli hills, covering parts of Mahendergarh, Rewari, Gurgaon and Faridabad districts form a broad zone of ground water decline. The extreme rise and fall of ground water and unequal distribution of canal water needs immediate check to save highly fertile land of the state from converting into wastelands. In the State of Haryana better water management with conjunctive use of surface and ground water is the need of the hours to supplement of irrigation and domestic supplies.

Keywords: topography, rain, canal irrigation

Abstract Id: 736
URBAN SUBSIDENCE DETECTION USING THE SENTINEL-1 MULTI-TEMPORAL INSAR DATA

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This paper presents the result of subsidence estimation over an urban area using the Sentinel-1 data using PS-InSAR technique. The study area selected is Chandigarh City (UT, India) and its near vicinities, which is located at the junction of three Indian states namely Punjab, Haryana and Himachal Pradesh. PS-InSAR is a well-established technique to identify and monitor the ground deformation using the satellite imagery. This technique has been used in the different field for monitoring of the earth surface deformation. Time series Sentinel-1 data comprising of 33 images acquired during 2014 to 2017 over the study area has been used in this study. Sentinel-1 is launched and operated by the European Space Agency and data is freely available on user hub. Sentinel-1 carries a C-band synthetic aperture radar which collects the data at an interval of 12 days. The high spatial and temporal resolution of this data allows to carry out the time series analysis in an effective manner. All the PS processing has been carried out in Sarproz software package. The atmospheric phase screen of the SAR data has also been estimated and removed to minimise the noise in the estimated values. The preliminary results indicate the significant rate of the subsidence over the study area. The maximum rate of subsidence estimate is around -20 mm/year in specific locations. Most of the area appeared to be stable and show zero or very less subsidence. The results were correlated with the current ground water scenario and it is observed that the subsidence may be related to the depleting ground water condition in the area. This study provides a preliminary information on the health of urban infrastructure in the area. Multiple sensor and long-time series data may provide more insights into the ground water conditions of the area.

Keywords: Sentinel-1, Chandigarh, Subsidence, ground water

Abstract Id: 737
A REVIEW ON FEATURE EXTRACTION TECHNIQUES FOR MULTIRESOLUTION & MULTISENSOR IMAGE CLASSIFICATION

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Now a day, multi-sensor and multiresolution images seem to be promising datasets for exploring the objects/classes in an urban area. The classification accuracy of any urban area can be improved by studying the spatial and spectral features in an image. Various low level spatial features are extracted on the bases of color, shape and texture etc which helps in identifying the edges or shapes of any object in an urban area. While other set of spatial features can be extracted by studying the mathematical indices such as morphological profiles for segmenting complex structure in an urban areas such as buildings and roads etc. Along with the spatial features, spectral characteristics of multi-sensor images also play an important role in classification of an urban area. The spectral signatures of the objects/classes can be utilized where the spatial adjacencies between the objects may degrade the classification accuracy of any particular object/class. Therefore, the spectral features such as normalised difference vegetation index (NDVI) can be well explored in order to classify various objects/classes like trees, vegetation, soil and water bodies in an urban area. Hence, various feature extraction techniques can be explored in multi-sensor and multiresolution image for improving the classification accuracy. This study gives a detailed review of spatial and spectral feature extraction techniques for classifying the natural and man-made objects in an urban area.

Keywords: Multi-sensor, morphological profiles, feature extraction, NDVI, textural features

Abstract Id: 741
ANALYSIS OF SPECTRAL CHARACTERISTICS FOR IDENTIFICATION OF COAL AND OTHER COAL MEASURE ROCKS

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Mining industry provides the basis for any geo-resource needed for the developmental activities as well as for strengthening the national economy although the different mining activities lead to the environmental degradation in one or the other way over the concerned space and over a certain period of time. In such case remote sensing technology can be used effectively to monitor the environmental degradation over a large-scale with high accuracy. Spectral reflectance properties of typical land surface covers such as coals and other coal bearing sediments such as sandstone, shale, claystone has not been fully studied yet. Therefore, field and laboratory spectral reflectance of coal (bituminous), sedimentary rocks (mainly the coal measure rocks, like, sandstones, siltstone and shale) and its surrounding areas are investigated for their characteristics in the reflective domain, ranging from 400 nm to 2500 nm. In this purpose coal and sandstone samples from Jharia Basin is collected. Spectral signatures of collected samples are taken in laboratory using ASD spectroradiomater and studied and matched with the previous work. The measurements show that reflectivity of coal seam within 500nm to 800 nm is less than 10%; that between 900-950 nm is about 12% (peak value), while the reflectivity within 950 nm to 1100 nm is having a decreasing trend. Compared with other rocks, the reflectivity of the coal seams is the lowest in 400nm to 1100 nm band, and studies have shown that it's reflectivity is 5-30% lower than that of other coal measure rocks. Coal shows strong absorption bands between 2200 nm to 2500 nm resulting mainly from organic matter present within coal. Sediments exhibit common absorption features at approximately 2200 nm which are related to possible bond vibrations of Al-OH compound. Similar investigations of spectral reflectance properties for typical land surface covers in an area would provide the

Keywords: Coal, Coal Measure Rock, Spectral Signature, Absorption Band

Abstract Id: 742
Approach for Image Quality Improvement for High Resolution Sensors

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Image data quality is affected by many factors such as electronic noise, sensor performance, thermal effects, time of imaging, atmospheric conditions and ageing of the sensor. All the factors mentioned above deteriorate the quality of the data with time due to which the problem of striping, banding, and noise/degradation in the image data gets aggravated. Hence radiometric correction plays a significant role in data processing to enhance and improve the images in such a manner that they are acceptable by the end user. This paper delves into the analysis of problems reported in terms of striping, noise etc. over recent high resolution satellite data products and proposes different methods that are found to be effective in improving and enhancing the images.

The objective of this paper is to summarize the work done for radiometric quality analysis and improvement of data products by effectively removing striping as well as banding present in the original images. Various methods based on spatial and frequency domain techniques have been applied on the datasets, which include both generic and scene based approaches to restore images. Four methodologies are proposed to correct for banding as well as striping. Out of these, three are based on moving average filter which works in spatial domain and remaining one works in frequency domain. Filtering using FFT analysis is designed to selectively remove striping frequencies. This method has been tested on Cartosat-1/2 series datasets and is giving good results without introducing any artifacts. The results for all the techniques are presented in this paper along with their comparisons both qualitatively and quantitatively.

Keywords: Highresolution, striping, banding, frequency filtering

Abstract Id: 743
In this paper, a robust invisible watermarking algorithm for satellite imagery using Curvelet Transform is proposed. Haralick Co-occurrence texture features are used to identify the area for watermarking in the host image. Host image is tiled into smaller non-overlapping blocks. Based on the Haralick texture feature chosen, blocks with high value of chosen texture feature were selected for embedding. Thus, multiple watermarks are embedded in any given image. There are some unstable Curvelet coefficients so a little change of the image will result in a big change of these coefficients. These unstable factors can influence the extracting of watermark. Hence selection of position of embedding in the transformed domain plays a very important role in robustness of the embedding process. This algorithm encourages use of edges and curves for embedding watermarks. The experimental results show that watermark using proposed algorithm is robust against common attacks like Brightness, Contrast, Saturation, Tint adjustments, Low pass Filtering, JPEG Compression attack, Gaussian Noise attack and Laplacian Filtering, Symmetrical and Asymmetrical Image Cropping, Geometric Attacks like scaling and Rotation. Use of SURF features too ensures robustness to geometric attacks. Comparative study with wavelet watermarking algorithm proposed by Bazargani shows the improvements in results obtained.


Keywords: Curvelet, Wavelet, co-occurrence texture, watermark, Satellite, texture, Robust

Abstract Id: 744
A study was taken up to make use of free and open sources of software and data to observe vegetation in Nalgonda district of Telangana. The study period considered water years (June - May) from 2011-12 to 2015-16. NDVI derived from MODIS-Terra data product MOD09Q1, 8 day composite with 250 m resolution was utilised. Secondary data on crop area, rainfall and certain edaphic factors were used to understand NDVI, a popular vegetation index.

Bi-modal NDVI curves of monthly maximum value composites indicated two crop seasons i.e. Kharif and Rabi while there were differences in times of maximum NDVI in 8 day composites. Peak NDVI was seen on 14th, 22nd, 30th, 30th September and 24th October in Kharif of 2011, 2012, 2013, 2014 and 2015, respectively with a range from 0.729 to 0.878. Maximum NDVI during Rabi was noticed on 26th February in 2011 and 2012, on 22nd and 14th March in 2013 and 2014, respectively and on 25 January, 2015 with NDVI ranging from 0.692 to 0.795.

Rice area and rainfall during June and July in, 2011 and 2014 (deficit SW monsoon years) had correlation (‘r’ values of 0.295* 0.323*, respectively) (n = 59). Number of pixels in 0.0-0.2, 0.2-0.4, 0.4-0.6, 0.6-0.8 and 0.8-1.0 NDVI classes varied among years. There were correlations between area under rice and 0.6-0.8 class pixels in 2011, 2012, 2014 and 2015 (r’= 0.266*, 0.300*, 0.535* and 0.498**, respectively) and with 0.8-1.0 class pixels in 2012 and 2015 (r = 0.383* and 0.478**, respectively), which received normal SW monsoon.

Work is in progress to model dependence of NDVI on causative factors to study the rice vegetation. We attempt to highlight the usefulness of free and open sources of software and data in applied remote sensing and GIS techniques in agriculture.

Keywords: Free resources, MODIS, NDVI, crop vegetation

Abstract Id: 746
CHANGE VECTOR ANALYSIS: AN APPROACH FOR DETECTING FOREST CHANGE AROUND THERMAL POWER PLANT IN SINGRAULI DISTRICT, MADHYA PRADESH, INDIA

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Research studies have shown that there remains were little things that have been left untouched or still in its neutral stage. Change is continuous phenomenon. Mankind has in some way significantly altered the Earth’s surface and it has profoundly affected upon the natural environment that has resulted into a distinct land use and land cover change over a period of time. A number of techniques can be used for detection of land cover and land use dynamics using remote sensing data but the one used for this study is the change vector analysis (CVA) technique. Conversion of forest lands into clear fields and for human development purposes is rapidly changing the land cover of Singrauli region. The change in forest and its pattern was studied around Sasan Ultra mega thermal power plant covering an area of 10 km² for three years - 2005, 2010 and 2015, respectively. Chronologically, the year 2005 is the phase of pre-establishment of the thermal power plant; the year 2010 specifies the construction phase and 2015 is the operational phase. Landsat ETM and Landsat 8 data of remote sensing system were used for this study. The land use/cover (LULC) study showed a significant decrease in the forest cover, and a dramatic expansion in wastelands. The CVA technique was applied to a multi-temporal datasets to know the dimension of vegetation change in the study region. Change vector analysis is used to compare the differences in the time-trajectory of the greenness and bare soil index for two successive time period. The change characteristics produced by this method allow us to have a picture about the change dynamics over the study area.

Keywords: Change Vector Analysis (CVA); Land use/cover; Thermal power plant; Change detection

Abstract Id: 747
RESEARCH STUDIES HAVE SHOWN THAT THERE REMAINS LITTLE THINGS THAT HAVE BEEN LEFT UNTouched OR STILL IN ITS NEUTRAL STAGE. CHANGE IS CONTINUOUS PHENOMENON. MANKIND HAS IN SOME WAY SIGNIFICANTLY ALTERED THE EARTH’S SURFACE AND IT HAS PROFONDLy AFFECTED UPON THE NATURAL ENVIRONMENT THAT HAS RESULTED INTO A DISTINCT LAND USE AND LAND COVER CHANGE OVER A PERIOD OF TIME. A NUMBER OF TECHNIQUES CAN BE USED FOR DETECTION OF LAND COVER AND LAND USE DYNAMICS USING REMOTE SENSING DATA BUT THE ONE USED FOR THIS STUDY IS THE CHANGE VECTOR ANALYSIS (CVA) TECHNIQUE.

Conversion of forest lands into clear fields and for human development purposes is rapidly changing the land cover of Singrauli region. The change in forest and its pattern was studied around Sasan Ultra mega thermal power plant covering an area of 10 km2 for three years - 2005, 2010 and 2015, respectively. Chronologically, the year 2005 is the phase of pre-establishment of the thermal power plant; the year 2010 specifies the construction phase and 2015 is the operational phase. Landsat ETM and Landsat 8 data of remote sensing system were used for this study. The land use/cover (LULC) study showed a significant decrease in the forest cover, and a dramatic expansion in wastelands. The CVA technique was applied to a multi-temporal datasets to know the dimension of vegetation change in the study region. Change vector analysis is used to compare the differences in the time-trajectory of the greenness and bare soil index for two successive time period. The change characteristics produced by this method allow us to have a picture about the change dynamics over the study area.

Keywords: Google Earth Engine, Protected Area, Batanes, Land Use/Land Cover Change, Landsat
SUB-PIXEL MAPPING FOR PRODUCING LARGE-SCALE GLACIER FACIES MAP USING COARSE RESOLUTION DATA

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High radiometric resolution data captures the slightest variations among the glacier facies, thus facilitating segregation among spectrally similar facies. Such data may have limitations in terms of their spatial characteristics showing the dominance of mixed pixels (mixels). The presence of mixels contaminates the spectra of glacier facies and deteriorates the classification results when mapped at per-pixel level. Solution to this comes in the form of sub-pixel mapping (SPM) which primarily involves the facies mapping at sub-pixel scale from coarse resolution data and then assigning the spatial locations to glacier facies within mixels. Therefore, this study is aimed at a) sub-pixel classification of Advanced Wide Field Sensor (AWiFS) data (56m spatial resolution) for the extraction of various glacier facies, and b) yielding a large-scale glacier facies map of Gangotri and surrounding glaciers in Garhwal Himalayas using the sub-pixel estimates of various glacier facies. A thorough spectral profiling was carried out on the AWiFS data for the proper identification of glacier facies in the study site. This was followed by the sub-pixel classification of glacier facies using Support Vector Machine (SVM). Soft classification outputs so generated were validated against the soft reference data prepared from Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) data (15m spatial resolution) and WorldView-2 data (1.84m spatial resolution). The proportional estimates were finally inputted to the pixel swapping algorithm (PSA) for producing a fine spatial resolution glacier terrain map. This super resolved map was evaluated for its accuracy against the hard classification map derived from ASTER and WorldView-2 data. The snow covered area derived from super resolved map and NDSI closely matched with that obtained from reference fraction images. Results showed that PSA succeeds in harnessing the coarse resolution data for effectively discriminating and mapping the glacier facies.

Keywords: Sub-pixel mapping, AWiFS, Gangotri glacier, Facies, Pixel swapping

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UTILISATION OF DEIMOS-2 DATA IN URBAN AND INFRASTRUCTURE PLANNING

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Developing and newly industrialized countries in any part of the world are experiencing a rapid expansion in economic growth mirrored by the expansion of the cities, urban development, infrastructure and industry. Geospatial Technology and Satellite Data plays a major role in Urban / Rural Planning which involves determining appropriate future decisions and actions through a series of choices. Making choices requires, in addition to thorough planning knowledge, comprehensive (geo)data about the past, present and future.

With the second largest population in the world and its enormous urban growth, India’s engineering, architecture and urban planning sectors are key to foster sustainable development and, as a result, mapping technologies may also play a crucial role. In this endeavor, in 2015, the Indian Government launched the “Smart Cities Awas Yojna Mission” to develop 100 smart cities and rejuvenate 500 others.

Maps are an essential tool, not only in our everyday lives, but also to foster sustainable growth through urban planning. As cities continue to expand in India, even the most accurate maps will be quickly outdated. Thus, a challenge arose: to develop an easy-to-use and cost-effective solution to map new infrastructures and urban growth.

Deimos Imaging has played a key role in the design, implementation and operational consolidation of highly relevant services in Urban Planning and Infrastructure Mapping in different parts of the world. DEIMOS-2, launched in June 2014, is a very-high resolution (75cm pan-sharpened) multi-spectral optical satellite with a 12-km swath. The whole end-to-end DEIMOS-2 system has been designed to provide a cost-effective and highly responsive service to cope with the increasing need of fast access to very-high resolution imagery.

This paper is meant to showcase DEIMOS-2 data use-case for various application areas:

• Asset Mapping
• Project Monitoring
• Encroachment Monitoring
• Building Height Estimation
• Land Movement Monitoring
• Slope Analysis
• Monitor Height Changes

Keywords: Smart City, Satellite Data, Change Detection, Digital Elevation Model, Urban Modelling

Abstract Id: 752
Detection and identification of targets involve gathering of spectral signatures, which can uniquely determine the surface properties of the target or object under consideration. Availability of prior knowledge which includes meta-data (latitude, longitude information, fore-optics of sensor and environmental conditions) and reference spectra of object, plays a crucial role in implementation of spectral matching and spectral anomaly detection algorithms for further analysis. The spectra at a particular pixel is influenced by certain parameters such as illumination effects, height and background material, color, material composition, surface geometry of object (slope, orientation and texture), age of material as well as atmospheric interactions. Therefore, for investigating the above parameters in order to interpret the engineered surfaces such as roads, bridges, roofs, sports infrastructure, railway tracks, monuments, water surfaces and engineered objects which are aircrafts, vehicles; an experimentation is being conducted to obtain the most optimum reference spectra. The urban region considered for the study is Udaipur, Rajasthan located in western part of India. The site consists of diverse engineered surfaces and objects making it optimum for proposed analysis. This paper presents an analysis of various parameters which affect the spectra of engineered surfaces and objects in field and which need to be considered during field data collection.

Keywords: Spectral libraries, Reference spectra, hyperspectral remote sensing, Spectroradiometer, engineered surfaces and objects

Abstract Id: 753
COMPARATIVE ASSESSMENT OF SOIL EROSION ACROSS MULETA WATERSHED, PHILIPPINES USING ARCSWAT MODEL

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Mindanao plays an important role in the agriculture sector by contributing 14 percent of the total GDP in 2015. However, Mindanao suffers from environmental degradation such as erratic stream flows, soil erosion, and sedimentation due to rapid land conversion and climate change. Consequently, Geo-informatics for the Systematic Assessment of Flood Effects and Risks for a Resilient Mindanao (Geo-SAFER Mindanao) program aims to quantify the volume of sediment yield of critical watershed of Northern, Mindanao Philippines. Among the area covered of the program and critically endangered watershed reported by Mindanao Development Authority is the Muleta watershed. Determination of sediment yield per erosion was done using ArcGIS with Soil and Water Assessment Tool (SWAT) conducted using the 2015 simulation result. Result shows that the accumulated sediment yield of all sub-basins in each section of the watershed coincides the degree of elevation and pattern of land use change of Muleta watershed with the sediment yield of around 47t/ha, 71 t/ha and 136 t/ha in upstream, midstream and downstream areas respectively. High sediment yield in the downstream area is expected, given that soil loss in various areas of the watershed travels downward towards the outlet. The land cover in the watershed is one factor for the rate of erosion occurrence. The continuing conversion of close canopy to agricultural cultivation and settlements evident in the watershed may be one cause of high amount of soil loss. This implies that Muleta watershed especially along its downstream area has unsustainable land use.

Keywords: Watershed, Soil Erosion, Sediment Yield, SWAT

Abstract Id: 754
USING ALTIMETRY AND REMOTE SENSING IMAGERIES TO OBSERVE LAND VERTICAL MOTION ASSOCIATED WITH 2004 INDIAN OCEAN EARTHQUAKE

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A great Indian Ocean earthquake occurred in 2004 has caused uplift and subsidence with various rates in Sumatra and Indonesia. The post-seismic land vertical motion apparently changed land formation and coastal topography. However, it’s usually difficult to quantify how coastline has changed after an event in a short time and with low cost. In this study, we utilize historical Landsat images in this region to first compose an inundation chance model along the coastal zone. This model is then converted into digital elevation model by giving height references (upper and lower boundaries) from satellite altimetry measurements. We exploit TOPEX/Poseidon (T/P), Jason-1, and Jason-2 time series in 1992-present to inspect land formation changes before and after the earthquake. Our preliminary result shows that the accuracy of our model is at 50 cm accuracy as compared indirectly against tide gauges. The vertical motion in a range of ±40~60 cm can be seen in several tidal flats potentially caused by this megathrust earthquake.

Keywords: Satellite Altimetry, remote sensing, post-seismic deformation, coastal change

Abstract Id: 755
CREATION AND HARMONIZATION OF VILLAGE BOUNDARIES USING GIS TECHNIQUES

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Village boundary is a well defined line that is drawn on a plan around a village, which includes the built up area and the land belonging to that village. Village boundary is a widely utilised planning tool for guiding, controlling and identifying limits to development for an individual village. In India the village boundary also forms the basic unit of any administrative entity like block, taluka, district or state. Due to its importance in decentralized planning at Panchayat level, the requirement of creating precise village boundaries in India has long been felt. But no organization has been able to provide these boundaries with acceptable accuracy. Some organizations like Survey of India (SOI), Census Department and National Informatics Centre (NIC) have attempted to create village boundaries, but there are a lot of variations among the boundaries from different sources. The present paper attempts to describe the use of GIS and high resolution satellite data in the creation of digital village boundary dataset, that can be extended to construct block, tehsil, sub-division, district, division and finally the state boundaries.

Jhajjar district of Haryana state was selected for the pilot study for extracting village boundaries. The methodology involved multi-step and multi-verification approach to ensure completeness and authenticity of the boundaries. As a first step digitization of Village boundaries was attempted from Ortho-Rectified Cartosat-1 Data (2.5 Meter Resolution). As consolidation has been done in Haryana and rectangular fields (9:10) have been created, the village boundaries cutting across these rectangular fields are discernible on very high resolution satellite image at many places. These village boundaries were digitized from ortho-rectified cartosat-1 data. However, at many places these boundaries were not clear. Therefore, as a step two the village boundaries were generated using digitized cadastral data of the state. Cadastral data was corrected for topological errors such as gaps and overlaps and codes were assigned so that all boundaries could be derived by a single database. By dissolving cadastral data of the villages on New Village (NV) codes created by NIC for the Revenue Data, the village boundaries were created. The village boundaries were tested for accuracy on high resolution satellite data. All The Village Boundaries of Jhajjar Tehsil created using this method and boundaries prepared by SOI were converted to KML file and overlaid on the on Google Earth data for checking accuracy. Our boundaries perfectly followed the village boundaries on the satellite data wherever discernible, whereas the boundaries from other sources were quite off. This amply proved the accuracy of the boundaries created using cadastral data.

Keywords: Village boundary, harmonization, GIS, Cartosat-I, Google Earth

Abstract Id: 756
Deimos Imaging has played a key role in the design, implementation and operational consolidation of highly relevant services in precision agriculture in different parts of the world. DEIMOS-1 has demonstrated large-scale coverage capacity since 2011 by providing the US Department of Agriculture (USDA) with the satellite imagery to retrieve in-season crop statistics and crop monitoring for the 48 contiguous states. This is done in cooperation with its twin satellite UK-DMC2, owned by Airbus.

Apart from USDA, major precision agriculture services in the world use Deimos Imaging as data source. The main contribution is the continuous optimization in the provision of DEIMOS-1 and UK-DMC2 data to empower the precision agriculture users at different stages: (i) Planning; (ii) in-season; and (iii) yield.

During the planning stage, the data provided by Deimos Imaging is being used in:
- The definition of uniform management zones and yield potential based on the analysis of the historical performance of the crops
- Planning of soil sample
- The definition of maps for variable rate of seeding and fertilizer

During the in-season frequent monitoring, the data is being used in:
- Prescriptions for variable rates: fertilizer and plant protection products (pesticides, herbicides, etc.) In function of the growth anomalies
- Prescriptions for irrigation support systems.

After harvesting, yield values are compared to the management zones maps and yield potential maps. Satellite archive record is reanalyzed for a better understanding of crop performance and for readjusting the management zones for the next season.

This presentation we will cover the results of various campaigns in agriculture, carried out with DEIMOS-1 and UK-DMC2 since 2011. Finally, Deimos Imaging will introduce “UrtheDaily”, a new constellation of satellites for a worldwide daily monitoring of entire landmass of Earth.

Keywords: Precision agriculture, advanced geoanalytics services, multi-disciplinary applications, long time data series, crop performance

Abstract Id: 757
IDENTIFICATION AND DEMARCATION OF ARAVALI PLANTATION AREA OF BHIWANI DISTRICT USING GEO-INFORMATICS TECHNOLOGY

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In the Aravali Hills, a large number of mining activities, operation of stone crushers and pulverisers, deforestation and unplanned construction activities are causing environmental degradation. The project is to demarcate the Aravali Plantation area for Bhiwani District. There are 33 Villages of Bhiwani District in which Aravali plantation area is falling as per Forest Department. In the study of Identification and Demarcation of Aravali Plantation area world view II image is used. Firstly Cadastral data of villages and Satellite data is taken and then Aravali Plantation area is extracted as per information provided by Forest Department and after that Geo-referencing and Rectification with Satellite Data is done. Non-spatial data also collected by taking GPS point of Aravali Plantation area during field visit. After field visit list of Aravali Plantation Numbers are updated and compare with forest data of Bhiwani district so that it may finds out that how much area covers by Aravali Plantation from total forest area. Finally Aravali Plantation area is Demarcated and Composed for the Final maps. Lastly Analysis part is to be completed which finds out that how People with the lack of knowledge exploiting resources to maintain standards which results environmental degradation and how other activities like mining affecting Aravali Plantation area. The study also emphasis on the encroachment of the urban area which is affecting and disturbing Aravali Plantation area.

Keywords: Remote Sensing, GIS, geo-informatics, GPS, Aravali Plantation.

Abstract Id: 758
Crop residue burning is a long-standing agricultural practice, but increasing population and demand for agricultural land and food has had a profound effect on the extent of crop residue burning. Farmers opt for burning because it is a quick and easy way to manage the large quantities of crop residues and prepare the field for the next crop well in time. Agricultural residues burning may emit significant quantity of air pollutants like CO2, N2O, CH4, and emission of air pollutants such as CO, NH3, NOx, SO2, NMHC, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) and particulate matter like elemental carbon that have a significant impact on air quality, human health, and climate and significantly contribute to the global warming. Although agricultural open field burning was prohibited by the government, the effectiveness of this ban is limited. Highly mechanized farming practiced in Indian Punjab leads to approximately 15-20 Tg of crop residue burning in fields every year. Therefore, the present study was undertaken with the objectives to study the district-wise burning pattern, extent and area of burning and to work out total area under residue burning. To achieve the objectives images of MODIS Terra/Aqua were acquired from 15-Oct to 15-Nov to capture active fire events. For estimating total burnt area multi-spectral, multi-sensor and multi-date images from IRS Resourcesat-2 (AWiFS LISS-III and LISS-IV, having spatial resolution of 56m, 24 m and 5.8 m, respectively) and Landsat-8 with 30 m spatial resolution were used. The results of the study revealed that maximum frequency of fire events were observed in the central, western and southern districts of the state. However, Northern and eastern districts of the Punjab show less fire events. Alternate uses of crop residue to decrease burning in the open fields have also been suggested in the study.

Keywords: Climate, Crop Residue Burning, Farmers, Air Pollutants, Multi-Sensor

Abstract Id: 759
HOW REPRESENTATIVE IS THE GRACE DERIVED LIQUID WATER EQUIVALENT THICKNESS IN THE TROPICAL INDIAN OCEAN

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Sea Level is an important ECV and it represents the Ocean dynamics. The present study focuses on the water mass-induced (Eustatic) sea level variability and the behavior of the GRACE data in comparison to steric corrected altimeter data over the Tropical Indian Ocean (TIO). We obtained GRACE derived Liquid Water Equivalent Thickness (LWET) based on RL05 spherical harmonics from Center for Space Research (CSR) and merged Sea Level Anomaly data from Copernicus Marine Environment Monitoring Service (CMEMS). The steric sea level is computed from SODA derived Temperature, Salinity profiles. The two data sets LWET and SLA-STERIC have been analyzed to understand Eustatic sea level variability over TIO at different time scales. The coherency between these two datasets is observed maximum (with $r=0.77$) in the Southern TIO, minimum (with $r=0.15$) in the Arabian Sea. The FFT analysis suggests the predominant oscillations in the datasets are at annual and semi-annual time scales. The amplitude and phase values of these oscillations have been computed using Harmonic analysis. The Annual and Semi-annual amplitude patterns and their occurrence times have been estimated. It is observed that the distribution of semi-annual amplitude of sea level variability in the TIO is much less compared to annual sea level variability. The maximum annual amplitude about 24-30mm has been observed from LWET data in the central southern Tropical Indian Ocean and the Eastern Bay of Bengal (BOB) the occurrence of maximum variability is in the month of June and July. Similar ranges of SLA-STERIC annual amplitudes are seen in the southern TIO and in the western parts of the Arabian Sea and Eastern parts of the BOB. GRACE observations show the semi-annual amplitude is varying between 0-20mm in the study region. But comparatively higher semi-annual amplitudes about 12-20mm of SLA-STERIC are observed in the Andaman Sea, off Indonesian Islands, Yemen, Oman and Kenya coast. Assessment study to understand the role of steric and Eustatic sea level long-term (2002-2015) trends on total sea level trend reveals the major contributor for sea level rise is steric sea level over the TIO.

Keywords: GRACE, Steric, Eustatic.

Abstract Id: 760
CLASSIFICATION OF VEGETATION IN JAPAN USING MODIS BY MACHINE LEARNING METHOD

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The classification of land use and land cover (LULC) from remotely sensed imagery can be conducted with two general image analysis approaches: i) pixel-based classifications, and ii) object-based classifications. While pixel-based analysis has long been the mainstay approach for classifying remotely sensed imagery. However, object-based analysis has become increasingly commonplace over the last years. Topography and geology are factors to characterize the distribution of natural vegetation. Topographic contour (elevation, slope, slope direction) determines the living conditions of plants such as soil moisture, sunlight, and windiness. The similar topographic conditions exhibit the similar distribution of vegetation unless natural disturbances or artificial disturbances being occurred. A vegetation map of Japan was developed using an object-based segmentation and pixel-based approach, included in machine learning package, with topographic information and climate information (monthly average temperature, monthly average precipitation) with MODIS remotely sensed data. The results of four methods were compared: i) object-based considering climate information ii) pixel-based considering climate information iii) object-based not considering climate information, and iv) pixel-based not considering climate information. Through the comparison, the object-based classification is more effective to produce a vegetation map than the pixel-based classification. In addition, the classification accuracy with considering climate information was higher than not considered. In a study on areas with elongated topographical features like Japan, it is necessary to consider horizontal distribution due to the latitude of vegetation and vertical distribution due to altitude.

Keywords: MODIS, Machine learning, Comparison, Object-based, Classification

Abstract Id: 761
MAPPING DECIDUOUS FOREST USING TIME SERIES SENTINEL-1A DATA IN DAKLAK PROVINCE, VIETNAM

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Deciduous forest is a typical forest in the Central Highlands of Vietnam and some parts of Southeast Asia. Deciduous forest plays a vital role in developing of fauna and flora and preserving biodiversity in the Central Highlands. However, the requirement of economic development and the lack of knowledge about the role of deciduous forest are the major reasons of decreasing deciduous forest area in Daklak province. Time series SAR image data are the appropriate resource for monitoring changes of deciduous forest. Sentinel-1A satellite of the European Space Agency (ESA) is a new microwave satellite and offer free data. Sentinel-1A satellite carries a Synthetic Aperture Radar sensor with band-C, spatial resolution is 10 m and acquisition cycle is 12 days. In this paper, the authors propose a process for discriminating deciduous forest in Daklak province using time series Sentinel-1A data in 2015. The experience data is Sentinel-1A data with VV polarization and IW mode. Random Forest is applied for classifying with the sample data are gathered by the field surveying. The accuracy can achieve up to 87%.

Keywords: Sentinel-1A, deciduous forest, time series, Random Forest

Abstract Id: 762
Mangroves are coastal wetland forests established in the intertidal zones of tropical and subtropical latitudes that nurture and safeguard local ecology of the area. World-wide mangroves are disappearing at an alarming rate. Amongst the maritime States of India, Gujarat has the second highest mangrove cover after West Bengal. In around three decades Gujarat has more than doubled its mangrove cover. Amid Gujarat, mangroves are well developed in Lakhpat taluka (block) situated in Kachchh district. Assessment of mangroves health and the intertidal area are very important for assessing the overall ecology of Lakhpat mangroves. Remote Sensing is an indispensable tool for assessing and monitoring land use/land cover changes and supports in planning appropriate conservation measures. Gulf of Kachchh has experienced both natural and anthropogenic changes which made it a distinctive site to analyse how natural processes and anthropogenic activities determine land use change.

In this study, multi-temporal Landsat TM data covering Lakhpat taluka (block) of February-1995, 2000, 2010, 2015, 2017 Sentinel data (spatial resolution 10 m) of April-2017 was analyzed. The various vegetation indices (VIs) like Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), Infrared Percentage Vegetation Index (IPVI), Difference Vegetation Index (DVI), Normalized Difference Mangrove Index (NDMI) and Shortwave Infrared Absorption Depth (SIAD) were generated, evaluated and compared for assessing its suitability for discrimination of mangroves and other terrestrial vegetation. Health assessment of was attempted using various criteria like mangrove density based on NDVI, anthropogenic stress, and availability of water flow to riverines during the high tide for good mangrove growth.

It was observed that NDWI and SIAD are two promising indices for distinguishing mangroves from other agriculture and terrestrial vegetation. Criteria based analysis shows health of mangroves of Lakhpat. However, distance of habitation from mangrove has negative impacts on the mangrove health due to human interference.

Keywords: Mangrove health monitoring, Vegetation indices, Multi-temporal Landsat TM data, Criteria based analysis

Abstract Id: 763
CONSTRUCTION OF GLOCAL MONITORING SYSTEM FOR DISASTER MONITORING

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In 2016, Tokai University initiated a new project call “Constructing glocal monitoring system for safe and secure society”. “Glocal” is the coined word of “global” and “local”. The main concept of the project is to connect global monitoring system using satellite observation with local monitoring system using SNS for monitoring disasters and environmental changes. The project was approved by the Ministry of Education, Culture, Sports, Science and Technology(MEXT) of Japan as one of the Research Branding Project of Private Universities in Japan supported by NEXT for five years. Tokai University is receiving MODIS, VIIRS and AVHRR data at it's ground station in Shonan Campus. The data are automatically processed and archived in near real time. On the other hand, the authors have been operating Disaster Information Ttweeting System(DITS) for disaster information collection. The authors are constructing the Glocal Monitoring System by connecting the satellite data system with DITS.

Keywords: disaster, satellite, SNS, global, local

Abstract Id: 764
T- NETWORK ANALYSIS OF HISAR TOWN BY USING HIGH RESOLUTION SATELLITE DATA

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ESRI Social Network Analysis (SNA) provide multiple solution aspects for a variety of problems pertaining to T-networks include understanding the location science for efficient travel route, generating travel directions, locating the closest facility and defining service areas based on travel time and distance covered. The present study analyzed the potential use of network and in defining the optimal service area of different services such as hospitals, schools and fire stations of Hisar city. Quick Bird (0.6 mtr.) image of Hisar city has been used for this study; it was then geo-referenced. Digitization was carried by using Shape file generated for different analysis. The network analysis tool was used to measure the efficiency of services in terms of time and distance. It also help in analyzing the gap existing in the spatial allocation of these services in city area and whether the existing resource allocation is good or bad in term of efficiency of these services. Network analysis in GIS rests firmly on the theoretical foundation of the mathematical sub-disciplines of graph theory and topology.

Keywords: SNA, T-Network, Graph Theory, Location Science, Optimal Service

Abstract Id: 768
A REMOTE SENSING BASED STUDY OF LAND USE AND LAND COVER TRANSFORMATION ALONG KUSMUNDA COLLiERY, KORBA, CHHATTISGARH, INDIA

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The remote sensing technologies have become an intelligent method to visualize relative transformation over a period of time. It can act as a support system for the entire mining life cycle. As, these are capable of assessing the project planning, mining operations, transportation management, and risk analysis. The analysis of land use and land cover alterations can reveal the significant information for understanding the pattern of mining and environmental degradation. Which can provide much information for decision-making, as these analyses the mutual conversions among diverse land use and land cover classes. The mining regions along the along Kusmunda Colliery, Korba, Chhattisgarh, India have been reported to be facing environmental challenges, due to anthropogenic impacts. Therefore paper attempts a preliminary assessment of the various features surrounding the mining area. The Land-use/land-cover (LULC) study was performed with the help of multi-temporal remote sensing datasets (like Landsat TM, ETM, and OLI) in order to recognize the several classes contributing to environmental degradation. The temporal changes have been brought out on the feature classes to establish a spatial transition in the feature classes. This study assesses the decadal changes occurred due to mining activities. The LULC maps for the recent as well as for the past year have been prepared using band ratios as a pre-classification step, followed by implementation of a combination of supervised and unsupervised classification called hybrid classification. An accuracy assessment was carried out for each of the datasets to assess the overall accuracy of the classifications being performed. These maps will contribute to the development of sustainable land use planning as well as protection measures, as the geoscientific data can be easily moved in and out of a GIS environment for various types of analysis.

Keywords: remote sensing, environment, land use/land cover, mining safety.

Abstract Id: 771
A STUDY ON HEALTH CARE SERVICES AND LIVING CONDITIONS OF THE SLUM DWELLERS IN BATHINDA CITY" USING BY GEOINFORMATICS TECHNOLOGY

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A group of buildings, or area characterized by overcrowding, deterioration unsanitary conditions or absence of facilities or amenities, called as slums. Bathinda is one of the oldest towns in the state of Punjab and has many historical associations. There is an ancient "Fort" in Bathinda, Bathinda has an urban population of 2,17,256 comprising 41,645 households.

The Present Study are described the objectives set to examine the level of conditions in slums of Bathinda city:- Inventory of Notified and non-Notified slums in Bathinda city and analyzing on Land use compatibility. For the purpose of understanding the character of slums and the level of basic amenities at the city level, the detailed study of 4 slums (1 from every cluster) has been selected on the basis of the scoring. The slum with least score and maximum population has been selected for the study and further improvement and up gradation under AMRUT Guidelines. Existing situation of the basic facilities and amenities is analysed by doing the primary survey at site level and the household level in each case study area. Level of basic facilities and housing condition is also accessed to come to know about the availability and accessibility of basic facilities and amenities in the selected case studies as in Kheta Singh Basti, Janta Nagar, Sanjay Nagar and Dhobiana Kachi Basti.

In this project, we conclude that why we take the slum conditions and quality of life of the slum dwellers, what will be coverage about the slums, limitations and to detail the methodology. In the following the next chapter we discuss the parameters of factors responsible for the condition of slums, and all theoretical part. Adopts a project approach to ensure basic infrastructure services relating to Water supply, Sewerage, Septage management, Storm water drains, Transport and Development of green spaces and parks. Final we are prepare the slum maps composed with the help of GIS and Simple statistical techniques are used to interpret the data and different statistical diagrams are made to show the results.

Keywords: Municipal Corporation, quality, slums, Guidelines, analyzing

Abstract Id: 772
PREPARATION OF DEVELOPMENT PLAN OF HISAR TOWN, HARYANA USING REMOTE SENSING & GEO-INFORMATICS

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Current Study describes the methodology for preparation of Development Plan for Hisar town for the year 2021 A.D. using geo-referenced Satellite data. Thematic database consisted of urban information, such as District Boundary, Controlled Area Boundary, M.C. Boundary (old and extended), Village Abadi, Road, Railway, greenbelt etc. were digitized and geo-referenced. These are required for further analysis to develop and customize complete urban information system for administrators and planners.

The present study demonstrates the status, scope, need, methodology and outcome of the thematic mapping for the purpose of urban Planning of Hisar town of Haryana. For this high resolution Word-View data for the year 2012 was interpreted and analysed.

Generation of urban planning thematic layers database is accomplished through a series of procedural steps. Basically the methodology comprised of the functional components like data acquisition, data processing and integration, developing of a classification scheme, field verification, and preparation of Master Plan.

The output was generated based on the design standards and template of development. Development Plan is a detailed plan for a Zone conceived and prepared within the framework of a Master Plan containing proposal for various land used, roads, park and open space, community facilities, services and public utilities etc. The output was generated based on the planning boundaries of the town. These development plan maps are very useful for development of urban area and management at district level.

Keywords: Geo-referenced, Controlled Area Boundary, Management, Word-view,Master Plan.

Abstract Id: 773
SITE SUITABILITY ANALYSIS FOR LOCATING OPTIMAL MOBILE TOWERS IN UTTARAKHAND USING GIS

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With the rapid growth of wireless communication and increasing size of cellular network, the task of cellular network planning and resource optimization is becoming more and more challenging. A good network planning will be the one, which results in less infrastructural expenses by utilizing optimal resources while ensuring more customers’ satisfaction. The increase in number of mobile tower sites Base Transreceiver Station (BTS) with growing customers, not only raises the total cost of the cellular network but it also has a great impact on radiation hazards issues. It is vital to optimally select BTS sites in the design of cellular networks. Selecting BTS sites in a varying topographic area with non-uniform users’ distribution, such as Uttarakhand, is another major challenge. With path loss estimation along with propagation prediction models coupled with careful analysis of spatial data and obtaining topographical information from Geographic Information Systems (GIS), potential tower locations can be determined. This paper proposes a methodology for assessing the site suitability of Base Stations of BSNL cellular radio networks in Uttarakhand with the objective of optimizing and automating the process of network planning. Geographic information, such as satellite images, topographical maps, municipal digital maps, Aster DEM, site parameters of existing BSNL towers (such as Latitude and Longitude, antenna height, frequencies) of study area are collected from different sources. Using these data various layers of road network, rivers, habitats, forest cover, and tourists point have been formed in ArcGIS software to locate the suitable sites. Out of these suitable sites, only the indispensible and optimal locations are chosen with the help of an optimization algorithm. Hence, the proposed method provides cost-effective way for finding the optimal positions of tower placement.

Keywords: Cellular Network Planning, Base Transreceiver Station, GIS and Optimization

Abstract Id: 774
EVALUATION OF MULTI-TEMPORAL/SENSOR DATA FUSION FOR URBAN CHANGE ANALYSIS

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Natural Resource Management, Planning and Monitoring programs depend on accurate information about the land cover/use for varying sized regions. Satellite sensor images with moderate to various resolutions have facilitated scientific research activities at landscape and regional scales. Availability of new generation satellite imagery can provide a variety of spatial resolutions for analysis of urban growth and transportation development in terms of assessment and monitoring. Moreover, multispectral image data provide increased spectral resolution that can be used to further analyze and classify environment condition, land cover/use characteristics, change detection and how urban growth development impact these conditions. Especially for land cover/use analysis, static attributes such as class types and their areal coverages and dynamic attributes such as changes in classes and the rate of change can be determined by use of multi-temporal/sensor satellite images.

In this study, a part of Istanbul metropolitan area that faced a great land cover/use change was investigated. For that purpose, 1992 dated SPOT 4 panchromatic image was fused with 2016 dated Landsat 8 OLI multispectral data. As an inverse approach 2016 dated Landsat 8 OLI panchromatic image was fused with 1984 dated Landsat 5 TM multispectral data. Image fusion processes were performed using Gram Schmidt fuse algorithm which integrates all bands of the multispectral image into fusion. After fusion operations, two image datasets were classified in order to determine land cover/use changes. Results of the study showed that proposed methodology provided efficient and rapid determination of the changes due to their distinct spectral characteristics from their surroundings in fused images. This methods add significant advantages for land use/cover classification.

Keywords: Image fusion, land cover/use change, Gram Schmidt fuse algorithm, Istanbul

Abstract Id: 775
UAV REMOTE SENSING FOR MAPPING OF LAND ACQUISITION PROJECTS IN ANDHRA PRADESH: A CASE STUDY

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Unmanned Aerial Vehicle (UAV) platforms are nowadays a valuable source of data for surveillance, inspection, mapping and 3D modelling. UAVs can be considered as a low cost, short & close range alternative to the classical manned aerial photogrammetry. At the current state low cost UAVs are being used mainly in mapping projects with low budgets. UAV based mapping provides not only the required accuracy at micro scale and also for the generation of elevation models in small scale areas. Rotary and fixed wing UAVs are capable of performing the photogrammetric data acquisition with amateur or single lens reflex digital cameras and it can fly in manual, semi-automated and autonomous modes. The outputs of the UAV technology includes 3D results like Digital Surface or Terrain Models (DTM/DSM), contours, textured 3D models, vector information, etc. In the present study, an attempt is made for mapping of different structures using UAV technology in Kovvada village, Ranastalam mandal, Srikakulam district, Andhra Pradesh for rehabilitation purpose. The abilities of UAV imageries in mapping of structure are assessed. The study reveals that the information generated on various types of structures with measurements in the village is very precise and serves the needs of the administration for taking compensation and rehabilitation measures in any land acquisition sites, in a short duration.

Keywords: UAV Remote Sensing, Drone, DTM, DSM, 3D

Abstract Id: 776
MAPPING SUPRAGLACIAL STREAMS USING MAXIMUM LIKELIHOOD AND MAHALANOBIS DISTANCE CLASSIFICATION ON WORLDVIEW-2 DATA

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Supraglacial streams are key geographic features in Antarctica that prevent the disintegration of ice sheets and glaciers. Supraglacial streams also act as a mode of transportation for sediments, solutes and other biotic and abiotic features. This study focuses on geospatial mapping of supraglacial streams from Schirmacher Oasis in Antarctica using high resolution optical satellite imagery. This could help advanced researches on the stream networks such as bathymetry study, hydrological studies etc. Supervised classification methods; Maximum likelihood classification (MLC) and Mahalanobis distance classification (MDC) have been employed and accuracy has been assessed in different levels such as accuracy of few regions that undergone MLC, method-wise accuracy and finally length-wise accuracy assessment. It is seen that MLC is successful overall with average RMSE less than 5 m with a notable limitation of mapping only longer streams of an average length 350 m and above more accurately. Spectral mixing in the available data, presence of sediments, sun angle during data acquisition, streams being dry during most of the year etc., are some of the limitations faced during the study. A higher spectral resolution data or a combined classification system or both together can be employed for better results in the future.

Keywords: Supraglacial streams, Optical satellite imagery, Supervised classification, Bathymetry

Abstract Id: 777
Land Surface Albedo (LSA) plays a key role in land-surface energy balance studies, weather & climatic modeling and climate change investigations. In this study, Oceansat Ocean color monitor (OCM-2) Broadband Land surface albedos were analyzed for inter annual and intra annual variations in concurrence with different land cover types. The influence of Normalized Difference Vegetation Index (NDVI), Land Surface Temperature (LST) and sun zenith angles on LSA on different land cover types were also analyzed. Intra annual variation in LSA follows a Gaussian distribution for most of the land cover type which includes grassland, dry deciduous forest, semi-ever green forest, wet ever green forest and cropland. A negative correlation was observed between LSA and LST. The vegetation density variability (NDVI) was mostly found to be inversely correlated with LSA. Inter annual variation (for a period of 4 years) in LSA for the various land cover considered were found to be very minimal.

Keywords: LSA, intra annual variations, inter annual variations, NDVI, LST

Abstract Id: 780
ESTIMATION OF RADIOACTIVE POLLUTANTS ADVECT FOR FUKUSHIMA NUCLEAR POWER PLANT BY A PARTICLE MODEL

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On March 11, 2011, the Great East Japan Earthquake brought strong shakes and tsunami in East Japan, and Fukushima Daiichi Nuclear Power Plant became out of control. Finally worldwide radioisotope pollution occurred. Especially hydrogen explosions and vent operations emitted radioisotopes and impacted neighboring areas significantly. In this study, an atmospheric diffusion simulation was carried out for each pollution using a simple particle model. Without complex and vast calculation, instantaneous diffusion damage predictions for the accident or trial atmospheric diffusion simulation before the accident are expected with much effect. Calculations with the particle model were carried out from Mar 12 to 30, 2011.

The wind velocity and direction data were from atmospheric analytical data in 5 km-grid every hour with 8-class heights from surface to 3000 m. The precipitation data were used from the composite data of RADAR and AMeDAS. Radar-Amedas is precipitation data in 1 km-grid every 30 minutes. Particles were 10 sizes of 0.01 to 0.1 mm in diameter with specific weight of 2.65 and vertical speeds given by the Stokes equation. In rainy time, the particles fell down at a moment as wet deposit in calculation. The altitudes on the ground were given by DEM with 1 km-grid. The spatial dose by emitted radioisotopes was referred to the observation data at monitoring posts of Tokyo Electric Power Company.

The falling points of radioisotopes were expressed on the map using the particle model. As a result, almost the same distributions were obtained as the surface spatial dose of radioisotopes in aero-monitoring by Ministry of Education, Culture, Sports, Science and Technology. By the particle model, the falling positions on the ground were estimated each particle size and height. Particles with more than 0.05 mm of size were affected by the topography and blocked by the mountains with the altitudes of more than 700m.

Keywords: Fukushima, Radioactive pollution, Particle model

Abstract Id: 781
ESTIMATION OF WHEAT STUBBLE BURNING AREA IN MAJOR CROP GROWING DISTRICTS OF HARYANA USING GEOINFORMATICS

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Mechanized combine harvesting technologies, which have become common in Rice-Wheat System (RWS) leave behind large quantities of straw in the field. Burning of these straw results in release of polluting gases like CO2, CO, CH4, N2O, NOx, NMHCS and aerosols. Besides, the burning kills the useful microflora of the soil causing soil degradation. The present paper describes the methodology and results of assessment of wheat stubble burnt areas for twelve major crop growing districts of Haryana for the year 2017.

Multi-date AWiFS sensor data from Resourcesat 1 and 2 satellites from April 03 to May 25, 2017 for 12 dates were used for estimating acreage of wheat stubble burning areas for the year 2017. In season collected ground truth data and field photographs were used to identify area of wheat stubble burning area and associated land features. Complete enumeration approach was used for digital analysis using multi-phase unsupervised classification approach using Iterative Self-organizing Data Analysis Technique (ISODATA) Clustering classifier.

Total wheat stubble burning area in the twelve project districts was observed to be 292.8 thousand ha. which is 14.6% of the total wheat area. Study indicates that concentration of burnt wheat stubble burning area is more in Fatehabad (48.0 th. ha.), Karnal (41.8 th. ha.), Jind (41.5 th. ha.) and Kaithal (33.7 th. ha.) districts and moderate in Sonipat (20.5 th. ha.), Hisar ( 19.9 th. ha.), Rohtak ( 18.6 th. ha.), Sirsa (18.4 th. ha.) and Panipat (16.8 th. ha.) districts while Low is in Kurukshetra (12.5 th. ha.), Jhajjar (11.8 th. ha.) and Bhiwani ( 9.3 th. ha.) districts. Low wheat stubble burning in Kurukshetra, Jhajjar and Bhiwani districts may be due to utilization of residue for fodder and other purposes.

Keywords: AWiFS, Wheat, Stubble, Geoinformatics, Burning

Abstract Id: 782
MONITORING OF KEY PARAMETERS OF WHEAT CROP USING UAV MOUNTED WITH NIR CAMERA

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Agricultural experts usually use satellites to assess crop health. UAVs are a natural progression from macro to micro, from large-scale to small scale farms. The present study was conducted for wheat crop at two different research locations of Punjab Agricultural University with an aim for determining effect of various vegetation indices obtained by image processing. The drone used was self-fabricated and was mounted with Mapir Survey Grid 2 NDVI (Red + NIR) camera over a gimble which was used for taking the images. The NDVI model sees both Near Infrared at 850nm and Red at 660nm light. NIR images were acquired at different growth stages of wheat crop. Experiment was planned for different crop parameters like nutrient requirement, lodging of crop etc. Images captured from this camera were calibrated into an index image and then a coloured lut was applied to show the contrast between stages of vegetation crops. Normalised Difference Vegetation Index (NDVI) was computed by image processing and maps were plotted using Arc GIS. The vegetation indices obtained from images of UAV were in excellent agreement with those acquired with the ground-based sensors and ground conditions.

Keywords: UAV, NDVI, Wheat, Agriculture, GIS

Abstract Id: 783
On March 11, 2011, the Great East Japan Earthquake brought the earthquake and tsunami in East Japan, and Fukushima Daiichi Nuclear Power Plant became out of control, finally worldwide radioisotope pollution occurred. Atmospheric diffusion of radioisotopes was simulated by SPEEDI and various methods so far as validations and reproduction. Tokyo Electric Power Company presented analytical results for radioisotope emission estimation, and most of estimates for the accident and examinations for simulations are still calculated continuously. In this study, pollution simulations were carried out discretely using a simple particle model. The radioisotope pollution shows two kinds of patterns: dry and wet deposits for nuclear power plant accidents. Two surface pollution patterns were analyzed by fractal. Dry deposits correspond to the shape of the watershed, while wet deposits correspond to the shape of clouds. On the other hand, wind flow patterns are laminar and turbulent depending on flow speeds. Chernobyl accident was another objective. As a result, Fukushima Daiichi Nuclear Power Plant accident pollution was carried out by dry and wet deposits with laminar flows. Chernobyl Nuclear Power Plant accident pollution might be progressed by wet deposit with turbulent flow.

Keywords: NOAA/AVRR, Fukushima, Chernobyl, Fractal

Abstract Id: 785
COMPARISON OF INSAT-3D SST WITH MODIS AND IN-SITU MEASUREMENTS

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INSAT-3D is an advanced weather satellite, indigenously developed by ISRO, for meteorological observation, monitoring of land and ocean with high frequency of 48 (half an hour interval) observations in a day. INSAT-3D imager provides a wide range of derived geophysical products, in which, SST is one among them. These high-frequency SST data may allow studying the diurnal variability of upper ocean thermal state and air-sea interaction processes. This is otherwise not possible from other conventional polar orbiting satellites. Before using INSAT-3D high-frequency SST for any such application, its assessment is essential. In the present study the quality standards of INSAT-3D SST is assessed by comparing with in situ and other contemporary satellite observations such as Moderate Resolution Imaging Spectroradiometer (MODIS) SST. Inter-comparison of INSAT-3D SST with MODIS SST for the Indian Ocean region is carried out for a period of 17 days from 1st to 17th January 2014. Spatially and temporally both data are matching very well. Strong positive correlation has been found between MODIS and INSAT-3D SST with RMSE of 1oC. INSAT-3D SST has been analyzed for diurnal variation with in-situ measurements at RAMA buoy locations, one is at 90oE, 15oN and other is at 90oE and 12oN locations for a period of 1st to 17th January 2014. In situ data shows up to ~1oC variation over the 17 days, whereas INSAT-3D SST has shown around ~5oC variation. The results show that, the INSAT SSTs are comparable in accuracy to the MODIS SST fields. The large differences in the diurnal variation between buoy and INSAT-3D measurements is attributed to the fact that buoy measurements are at a depth of 1m whereas INSAT-3D (IR channels) measures SST skin temperature (10-20μm depth) and also due cool skin layer effects in night time and warm layer effects in day.

Keywords: Sea surface temperature, INSAT-3D, MODIS, Inter comparison, Diurnal variability

Abstract Id: 786
INTEGRATED USE OF MODIS DATA DERIVED APPARENT THERMAL INERTIA (ATI) AND SATELLITE GRAVITY DATA FOR LITHOLOGICAL AND STRUCTURAL MAPPING: A CASE STUDY IN PARTS OF BANSWARA, RAJASTHAN, INDIA

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The present study is aimed to integrate the remote sensing and geophysical data for lithological and structural mapping. Apparent thermal inertia (ATI) is a geophysical parameter which is related to resistance offered by a material to change in temperature. It can be used to map lithological units because every lithogical unit behaves differently to change in temperature. Gravity is also a geophysical parameter and is directly relate to change in density. Also, it can be used to demarcate contacts between different lithogical units. The present study area is located in the Banswara district of Rajasthan. The major rock types present in the study are dolomite, phyllite, quartzite, gneiss, basalt and chlorite- schist. Moderate Resolution Imaging Spectroradiometer (MODIS) data have been used to derive ATI image for lithological mapping. ATI is directly proportional to co-albedo and inversely proportional to day and night temperature difference. It is calculated using MODIS day and night land surface temperature, and albedo images. Satellite gravity data model EIGEN-6C4 is used to derive different gravity data products for lithology and structural mapping. Satellite gravity data is processed to separate regional gravity from residual gravity field. Residual gravity anomaly represents the effect from the shallow subsurface features. Also, Gravity data is processed to find deep seated structures (fault) and to estimate basement depth. We observed that the rocks which have high density consists low ATI values and the rocks which have medium density shows high ATI values.

Keywords: ATI, MODIS, Satellite Gravity, Residual gravity anomaly

Abstract Id: 787
The formation of Urban Heat Island (UHI) mainly is due to many factors, such as climatic factors and city parameters like low-albedo materials, low vegetation cover and urban geometry etc. Spatial identification of UHIs is a necessity to take appropriate remedial measures to minimize their adverse impacts. Satellite Remote Sensing provides a cost-effective and time-saving method for Spatio-temporal analyses of Land Surface Temperature (LST) distribution. Objectives of this study were to spatially identify the UHI formations in urbanizing city of Kandy, identify the relationship between LST distribution and vegetation cover by analyzing Landsat satellite imageries obtained in last week of January in 1992, 2000, 2009 and 2016. The study area is in Northern latitude 70°13’- 70°21’ and Eastern longitude 80°33’- 80°41’ in central Sri Lanka with consists 144 km² of area. Landsat satellite data was utilized. Thermal bands were analyzed to identify the Spatio-temporal LST distribution pattern. Vegetation cover was extracted by using NDVI method and subsequently examined with the distribution of LST. The results show that the LST of the Kandy has fluctuated from year to year but it has slightly increased and areas which are undergoing a temperature between 25°C and 31°C are expanding in the time and space. The city has changed into heat island and creation of UHI, urban growth and urban sprawl have happened beyond the city limits. When compared LST and NDVI, the LST is always lower in areas covered with vegetation relative to non-vegetated areas. But timely LST increased in vegetation areas. This may be due to increasing LST in surrounding areas. Remedial measures such as increasing the albedo of the city protect of vegetation cover and use green roofs can be introduced to high LST areas identified in this study based on LST distribution and lack of vegetation cover in order to minimize the adverse socio-environmental effects of UHIs.

Keywords: Urban Heat Island, Land Surface Temperature, NDVI, Landsat Image, Kandy City

Abstract Id: 788
DETECTION AND IDENTIFICATION OF TARGETS USING FUSION OF
HYPERSONTRAL AND LIDAR DATA

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A target in remote sensing may be defined as an object/activity of interest. Though primarily, the problem of target detection can be defined as a binary hypothesis testing problem which confirms the presence or absence of targets of interest, however, detection of a target itself may not be sufficient in decision making. Target detection therefore consists of several interlinked processes which may include, detection, discrimination, classification, identification and quantification etc, all of which may be required to arrive at certain effective decisions. On the other hand, detection and identification of target using remote sensing data is a challenging task due to spatial resolution, small size of target, accuracy requirement etc. Despite its high spectral content, at times, hyperspectral data may not provide any results other than indicating presence of targets. The associated tasks of classification, identification and quantification etc may require additional data to extract geometric, contextual and other target characteristics. Therefore, fusion of different datasets may produce better understanding of the area being investigated and thus may aid in improving accuracy of detection. In this paper, an approach for detection and identification of different types of targets (vehicle, fabric, building and tree) using decision level fusion of HSI and LiDAR data has been proposed. Firstly, spectral detection using HSI data has been implemented. Next, LiDAR point cloud classification has been performed and used for computing morphological parameters for each target. Lastly the decisions obtained from HSI, LiDAR and morphological analysis have been fused to infer identity of desired targets. Results demonstrated that all of the four targets have been successfully identify variety of man-made and natural targets considered.

Keywords: HSI, LiDAR, Detection, Identification, Spectral Matching, Morphology

Abstract Id: 789
COMPARISON OF OCEAN SURFACE WINDS FROM SCATSAT-1 SCATTEROMETER WITH BUOYS MEASUREMENTS

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The Scatsat-1 satellite was launched by Indian Space Research Organization (ISRO) on September 26, 2017. Scatsat-1 is a continuity mission for Oceansat-2 Scatterometer which provides wind vectors i.e. wind speed and direction over the global oceans. These wind vector data products are being used for weather forecasting, cyclogenesis prediction, cyclone detection and tracking services by different national and international users. The satellite covers the entire globe over a period of two days. Validation of satellite derived observations with ground truth information is required for operational usage of data products in different applications. This paper describes the validation of ocean surface winds derived from Scatsat-1 Scatterometer using global moored buoy observations. Sea surface winds derived from SCATSAT-1 over global oceans are evaluated against the data from global in situ buoys by National Data Buoy Center (NDBC) and Tropical Atmosphere Ocean (TAO) project for the period of 6 months i.e. from Nov 2016 to APR 2017. The root mean square (RMS) difference is used as the indicator for evaluation of data products. RMS differences are calculated for wind speed and direction separately in both rainy and rain-free conditions using the rain quality flag. The RMS differences in the wind speed and wind direction are 1.51 ms\(^{-1}\), and 26.4° respectively for rain free conditions. The accuracies of SCATSAT-1 wind products in speed and direction are 2 ms\(^{-1}\) (or 10% whichever is higher) and 200. The wind speed indicator RMS is well within the specified SCATSAT-1 accuracy, however wind direction is larger than the specification. Sensor specifications are better achieved for rain free conditions than rainy conditions. The reasons for deviation in wind direction from specification are discussed in this paper.

Keywords: Scatsat-1, Scaterometer, Root Mean Square Error, Buoys, NDBC, TAO

Abstract Id: 790
HYDROLOGICAL MODELING APPROACH FOR FLOOD EARLY WARNING IN GANDAK RIVER BASIN

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Flood is the most common disaster in India causes immense loss to the country's property and lives. Anticipating floods before they occur allows for precautions to be taken and people to be warned so that they can be prepared in advance for flooding conditions. Bihar is India's most flood-prone State, with 76 percent of the population, in the north Bihar living under the recurring threat of flood devastation. The present study is to simulate the discharge of Gandak basin through semi-distributed hydrological modeling approach using space inputs. The basin is geographically located between 290 30' N to 250 30' N latitude and 820 30'E to 860 E longitude. The aerial extent of the basin is approximately 45,731 Sq. km. This river originates in Tibet, flows through Nepal and enters into India. Hydrological modeling is the challenging task in the trans-boundary rivers due to non-availability of field data. CARTO Digital Elevation Model (DEM), land use/land cover derived from IRS-P6 AWiFS data, and soil textural data of National Bureau of Soil Sciences and Land Use Planning (NBSS&LUP) of the study area are used in the hydrological modeling. For non-Indian topography Global data sets of land use/land cover and Soils obtained from FAO were used. The hydrological modeling approach involves topographic and hydrologic parameter extraction, hydrometeorological model setup, computing runoff volume, modeling direct runoff, flow routing to the river outlet. Rainfall data of 2010, 2011, 2012 and 2013 obtained from Indian Meteorological Department (IMD) and Climate Prediction Centre (CPC) is used to run the model. The model results are verified at CWC gauge site and found to be matching with the observed data.

Keywords: Flood Forecasting, Gandak basin, Hydrological Modeling

Abstract Id: 791
FORTNIGHTLY ASSESSMENT OF MODIS - NDVI DATA TO UNDERSTAND GROUNDNUT YIELD BEHAVIOUR IN MID SEASON FOR PRODUCTION ESTIMATES - A CASE STUDY IN ANANTAPUR DISTRICT OF ANDHRA PRADESH

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The study explored the suitability of the Normalized Difference Vegetation Index (NDVI) from the Moderate Resolution Imaging Spectrometer (MODIS) obtained for Anantapur district, over ten years (2008–2017) to understand the behaviour of Groundnut (Arachis hypogaea) yield in mid season (at peak crop growth stages) and its total production. Pre-harvest crop yield forecasting plays a vital role in coping with the challenges of the impacts of climate change on agriculture. NDVI product of MODIS (MOD13Q1-250mt) of 16 days composite (fortnightly) were analysed for predominant groundnut growing mandals of Anantapur from August to September. For this study, Anantapur district selected as since this is a perennially drought prone district of Andhra Pradesh and the major kharif crop is Groundnut, contributing 6 to 8 lakhs ha in kharif season per year. It is essential to frequently monitor the Groundnut crop condition within crop growing season and assess the yield prospect. The peak vegetative growth of Groundnut crop is mainly covered in August and September month in Anantapur district. The average yield of nine years (2008 to 2016) of selected mandals is varying from 136 kg/ha. to 496 kg/ha. Initial relationship between NDVI and yield were made fortnightly from June to September and a significant relationship were observed between NDVI and yield in selected mandals for 1st fortnight of August, 2nd fortnight of August and 1st fortnight of September varying from $R^2 = 0.08$ to $0.44$, $R^2 = 0.09$ to $0.52$ and $R^2 = 0.05$ to $0.52$ respectively. The current year (2017) fortnightly NDVI values were used to forecast yield in mid season and a significant correlation were observed between predicted yield and observed average yield (2008 to 2016) for 1st fortnight of August, 2nd fortnight of August and 1st fortnight of September with $R^2 = 0.74$, $R^2 = 0.82$ and $R^2 = 0.48$ respectively. The total production was estimated in mid season using groundnut actual crop sown year up to 12th September, 2017 at mandal level.

Keywords: MODIS, NDVI, Crop condition, Groundnut

Abstract Id: 792
Landslide hazard zone should indicate the possibility of landslides occurring throughout a given area. An ideal landslide hazard zones would show, not only the chances that a landslide may form at a particular place but also the chance that it may travel downslope in a given distance of a region. The recent decades have a prolonged history of disastrous landslides in South India, especially the mountains (viz. The Nilgiris, Kodaikanal, Valparai, and Sahyadri hills) of Tamil Nadu. The aim of the study is to demarcate the vast stretch of Landslide Hazard Zones (LHZ) in Tamil Nadu. Further, to understand landslide causes, the Relative Effect Method (REM) has been adopted for studying the hazard. Among various methods, this statistical method has been developed within the framework of the Geographic Information System (GIS) to map LHZ in a mountainous region. This method uses logarithmic function, and further determines the Relative Effect (RE) of each unit influencing landslides, such as data layers of geology, land use/land cover, geomorphology, relief, slope, lineament density, drainage density, road buffer, and soil; which are analysed by calculating the ratio of the unit portion in coverage and landslide. The advantage of using logarithmic function is that the positive effect and negative effect are quantitatively equal. The result obtained through RE’s were summed and classified into five zones viz., very low, low, moderate, high and very high landslide hazard zones; after computing the magnitude of factors influencing each grid unit. The present study would be useful for preparing an effective regional disaster management strategy, which can be used to reduce damages associated with landslides; and also to consider the land use/land cover for better management of evolving strategies in the mountainous region of Tamil Nadu.

Keywords: Hazard, Relative Effect Method, Mountainous region, regional disaster management, The Nilgiris

Abstract Id: 793
As a result of industrialization and population explosion, the whole world is undergoing tremendous landuse/ land cover changes (LULCC). The LULCC can be observed spatially from micro watershed to the continental level and temporally from seconds to several decades. Manual analysis of the transformation of landuse in a micro watershed for a decadal period itself is a challenging task due to constraints such as data availability, time requirement and so on. However, developments in technology have helped to make the assessments easier and accurate. In this century, remote sensing (RS) and Geographical Information System (GIS) have emerged as cost-effective, accurate, rapid and advanced techniques for monitoring and assessment of LULCC on a spatial and temporal scale. In this study, evaluation of the LULCC in the Bharathapuzha River basin, the largest river basin in Kerala, India, during the period 1973 to 2017 was performed. Freely available, medium resolution satellite images for the years 1973, 1990, 2001 and 2017 were used to produce landuse/ land cover maps of the area with the help of ERDAS Imagine software. The five landuse categories in the basin such as waterbody, sand/soil, vegetation, rocky terrain and settlement were classified by spectrally oriented supervised classification procedure. These classified maps were generated with an overall accuracy of more than 90%, and Kappa index around 0.8. Results indicate large scale loss of vegetation and expansion in urban area in the basin. If the current trend in landuse change continues, it will adversely affect water resources in the basin. The developed landuse/ land cover maps can be used to predict the future landuse/ land cover dynamics and the computed statistics of land use change can be used to formulate sustainable management policies for the river basin.

Keywords: Bharathapuzha river basin - land use/cover - supervised maximum likelihood classification - overall accuracy - Kappa index

Abstract Id: 795
Disaster analysis and management is required in mountain regions, which are more vulnerable than other parts of the globe under the climate change resulting in increased contribution of melt runoff in the lakes situated at upper part of mountains. These glacial lakes are formed behind the moraine dams created due to landslides or other natural phenomena. These dams are formed by highly permeable and porous soil materials and are highly susceptible to breaching. The collapse of moraine dam depends upon hydraulic, erosion, geotechnical parameters etc. Uncertainty of these parameters creates a challenge in determining vulnerability of disaster prone lakes. With the recent developments in Remote Sensing, due to availability of high resolution imageries in different specific bands, an inventory of glacial lakes depicting their spread, volume, stability of dam, upstream and downstream conditions etc. can be prepared. To identify the individual glacial lakes, different enhancement techniques are useful. To study the change in spread and nature of lakes, a regular monitoring is required. Potential dangerous lakes should be identified based on field observations, verifying past events, geo-morphological and geo-technical characteristics of the lake, its surroundings and other physical features. Sudden discharge of large volume of water with debris from the potential dangerous lake is the cause of glacial lake outburst flood (GLOF). Once the vulnerable lake is identified, mathematical modelling of dam breach floods can be carried out. The area downstream of the dangerous glacial lake remains vulnerable to a large scale disaster due to release of very high volume of water generated from glacial lake outburst. A proper disaster management plan to mitigate the risk is required to be prepared on the basis of the dimension of the flood water (discharge, travel time) reaching at different river cross-section in the downstream area. This paper seeks to address these issues.

Keywords: Disaster, GLOF, Hydrological, Remote Sensing, Moraine

Abstract Id: 798
EARTHQUAKE DISASTER AREA EXTRACTION BY MACHINE LEARNING

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When a large-scale natural disaster occurs, it is important to grasp an overall picture of the damage the area has suffered as soon as possible. In addition, maps and images that show the status and locations of damage in the area are necessary to support the efficient performance of firefighting, volunteer and other groups. The final goal of this study is to create data to support emergency efforts in a disaster affected area by locating damaged buildings shortly after the disaster. In this study, prioritizing the practicality of the method for emergency purposes, we designed a method only to use a single satellite image of an affected area, eliminating the use of complex algorithms and auxiliary data. The uniqueness of our method lies in the application of an object-based region segmentation to images and the use of features of objects obtained from texture, hierarchical and other information in order to extract damaged buildings. Out of 26 features resulting from the analysis of objects, we found one feature and three combinations of two different features that are effective in extracting damaged buildings, such as Rectangular fit, Homogeneity, Number of sub-objects/Area, and Length of longest of edge/Area.

Keywords: machine learning, earthquake, disaster area, object-based analysis

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GEOSPATIAL TECHNOLOGY FOR THE URBAN HEALTH EQUITY

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Urbanization has accelerated the proportion of an entire population to shift towards cities and the suburbs of cities. When humans live in large numbers in close proximity to each other, generally it gives birth to health challenges through the import of water, food, waste products, and other essentials. The people are exposed to a variety of factors that can either promote good health or be precarious health. Many people in low-income or informal settlements (like slums) in cities face health challenges induced due to these factors. The health condition in urban areas can be improved via their material, service-provision, cultural, and aesthetic attributes. It has been pointed out by many researchers that the health inequity raised by poverty is not only a question of money, but it has further other dimensions: lack of opportunities (for employment and access to productive resources), lack of capabilities (access to education, health, and other public services), lack of security (vulnerability to economic risks and violence), and lack of empowerment (absence of voice, power, and participation). These inequities and health hazards are a threat to the urban areas but due to the advancement of knowledge and technologies in the domain of geospatial technology for creating a healthy city are accessible. The current work also acclaims the inclusion of technological dimension for urban environmental health tracking for developing a spatially explicit model to achieve the health equity in urban areas by reducing vulnerabilities and disparities. The demand for new technological skills is rapidly increasing due to scientific and industrial development to play a visible role in human life. Thus, new approaches for simulation, modeling, and evaluation of multiple scenarios towards investigation at various assumptions for health equity will be a giant step towards tracking and control of various diseases in an urban environment.

Keywords: Applications, Geospatial Technology, Epidemiology, Health GIS, Medical Research, Public Health

Abstract Id: 801
EFFECT OF INCREASE IN RESOLUTION OF DEM ON SCALE OF LANDSLIDE SUSCEPTIBILITY MAPPING

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The resolution of the DEM plays a vital role in identifying topographic features and their corresponding results in Landslide Susceptibility (LS) mapping. Landslide mapping is an essential step for disaster management and planning development activities in hilly terrains. The main objective of the present work is to carry out landslide susceptibility mapping on 1:50 K, 1:10 K and 1:5 K scales in parts of Himalayan region. LS maps are created based on the relative weights assigned on ordinal scale using prominent factors like geomorphology, lithology, lineament and land use prepared through interpretation of Cartosat-2(1 m), Cartosat-1(2.5 m) and RS-2 LISS-IV(5.8 m) satellite images. DEM derived from Cartosat-2(5 m), Cartosat-1(10 m) and SRTM(30 m) are used to generate primary topographic attributes namely slope, aspect, relative relief and drainage. The spatially classified maps are validated using landslide inventory maps wherein available and predictive rate curves based on the causative factors inducing landslides. The result of the analysis clearly depicts the significance of different spatial resolution of DEM on the scale of LS mapping.

Keywords: DEM, Cartosat, Resourcesat, SRTM, Hazard, Disaster

Abstract Id: 803
Irrigation is the largest consumer of fresh water. It is estimated that about 70% use of fresh water produces 30% to 40% of world’s food with 17% of acerable land. Due to increase of population need for food production increases, for which there is need for optimal use of fresh water resources. Due to advancement of satellite technology and mapping of earth surface with short revisit time, remote sensing method becomes suitable for monitoring vegetation distribution and water needs for agriculture application.

Temporal use of microwave data and vegetation index derived from optical data can be used for estimating net area irrigated and gross irrigated area for a particular irrigation command area. As microwaves can penetrate cloud, microwave remote sensing can be a good alternative for VIS/IR hyper spectral data for monitoring vegetation distribution and water needs for agriculture application.

Keywords: microwave, dielectric constant, vegetation index

Abstract Id: 804
ASSESSMENT OF SURFACE COAL MINING IMPACTS USING LANDSAT TIME SERIES DATA

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Mining is an integral part of the development of many countries in the world and is associated with adverse environmental impacts. It, therefore, becomes pertinent to optimize and minimize these impacts by adopting proper mining techniques. For this, it is necessary to have quickly accessible, cost-effective and periodical information regarding the area. Satellite remote sensing is able to provide such data. The Jharia coalfield (JCF) in the state of Jharkhand is the only coking coal mine in India. It is also infamous for its surface and subsurface coal fires which have been burning now for more than a century. Surface mining is the dominant driver of land use/land cover change here. Large scale deforestation has affected ecosystem services such as aesthetics, biodiversity and availability of clean air. Coal fires have caused not only severe environmental pollution by toxic exhaust gases but also have left many landscapes devoid of vegetation and uninhabitable. To study the impact of surface coal mining activities in a part of JCF, a multi-temporal analysis of Landsat (TM and OLI/TIRS) data has been undertaken for the years between 2006 and 2016. Two indices namely Normalized Difference Vegetation Index (NDVI) and Tasseled Cap Transformation (TCT) have been used to analyze the changes in the vegetation pattern, health and density. Secondary assessment based on surface temperature (derived using thermal infrared bands) have also been attempted. It has been observed that during the years 2006 to 2016, moderate to dense vegetation has decreased drastically due to the intense mining going on in the area. Surface temperature data obtained shows a constant increase during the ten year period apparently due to coal fires. The utility of remote sensing data in such studies has been emphasized.

Keywords: NDVI, Surface Temperature, Tasseled cap transformation, Landsat, Jharia coalfield

Abstract Id: 805
ANALYSIS OF IMPACT OF ACCESSIBILITY ON RESIDENTIAL PROPERTY VALUES IN GOTRI AREA OF VADODARA CITY, INDIA USING GEOINFORMATICS

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Residential property value and its assessment is a complex and challenging task since it involves the consideration of a variety of underlying factors of the market and the way they affect the value of the property at a given time. It is also commonly accepted that properties are spatially unique and this means that location is an intrinsic attribute of a dwelling that directly determines housing quality and market value. Among the range of locational attributes, the accessibility to services, facilities and amenities is an essential factor affecting the residential property development. The present study is aimed at analyzing the impact of accessibility on residential property values in Gotri area of Vadodara city, India using the tools of Geoinformatics. Data on more than 30 parameters related to structural (type of property, super built-up area, age of the property, no. of bed rooms etc.) locational (location of the property, distance to nearest major road, market, public transport facility, public health service, recreational areas, central bus depot/railway station, central market, noise producing facilities etc.) and amenities (absence/presence of parking - 2/4 wheeler, open/close, common/allotted, club house, open play area/garden, gymnasium, community hall, walking track etc.) were collected for 162 residential properties selected through stratified random sampling method in the study area. The data on per square feet value of the residential properties were also collected from the respondents and were normalized based on inputs received from property experts. Multiple regression analysis was run on the data to understand the relationship between various attributes affecting residential property values. Weights were assigned to selected accessibility attributes following multi criteria analysis (MCA). The composite accessibility index was calculated and was correlated with residential property values.

Keywords: Property values, Accessibility, Geoinformatics, Multiple regression, MCA

Abstract Id: 806
PAST IMPRINTS OF RETREAT OF JORYA GARANG GLACIER, H.P., INDIA THROUGH RS AND GIS

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Jorya Garang glacier of Baspa valley is characterized by landforms that have preserved the imprints of glacial processes and are sensitive indicators of climate change. The glacial geomorphic records of the Jorya Garang i.e terminal moraines, deglaciated valley and snout together are interpreted through the multi date remote sensing data, International map series of 1946 and GIS have revealed variations in the rate of retreat.

Lengthwise retreat of the Joryagarang glacier estimated from the AD 1946 to 2001 from satellite data is around 3325 ± 172 m. Hence, the average rate of retreat for the period of 1946 to 2001 AD can be estimated to 60m per year which further increased to 69m per year from 2001 to 2005 AD. The rate of retreat reduced between 2005 and 2014 AD and attained the rate of about 26m per year. Postulating that the Jorya Garang extended up to Baspa River in the past, an estimate is further made for the number of years it required to reach at the confluence of Jorya Garang glacier with Baspa River. Extrapolating 56m per year rate of retreat between (1946-2014 AD) prior to 1946 AD also, the Jorya Garang glacier would have reached up to a junction of Baspa river in 61 ± 3 years (AD1885±3years). It is evident that the extent of Jorya Garang glacier was up to Baspa River during the Little Ice Age (LIA) since the period of LIA is considered between 16 to 19th century (Mann et al1998). Hence, we can say that the Jorya garang glacier was much longer than today during LIA and started retreating post LIA.

Keywords: Remote Sensing & GIS, Geomorphic Indicators, Glacial retreat, Little Ice Age

Abstract Id: 807
Himalayas, the youngest mountain range, has active orogeny and hence is prone to several natural disasters. Landslide is considered as one of the most devastating and most costly natural hazards in the mountainous terrain. Immediately after occurrence of landslides, its mapping/detection is carried out for damage estimation and relief operations generally through field investigations. With the recent advances in remote sensing, availability of satellite images has increased tremendously which paves the way for exploring fast and efficient landslide detection that can replace conventional practices. In this paper Object based Change Detection technique has been employed to map the landslide events of Tawang region in April 2016 triggered by incessant rainfall lasting for nearly 10 days using high resolution Rapideye-3A (5m, march 2016) and PlanetScope-AnalyticMS (3m, april 2017) images. NDVI parameter was used to primarily delineate the landslide candidates from which false positives were corrected using PCA and other parameters. The results were validated with reference to the site investigations of Geological Survey of India. This paradigm can be further be used for automatic landslide mapping of other such events.

Keywords: Object based, Change Detection technique, Remote sensing, Landslide, PlanetScope

Abstract Id: 808
Transformation in the pattern of an urban landscape is a consequence of rapid urbanization. The scale of urbanization may differ from one city to another. This depends upon the significance of the city in terms of socio-political and socio-economical context. Consequently, urban policies for sustainable planning are certain to differ as socio-political and socio-economical factors vary. Therefore, it is necessary to assess an urban landscape of a city from socio-political / economical perspectives. It would enable urban planners to identify factors which are significant in transforming the landscape of a city. Furthermore, growth and evolution of a city should also be assessed with respect to surrounding cities to determine the possible impact of their growth on the city. Identification of urban processes responsible for inconsistencies in a city in terms of urban landscape transformation is a necessity. It will enable urban planners to develop robust urban models which can monitor the growth of a city in a sustainable way.

This work aims to develop an urban model to assess and quantify various aspects of the urban landscape pattern considering the aforementioned factors, i.e. socio-political / economical factors and influence of surrounding cities on growth of the city. The model is developed using decision tree, and GIS. Satellite remote sensing data is used in this study to characterize and quantify the spatio-temporal complexities of the city. Results obtained from the proposed model succeed in highlighting the significance of socio-political / economical factors and influence of surrounding cities in shaping landscape pattern of the city. In addition, possible influence of different surrounding cities in shaping the city is categorized in terms of their significance. The results of this study can be used to devise robust and sustainable urban policies.

Keywords: Urbanization, Urban Processes, Sustainable development, Decision tree, Satellite remote sensing

Abstract Id: 810
LAND USE/LAND COVER CLASSIFICATION USING RADAR DATA IN THE ODRA RIVER BASIN (CZECH REPUBLIC)

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Radar is known to be very sensitive to vegetation physiognomy and biomass. An important property of SAR is that it is a coherent imaging system, meaning that the phases of the radar pulses used to illuminate the target are tightly controlled. This paper presents recent work on the use of Synthetic Aperture Radar (SAR) from the Sentinel-1 mission. The study areas were two agricultural locations in the Odra river basin, located in the Czech Republic. The images recorded in 2016 were used for a per-pixel and object-based classification of agricultural land. The per-pixel classification was performed by the maximum likelihood algorithm, the object-based classification then using the support vector machine algorithm. The legend was taken from the Land Parcel Identification System (LPIS) and contained the following three classes - grassland, arable land and a class that involves hop fields, vineyards, and orchards. The outputs from the classifications were compared and the object-based classification using the support vector machine algorithm appears to be significantly better.

Keywords: land use, radar, Sentinel 1, classification

Abstract Id: 811
Increasing urban temperature is the main issue of many countries of the world. With the industrialization, urban population increase exceeding the carrying capacities. To fulfill their requirements the natural flora and fauna have to sacrifice their lives. It has destroyed the balance between urban and natural environment. This destruction caused lots of devastating problems to both human and natural systems and at present the earth is in a critical state with hordes of long lasting problems. Some of these burning problems are increase of environment temperature, natural hazards like flooding, landslides, tsunamis, drought, and diseases to all living beings which cannot be cured easily. This research was focused on the increase of environmental temperature with the urbanization. Heat island effect can be clearly identified in urban areas. Northern Province of Sri Lanka was recently populated after the civil war in 2009. With the rapid increase of urban population, the forest areas were cleared to facilitate the livelihood of people. With the urbanization and the deforestation the temperature of the Northern Province has increased drastically during last decades. Through this research the relationship between heat island effect and the deforestation was analyzed and a green area ratio was proposed to minimize the heat island effect in the study area. The research clearly depicted that the increase of temperature has started with the commencement of deforestation of the Northern Province. To minimize this effect reforestation is essential and the area to be reforested was estimated using the developed green area ratio.

Keywords: Deforestation, Heat island effect, Reforestation, Urbanization

Abstract Id: 812
DETECTION OF MARINE VESSELS BASED ON POLARIZATION POWER SCATTERING MATRIX

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Satellite images are playing very important role for the coastal security of any country. Independence of Synthetic Aperture Radar (SAR) images from weather and sun illumination helps us in maritime surveillance like an oil spill, to identify the illegal fishery activity and unauthorized marine vessels. Marine vessel detection is like a point target detection in coarse to moderate resolution images. Detection of point targets is adversely affected by speckle noise, thus improvement in the power of point target leads us to reduced number of false alarms. In this paper, an algorithm is presented for marine vessel detection. The algorithm is divided into three parts. First part uses Grave matrix which is a (2*2) Hermitian power matrix, generated by the multiplication of Sinclair matrix and its conjugate. Second part uses a discrimination criteria to discriminate between clutter and vessels based on eigenvalue of the Grave matrices. The third part is a post-processing part to fill the gaps and to find the centroid of the vessels. The algorithm has been tested on two full polarization (HH, HV, VH, VV) data sets and promising results are obtained with less number of false alarms. The first data set is AlOS-1 PALSAR L-band data, with size of 498*498 near the coastal region of Singapore. The second data set is of size 472*472, covering coast of Vancouver acquired in C-band by Radarsat-2.

Keywords: Grave matrix, SAR, Marine Vessel, Sinclair matrix

Abstract Id: 813
We have developed an algorithm for house detection from high resolution satellite image. High resolution satellite image has two kind of images. One is panchromatic image. The other is multispectral image. Multispectral image has color information. But, ground resolution of multispectral image is less than that of panchromatic image. We tried to use edge and color features for extraction of house border. Edge of house is extracted from panchromatic image. Density levels of a house roof are not homogeneous because of the difference of roof surface direction to the sun. Edge line can be extracted by using differential filtering technique. Differential filtered image has many small lines and many small rounded areas. These lines and areas are deleted. House border line sometimes become dotted line. We used Canny edge detector to prevent such phenomena. Color information can be used to integrate some roof area of a house. We used hue and NDVI (Normalized Difference Vegetation Index) as color information. Hue can be calculated by using RGB (Red, Green, Blue) bands image. NDVI can be calculated by using red band image and near infrared band image. Extracted result showed the effectiveness of the proposed algorithm.

Keywords: House, Border, Hue, Edge, NDVI

Abstract Id: 815
THE EFFECTS OF IONOSPHERE SCINTILLATION TO THE GPS SIGNALS DURING THE SOLAR MAXIMUM PERIOD IN THAI REGION

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The solar maximum conditions are expected to occur during 2013-2016 and it has a serious effect on GPS measurement especially in equatorial countries over the world. Due to this phenomenon, GPS signal is delayed when propagates through the ionosphere layer which is called Ionosphere scintillation. Ionosphere scintillation is an effect that causes a fluctuation of GPS signal. If the signal level drop completely below the GPS receiver lock threshold, the loss of lock will occur and result in the accuracy degradation of GPS positioning results. In order to observe this phenomenon, a collaboration work among Chulalongkorn University, King Mongkut's Institute of Technology Ladkrabang (KMITL) and Japan Aerospace Exploration Agency (JAXA) was initiated. Under this collaborative work, three Ionosphere scintillation monitor (ISM) systems were installed in Thailand (two in Bangkok and one in Chumporn) and the data used in this article from CUSV station. This article aims to describe the characteristics of ionosphere scintillation, how it effects the GPS measurement, how ISM works, how to down-weight satellite signal as a function of SNR (Signal to noise ratio) and compare its position error. The results confirm that there is a correlation between rate of total electron content change Index (ROTI) and the S4 index. Moreover, the loss of lock will occur and result in the accuracy degradation of GPS positioning results.

Keywords: Ionosphere scintillation, solar maximum, S4 index

Abstract Id: 816
This paper presents the GeoSAFER Mindanao: Agusan Project, one of the component projects of the GeoSAFER Mindanao Program, or the "Geo-informatics for the System Assessment of Flood Effects and Risks for a Resilient Mindanao". The project aims to conduct geo-informatics based approaches for the systematic assessment of flooding in the Agusan River Basin, the Philippines’s third largest river basin. The project builds upon the process flows and methodological approaches of the Nationwide Phil-LiDAR 1 Program but with some enhancements and innovations that put particular attention to explaining specific issues and problems pertaining to the flooding problem in the basin such as the roles of anthropogenic activities like mining, deforestation, and land-use conversions in the hydrologic and hydraulic characteristics of the basin. The project processes and analyzes very detailed LiDAR-derived Digital Terrain and Surface Models (DTMs and DSMs) and information extracted from optical and Synthetic Aperture Radar (SAR) remote sensing images, and then utilized these as inputs to numerical simulation models for hydrologic and hydraulic characterization of the basin, and to produce detailed flood hazard maps for different flood scenarios. These scenario-based flood hazard maps basically show which areas can get flooded when rainfall of varying duration and intensity occurs over the basin. These hazard maps are further analyzed to find infrastructures like building, roads and bridges that are at risk to the effects of flooding. These barangay and municipal-level flood impact assessment maps and statistics are important source of information for Local Government Units (LGUs) in their decision making to ensure the safety of their constituents before, during, and after a flood disaster. Also part of the project is the development of a web-based platform that is capable of providing near-real time information on the spatial distribution and detailed characteristics of the current and future (forecasted) flood scenarios.

Keywords: GeoSAFER Mindanao, Agusan River Basin, Floods, Disaster Management, Geo-informatics

Abstract Id: 817
Nowadays chronic traffic congestion is a severe problem in Indian cities. Although some countermeasures, such as highway construction and the expansion of public transportation, were done, it doesn’t seem to be enough to manage the rapid increase of traffic demand. In order to take more useful measures, grasping the traffic situation precisely seems to be needed. Looking at the metropolitan area in India, taxi is one of popular transportation. It is said that the taxi fare is the cheapest in the world in Delhi, and the middle class people often use taxi for just shopping or commute. Then understanding the taxi behavior might be important. For this reason, probe data or floating car data is widely used nowadays. Drivers’ behavior, such as their usual routes and the strategy of their business, were analyzed. In more micro-scale, some researches revealed the features which affected drivers’ route choice behavior. However, these researches were done mostly in developed countries and there are few analyses in developing countries like India because of lack of data volume, although traffic situation there is totally different from that in developed countries. Therefore, the aim of this research is to get good knowledge about Indian taxi drivers’ behavior using long-term probe data. For example, what for people in Indian cities use taxi, where taxi drivers wait for customer, and which factors would impact such their behavior. We got the taxi probe in the whole of India more than one year and analyzed focusing on 10 metropolitan cities.
CHANGES IN WHEAT CROP GROWTH PROFILE IN THE LIGHT OF CLIMATE WARMING: EXPLORING REMOTE SENSING DATA OF LAST THREE DECADES OVER NORTH INDIA

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Studies on patterns of changes in intensively managed agro-ecosystem over a long period of time may reveal crucial information about the influences of climate change and crop management which is a focal research area in recent era of climate-food nexus. Of late, Wheat, is in the centre of this nexus for possible negative impacts. Satellite remote sensing derived crop phenology can help in understanding these changes, acting as an indicator of climate change impacts. This study focused on deriving wheat phenology of north India from temporal satellite data, analyzed its trend and derived its relationship with climate over last three decades. Phenology was derived from two datasets: (1) GIMMS-NDVI and, (2) STAR-Global-Vegetation-Health-Products-NDVI, whereas, daily gridded-temperature data (1° X 1°) of India Meteorological Department (IMD) was used for climate. The analysis revealed a change in wheat growth profile over the region. Amplitude, maximum NDVI, small and large integral along with the rate of greening and browning has increased significantly in southern Punjab, northern Haryana and scattered parts of western and eastern Uttar Pradesh (UP). Indicating the increase in kurtosis of growth profile with time. Along with these changes, a significant early shift in start-of-season over Punjab and Haryana and delay in UP was observed. As end-of-season always occurred early, length-of-season increased in some parts of Punjab and Haryana over last three decades. The growing-degree-days (GDD) did not show any statistically significant trend in spite of the change in length-of-season, indicating adaptation by farmers in response to increase in temperature to avoid terminal-heat-stress. Extreme-growing-degree days (EDD) could clearly relate the changes in shortening of growing season and crop growth during recent heat-stress years. The detailed analysis using zone-specific crop management and varietal data may be crucial in apportioning impacts of change in management practices and climate to devise scale-specific adaptation strategies.

Keywords: Climate Change, Terminal heat, Crop Phenology, Growing Degree Days, Remote sensing

Abstract Id: 819
COMPARATIVE CORRELATION ANALYSIS OF LAND SURFACE TEMPERATURE AND LAND USE/LAND COVER INDICES IN HYDERABAD CITY, INDIA

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Remote sensing technique often analyzed the thermal characteristics of any area. The present study focuses on the estimation of land surface temperature (LST) of Hyderabad city as a whole and for the most heated zones of the city and their relationship with Modified Normalized Difference Water Index (MNDWI), Normalized Difference Vegetation Index (NDVI), Normalized Difference Bareness Index (NDBaI) and Normalized Difference Built-up Index (NDBI). Landsat 8 OLI data of winter season was used for the whole study. Several urban heat islands (UHIs) and urban hot spots (UHSs) were identified as the most heated zones throughout the city. The UHIs were developed along the outskirts of the city except for the central and eastern part while the UHSs mainly existed along the western and south-eastern periphery within the UHIs. The result shows that LST has a strong negative correlation with MNDWI (-0.73), a weak positive correlation with NDVI (0.13), and a moderate to strong positive correlation with NDBaI (0.51) and NDBI (0.63) for the whole Hyderabad city. But, these relationships become much weaker for UHIs. It indicates that landscape heterogeneity reduces the reliability of the relationship between LST with MNDWI, NDVI, NDBaI, and NDBI.

Keywords: Remote sensing, Land surface temperature (LST), Urban heat island (UHI), Land use/land cover (LU-LC), Landsat.

Abstract Id: 820
REMOTE-SENSED MAPPING OF SEAGRASS DISTRIBUTION IN PALK BAY, SRI LANKA, USING HIGH SPATIAL RESOLUTION WORLDVIEW-2 SATELLITE DATA

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This study incorporates field observations and high spatial resolution WV-2 imagery processing techniques to provide an assessment of shallow coastal marine seagrass beds in Palk Bay, North-Western coast of Sri Lanka. The main objective of this study is to influence decision making and coastal planning in Sri Lanka with the increased knowledge on the seagrass habitats in Palk Bay with special reference to Dugong conservation. Field observations were conducted in once a month during 2015 to 2016 and methods included free diving, monitoring transect lines, quantify quadrats, and underwater photography techniques. Common species encountered in study areas were Enhalus acoroides, Cymodocea rotundata, Cymodocea serrulata and Halodule pinifolia. Cloud free WV-2 satellite imageries of 15th June 2015 and 11th February 2016 were selected as remote sensing data sources. After image pre-processing, supervised image classifications were performed using maximum likelihood, minimum distance to means, and spectral angle mapper methods to compare relative accuracies in mapping seagrass coverage. The maximum likelihood classification produced the highest overall accuracy of 94%. The spectral angle mapper yielded the lowest accuracy due to the predominant influence of water-column optical properties on the apparent spectral characteristics of seagrass and sand bottom. The results achieved by our classification methodology were validated with visual interpretation and field data. The combination of in-situ data and three classification methods resulted in highly accurate classification outcomes that showed the distribution patterns of seagrass of the study area. Based on the results, we conclude that eight-band high resolution multispectral WV-2 satellite imagery has great potential for mapping and monitoring seagrass beds in shallow coastal waters with large-scale coverage. Thus, the primary results of this study provide useful baseline information that is necessary for marine-conservation strategic planning incorporated to protecting feeding grounds of dugongs around the North-Western coast of Sri Lanka.

Keywords: high-resolution multispectral imagery, Palk Bay, seagrass, WorldView-2 (WV2)

Abstract Id: 821
Geospatial Sciences has become an indispensable part of teaching and research enabling to capture information, to visualize, analyze, and share. The big data analytics approach to GIS allows analysis and decision making from huge data sets, by using algorithms, query processing, and spatiotemporal data mining. Which extracts information from maximum possible sources using established procedures and computational techniques. The discovery of the greater value of data analytics helps us to visualize and analyze data to reveal patterns, trends, and relationships from the data existing in many disparate places, streams, or web logs to help focused decision making. Geospatial technology offers a platform for big data analytics for enhanced analysis in segments like Climate modeling and analysis, Location analytics, Intelligence gathering, Terrorist financing, Aviation industry, Disease surveillance, disaster response, political campaigns and elections, banking, insurance and fraud analysis etc. The current technology is capable of processing large magnitudes of data in the shortest curve, therefore emerged as a new frontier for geospatial analysis and has made inroads into climate research integrating the past and current global climate data with geographies. This has enabled a synergized approach to climate modeling, analysis and resilience building. The current work evaluates the prospects of big data analytics (or data science) to the process, examining large and varied data sets to uncover hidden patterns, unknown correlations, and other useful information to help organizations in more-informed decisions. These use of advanced analytics techniques such as text analytics, machine learning, predictive analytics, data mining, statistics, and natural language processing, businesses can analyze previously untapped data sources independent or together with their existing enterprise data to gain new insights resulting in significantly better and faster decisions, big data analytics is impacting everything worldwide to discuss the issues that arise at the juncture of GIS and

Keywords: Applications, Data Analytics, Geospatial Technology, Intelligence gathering, Terrorist financing

Abstract Id: 822
SPECTRAL UNMIXING AND SUB-PIXEL CLASSIFICATION: AN ANALYSIS OF LEARNING STRATEGIES

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Sub-pixel details in the hyperspectral images are generally ignored by the conventional classifiers. However, some recent approaches use this information to generate fine resolution land cover maps from images having coarse spatial resolution. Two main aspects in this regard are: 1) estimation of fractional abundances of the reference signatures at each pixel (spectral unmixing); and 2) prediction of class distributions at sub-pixel scale (sub-pixel classification). This study proposes some spectral unmixing as well as sub-pixel mapping techniques that take into account certain constraints which are usually ignored by the conventional approaches. In the context of spectral unmixing methods, our novel contributions are: 1) Analysis of compositional models to derive fractional abundance information from training samples; 2) Modification and comparative analysis of Support Vector Machines (SVM), Support Tensor Machines (STM) and Extreme Learning Machines (ELM) to incorporate fuzziness in the unmixing process. In case of sub-pixel mapping methods, our study may be summarized as: 1) Modelling deep auto-encoders for predicting the spatial distributions at target scale; 2) post and pre-optimization refinements using contextual knowledge derived from the coarse image; 3) consideration of spectral unmixing error in the sub-pixel mapping process. Also, we have compared the effectiveness of Auto-Encoders and their convolutional counterparts in learning the coarse image features. Among the proposed unmixing approaches, the ELM has given better results followed by the STM and SVM. The variogram based as well as the deep learning based sub-pixel mapping approaches have produced comparable results, with the latter performing better for complex scenes. The refinements, suggested in this paper, are found to improve the accuracy of the conventional methods. The sensitivities of all these techniques towards various tunable parameters are also analyzed.

Keywords: Spectral unmixing, sub-pixel classification, deep auto encoder

Abstract Id: 823
MONITORING TEMPORAL COASTLINE VARIATION OF TAIWAN’S OUTLYING ISLANDS BY MULTIPLE SATELLITE IMAGERIES AND TIDE MODELS

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Three of Taiwan’s outlying Islands, including Kinmen, Penghu and Matsu are observed for their coastline changes in this study. These islands with unique geography and climate are the habitats for various protected and vulnerable species. However, due to human and natural forces, the erosion and accretion along the coastal zone has affected the environment and changed local ecosystem. Therefore, we aim to monitor changes along the coast for environmental sustainability. It is usually challenging to define the range of intertidal zone and reconstruct coastal DEM in a large area by means of classic land surveying. Hence, we develop a workflow that utilizes multiple optical remote sensing satellites, including Landsat series and Sentinel-2, to track the long-term variation of the coastline. We first collect historical cloud-free images since the 1980s and calculate the Modified Normalized Difference Water Index (MNDWI) to identify water pixels. After computing water appearance probability of each pixel, we convert it into actual elevation by introducing the DTU10 tide model for high tide and low tide boundaries. A digital elevation model (DEM) of the intertidal zone is reconstructed and compared with in situ DEM collected by an Unmanned Arial Vehicle (UAV). Finally, we define the up-to-date intertidal zone and estimate temporal changes of nearshore sediment.

Keywords: Tidal Flat, Remote Sensing, MNDWI, DTU10, Island

Abstract Id: 825
RETRIEVAL OF AEROSOL OPTICAL THICKNESS FROM SATELLITE IMAGES BY MACHINE LEARNING

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Aerosol measurements are routinely obtained through ground observation networks of sun-photometers such as the AERONET. Such implementation gives accurate and periodic observations of aerosol properties at each observation station. Satellite observations can provide wide areal coverage of aerosol optical thickness (AOT). However, retrieval of AOT from satellite data usually involves execution of complex radiative transfer codes and is complicated by the influence of different ground covers. In this study, AOT retrieval from satellite images using machine learning is presented. Simulated satellite signals were generated using the 6SV radiative transfer code. The simulated dataset comprised of different permutations of varying geometrical conditions, atmospheric model, target and sensor altitude, spectral conditions, ground reflectance and the top-of-atmosphere (TOA) reflectance output from 6SV. A feed-forward neural network (NN) model with backpropagation algorithm was developed to retrieve AOT, surface brightness (SB) and normalized difference vegetation index (NDVI) from the observed TOA reflectance. The simulated dataset was used for training, validation and testing of the NN model. The trained NN model was then applied to retrieve AOT, SB and NDVI from WorldView-2 satellite images. Test results give a coefficient of determination (R-squared) of 0.726, 0.824 and 0.986 for retrieval of AOT, SB and NDVI respectively. The machine learning method has shown a promising capability for spatial and temporal monitoring of aerosols distribution using satellite data, especially during episodes of biomass burning and smoke-haze.

Keywords: Aerosol, Aerosol Optical Thickness, Simulated Satellite Signals, Machine Learning, Neural Network

Abstract Id: 826
A REAR AND FRONT VIEW OF LAND USE AND LAND COVER DYNAMICS OF TWO INDIAN RIVER BASINS DURING 1985 AND 2025 USING REMOTE SENSING AND MODELLING

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Transformation of terrestrial ecosystem via land use land cover (LULC) modification is a key element of global climate change by influencing land surface processes. Declinations of forest for agriculture land expansion, urbanization, industrialization etc. are primarily the humans’ response to economic opportunities that drive the land use changes. We generated LULC maps employing on-screen digitization technique over Landsat images in three decadal intervals i.e., 1985, 1995 and 2005 in two major River basins of India as Brahmaputra and Mahanadi. Rain-fed, Mahanadi River basin (MRB) is densely populated and cropland dominated landscape covered 56% of total land by agriculture land followed by 26% deciduous forest, wherein glacier-fed, Brahmaputra River basin (BRB) is less populated and forest dominated landscape has 37% forest and 17% agricultural land. In two decades (during 1985-2005) 1276 km² forest cover lost with 745 km² cropland and 569 km² built-up area expansion in MRB; which were 3171 km², 2717 km² and 231 km² respectively in BRB. Construction of reservoirs and aquaculture farms were the forms of water body increase in MRB; whereas snow and ice melting attribute to creation of more water bodies in BRB. Scrub land acts as an intermediate class for forest conversion to cropland in BRB, whereas direct conversion of scrub land to crop land is seen in MRB. While habitation contributes primarily to LULC change in BRB, the proximity zones around habitat and socio-economic drivers contribute to LULC change in MRB. With >97% classification accuracy of LULC maps, the model (Dyna-CLUE) has very well predicted the LULC scenario for 2025, as validated the modelled and actual LULC maps in 2005. The LULC scenario analysis for the past 2-decades and prediction for 2025 would help the land use planners for regional planning and ecosystem balance, especially in a changing climate.

Keywords: Mahanadi, Brahmaputra, ILULC-DMP; β-coefficient; Mapping

Abstract Id: 827
DEVELOPMENT OF SUITABLE CRITERIA FOR URBAN PLANNING IN HILLY AREA OF NEPAL

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Identifying suitable criteria for urban development is one of the critical issues of urban planning. The main objective of this research is to develop the suitable criteria for urban planning in hilly areas of Nepal. For this purpose panchromatic and multispectral satellite image data were used to generate land use land cover map using digitalization and visual interpretation method in ArcGIS 10.3 software. The five parameters and suitability criterions as geology, elevation, slope, aspect, and Land Use Land Cover (LULC) were used for urban development. The eight categories of LULC used were Agriculture, Commercial, Forest, Industrial, Public Use, Residential, Road and Water Bodies. The process for identifying the suitable areas map begins with ensuring all data are in the appropriate raster format. The polygon shapefile such as geology buffer, forest area buffer, drainage/water bodies’ buffer, residential area buffer, commercial area buffer, industrial area buffer and road area buffer should be converted from vector to raster using Feature to raster tool. A slope raster was created with the elevation raster using spatial analyst tool. All raster files were reclassified using reclassify tool. The appropriate distance values were binned into four classes based and favourability values were assigned. All criterions were assigned to correct favourability classes, which is as: 1= not suitable, 2= least suitable, 3= moderately suitable and 4= highly suitable. Urban growth and land use study through use of GIS and remote sensing is very useful in local government as well as in urban planners for the appropriate plans of land use planning in sustainable urban development as it provides spatial analysis tool required information about the current state of development and the nature of changes that have occurred, physical conditions, public service accessibility, economic opportunities, local market, population growth, and government plans and policies.

Keywords: Site Suitability, Land Use Land Cover, GIS, Suitability Criteria, Urban Planning

Abstract Id: 828
It is well known that the ionospheric bias is considered as the main error source in the GNSS observations. The ionospheric bias degrades the accuracy of GNSS positioning results especially when the fluctuation and rapid change in Total Electron Content (TEC) occur. This phenomenon is usually called an 'Ionosphere Scintillation' which occurs much more often in the Solar Maximum year. If the signal level drop completely below the GPS receiver lock threshold, the loss of lock will occur and result in the accuracy degradation of GPS positioning results. This paper analyzes the GPS data during 2016 collected at the CUSV station. The S4 index and Signal to Noise ratio (S/N) are calculated from the GNSS signals via the Rxtools software. The GNSS signals affected by the Ionosphere Scintillation are detected for post processing GPS L1 code only. A comparison of positioning accuracy results obtained from the GNSS signal affected by an Ionosphere Scintillation and the normal GNSS signal is presented.

Keywords: Ionosphere Scintillation

Abstract Id: 829
DROUGHT HAZARD ZONATION USING GIS BASED MULTI CRITERIA EVALUATION APPROACH WITH REMOTELY SENSED DATASETS

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Drought is an intricate phenomenon governed by several atmospheric factors such as precipitation, temperature, evapotranspiration, soil moisture, vegetation cover, stream flow etc. To monitor drought hazard, several criteria and factors will need to be evaluated. The main objective of this study was to evolve a drought hazard map with the selected five main parameters viz., standardized precipitation index, land surface temperature, soil moisture, evapotranspiration and normalized difference vegetation index during the monsoon period from 2002 to 2014 employing GIS aided multi-criteria evaluation (MCE) technique. To standardized the input data layers and deciding the factors weight for the MCE, analytical hierarchy process (AHP) approach was applied. Bundelkhand region of Uttar Pradesh was selected for this study as drought is very frequent and dominant here. The results depicted that about 55.9% and 7.5% of the total area is classified under high and extreme drought hazard zone respectively however, about 36.59% of the total area found to be the least vulnerable (moderate to low) to drought hazard. Central parts of the region namely Jhansi, Mahoba, Jalaun and Hamirpur districts are highly affected by drought condition. Based on finding of this study we recommend the use of MCE techniques for effective and precise drought hazard zonation.

Keywords: Drought hazard zonation, GIS, Rainfall, Standardized Precipitation Index, MCE-AHP

Abstract Id: 830
This study focuses on the spatial and temporal variability of sea level and to investigate the impact of Northeast Monsoon and Southwest Monsoon to the amplitude of sea level over the Southeast Asia region. It is also to understand the relationship between changes of sea level amplitude with surface current and wind. It is examined using SARAL/AltiKa satellite altimetry observation along with ocean surface current and wind data. The improved-accuracy of sea level anomaly (SLA) data from the Ice-1 retrackers which are provided in the Archiving, Validation and Interpretation of Satellite Oceanographic Data (AVISO) ftp site and surface current and wind data are obtained from Global Surface Current Data Product (GECKO) are utilised in this study. The oceanographic conditions in the South-East Asia region are dominated by two monsoonal systems, which are Northeast Monsoon and Southwest Monsoon. The Northwest Monsoon brings south-westward winds, which turn contradictory during Southwest Monsoon. The surface current during the Northeast Monsoon flow north-northwest direction forming an anticyclonic circulation and during the Southwest Monsoon the current flow turns to the southwest-southward forming a cyclonic circulation. The wind and surface current during the monsoon season influences the surface ocean circulation in the basin leaving a clear pattern in the coastal sea levels. The mean amplitude of sea levels are varies over the year, between 0-25 cm. The amplitude reaching a maximum value during Northeast Monsoon, which is 7 cm at Strait of Malacca, 11 cm at Andaman Sea, .17 cm at Gulf of Thailand, 19 cm at Sulu Sea, and 25 cm at South China Sea. During the Southwest Monsoon season, the mean amplitude of SLAs are 5 cm at Strait of Malacca, 13 cm at Andaman Sea, 14 cm at Gulf of Thailand, 18 cm at Sulu Sea, and 21 cm at South China Sea.

Keywords: SARAL/AltiKa, Satellite Altimetry, Coastal Sea Level, Southeast Asia, Seasonal Variability

Abstract Id: 831
A watershed is an area that feeds all water bodies running under it. Morphometric analysis of a watershed provides a quantitative description and an important aspect of the characterization of watersheds.

In this research Watershed delineation and morphometric analysis of Beas Upper Catchment in India was carried out using Remote Sensing and GIS techniques. Data inputs in the study include ASTER & Cartosat (Bhuvan) DEM (30m) and satellite image of IRS P6(LISS-IV). Watershed delineation and boundaries comparison were done using both ASTER & Cartosat DEM using ArcGIS Spatial Analyst Hydrology Tool.

The 22 morphometric parameters were analyzed through measurement of linear, aerial and relief aspects and total 10 watersheds were delineated, whose area was found to be ranging from 324.51 to 850.34 km² and 322.27 to 850.03 km² for ASTER & Cartosat DEM respectively. Total basin relief of Beas upper catchment is found to be 5800 m and 5412 m, total basin relief of Beas upper catchment is found to be 5800 m and 5412 m delineated, Bifurcation ratio (R_b) in the catchment is found to ranging from 2 to 7.49 and 3 to 6.67 for drainage map prepared, the drainage density (Dd) of the catchment delineated DEM is 1.36 and 1.45, relief ratio of the catchment is 0.038 and 0.036 respectively for both ASTER & Cartosat DEM. The morphometric parameters analysis reflects the area is southerly sloped, extremely rugged, moderate permeability, porosity and infiltration. It indicates that area is moderate sloping to very steep sloping and the intensity of erosion process may be high.

Hence, from the study, it can be concluded that there is very less difference in the watershed boundaries delineated using ASTER and Cartosat DEM. DEM and Satellite data coupled with GIS techniques have proven as a competent tool in watershed delineation and morphometric analysis.

Keywords: Watershed Delineation, Morphometric Analysis, ASTER DEM, Cartosat DEM
Remote Sensing (RS), Geographical Information System (GIS)
Abstract Id: 832
Groundwater, which is in aquifers below the surface of the Earth, is one of the most important natural resources. Due to the increased population, drought, improper irrigation practices and pollution, depletion of groundwater taking place more rapidly. With the advent of remote sensing data and geographical information systems, mapping of groundwater recharge zones became much easier. This study requires historic rainfall data analysis, watershed drainage density, geology of the area, aquifer boundary conditions. Multi criteria analysis is performed to evaluate suitability to the ground water recharge for each factor according to its associated weights. Thematic layers were prepared, classified, weighted and integrated using GIS environment to get ground water recharge zones.

Keywords: Ground water recharge

Abstract Id: 833
ACCURACY ASSESSMENT OF FLOOD INUNDATION MAPS GENERATED USING DIGITAL ELEVATION MODELS OF VARYING SPATIAL RESOLUTION


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Digital Elevation Models (DEMs) which are the digital representation of the Earth’s surface are the main data utilized as inputs in hydraulic model simulations to produce flood hazard maps. In the Philippines, Light Detection and Ranging (LiDAR) DEMs with a horizontal spatial resolution of 1 m and vertical accuracy of 0.20 m integrated with river bathymetric data are currently considered as the most detailed and accurate DEM to produce flood hazard maps. However, the acquisition of these LiDAR datasets is very expensive including its processing to produce the necessary DEM utilized in flood modeling. In this paper, we tested several DEMs covering the Philippines to know which among them is a better substitute in case LiDAR DEMs of an area are unavailable. These DEMs are the 5-m Interferometric Synthetic Aperture Radar (IfSAR), 30-m Alos World 3D 30 (AW3D30), and 30-m Shuttle Radar Topography Mission (SRTM) DEMs. Bathymetric data were integrated to these DEMs and were then used as inputs to two-dimensional (2D) hydraulic modeling using HEC RAS 5. The flood maps resulting from each simulation were assessed and compared to the simulation result using LiDAR DEMs. Assessment of the flood map accuracies were based on Root Mean Square Error (RMSE), Measure of Fit (also known as F-measure) and the over-all accuracy through a confusion matrix. Major results show that the flood depth and extent generated using non-LiDAR DEMs differs from that using LiDAR DEMs. Higher RMSEs and lower F values were found for flood maps generated using AW3D30 and SRTM DEMs. A more acceptable result comparable to that using LiDAR DEM was found for flood maps generated using the IfSAR DEM.

Keywords: DEMs, LiDAR, IfSAR, AW3D30, Flood Mapping, SRTM, Accuracy Assessment

Abstract Id: 834
This study describes the spatial pattern in glacier area change in the Himalaya based on Landsat OLI, Landsat TM and ASTER GDEM. A total of 14141 numbers of glaciers is taken into analysis. A loss of 2801.73 sq. km of ice area observed in a time span of 25 years i.e. from 1990 (14438.56 km²) to 2015 (11628.83 km²). Glaciers in the Himalaya show an overall recession rate of -0.65%/yr. Glaciers from different regions i.e Jammu & Kashmir and Himachal Pradesh (Region-I), Uttarakhand (Region-II), central Nepal (Region-III), Everest (Region-IV) and Bhutan (Region-V) have different area change rate viz- 0.027%/yr, -0.41%/yr, -1.32%/yr, -1.58% /yr, -1.2%/yr respectively (-ve sign is area loss and +ve sign area gain). The Himalaya is experiencing a gradual decrease of total ice area from14438.56 km² (1989), 13689.17 km² (2000), 12863.05 km² (2010) to 11628.83 km² (2015). Glacier's of Region (II-V) are showing decreasing trend of ice area where as Region-I i.e. Jammu & Kashmir region was showing some exception i.e initial decreasing trend from1989 up to 2010 [1989(4236.77 km²), 2000(4150.98 km²), 2010 (4088.17 km²)] and increasing after up to 4258.58 km² in 2015. TRIMM precipitation data shows that in the western Himalaya precipitation trend increases from 2000, whereas in eastern Himalaya precipitation decreases year wise. Mean temperature data showing that eastern and central Himalaya has a more temperature than western Himalaya. The recession observed might be due to change in the precipitation and temperature pattern.

Keywords: recession, Area change, debris, TRIMM

Abstract Id: 835
ASSESSING TRADITIONAL CLASSIFICATIONS ABILITY IN IDENTIFICATION OF FLOWERING TREES IN URBAN ECOSYSTEMS

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Spring flowering dates of cherry blossoms have been slowly advancing due to global warming and urban heat island effect. Monitoring the changes of cherry tree flowering timing is quite challenging especially when cherry tree were planted in high heterogeneous urban area making it difficult to identify the flowering cherry trees. We hypothesized that Support Vector Machine (SVM) has ability to identify pixels of flowering cherry tree (Prunus x yedoensis) better compared to Maximum Likelihood Classifier (MLC). Thus, to test the effectiveness of traditional classification of MLC and SVM, both classifications were assessed by employing on multispectral IKONOS image in identification of flowering cherry trees at small spatial scale and was upscale to large spatial extend. The results obtained shows that SVM gave encourage accuracy results than MLC at both small and large spatial scale. Therefore, this results suggested that SVM classification was useful in identification and monitoring of flowering trees in high heterogeneous urban ecosystems.

Keywords: Flowering trees, Urban Ecosystems, Traditional Classification, Maximum Likelihood (MLC), Support Vector Machine (SVM)

Abstract Id: 836
MAPPING THE AREA EXTENT OF PROSOPIS JULIFLORA USING REMOTE SENSING AND GIS TECHNIQUES IN CHENGALPATTU TALUK, TAMILNADU

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The growth and spread of Prosopis is tremendous mainly due to its inbuilt mechanism to overcome adverse conditions. Prosopis Julifora was introduced in India during the 1870s to meet the fuel wood demand and in Tamil Nadu the 1960s, particularly in the composite Ramanathapuram and Tirunelveli districts. Now the species is spread to other districts and has become a threat to environmental ecosystem. This study aims to study the spread of Prosopis species in Chengalpattu taluk, Kanchipuram District, Tamil Nadu using Remote Sensing and GIS Techniques. The conventional classification methods like unsupervised, supervised and hybrid techniques were used to classify the Prosopis. The accuracy assessment was done for all the classification techniques. Geographic information system and satellite imageries (Landsat images 2005, 2010 and 2017), and GPS points were the main tools used for this work. Standard spatial statistical analysis procedures were employed using the software Erdas Imagine 8.4 and ESRI ArcView to generate land cover changes associated with prosopis species. The study found that a hybrid classification give better accuracy than others. The hybrid system consist of PCA, RGB clustering and etc.

Keywords: Remote sensing, GIS, Prosopis, RGB clustering

Abstract Id: 839
MAPPING LAND SUBSIDENCE OF KRISHNA-GODAVARI BASIN USING PERSISTENT SCATTERER INTERFEROMETRY (PSI) TECHNIQUE

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SAR Interferometry (InSAR) is a technique by which a wide area can be mapped for surface deformation. The conventional InSAR technique has limitations due to baseline restriction, atmospheric phase delay, and temporal decorrelation. Persistent Scatterer Interferometry (PSI) technique is an advanced InSAR technique, and it mitigates the atmospheric phase delay effect and geometric decorrelation to a large extent by utilizing a stack of interferograms and gives time series of deformation with high accuracy. Extraction of oil and natural gas from underground deposits will lead to a natural land subsidence. The East coast of Andhra Pradesh (A.P) in Krishna-Godavari basin is most likely to be affected by this phenomena because of extraction of oil and gas from its underground reservoirs for last two decades. In this paper, an attempt is made to know how the urban cities in this region are affected due to land subsidence using PSI technique. For this, two coastal test areas are selected and ALOS-1 PALSAR time series datasets from 2007-2011 comprising of 11 and 13 scenes corresponding to these test sites are processed using PSI technique. From the results, land deformation rates of different cities in test sites are observed. The subsidence rate of Palakollu town is -20mm/year and Kakinada city is around -13 mm/year. Narsapur town is showing 4mm/year upliftment because it has more prospect of ground water recharge from river Godavari. Although the area predominantly agriculture; small villages, towns and cities provide adequate Persistent Scatterers.

Keywords: Persistent scatterer, interferometry, land subsidence, ALOS-1 PALSAR

Abstract Id: 840
Global warming is one of the most serious problems we are facing in the 21st Century. Sea ice has an important role of reflecting the solar radiation back into space. However, once the sea ice area melts, the area starts to absorb the solar radiation which accelerates the global warming. This means that the trend of global warming is likely to be enhanced in sea ice areas. Thus, the importance of monitoring sea ice is increasing. In this study, the authors have developed a method to extract thin ice area using MODIS data. The reflectance of thin sea ice area is rather low. Especially, near infrared is quite sensitive to water, and the reflectance dramatically reduces with the existence of water. Since the surface of thin sea ice is likely to be wet, the reflectance of near infrared is lower than that of visible channel in thin sea ice areas. Considering these characteristics, the authors have developed a method to extract thin sea ice areas by using the scatter plots of reflectance of Channel 1 and 2 data of MODIS. As a result, by using three equations in the MODIS Channel 1 and 2 domains, most of the thin ice area could be extracted in the Sea of Okhotsk, Sea of Bering and Gulf of Saint Lawrence.

Keywords: sea ice, optical sensor, global warming, glaciology

Abstract Id: 841
THIN ICE AREA EXTRACTION IN THE BERING SEA USING AMSR2 DATA

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Sea ice has an important role of reflecting the solar radiation back into space. In addition, the heat flux of ice in thin ice areas is strongly affected by the ice thickness difference. Therefore, Ice thickness is important parameter of sea ice. The authors have developed the thin ice area extraction algorithm using passive microwave radiometer AMSR2 for the Sea of Okhotsk in the past. The purpose of this study is to investigate the possibility of expanding the algorithm to the Bering Sea. The Bering Sea is a seasonal sea ice zone like the Sea of Okhotsk. Thus, the authors thought that the Bering Sea is suitable area for testing the thin ice algorithm developed for the Sea of Okhotsk. We have applied the algorithm to the multiple AMSR2 scenes of the Bering Sea and verified the result by comparing with MODIS images taken at the same time. The initial result suggested that the algorithm is applicable to the Bering Sea with some modification of the parameters.

Keywords: sea ice, passive microwave radiometer, global warming, glaciology

Abstract Id: 843
On March 11, 2011, Tohoku Area of Japan was seriously damaged by the Japan Earthquake. At that time, a large-scale tsunami associated with the earthquake hit the large area along the coast including many of paddy fields. In this study, the authors have investigated the possibility of using MODIS NDVI for monitoring the recovery condition of the tsunami damaged paddy fields. The authors have selected a number of test sites for normal paddy fields, inundated inshore paddy fields, and inundated inland paddy fields. Usually, the NDVI of typical paddy field gradually increase from May to August and suddenly decreases in September due to harvesting. As for the year 2011, the NDVI of the inundated paddy fields in March by the tsunami did not increase much even in the summer time. However, in inundated inland paddy fields which were suffered by the tsunami in 2011, the NDVI variability became almost the same as that of normal paddy field in 2012. This means, that those inland paddy fields were recovered within one year. On the other hand, the inundated inshore paddy fields did not show such clear recovery. The results well matched with the paddy recovery report provided from the local government.

Keywords: disaster, earthquake, Tohoku, Terra, Aqua

Abstract Id: 844
ANALYSIS ON THE EFFECTS OF ANTHROPOGENIC ACTIVITIES TO THE HYDROLOGIC AND HYDRAULIC BEHAVIORS IN A MINED WATERSHED IN CARAGA REGION, PHILIPPINES

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Land use conversion has been very prominent in the Caraga Region in Mindanao, Philippines. Most of these are mainly associated with the urban development, crop conversion and the sprawling of mining companies, among many others. Also, in the Philippines, heavy to torrential rains are frequently experienced caused by tropical storms and typhoons at least once every year, which then results to severe flooding in communities. In this paper, we present the possible effects of anthropogenic activities such as mining to a watershed’s behavior during heavy rainfall events. This analysis was made in the Sulibao Watershed located in the Province of Agusan del Sur, Caraga Region wherein an open-pit mining operation is currently taking place. This paper involves the analysis on the land cover maps of the area before the mining operations and to the present situation wherein majority are already barren. Land cover mapping was done through Maximum Likelihood classification using Landsat Satellite Images. Two hydrologic models were developed; one was parameterized using the historical land cover scenario, while the other is parameterized using the present. Moreover, a 2-dimensional hydraulic model was developed to analyze how the runoff water behaves given the different land covers. Both the development of the hydrologic and hydraulic models mainly utilizes LiDAR (Light Detection and Ranging)-derived Digital Terrain Models (DTMs) for their elevation data with a horizontal resolution of 1.00 meter and a vertical accuracy of 0.20 meter. For the different set of models with different land cover parameters, hypothetical rainfall scenarios were simulated with return periods of 2, 5, 10, 25, 50 and 100 years and generated several flood characteristics like extent, depth, velocity, and arrival time. Simulation results showed that the mining activity in Sulibao Watershed greatly impacted the behavior of rainwater during rainfall events.

Keywords: anthropogenic activities, hydrologic, hydraulic, runoff, flood simulation

Abstract Id: 846
This paper presents the mapping and assessment of existing flood control structures in Agusan River, Butuan City, Mindanao, Philippines through the combined use of LiDAR topographic datasets and flood simulation models. It can be recalled that several flooding events in Butuan City due to the overflowing of the Agusan River has caused catastrophic damages to both properties and human lives, especially last January 2014 during the onslaught of Tropical Storm 'Agaton', and lately in January 2017 during the torrential rains brought by a tail end of a cold front. One of the questions raised during the occurrence of these flooding events are the roles and effectiveness of the existing flood control structures which consists of concrete flood walls and dikes. In this study, we utilized LiDAR-derived data products such as Digital Terrain and Surface Models (DTM & DSM) to extract/map existing flood control structures such as dikes, levees, detention ponds, impounding structures, and diversion channels. Then, an integrated 1D-2D hydrologic and hydraulic models based on HEC HMS and HEC RAS that are capable of simulating detailed and spatially-distributed flood depth and other characteristics such as flood arrival time, velocity, extent, duration, and recession were developed using LiDAR-derived topographic datasets (DTMs and DSMs). The integrated HEC HMS and HEC RAS 2D hydraulic model are then used to simulate the impacts of flooding caused by recent events. The model outputs were used to differentiate the impacts of flooding with or without the presence of flood control structures. Finally, an assessment of the effectiveness of current flood control structures was conducted. The approach presented in this study can be an important reference for undertaking flood control structures assessment in the Philippines.

Keywords: Flood Control Structures, Assessment, LiDAR, Model Simulation

Abstract Id: 847
Inventory of coffee plantations using geospatial technology

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Reliable and timely database on area and production estimates of coffee is a critical input for proper planning and management. In this regard, a collaborative pilot study was carried out for inventory of coffee plantations using geospatial technology in six traditional coffee growing talukas. Temporal Resourcesat LISS-III data was used for characterising the phenology of vegetation types while LISS-IV and Cartosat-1 data was used for mapping of coffee plantations. The analysis indicated that coffee plantations cultivated as mono crop or under mono shade trees showed typical spectral signature and could be classified using object based approach. In case of coffee plantations existing as an understory crop with mixed tree stands, the spectral signatures varied depending on the shade tree types, thus, digital classification technique was not applicable Interactive visual interpretation was followed for mapping of coffee plantations in such areas. The field verification of interpreted maps revealed that the mapping accuracy was better than 90.0 per cent. RS based coffee area estimates compared with Kelagur coffee estate map which showed good agreement spatially and statistically. The total coffee acreage estimated from geospatial technique was 1.94 lakh ha in comparison to Coffee Board estimate of 1.70 lakh ha. The pilot study established the feasibility of utilizing multi-resolution remote sensing datasets for mapping of coffee plantations in diverse geographic and agro-climatic regions for creation of geospatial database. However, species level differentiation of Arabica from Robusta coffee types was not feasible through currently available remote sensing data and further research efforts are necessary in this direction. Based on the successful completion of the study, a national project on is initiated covering major coffee growing regions of India to generate baseline database on coffee plantations.

Keywords: Coffee, Geospatial, Inventory, classification, accuracy

Abstract Id: 848
GEO-SPATIAL FLOOD EVENT VISUALIZATION MOBILE APPLICATION USING AUGMENTED REALITY TECHNOLOGY


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In the Philippines, flooding is the primary hazard that has been the common problem continuously been engaging by the government and the communities situated in the flood prone areas, particularly in Butuan City, Caraga Region, Mindanao. Hence, propagating awareness and early hazard warnings should be apt and visually realistic as possible, so the impact can be mitigated if not prevented. Nowadays, the medium of broadcasting emergency advisories and notifications are not just through televisions and radios but also through smartphones, android phones specifically. Taking advantage on the advanced features of android phone, the Geo-SAFER Agusan Project of Caraga State University initiated the development of an android application that supplements the dissemination of flood related information in a visually reasonable approach. The integration of augmented reality technology to the development delivers a much more realistic 3-dimensional visual representation of the flooding incident of the actual topographic location. The application can cater both near-real time flooding instance and simulated scenario. In realizing a 3-dimensional view of flooding situation, Unity - game development platform for building high-quality 3D and 2D environment, was used. The utilization of the Location-based services of an android device, Geo-fencing and the availability of cellular networks supports in determining whether the user’s recent, if not actual, geographical location is inside the identified hazardous boundary. If a user is within the said boundary, flood advisories and notification will be sent 6-12 hours prior to the impending flooding event. The application will provide an actual visual representation of a near-real time flood occurrence and alternatively, a simulated flooding scenario earlier than expected. The application is completely suitable for an android platform which is beneficial as a supplementary early warning tool of flood disaster risk reduction and management programs of Local Government Units and it could also serve as an effective educational means.

Keywords: Location Based Services, Push Notification, Geo-fencing, Augmented Reality, Unity3D

Abstract Id: 849
REMOTE SENSING FOR DISASTER PROJECTION MODEL

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Natural disasters are natural phenomena that cannot be avoided by humans; but human beings are able to mitigate its impact on the humanitarian aspects. Therefore monitoring, predicting and managing natural phenomenon in the earth is one of the method to mitigate disaster - one of them by using remote sensing technology. Integrated of imageries from near real time remote sensing satellite system to the higher resolution with the support of the ancillary data may develop a spatial information for any mitigation purposes. Therefore, the aim of the study is to develop a projection model of natural disasters. The disasters associated with landslides or floods may be used for example, because these two disasters often hit the Asian region. The fuzzy and hybrid method following NDVI and weighting method were used to develop the model. A projection of prone area and its emergency response can be spatially visualized to mitigate further humanitarian disasters.

Keywords: disaster, projection

Abstract Id: 851
ANALYSING THE IMPACT OF URBANISATION ON LAND SUBSIDENCE IN BANGKOK METROPOLITAN AREA USING DINSAR TECHNIQUE

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Land subsidence particularly occurs where the intense urbanisation implies increasing water consumption with a significant pumping of the aquifers. In Bangkok metropolitan, with its rapid urbanisation processes, groundwater is the main resource for household and industry. In recent years land subsidence has been identified an important issue in this region. To investigate the land subsidence, the use of Synthetic Aperture Radar (SAR) technique has been considered an efficient approach. Since October 2014, Sentinel-1 data are freely available via the ESA’s Sentinels Scientific Data Hub. In this study, Sentinel-1 SAR images were collected over the 2015 - 2017 period focusing on entire Bangkok metropolitan including the coastal area. The results are achieved by Differential Synthetic Aperture Radar Interferometry (DInSAR) technique which generates a land subsidence map, aided by Geographical Information System (GIS). This study shows the recent land subsidence rates and its correlation to urban development map, and also illustrates the applicability of Sentinel-1 data for land subsidence detection monitoring.

Keywords: DInSAR, Bangkok, Urbanisation, Sentinel-1

Abstract Id: 853
Landslides are most common natural hazards in the Himalayan region. Causes and effect of occurrences of landslides are identified by some important variables and parameters of geologic, geographic, climatic conditions. Geospatial techniques and satellites images providing many advantageous information in RS & GIS environment with other factors like as rainfall, soil-moisture, geological, geographical, climatological and anthropogenic cause influencing the order of increment of occurrences of landslides. Landslide inventory is a major way of assessment of study of landslide hazard. Landslide inventory can be completed by landslide mapping, cause and effect using satellite data like as IRS-P6, TRMM rainfall data (25x25 km.), along with Survey of India Toposheet No.53N/7, 10, 11. Alaknanda catchment is characterized by frequent monsoon of subtropical climate. Assessment of rainfall threshold (3-days prior and 15-days cumulative) with soil-moisture shows a direct relationship among landslides occurrence, soil thickness, drainage density, lineament density, lithology, climatic condition, vegetation, geomorphology and physiography of the study area. The geologic, geomorphic and climatologic parameters and factors directly interrelated to initiation of landslide occurrences, as well as intensity of rainfall and soil-moisture is also main important variable of intensity of occurrences of landslides in the study area. A process based (soil-moisture) approach verify the rainfall threshold in initiation of landslide.

Keywords: Landslides, Rainfall threshold, Soil-moisture, Remote sensing

Abstract Id: 855
SIMULATING THE EFFECTS OF DREDGING TO RIVER HYDRAULIC CHARACTERISTICS USING LIDAR

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Dredging is known to be the simplest and cost effective way to address the flooding in the rivers by widening and deepening its channels. It is a process wherein materials from the bed or banks of the river are removed and are disposed to a different location. Although this method would increase the capacity of the river to contain and prevent flood waters from spillage, this also causes the flow of the river to become faster going downstream. In this paper, we present the possible effects of dredging to the hydraulic characteristics of a river with the use of high spatial resolution LiDAR-derived Digital Terrain Model (DTM), field surveying, hydrologic modeling and 2-dimensional hydraulic modeling. The analysis involved the comparison of hydraulic simulation results between the models with actual river profiles and hypothetical or dredged river beds at different volumes. The 2D simulations generated several hydraulic characteristics that are to be compared; namely, the river velocity, shear stress and stream power. The analysis was conducted in Agusan River, Caraga Region, Mindanao, Philippines; wherein industries of fishponds and water transportation are existing and are currently operating. Aside from simulating the normal flow of the river to the different models, rainfall scenario based events of 2-year, 5-year, 10-year, 25-year, 50-year and 100-year return periods are also simulated and generated with the different hydraulic characteristics. The result of the analysis provides a quantitative approach in determining the maximum limit of volume of soil to be removed on a dredging activity that serves as an effective tool for monitoring if ever they are planning or wanted to conduct dredging in Agusan River.

Keywords: Dredging, Hydraulic impacts, Hydraulic simulation, LiDAR

Abstract Id: 856
THE SILHOUETTE WIDTH CRITERION FOR CLUSTER ANALYSIS-BASED FINDING OPTIMAL SET FROM FEATURE SELECTION ALGORITHM ON DATA CLASSIFICATION

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Image data is an unstructured data. Currently, the technology of photography is growing that effects of an image are high resolution, but it is difficult to analysis or extract for implicit knowledge because it used a long time or high-performance computer to process. The popular techniques are feature selection method for solving this problem of image is high-resolution. Feature selection is a method of reducing data dimensional by return optimal set of the feature in data. However, most algorithms in feature selection are returned in form score for each feature, so it is difficult to choosing features with scoring because we do not know which score range is best for data classification. Therefore, in this research intends to solve the finding best optimal set of feature by using clustering technique for the group the similar features on score features. Clustering technique must specify the number of clusters, but we do not know the best number of clusters. In this research, we propose the method for using silhouette width criterion for cluster analysis-based finding an optimal set of features from feature selection algorithm on data classification. The proposed method of this research show performance on forest type classification in Japan with high-resolution imaging from ASTER satellite Experimental results to confirm the efficacy of our proposed method.

Keywords: Feature selection, Clustering, Silhouette, Data classification, Forrest classification

Abstract Id: 859
Urban and suburban developments cause profound changes to natural watershed conditions by altering the terrain, modifying the vegetation and soil characteristics. Half of the global population already lives in cities, and by 2050 two-thirds of the world's population are expected to live in urban areas. Poverty and environmental degradation are two burning issues being faced by the most of the cities in the world.

The present study aims at assessing the impact of urbanization on depletion of natural resources such as water resources and vegetation in Hyderabad city, India using Remote sensing (RS) and Geographical Information System (GIS) techniques. Hyderabad city is one of the fastest growing urban agglomerations in India, with a population growth of more than 5% (UN 2009). The city is spread over 650 square kilometres with a population 7.7 million (2011 census). It is India's fourth most populous city and the sixth most populous agglomerations. The population of the city is expected to exceed 10 million by the end of this decade and is expected to rise from its current rank of 31st largest urban agglomeration to the 22nd largest urban agglomerations in the world surpassing Bangkok, Lima and Hong Kong (UN 2009). RS and GIS techniques are widely used for thematic mapping of natural resources and in planning, development, management, monitoring of land and water resources. The present paper focuses on the assessment of spatio-temporal impacts of urbanization quantitatively on surface water resources and vegetation in and around Hyderabad city using RS and GIS techniques.

Keywords: Urbanization, water resources, vegetation, Remote sensing, GIS

Abstract Id: 861
GEOSPATIAL APPROACH FOR RECONCILIATION OF NOTIFIED FOREST LANDS AT CADAstral LEVEL


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Forest lands are vulnerable to degradation and encroachment and hence spatial maps indicating ownership along with jurisdictional boundaries are important for enforcing forest conservation. In this context, a pilot study was carried out to generate geospatial database for forest lands in collaboration with Karnataka Forest Department for reconciliation of notified forest lands at cadastral level. The pilot study was carried out in four forest ranges covering 220 villages representing overall diversity in terms of terrain and forest types. The major input for the study included high resolution data (Cartosat-1, LISS-IV), GAGAN based GPS, cadastral and notified forest land maps. GAGAN based GPS devise was used for collection of accurate GCPs. One set of GCPs were used in the photogrammetric block adjustment of Cartosat-1 stereo images for generation of DEM and orthorectification. The results indicated reasonable positional accuracy of the orthoproducts. The scanned village cadastral maps were georeferenced using second set of GCPs. The georeferenced cadastral maps were overlaid on the merged data to compare the extent of matching between parcel boundaries with field boundaries as manifested on high resolution data. The results are quite encouraging with 80.2 per cent of the cadastral maps showed better than 5.0 m accuracy along the field boundaries. Two seasons LISS-IV and Cartosat-1 merged data was used for reconciliation of notified forest land boundaries. A comparative study was carried out to analyze the land use change within notified forest lands which indicated significant diversion of forest lands to agriculture. Further, decadal changes in the forest lands were analyzed using historical satellite database from 1965 - 2015 to study the diversion of forest lands to other purposes. Based on the encouraging results of the pilot study, a Standard Operating Procedure (SOP) was developed to extend the study to Karnataka state for reconciliation of

Keywords: Notified forest lands, high resolution, GAGAN, GCPs, reconciliation

Abstract Id: 862
THE EFFECT OF DEFORESTATION ON GLOBAL CHANGING AND ITS CONSEQUENCES IN TURKEY

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Land use has generally been considered as a local environmental issue, but it is becoming a force of global importance. Global changes to forests, farmlands, waterways, and air are being driven by the need to provide food, water and shelter to more than six billion people. Global croplands, pastures, plantations and urban areas have expanded in recent decades, accompanied by large increases in energy, water and fertilizer consumption, along with considerable losses of biodiversity. The changes in land use have enabled humans to appropriate an increasing share of the planet's resources, but they also potentially undermine the capacity of ecosystems. Global Warming and Climate Change are the two main fundamental problems facing Turkey as well as the World. The expedition and size of this change is becoming noticeably conspicuous now. According to the International Union for Conservation of Nature (IUCN), the global temperature has been increased of about 0.74 degree Celsius since the Industrial Revolution. Interdisciplinary science that integrates knowledge of the many interacting climate services of forests with the impacts of global change is necessary to identify and understand as yet unexplored feedbacks in the Earth system and the potential of forests to mitigate climate change. The general scientific opinions on the climate change states that in the past 50 years, global warming has effected the human life resulting with very obvious influences. Remote sensed data for wide regions in Turkey proves the fact for the land changes caused by deforestations. High rates of deforestation within a country are most commonly linked to population growth and poverty. In Turkey, the forests are destroyed for various reasons resulting to a change in the climate. This study examines the causes of deforestation and its consequences on the climate change in Turkey. Suggestions on preventing negative effects are also given.

Keywords: Global Changing, Deforestation, Environment, Climate

Abstract Id: 863
WEB AND MOBILE GIS SYSTEM FOR SEARCH AND RESCUE MISSION OF MEETHOTAMULLA GARBAGE-SLIDE

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For many years Sri Lanka has had its own tradition of dealing with waste to maintain the cleanliness of Colombo city. As a result, there is nothing so senseless as to allow, a huge garbage dump of about 300 feet tall formed few kilometers away from the heart of Colombo, in Meethotamulla area, creating series of social and health issues. Unfortunately, in 14th April 2017 this garbage mountain made an catastrophe by sliding down and burying people under collapsed buildings and garbage-slides.

However, due to the extended sudden changes of ground condition, the existing maps of the area will be obsolete for any search and emergency rescue missions. Hence, a preparation of disaster map in quick time and make it available for real-time field operations are vital requirements. Therefore, this paper has presented the web and mobile GIS system developed and implemented for search and rescue mission of Meethotamulla garbage-slide. To accomplish this, the damage map has prepared by comparing the multispectral images captured just after the disaster using UAV and pre-disaster airborne LIDAR image map. Within few hours the system has implemented and made available for the rescue teams to access via www. Based on which the berried houses were identified with reasonable accuracy and this system has successfully utilized throughout the rescue mission. The spatial resolution of the developed 2D map is 3 cm and the ground accuracy was tested as 4 m. Further, a real-time mobile application has developed to collect spatial and non-spatial data related to the disaster. Those collected data has upload real-time to the server and made available to the rescue teams and any party interested via the developed web application. It has been tested that throughout the rescue mission the data has accurately sent to the server with only 10 to 15 seconds delay

Keywords: Search and rescue, Drone mapping, disaster management, web-GIS

Abstract Id: 865
URBAN FLASH FLOOD MODELLING USING REMOTELY SENSED DATA 
AND HEC-RAS: PUNE CASE STUDY

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Urban flooding is becoming one of the common reasons recently for loss of human life and property. India, in the past, has experienced two such major urban flooding incidents affecting large amount of population and resulting substantial loss of human property: Mumbai and Chennai. This motivates us to model the flood for Indian urban catchments and to simulate some of the alarming scenarios of flood in the different parts of the city. We present in this paper such a case study of the urban flood modelling for Pune city. The secondary objective of the research was to find correlation between water depth at the different locations in the city and daily average rainfall. This information further provides important input to the vulnerability assessment studies.

Integrated use of remote sensing and geographic information system is ideal solution in this case. We used recent Landsat data to calculate the area covered by impervious surfaces. Supervised learning was used to classify the urban scene into different vegetation, impervious surface and soil classes. The calculated impervious area along with other important land use land cover classes was considered for runoff calculation. Other supporting data required for hydrological modeling such as rain gauge data and river gauge data was collected for the study area. All the required map layers were created using QGIS package. We used HEC-RAS model to estimate the flood depths in Pune city for various rainfall conditions in 2016 monsoon.

The estimated water depths at various locations in Pune city indicate moderate flooding in isolated pockets of the city. For above average rainfall conditions on 2 consecutive days (Aug. 2-3, 2016, 22.9 mm, 54.6 mm) water depths of ~1 m was estimated in a few low laying areas.

Keywords: Remote sensing, Urban flooding, HEC-RAS, Impervious surfaces

Abstract Id: 867
TOWARDS AN APPROACH TO PREDICT URBAN VEHICULAR TRAFFIC AND PLAN CONGESTION FREE CITIES

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This study provides a framework that estimates the urban traffic based on structure of already-built or proposed-built environment. The built environment comprises of buildings and street networks; the study presumes that built environment inherits the characteristic properties (viz. activities, services) in an urban setting which then govern the movement patterns within the setting. The presumption is based on Space Syntax theory which suggests that the social phenomena for a space and neighborhoods are deeply connected to how the elements (road networks) in a system are arranged, and on Urban Network Analysis theory that suggests how buildings interact with each other having roads as the elementary connection links. The freely available OSM (open street maps) data sets for the roads and buildings GIS (Geographic Information System) layers of New-York are used for the study. Apart from this, the free available data sets for AADT (Average Annual Daily Traffic) counts for the same regions are used as target layer while developing the framework. We couple building to building (point to point) accessibility considering metric distances and their respective volumetric capacities with the space syntax based segment angular analysis on urban streets. The approach creates a multi-dimensional feature vector on top of buildings layer. Feature vectors consist of building volumes, their reach, betweenness for metric search radius of 500m, and 1km and local integration & choice values of road segments adjacent to which they lie for metric distances of 2km, 5km and 10km. Further we use these feature vectors to train a decision tree based machine-learning classification model that gives 83% accuracy for predicting relative traffic classes on testing data set. The pipeline for model creation stands good to plan a congestion free city or to modify areas in an already built environment from frequently congested to a non-congested or mildly congested.

Keywords: Urban Planning, Traffic Estimation, Classification, Machine Learning

Abstract Id: 868
Hyperspectral narrow-band spectral data are fast emerging as practical solutions in modelling and mapping vegetation. Recent research has demonstrated the advances in and merit of hyperspectral data in a range of applications including quantifying agricultural crops, modelling forest canopy biochemical properties, detecting crop stress and disease, mapping leaf chlorophyll content as it influences crop production, identifying plants affected by contaminants such as arsenic, demonstrating sensitivity to plant nitrogen content, classifying vegetation species and type, characterizing wetlands, and mapping invasive species. This study aims at Hyperspectral approach to study the vegetation for the available strip of Hyperion data in the region of Uttrakhand, India. This strip faced a high variability of the elevation ranging from 250m to 4450m. The main objective of this research is to find out stress on vegetation using vegetation indices like Normalised Difference Nitrogen Index (NDNI), Carotenoids Reflectance Index (CRI), Plant Senescence Reflectance Index (PSRI), Modified Chlorophyll Absorption Ratio Index (MACRI), Normalised Difference Vegetation Index (NDVI). GIS and RS software were used in this study to; 1) Calibration satellite data, 2) Calculation of different indices, 3) Generate thematic layers representing the spatial distribution of different indices and vegetation stress. The results show different conditions of vegetation as landforms variations in the area. Furthermore, it was concluded that the combination of various indices offers better understanding and better monitoring of vegetation health/stress.

Keywords: Hyperspectral, Vegetation, Health

Abstract Id: 870
A land is defined as that portion of the earth which is not enveloped by water. The land cover takes into account the various objects present on the landscape such as agriculture, barren land, built-up etc. Due to anthropogenic pressure, land cover is changing rapidly. If the land cover change is not monitored and controlled, soon the natural as well as the derived resources such as water, minerals, vegetation etc. will vanish. Remotely sensed images help in monitoring the land cover change by providing the repeatable observations of the same area and also of the areas that are inaccessible.

Modelling is given an aforethought for exploring the changes in land cover. Socio-economic and bio-physical factors affect the land cover change. Land cover change is modelled using the remotely sensed images and the factors that affect the changes such as population, temperature etc.

Machine learning models perform better than the other models such as cellular automata-markov in predicting the land cover changes. Machine learning algorithms, such as neural network has the ability to capture the non-linear relationship among the driving factors that causes the land cover change. Recent researches shows that deep learning neural network has the capability to model higher layers of abstraction in the data. There are several hidden layers in between the input and the output layer, which enables the deep neural network to extract the non-linear features from the data, it also helps in acknowledging the spatial pattern associated with the driving factors.

Therefore deep learning is used to model the land cover change and look for any spatial pattern associated with the drivers. This research coils around the development, analysis and assessment of the deep learning technique for the prediction of the spatial structure i.e. grouping or association of the different classes with the other classes.

Keywords: land cover change, modelling, deep learning, prediction, neural network

Abstract Id: 871
SEAMLESS MOSAIC OF HYDROGEOMORPHOLOGICAL MAPPING OF ANDHRA PRADESH USING REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM

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Andhra Pradesh covers diversified geology, topography and climate. The prevalent rock formations range in age from Archaean to Recent and vary widely in composition and structure. Similarly, the variations in the landforms are also significant. The topography and rainfall virtually control runoff and groundwater recharge.

The objective of the study is to prepare the groundwater prospects maps, corresponding to Survey of India (SOI) toposheet on 1:50,000 scale, covering all the habitations. There are 303 SOI toposheets on 1:50,000 scale covering entire Andhra Pradesh. The map shows a) prospective zones for groundwater occurrence b) tentative locations for constructing recharge structures. On screen visual interpretation of IRS 1C/1D satellite data (precision geocoded images) is used as the input for preparation of the ground water prospects maps. The methodology consists of a) creation of individual thematic layers on lithology, geomorphology, structures, hydrology along with base map details in conjunction with limited field work / existing data, and b) derivation of hydrogeomorphic units by integrating the thematic data. There are seventeen layers generated from digital SOI toposheets, satellite data and layers prepared interactively in each map. The database for entire State was created by different government and private organizations at different times and there is no boundary matching among many toposheets for various themes. All these corrections are made using SOI toposheets and satellite data and mosaiced all the layers seamlessly. Thus, the data created at different stages is organised into a digital database as per the standards and specifications furnished by RGNDWM Phase-III.

The database consists of 1) basic data as different layers 2) individual thematic maps and base map details and 3) integrated ground water prospects map as a final output in GIS format. All the groundwater prospects maps on 1:50,000 scale are hosted on APSAC and BHUVAN websites.

Keywords: GIS, Hydrogeomorphology, Hydrology, Lithology, Remote Sensing, Structure

Abstract Id: 872
DETECTING HUMAN SETTLEMENTS IN RURAL AREAS USING REMOTE SENSING (CASE STUDY: UTTARAKHAND, INDIA)

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Uttarakhand is the second fastest growing states in India, with the massive growth in capital investments arising from conducive industrial policy and generous tax benefits. Despite its growth in the economic sector, Uttarakhand is facing problems from the rapid increase of population. Based on the Census 2011, Uttarakhand population was around 10 million people with the growth rate of 18.92% in the previous decade. Its population in the year of 2017 is estimated to be 10.32 million people. Hence, sustainable spatial planning strategies for settlements are needed, especially in rural areas that are inhabited by more than two-third of the state's population (69.77%). Although the information on the distribution of the existing settlements is crucial to develop the plan, the information is still lacking. In filling this information gap, remote sensing offers methods to detect settlements. There were many researches that have been implemented to detect human settlements, especially in the urban areas. In this research, freely available data from European Space Agency (Sentinel-1 and Sentinel-2) will be used and machine learning methods (Random Forest and Support Vector Machines Classification) will be applied to detect human settlements in rural areas of Uttarakhand, India. Existing human settlement information from manual digitizing will be used to train and validate the result.

Keywords: rural, settlements, machine learning

Abstract Id: 873
The updated Landscape maps are essential for management planning and strategic decision making for biodiversity conservation. These are also important for mid-course correction and directing future efforts, because ignorance should not lead to irreparable damage. The Shiwalik Landscape of Uttarakhand, Haryana and southeastern Himachal Pradesh is the north-western limit of wild population of Asian elephant. Elephant habitat in this landscape is characterized by mixed moist and dry deciduous forests. Geomorphologically southern aspect is highly dissected supporting mix of dry and moist deciduous forests, while northern aspect has moist deciduous forest of Shorea robusta (Sal) and its associates like Mallotus philippensis (major fodder species of elephant) and Lagerstroemia spp., etc. However, demographic changes including enhanced religious activities and urbanization, patterns of forest resource utilization and cropping, certain management actions, increased industrialization and communication network in last few decades have led to the changes in land use and land cover (LULC) and forest cover density. We have attempted to analyze changes in LULC and forest canopy density in last 35 years using satellite remote sensing data with an objective to find out changes LULC and cropping patterns for cash crops and the man-elephant conflict zones. LANDSAT images of 1979, 1991, 2003 and 2015 were used to map forest cover type and density by integrating dry and wet seasons data to capture phenology using unsupervised classification approach. Post monsoon images were used for density mapping. Mapping accuracy for 1979, 1991, 2003 and 2015 was found 87%, 89%, 90% and 91%, respectively. From 1979 to 2015 about 400% expansion in urbanization was observed at the expense of other land use types, e.g. agriculture land, putting additional pressure on forest resources. A major changes of about 105% was observed between 2003 and 2015. It may suggest as one the major causes for increased man-elephant conflict.

Keywords: Shiwalik Landscape, North-Western Habitat Limit of Asian Elephant, Land Use/Land Cover Dynamics, Forest Canopy Density

Abstract Id: 876
Horticulture which is fastest growing sector within agriculture is now contributing more to nations GDP thus needs utmost emphasis in terms of reliable agricultural statistics. In mango production, India ranks first in the world. Therefore, reliable and timely estimates of area under mango at national level is essential for policy makers and planners for market planning and export activity. Previously only survey methodologies were used for area estimation under horticultural crops which are time consuming, requires extensive ground survey and involves huge cost. Modern space technology i.e. satellite data can be used as auxiliary variable to improve estimates obtained by survey. An attempt has been made to estimate area under mango using survey data along with satellite data as an auxiliary variable in this study. Traditionally Maximum Likelihood Classifier (MLC) is used for satellite image classification. MLC along machine learning classifiers like Support Vector Machine (SVM) and Artificial Neural network (ANN) were used in this study for satellite image classification. Support Vector Machine using three different kernel functions namely Radial basis function, Sigmoid kernel and polynomial kernel were used to improve the classification accuracy for delineation of mango. The study was undertaken in West Godavari district of Andhra Pradesh using Sentinel 2 satellite data. Best classification method was selected on the basis of kappa coefficient and overall accuracy. SVMRBF outperformed over all the methods with overall accuracy of 94.44 and kappa coefficient 0.9218. The estimates of area under Mango were obtained from survey data and satellite image classification technique. These estimates were further improved by integrating survey data and satellite data as auxiliary variable using ratio and regression estimators. Regression estimator gave very low Standard Error (SE) 11% as compared to ratio estimator (14 % SE). Thus, the study concludes that by integrating survey data and remote sensing data as auxiliary variable improved estimates of area under mango can be obtained.

Keywords: Artificial Neural Network (ANN), Maximum Likelihood Classifier (MLC), Support Vector Machine (SVM)
Monitoring Forest Cover Change Dynamics in West Singhbhum District of Jharkhand

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West Singhbhum district spreads from 21.97°N to 23.60°N and from 85.00°E to 86.90°E. A large part of the areas is covered by hills, valleys, steep mountains, and deep forests on the mountain slopes. It covers Sal tree forests and the famous Saranda forest. It exhibits a very rich forest ecology including a large variety of plants, wildlife, and micro-organism. But this ecological environment is facing alarming threats posed by fast decreasing forest cover types in this area. One of the main cause of shrinking forest cover type in this area is large deposits of mineral specially iron ore which are increasingly being unearthed to feed the increasing demand for steel production. The increasing mining activity and growing human habitat around these forest area results heavy loss of forest cover and severely influences the ecology of the area. In view of this situation, it has become obvious to map and monitor the forest cover change dynamics for this area. In this regard, the time series Landsat data starting from 1987 with 10 years' time interval (i.e. data acquired in year 1987, 1997, 2007 and 2017) are chosen. For each of the data, land cover classification are carried out using maximum likelihood classification method and accuracy assessment are performed. The major land use land cover classes involved in this study were dense forest, open forest, agricultural and scrubs, waterbodies, built-up area, quarries, and Barren area. Land cover change dynamics were finally estimated for the periods of 1987-1997, 1997-2007 and 2007-2017. The result revealed the tremendous loss of deep forest due to various human activities in that area during period of 1987-2017. It is also observed that rate of declining forest cover types becomes alarming after year 1997.

Keywords: Remote sensing, land cover land cover, classification, forest cover, change dynamics

Abstract Id: 879
CLASSIFICATION UNDER LABEL NOISE BASED ON OUTDATED MAPS

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Supervised classification of remotely sensed images is a classical method for change detection. The task requires training data in the form of image data with known class labels, whose manually generation is time-consuming. If the labels are acquired from the outdated map, the classifier must cope with errors in the training data. These errors, referred to as label noise, typically occur in clusters in object space, because they are caused by land cover changes over time. In this paper we adapt a label noise tolerant training technique for classification, so that the fact that changes affect larger clusters of pixels is considered. We also integrate the existing map into an iterative classification procedure to act as a prior in regions which are likely to contain changes. Our experiments are based on three test areas, using real images with simulated existing databases. Our results show that this method helps to distinguish between real changes over time and false detections caused by misclassification and thus improves the accuracy of the classification results.

Keywords: Supervised Classification, Label Noise, Logistic Regression, Map Updating

Abstract Id: 880
DEVELOPMENT OF GEOSPATIAL MAP WEB PORTAL FOR NEW DELHI MUNICIPAL COUNCIL

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The Geospatial Delhi Limited (GSDL), a Govt. of NCT of Delhi Company formed in order to provide the geospatial information of National Capital Territory of Delhi (NCTD) to the Government of National Capital Territory of Delhi (GNCTD) and its organs such as DDA, MCD, DJB, State Election Department, DMRC etc., for the benefit of all citizens of Government of National Capital Territory of Delhi (GNCTD).

This paper focuses on development and implementation of a web-based GIS application for New Delhi Municipal Council (NDMC) of NCT of Delhi. The GMWP has been developed as a map based spatial decision support system (SDSS) for planning and development of NDMC area to the NDMC department and it’s having the inbuilt information searching tools (identifying of location, nearest utilities locations, distance measurement etc.) for the citizens of NCTD. This method provides users easy access to GIS data and basic functions on the Internet with low technological requirements. The user is not required to learn anything beyond the basics about how to interact with the system as well. In the study, a GIS application and a web site was developed to serve the system on the Internet. Spatial data to GMWP includes Circle, Division, Sub-division boundaries of department pertaining to New Delhi Municipal Council, Parcels of residential, commercial, and government buildings, basic amenities (Police Stations, Hospitals, Schools, Banks, ATMs and Fire Stations etc.), Overground and Underground utility network lines, Roads, Railway features. GMWP could help achieve not only the desired transparency and easiness in planning process but also facilitates through efficient & effective tools for development and management of MCD area. It enables a faster response to the changing ground realities in the development planning, owing to its in-built scientific approach and open-ended design. Furthermore, this model enables easy data management including maintenance and updating.

Keywords: Geospatial Map Web Portal (GMWP), New Delhi Municipal Council (NDMC), Spatial Decision Support System (SDSS)

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POLARIMETRIC SAR DATA ANALYSIS OF SEMI URBAN/ URBAN AREA FOR LAND-COVER CHARACTERISATION

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Classifying urban area using synthetic aperture radar (SAR) data is a complex task. Urban surface is overall depicted by lesser homogeneity. It is characterised by natural and man-made features which are densely spaced, with smaller areal extent and higher vertical heights. Single polarisation SAR data is only able to represent such landscape to some extent. Polarimetric SAR system is able to depict the details better by measuring the complex scattering matrix [S] of an object or surface with quad polarisations. For better understanding of polarimetric SAR data polarimetric target decomposition is a useful technique.

Urban objects are first needed to be discriminated from surrounding natural terrain using polarimetric decomposition methods. Several target decomposition methods (coherent and non-coherent) are developed in last decades but fewer literatures are available about their detail response for urban area. Present paper analyses the responses of different objects and surfaces using methods for object discernibility over urban area at different bands and resolution. This will help to understand the potential of these decomposition techniques for urban land-cover characterisation. It is observed that suitably use decomposition technique contribute profusely to the classification of urban man-made objects.

Keywords: Polarimetry, SAR, target decomposition, urban

Abstract Id: 883
MULTI-HAZARD VULNERABILITY ASSESSMENT ALONG THE COAST OF VISAKHAPATNAM, NORTH-EAST COAST OF INDIA

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Globally coastal areas are vulnerable to disasters such as tropical cyclones where 40% of global population lives within 100 km of coast. In India, about 13% of the population live within this coastal belt and hence they are vulnerable to cyclone disasters. The east coast of India is mostly affected by tropical cyclones originating from northern and southern Bay of Bengal, where 1-2 tropical cyclones occur every year along the coast. Our study carried out a vulnerability assessment of the Visakhapatnam coast using Coastal Vulnerability Index (CVI) with six parameters as inputs e.g. the probability of coastal erosion, coastal slope, coastal elevation, sea level rise, tidal range and tsunami arrival height. Multi-hazard maps were prepared by overlaying the multi-hazards which are affecting the coastal zone. The coastal vulnerability index (CVI) values along the study area of Visakhapatnam coastline varies from 2 to 16. The 25th and 50th percentile of the coast having CVI values ranging from 2.0 to 4.5 are considered to be low vulnerable, those ranging from 4.5 to 8.0 are considered to be medium variable and the remaining parts having CVI values more than 8.0 are highly vulnerable. Risk map was generated based on the above six parameters which provided detailed information about hazards, safe areas and evacuation route. The maximum extent of the hazard zone is seen as 20 km from the current coastline of the Visakhapatnam district and study shows that total area of 150 km2 has been delineated hazard zone.

Keywords: Coastal Erosion, Sea Level Rise, Tsunami Arrival Height, Coastal Vulnerability Index, Risk Map

Abstract Id: 885
Evaluation of Indices Using Near-Real-Time Remote Sensing Data for Crop Condition Monitoring in India

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Crop condition monitoring at the early stages of crop growing season is of great significance. Along with the development of remote sensing applications, satellite data has become the most crucial data source for operational crop condition monitoring at large scales. This study documents for the large-scale crop monitoring using long-term historical data from 2007 to 2016 and in-season data of 2017, for both the seasons (Kharif and Rabi) in India by using a Moderate Resolution Imaging Spectroradiometer (MODIS) derived products. MODIS suite of product includes 10 day composite Normalized Difference Vegetation Index (NDVI) and, 10 day composite Land Surface Temperature (LST) time series data sets at spatial resolutions 250m and, 1000m, respectively. Several sensitive indicators of crop condition were computed such as NDVI-Derivation, Vegetation Condition Index (VCI) and Temperature Condition Index (TCI) to examine the crop health at national scale in near real time. The products could clearly demarcate drought situation in the States of Tamil Nadu and Kerala and very good crop condition in Indo-Gangetic plains during the rabi season. The indices were related to the rainfall derived anomaly index SPI to evaluate them for regional scale drought monitoring in real time.

Keywords: Remote Sensing, Kharif, Rabi, MODIS, NDVI, VCI and TCI

Abstract Id: 886
Can remote sensing detect, monitor and track baboon damaged Pinus plantations located in South Africa?

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The sustainability of the South African forestry industry is constantly under threat due to the constant spread and increase of damaging agents in a challenging environment. Bark stripping by baboons (Papio ursinus) has further impacted the economic potential of the forestry sector. Currently, tree damage caused by baboons is measured in forest plantations using periodic field surveys while undetected or new damage have little chance of being captured. However, the forestry industry requires information that can be regularly updated and covers large spatial extents for the implementation of real-time adaptive management decisions. Therefore, this study aims to develop a remote sensing based surveillance system, using the Landsat 8 sensor, to detect, monitor and track baboon damage over a two-year time period. A baboon damage map was produced using two efficient algorithms (i.e. Stochastic gradient boosting and random forests) at a provincial scale for planted forests in 2014, with an overall best detection accuracy of 82.45%. This result was greater than those produced when using any of the monthly datasets alone. The mapping exercise was repeated in 2015 and produced comparison accuracies when using the temporal spectral profiles of the normalized difference vegetation index (NDVI) and the disturbance index (DI). Overall, this research was successful in developing a repeatable monitoring framework that contributes towards the surveillance of baboon damage in plantation forestry using a space-borne satellite platform.

Keywords: landsat 8, baboon damage, forestry

Abstract Id: 887
Improving the unsupervised detection of riparian bugweed in commercial forest plantations using hyperspectral data and LiDAR

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Accurate spatial information on the location of invasive alien plants (IAPs) in riparian environments is critical to fulfilling a comprehensive weed management regime. However, traditional invasive plant mapping approaches have utilised ground-based field methods that are time consuming, cost intensive and limited in extent. Mapping vegetation using remotely sensed data covers larger spatial areas that can be updated according to management requirements. This study aimed to automatically map the occurrence of riparian bugweed (Solanum mauritianum) using airborne AISA Eagle hyperspectral data (393 nm - 994 nm) in conjunction with LiDAR derived height. Utilising an automated unsupervised random forest (RF) classification approach, Anselin local Moran's I clustering and anomaly detection, results indicate that the integration of LiDAR with minimum noise fraction (MNF) transformed data produce the best detection rate (DR) of 88% with the lowest false positive rate (FPR) of 7.14%. Additionally, the method produced an overall accuracy of 83% for mapping riparian bugweed. In comparison, utilising the original hyperspectral wavebands with and without LiDAR produced lower DRs and higher FPRs with overall accuracies of 79% and 68% respectively. Overall, this research has shown the potential of combining spectral information with LiDAR derived height to accurately map the occurrence of riparian bugweed using an automated unsupervised RF anomaly detection framework.

Keywords: unsupervised anomaly detection, hyperspectral, LiDAR

Abstract Id: 888
FLIGHT OPERATION AND IMAGE CALIBRATION OF FOMOSAT-5 REMOTE SENSING INSTRUMENT

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Taiwan’s first self-reliant satellite- FORMOSAT-5 is to be launched on late August this year to resume the observation missions of the decommissioned FORMOSAT-2. There are many Taiwan-made key components in the Remote Sensing Instrument, including the Telescope; CMOS image sensors, Focal Panel Assembly, Electronic Units (RSI), and so on. The image processing system on ground is also developed by National space Organization (NSPO) itself.

In this paper, the flight operation for imaging and onboard image data handling are described. After images downlink, the processes for image commissioning and calibration are mentioned to show how the image quality specification is verified. The commissioning activity has been planned including verification of Ground Sampling Distance (GSD), Modular Transfer Function (MTF) and Signal-to-Noise ratio (SNR); while in-flight calibration activity is aimed to generate the radiometric and geometric parameters for following image processing. The real downlink data will support the richness and completeness of this paper.

Keywords: FORMOSAT-5, Remote Sensing Instrument, Modular Transfer Function, Signal-to-Noise ratio

Abstract Id: 890
Background: Epidemiological studies have consistently shown an association between particulate air pollution and adverse health impacts. Studies have also reported positive associations between PM2.5 and lung cancer emphasizing that long term exposure to high PM2.5 concentrations can increase the mortality rate from lung cancer. Epidemiological studies based on air pollution that rely on ground measurements provided by monitoring networks are often limited by sparse and unbalanced spatial distribution of the monitors. Studies have found correlations between satellite Aerosol Optical Depth (AOD) and PM2.5. Satellite aerosol data may be used to extend the spatial coverage of PM2.5 exposure assessment. The objective of the present study is to examine the association between Particular Matter concentrations derived from satellite data and lung cancer incidences in the western districts of Tamil Nadu.

Methods: Standardised lung cancer incident rates were computed for each taluk (sub-district) and the mean PM2.5 raster grid for the decadal time period 2001-2010 was acquired. Covariates including age standardized smoking (bidi and tobacco) prevalence rates were also incorporated into the study. A comparative analysis including three regression models (ordinary least squares, spatial lag and spatial error) were used to assess the relationship between PM2.5 and lung cancer incidence rates.

Results and Conclusion: The results provide a significant relationship between the aerosol particle concentrations and lung cancer incidences and also correlated with the age standardised cigarette smoking prevalence rates. The results of the present association study would support targeting of policy interventions on such areas to check air pollution levels. Remote sensing particulate matter concentrations could be used as an alternative indicator of air-quality and as a surrogate for health based studies.

Keywords: Lung Cancer, PM2.5, Spatial regression

Abstract Id: 891
DETECTION OF OLIVINE FROM CENTRAL PEAK OF SAGAN CRATER ON MARS: IMPLICATION FOR EXPOSED CRUSTAL AND MANTLE LITHOLOGIES ON MARS

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The record of earliest volcanism on Martian surface is preserved which is buried by the subsequent resurfacing events. The deep buried ancient material has been excavated and exposed by large impacts occurred on the Martian surface. Central peak craters excavate very deep buried lithologies and are found to contain unaltered mafic mineralogy situated in various Martian terrains. Here we analyse hyperspectral data from CRISM (Compact Reconnaissance Imaging Spectrometer for Mars instrument) onboard Mars Reconnaissance Orbiter (MRO) for studying composition of Sagan Crater, a central peak crater situated in the Oxia Palus Quadrangle of Mars at 10.8°N and 30.7°W. The crater is named after Carl Sagan, the famous astronomer. Central peak craters are thought to expose deep crustal material and provide window to the deeper crustal lithologies. Olivine has been detected from Martian surface in different geological terrains where the mineral is found associated with ancient (early) Noachian crustal rock and early Hesperian volcanism. Olivine is the first mineral that crystallizes from magma, the composition of which is a record of the degree of evolution of the source magma.

Sagan crater is imaged by MCC on 16th Sep, 2016 from an altitude of 3319 km with a resolution of 166m. CRISM is a hyperspectral instrument on NASA’s Mars Reconnaissance Orbiter. Olivine rich lithologies is exposed on one of the central peak of the crater and shows a broad absorption around 1100nm. The data show that one of the central peak of the crater is distinctly olivine-rich, while rest of the peaks are devoid of olivine signature. The olivine rich boulders are clearly visible in HiRISE image. Presence of olivine rich material on Sagan crater suggest an excavation of deep unaltered mafic pluton unit which represents part of earliest formed Martian crust.

Keywords: Mars, CRISM, Olivine detection, hyperspectral

Abstract Id: 892
NOISE REDUCTION OF MODIS 8-DAY COMPOSITE EVI TIME-SERIES DATA: COMPARATIVE STUDY OF VARIOUS FILTERING ALGORITHMS

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Time Series analysis of remote sensed data has gained special attention supported by availability of wide-coverage and high temporal satellite data; to estimate vegetation phenological parameters, or to monitor temporal changes in Land Use Land Cover and environment. However these Remote sensing data sets frequently suffer from noise due to instrumental errors, atmospheric scatter and cloud effects. This noise must be reduced before time-series data sets are used for further investigation. Several filtering techniques have been developed in the past for de-noising time series vegetation index data from various satellite sensors, however very few studies have compared these filtering algorithms systematically and broadly. This research investigated five techniques: Asymmetric Gaussian (AG), Double Logistic (DL), Savitzky Golay (SG), Stationary Wavelet Transform (SWT) and Whittaker Smoother (WS) technique for smoothing multi-temporal Satellite sensor EVI observations with ultimate purpose of determining the best filtering technique. The research used Moderate Resolution Imaging Spectroradiometer (MODIS, spatial resolution: 500 meter) terrestrial Enhanced Vegetation Index (EVI) data composited at 8 day interval over the period 2001 to 2014 covering the Uttarakhand region in India. The de-noising techniques were evaluated using root mean square error (RMSE), Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). The techniques were also evaluated using phenological parameter Start of Season (SOS) calculated for various vegetation species. The results indicate that Whittaker smoother, Savitzky Golay and Stationary wavelet transform techniques performed better than other techniques. The noise filtering technique varies with the different vegetation cover and EVI values. The appraisal results are consistent in respect of four evaluation indexes. The study will be helpful in choosing the best filtering techniques for time series vegetation index data for detecting trend and seasonality of various vegetation cover.

Keywords: MODIS, EVI, Time Series, Filtering techniques, SWT, WS, SG, AG, DL, Phenological parameter, SOS

Abstract Id: 893
Aspur Tehsil is situated in north-east part of Dungarpur district in southern part of Rajasthan State in India. As per Census 2011, the tehsil comprises 174 villages with a total population of 2.24 lakhs of which approximately 50 percent is tribal population. The tehsil is a major beneficiary of Som-Kamla-Amba Project. About 80 villages of the tehsil are included in the command area of the project while the remaining form part of the non command area. Aspur is a tribal dominated economically backward region where ground water is the predominant source of drinking water. Whereas the command area receives water supply from the Project, nevertheless the major thrust of the Project is provision of irrigation water. Thus the entire region and particularly the non-command area of the tehsil largely depends on ground water for domestic use. According to geological time scale this area was formed 70 crore years ago in Pre-Cambrian era with the Aravali mountain range in which Granite, Gneiss and Schist etc. rocks are majorly found. The ground water in the region is highly affected by fluoride concentration. Consequently use of ground water for drinking is a cause of rampant water-borne diseases further dilapidating life of the people. Effective redressal of the problem needs precise quantification of its intensity/vulnerability and identification of priority areas. The paper presents indepth analysis of drinking water quality in Aspur tehsil. Water samples have been collected making two fold division of the study area - command and non command area. Intensity of the problem has been quantified in terms of water quality indices. Spatial patterns of water quality have been mapped in GIS environment using tools of spatial interpolation and spatial statistics. Villages have been stratified at various levels of water quality thereby identifying priority areas for management and policy making.

Abstract

Keywords: Remote Sensing, Geographical Information System, Fluoride, Ground Water Quality, Spatial Interpolation

Abstract Id: 895
DEVELOPMENT OF SAR BASED CLASSIFICATION TOOL FOR IDENTIFYING TRANSIENT GLACIER ZONES OF HIMALAYAN GLACIERS

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Monitoring of glacial zones provides information on prevailing weather conditions and various glacial parameters, like, wetness condition and stratigraphy, etc. Use of Synthetic Aperture Radar (SAR) data facilitates monitoring of glaciers independent from solar illumination and atmospheric conditions (to some extent). Radar Imaging SATellite-1 (RISAT-1) Medium Resolution SAR (MRS) data is used to develop dual-pol SAR signatures of transient glacial zones, namely, Debris Covered Ice Zone (DCIZ), Bare Ice Zone (BIZ), Super-imposed Ice Zone (SIZ), Wet Snow Zone (WSZ), Seasonal Frozen Percolation Zone (Seasonal FPZ). The two dimensional SAR backscattering signatures (HH and HV polarizations) of the glaciers zones define the linear decision rules. The conditional loop based logics, consist of linear equations, classify glaciated region in to different zones (level 1). Purely backscatter based classification result produces error by mixing DCIZ and seasonal FPZ due to overlapped signatures. Altitude thresholds of accumulation zone are employed to segregate the mixing (level 2). A module is integrated under Microwave Data Analysis Software (MIDAS). MIDAS, is an in-house software, developed for analyzing microwave data and polarimetric signatures. The core module is written in C/C++, whereas, the Graphical User Interface (GUI) is written in TCL/TK. The module requires calibrated ortho-rectified sigma naught dual-pol SAR imagery in Geotiff (.tif) format. The glaciated area should be provided as shape file (.shp) format which will generate Area of Interest (AOI). A Digital Elevation Model (DEM) file is required for altitude threshold. The output classes are saved in separate files with Boolean values. The classification module is tested over the Himalayan region from west to east. The universal backscattering based classification result of level 1 is fully automatic. In level 2, altitude threshold is variable since formation of glacial zones depend up on the prevailing weather, which is highly variable from western to eastern Himalaya.

Keywords: Synthetic Aperture Radar, RISAT-1, Decision rule classification, Glacial zones, Himalayan glaciers

Abstract Id: 897
DETECTION OF SUPRA-GLACIAL DEBRIS SIZE USING SAR AND IN-SITU DATA

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Debris cover is of interest to glaciologists due to its influence on the glacier melt processes. Previous studies show a negative correlation between thickness of supra-glacial debris melting of glacial mass. Several studies reported rates of thinning of debris-covered tongues comparable to those of clean ice, with a low ice flux to glacier tongues. Understanding the various controls on glacier melt processes on these debris-covered tongues is complicated and not fully understood in areas such as the Himalaya. Collection of field data on the surface topography is difficult for Mountain glaciers, especially over Himalaya. Use of satellite data can generate detailed information of glacier surface which will be further help to understand role of debris in glacier mass balance. This study involves collection of debris size information from Chhota Shigri glacier of Himachal Pradesh during the year 2014. Synthetic Aperture Radar (SAR) backscattering from ground truth sites are correlated. A linear equation has been developed to detect the distribution of debris size from SAR backscattering. Satellite data of RISAT-1 Medium Resolution SAR mode is primary input. Surface profiler is used to collect debris size data from field. Cross polarized SAR backscattering has better correlation with debris size. The developed model is tested to detect supra-glacial debris size over Gangotri and Zemu glacier. Predicted debris size has been cross-check by measured debris size from high resolution optical data.

Keywords: Supra-glacial debris, surface roughness, Synthetic Aperture Radar, Himalayan glaciers, RISAT-1

Abstract Id: 898
ESTIMATION OF FOLIAR NITROGEN OF SAL AND BANJ OAK FORESTS IN WESTERN HIMALAYA USING HYPERSPECTRAL REMOTE SENSING

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Nitrogen (N) is an important element for plant growth and development and excellent indicator of forest health status. Hyperspectral remote sensing, a non-destructive technique helps in understanding the forest health by estimating N from the forest ecosystem. In the present study, N has been estimated in pure patches of Banj Oak (Quercus leucotrichophora) and Sal (Shorea robusta) species in the parts of Uttarakhand, India. Vegetation indices using different spectral band combinations were used to identify the appropriate wavelength representing N absorption features. The spectral bands at wavelengths 660 nm, 1517.82nm and 1689.30nm were found to be most suitable for these species. Among all the nitrogen indices, log normalized (1/R) nitrogen index performed better and exhibited strong positive correlations with foliar N content. For Banj oak, N was estimated to be 0.29 to 2.79 ± 0.03 t/ha at R2 = 0.82 using linear regression equation. Similarly, for Sal species, R2 achieved maximum at 0.92 and N was estimated to be 0.020 to 0.095 ±0.01 t/ha. The study indicates the utility of hyperspectral data to assess N concentration of Sal and Banj forest for quick monitoring of the forest health. The technique can also be used in indicating the disturbance and degradation in the forest ecosystem

Keywords: Nitrogen, Hyperion, Hyperspectral remote sensing, Vegetation Index

Abstract Id: 899
IDENTIFICATION OF WATERLOGGED AREAS IN ROHTAK DISTRICT USING SATELLITE IMAGERIES

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Waterlogging is a severe problem plaguing large parts of the country. Haryana is one of the worst affected states that is suffering critically from this problem, with nine districts of the state hit with acute soil salinity and waterlogging issues. Rohtak is one of the worst affected districts with almost half the district falling under potentially waterlogged category. Remote Sensing is a very reliable and expeditious technique for assessment and mapping of surface waterlogged areas. Several image processing techniques have been presented for the extraction of water features from satellite imagery. Band ratio based NDWI index (Normalized Difference Water Index) was used for extracting water pixels from optical imageries. To overcome the limitation of false positives and cloud penetration associated with optical imageries waterlogged areas was also extracted using SAR (Synthetic Aperture Radar) images. Thresholding of NDWI for optical image and Sigma0 for SAR images was done using respective histograms to distinguish water and terrestrial features. The results from two images were multiplied to generate the surface waterlogged areas map. The elevation profile generated from DEM (Digital Elevation Model) showed that the northern and north-western parts of the district have higher elevations and slope towards the southern and central parts with lower elevations. Surface waterlogged areas change temporally from pre-monsoon to post-monsoon period. Waterlogging is mainly associated with areas in the vicinity of major canals and surface drains. Waterlogging problem is also prominent and more critical in the lower elevation central and southern parts of the district. Results showed that major reasons for waterlogging problems in Rohtak district can be affiliated with the topographical location of the district, presence of sub-surface clay and the leakage from the extensive network of unlined canals and surface drains. Several innovative management techniques need to be undertaken to overcome this already precarious problem.

Keywords: Waterlogging, Rohtak, NDWI, SAR thresholding

Abstract Id: 902
Remotely sensed images of coarser resolution are mostly affected by mixed pixel as well as non-linear data. The non-linearity in the remote sensing data cannot be handled by classifiers like maximum likelihood but by using kernels these non-linear classes can be handled. The fuzzy based classifiers were found to be more efficient in generating accurate and quite successful in generating the realistic results of the image classification rather than hard classifier. Previously, FCM (Fuzzy c-means) and KFCM (Kernel based fuzzy c-means) has only been studied. In this research, Kernel based Noise clustering has been studied with three kernels: Polynomial, Hypertangent and Sigmoid Kernel. Implementation and the testing of these kernels have been performed on FORMOSAT-2 image, which contains six classes, Riverine Sand, Forest, Eucalyptus, Grassland, Water, and Wheat. The performance of the kernels has been tested on this image to detect the different class pixels from the mixed regions of varied class proportions. The optimization of the performance has been done by varying the value of \( m \) (weight constant parameter) and \( \delta \) (noise distance). Based on that optimized value of \( m \), entropy measure has been calculated. Polynomial Kernel was optimized at \( m=1.1 \) and \( \delta=10,000 \), Hypertangent Kernel was optimized at \( m=1.1 \) and \( \delta=10,000 \), and Sigmoid Kernel was optimized at \( m=1.6 \) and \( \delta=10,000 \). By obtaining these optimized values, the original Formosat-2 was classified and fractional outputs were generated. Classification accuracy was calculated using Error matrix with respect to the ground data by applying hard classifier. It has found that the overall classification accuracy was achieved for hard classifier for Polynomial Kernel at 88.33 % at threshold value 0.7, Hypertangent Kernel at 75 % at threshold value 0.5, Sigmoid Kernel at 95% at threshold value 0.9.

Keywords: Hypertangent Kernel, Polynomial Kernel, Sigmoid Kernel, Classifier, KFCM, Noise Clustering, Entropy

Abstract Id: 903
Satellite images are the most important available data sources for generation and updating of available maps. They have highly improved in terms of spatial, spectral and temporal resolutions and by the sheer volume of collected images, the necessity of simplification of automation in feature extraction. Road data play a key role in urban planning, traffic management, military applications, and vehicle navigation as well as for decision making in numerous applications. The faster updation of Road Infrastructure is a need because the technology has brought map in the hands of people in the form of mobile phones and tablets. Road detection is one of the major issues of the road infrastructure extraction. Its accuracy depends on the type of methodology used. An attempt is made here to analyse the first order, the co-occurrence texture features and image transforms useful for discriminating roads from other features specially the buildings. The identified dataset forms high dimension feature space and the Support Vector Machine is a theoretically superior machine learning methodology with great results in classification of high dimensional datasets. In the past, SVMs have been tested and evaluated only as pixel-based image classifiers. Moving from pixel-based techniques towards object-based representation, the dimensions of remote sensing imagery feature space increases significantly. An SVM approach for classification was followed, based on primitive image objects produces by a multi-resolution segmentation algorithm. The SVM procedure produced the final object classification results which were compared to the Nearest Neighbor classifier results and were found to give better results in OBIA domain.

Keywords: Support Vector Machine (SVM), Object Based Image Analysis(OBIA), Grel-Level Co-occurrence textures, Feature Extraction

Abstract Id: 904
Andhra Pradesh is battered by every kind of natural disaster: cyclones, floods, earthquakes and drought. The coastal region suffers repeated cyclones and floods. The Severe cyclonic storm Hudhud in October 2014 caused large scale damage to life and property. Hudhud cyclone that had hit coastal city of Visakhapatnam had triggered massive rainfall in Andhra Pradesh and Odisha. Continuous rains in Srikakulam district and adjacent areas of Odisha led to heavy inflows into Vamsadhara River. In the present study, a brief hydrological and hydrodynamic modeling has been carried out in the Vamsadhara River, Andhra Pradesh for approximate forecasting of flood discharges and computing spatial inundation in the river to study the impact of Hud-hud cyclone using the space based inputs, rainfall forecast data from GEFS, near real-time rainfall data from APSDMS, and IMD-Bhubaneswar. The Hydrologic Engineering Centre-Hydrologic Modeling System (HEC-HMS) model was used to model stream flow of vamsadhara river basin. The spatial domain of the catchment was discretised into smaller sub-basins to account for catchment heterogeneity in terms of topography, land use and soil. Computed peak discharge during 12th to14th October, 2014 was approximately 3343 cumecs (1.18 lakh cusecs) in the Vamsadhara River.

The computed flood hydrographs of the river were used in simulating the approximate flood inundation and in computing the dynamics of flow. Flood inundation simulations were done using high resolution processed Digital Terrain Model (CARTO DTM of 10 m resolution, msl datum with height accuracy of 3 to 4 m). Flood parameters such as flood extent and floodplain water depth were estimated. Bare earth elevation model is used to approximate ground level inundation scenario. Hence, the simulation results were found to be satisfactory and matching with the satellite data subsequently obtained.

Keywords: cyclone, Hydrological Simulation, Spatial Inundation

Abstract Id: 906
Atmospheric Boundary Layer and Tropopause Characteristics from Radio Occultation Refractivity

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An algorithm to determine Atmospheric Boundary Layer (ABL) height is established using the radio occultation refractivity data. The algorithm is based on quantitative estimation of the significant lapse of refractivity within the height range of 0.5 km to 3.5 km. It is known that the ABL is the region of significant lapse of humidity and temperature and is critical determinant of energy-flux and moisture-flux in the troposphere and for air pollution meteorology. Since radio refractivity derived from radio occultation technique is related to temperature and water vapour partial pressure, more dominantly, on the water vapour content in the lower troposphere where ABL is normally found, there is a high probability of detecting the ABL signature in the refractivity profile. Refractivity from COSMIC radio occultation is uniformly interpolated at 5m vertical height and linear regression is applied in the sliding window of width 300 m. The height at which the change in slope of the straight line fit is maximum in the consecutive windows is the top of the detected ABL. The result is compared with collocated radiosonde and yields ABL with a reasonably good accuracy.

Morphology of the global tropopause, crucial for understanding tropospheric-stratospheric exchange and coupling of water vapor and trace gases, as also its indicative role for monitoring global change, is generated using COSMIC radio occultation data. Tropopause parameters, in terms of tropopause- temperature, pressure, refractivity and sharpness, are determined based on detection of tropopause height using three different methods viz., cold point temperature, lapse rate of temperature (WMO method) and a newly developed refractivity-based method. The refractivity method compares exceedingly well with the WMO method, and both the methods demarcate anomalous tropopause cases in the cold point method, especially in the extra-tropical region. Comparison is done with the collocated radiosonde and the morphology of global tropopause properties are generated.

Keywords: GPS-RO, Atmosphere, Tropopause, Boundary-Layer

Abstract Id: 907
Spatial distribution of pesticide and chemical fertilizer application toward appropriate land use configuration along the Silang-Santa Rosa River Basin, Philippines

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Rapid urbanization has been recently observed over the peri-urban areas of Metro Manila in the Philippines and one of the watersheds that is greatly affected by this is the Silang-Santa Rosa River Basin. This is located in the south portion of Metro Manila covering the provinces of Laguna and Cavite. The rapid urbanization has led to the proliferation of non-conforming land uses and may also aggravated the decline of water quality in the river. In addition, agricultural lands in the upper portion of the river basin have shifted to cash crops fields mainly planted with pineapple. Although these cash crops are enhancing the residents’ income and living standard, extensive application of pesticides and chemical fertilizers was observed in the area and could possibly affected the natural environment in the downstream.

In 2016, the Intergovernmental Science-Policy Platform on Biodiversity (IPBES) reported a study on the effects of pesticides on pollinators’ roles. IPBES estimated around US$235-577 billion as the annual value of crops directly affected by pollinators and that over 40% of invertebrate pollinators were facing extinction. These findings revealed that the adverse environmental impacts of pesticides are still underestimated and that there are substantial external economic costs of pesticides worldwide to both human health and ecosystem services.

This study aims to quantitatively determine the threats of cash crop fields to surrounding natural environment and propose feasible solutions for residents and land-use planners taking into consideration agricultural development and residents’ livelihood. Cash crop development and time-series changes on land use were analyzed through spatial-based techniques. Also, the effects of the application of pesticides and chemical fertilizers were estimated through field surveys and interviews with farmers. Lastly, the amount of application of pesticides and chemical fertilizers was calculated through GIS spatial modelling to determine their spatial distribution patterns along the river.

Keywords: Pesticide, Chemical fertilizer, Cash Crop Fields, Spatial Analysis

Abstract Id: 908
HYPERSPECTRAL MODELLING FOR PREDICTION OF SOIL TEXTURE USING ASD SPECTRORADIOMETER DERIVED SOIL SPECTRA

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Hyperspectral Remote sensing or Reflectance spectroscopy provides an alternate method to non-destructively characterize key soil properties. Different approaches, including chemometrics techniques or specific absorption features, have been proposed to estimate soil properties from visible and near infrared (VNIR, 400-1200 nm) reflectance domains. The study was aimed at generation of soil spectral library in the laboratory conditions and predictive modelling of soil texture using various reflectance transformations. 133 soil samples collected from two different sites of Telangana i.e. ICRISAT and Shadnagar and covering a wide range of soil textures were preprocessed and analyzed in the laboratory for their textural composition (sand silt and clay %). Laboratory spectra of all soil samples were collected using ASD spectroradiometer (covering range of 350-2500 nm), after preprocessing. Spectral library of all soil samples were generated by taking averaging of 5 spectra. Fourteen distinct reflectance transformations were generated for each sample from lab generated spectra. Partial Least square Regression (PLSR) modelling was used for prediction of soil texture using these reflectance transformations, employing Unscrambler software. Many of these reflectance transformations showed accurate predictions (high R² values) for sand, silt and clay textural fractions. The PLSR modeling revealed best results for the Root R transformation of reflectance where (R²= 0.47, RMSE= 6.67) for clay, (R²= 0.73, RMSE =10.33) for sand and (R²= 0.54, RMSE= 9.59) for silt particle sizes. Similarly R, log R and 1/R transformations also yielded satisfactory predictions for soil particle size. The study showed us the potential of hyperspectral modelling employing PLSR technique for predicting soil texture and may help us in the spatial mapping of soil texture types using airborne and space borne hyperspectral remote sensing data.

Keywords: Hyperspectral, Reflectance transformations, soil texture, PLSR modelling

Abstract Id: 909
Vietnam is mainly mountainous with tropical monsoon humidity climate, heavy rain, so often occurring hazard such as floods, landslide… in which landslide is a type of disaster that often occurs in mountainous areas. Although landslides occur on a small scale and slowly but in a total year, this is the most serious damage for people and property. The study of landslide in Vietnam was very urgent and was done by researchers using field surveys, aerial photos, high resolution satellite imagery. Radar technology has been known for over 20 years when some generations of radar satellite are turned out. The Differential SAR Interferometry (DInSAR) method has made it possible to determine landslide by using at least two images at different periods of time acquiring in the same location. However, over time, the DINSAR method has some disadvantages of the influence of many factors such as atmospheric condition. The Permanent Scatter SAR Interferometry (PSInSAR) method is used for removing the atmospheric effects. Our paper want to show the use of radar images with PSInSAR method for landslide monitoring in Laocai area where is the landslide happened, where annual landslides occur. ALOS PalSAR time series were used between 2007 and 2011 for landslide detection. Some districts like Batxat found many landslides and were quite suitable for field surveys.

Keywords: Landslide, PSInSAR, InSAR time series

Abstract Id: 910
Cloud microphysical parameters are reasons of all rainfall extreme incidences and in turn also of floods in different regions. Identification of unique features in patterns of such parameters is of paramount importance in estimating the amount of rainfall that is, predicting the severity of the event. This type of simulation can predict the maximum discharge or flood peak amount and, if analyzed in time series, the frequency of disasters like flood and drought can be projected with a considerable degree of accuracy. The state of Jammu and Kashmir is unique in various terms; and it is very much prone to natural hazards, especially flood. In recent past, it has suffered from a major flood event in September, 2014 resulting in a total inundated area amounting to 557 sq. km. out of total area of 2, 22, 236 sq. km of the state which includes large amount of agricultural and horticultural land, built-up area, forest area and wasteland. Daily observation of parameters like Cloud Top Temperature (CTT) and Cloud Top Pressure (CTP), Cloud Fraction (CF) and Cloud Optical Depth (COD) has been performed with the MODIS Terra datasets of spatial resolution of 1°× 1 CTT during the Kashmir flood disaster event varies from -11.45°C to -28.57°C. Colder temperature persists during 3 - 5 September, when the heavy precipitation occurred. Peak was reached on 5th September with -28.57°C. CTP reached the lowest value of 322.45 hPa on 3rd September, corresponding to a cloud top height of approximately 8528m above mean sea level. Afterwards CTP increases to 540.9 hPa and cloud height decreases to 4674m in the region. cloud fraction reached a maximum of 87.4% cloud cover on 1st September with a high value of COD amounting 29.5. Proper simulation with empirical relationships can generate the amount of rainfall from these cloud parameters.

Keywords: Cloud top temperature, Cloud top pressure, Cloud fraction, Cloud optical depth, flood

Abstract Id: 913
MODELLING THE IMPACTS OF PROJECTED CLIMATE CHANGE (IPCC AR5) ON DISTRIBUTION AREAS OF ACONITUM HETEROPHYLLUM - AN IMPORTANT MEDICINAL PLANT OF HIMALAYA

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A large proportion of rural population in the Himalayan region depends on locally available medicinal plants to meet their health care and financial requirements. Developing conservation strategies of these species under the rapid regional threat of climate change coupled with over-exploitation in mountain regions requires accurate predictions of probable distribution of these species. Here, we have modelled the distribution areas of Aconitum heterophyllum (Ativisa) which is an endemic, endangered and highly traded medicinal species of high altitude alpine and subalpine areas in the Himalayan region. The objective is to predict the fate of the species under climate change via ensemble distribution modelling in R. Global Climate Model-HadGEM3 and two Representative Concentration Pathway- 6.0 and 8.5 based on Coupled Model Intercomparison Project Phase 5 (CMIP-5) from the Intergovernmental Panel for Climate Change (IPCC) Fifth Assessment Report (AR5) was used for modelling the distribution A. heterophyllum in 2070. Ten different algorithms were used for calibration and independent predictions while the final predictions were obtained as the weighted mean of each model outputs. The model performance was evaluated by using threshold-dependent (TSS, True Skill Statistics) characteristics as well as visual assessments of projected distribution maps. Only the models with high test scores (TSS > 0.8) were included in ensemble modelling. The results obtained show a drastic reduction in the probable distribution areas of A. heterophyllum under each climate change scenario. The Indian states of Himachal Pradesh and Uttarakhand especially may face significant proportion of loss of suitable range areas for A. heterophyllum. The study underlines the threats of climate change to the montane species and is helpful in pursuing appropriate state and national level climate change adaptation strategies.

Keywords: Climate Change, Medicinal Plants, Ensemble distribution modelling,

Abstract Id: 916
DIGITAL MAPPING AND 2D/3D VISUALIZATION/MODELING OF SUBSURFACE RESERVOIR USING GIS AND WELL LOG DATA IN PART OF MASILA BASIN, YEMEN

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Masila basin is known as one of the promising basin for hydrocarbon resources and it is the second richest petroliferous basin in Yemen. Most of discovered oil in the Masila basin in the Qishn clastic member, which is the main reservoir rock unit. The aim of evaluation of reservoir properties (Qishn clastic reservoir) is to estimate of hydrocarbon prospect zones. GIS plays a good role for mapping, visualization, overly and 3D. Subsurface log data is a reliable and quick method for study reservoir properties. The log data of seven wells are in the form of IAS file. It composite of Gamma ray log (GR), resistivity logs (LLS, LLD), caliber log (HCAL) and effective porosity log (density log (RHOB), neutron log (NPHI)). Reservoir properties parameters calculated from well log analysis include: Porosity ($\Phi$), permeability (mD), volume of shale ($V_{sh}$), fluid saturation: (water saturation ($S_{WE}$) and hydrocarbon saturation ($S_{H}$)) and formation evaluation (net pay). In addition gross thickness. Well log interpretation has been carried out by using Techlog2012 software which used for reservoir properties analysis and cut off summation. 2D and 3D maps generated by using ArcGIS 2.2, the effective porosity concentrate largely with maximum value of 37% on SE and minimum value of 17% on NW whereas permeability with maximum value of 24% on NE - SE and minimum value of 9% on NW. Water saturation is concentrated with maximum value of 14% on NW and SW and minimum value of 26% on SW whereas Hydrocarbon saturation concentrated with maximum value of 73% on SE - NE and minimum value of 85% on NW of the study area. The result of this work show that the SE and NE of this study area are more potentially for hydrocarbon due to high permeability, porosity, hydrocarbon saturation and less water saturation, volume of shale.

Keywords: GIS, Well log data, 3D visualization, Hydrocarbon potential, part of Masila

Abstract Id: 918
INFLUENCE OF THE AEROSOL UNDER THE CLOUD LAYER ON CALCULATION OF THE SHORTWAVE RADIATION FLUX IN CHINA FROM SATELLITE DATA

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In this study, shortwave radiation flux simulated from Himawari-8 satellite products is compared to ground-based observations in Xianghe and Xuzhou sites of China. In clear and cloudy sky with clean atmospheric conditions, the shortwave radiation fluxes using satellite products agree well with ground-based measurements. However, in cloudy sky with polluted atmospheric conditions, the fluxes using satellite products are overestimated by 17.5% as compared to the ground-based measurements. Aerosols below the cloud layer can bias the retrieval of the cloud optical and microphysical properties (e.g., optical thickness and effective particle radius) and lead to the overestimation of the shortwave radiation at ground level.

To quantitatively investigate the influence of the heavy aerosol in retrieval of the cloud properties, the RSTAR radiative transfer model is employed to simulate the retrieval error of the cloud parameters caused by aerosols in the boundary layer. The results indicate that when the aerosol optical thickness (AOT) is 0.1, the error of the surface shortwave radiation is small; whereas with the increasing AOT, the error of the shortwave radiation increases obviously. When AOT is 1.2, the relative error reaches 18.38%. For the heavily-polluted areas of North China, it is important to investigate the influence of aerosol on the retrieval of the cloud parameters and solar shortwave radiation in cloudy conditions, which is critical to the assessment of the energy budget in North China suffered from heavy aerosols below the cloud layer.

Keywords: shortwave radiation flux, Himawari-8, RSTAR, Remote sensing

Abstract Id: 919
CAN THE PRESENCE OF SURFACE MARINE VEHICLE AFFECT THE SCATTEROMETER MEASUREMENTS?

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Space-borne scatterometers working in the microwave frequencies of the electromagnetic spectra provide unique opportunity of measuring ocean surface vector winds in synoptic manner over the global oceans. The primary quantity that a scatterometer measures is the surface backscattering coefficient ($\sigma_0$, usually express in decibel). The $\sigma_0$ is mainly dependent on the ocean surface roughness and has a linear relation with the winds blowing over the ocean surface. The retrieval of the ocean surface vector winds from scatterometer measured $\sigma_0$ takes place by inverting a sensor specific Geophysical Model Function (GMF), which relates the $\sigma_0$ with wind speed, sensor azimuth, look angle and polarization. Thus the accuracy of the retrieved winds depends on the exactness of the measured $\sigma_0$. Apart from the systematic fading and thermal noises within the sensor, measured values of $\sigma_0$ get affected by the presence of impure oceanic scatterers (e.g, small islands, deep ocean buoys etc.) within the sensor footprint. Once such impure scatterer comes within a particular wind vector cell (WVC) of a scatterometer, the $\sigma_0$ values in that WVC gets contaminated and so the retrieved winds. Such a situation becomes even worse when the sub-satellite swath passes over zones of permanent impure scatterers like popular shipping lanes.

In this study, attempts have been made to analyze the impact of the presence of such a popular shipping lane on the scatterometer measurements by using data from recently launch SCATSAT-1. Various levels of SCATSAT-1 data have been analyzed to identify the impact of the ships on scatterometer derived parameters starting from $\sigma_0$ to the retrieved winds. It has been observed that the presence of the ships within a scatterometer WVC tends the retrieval to overestimate oceanic winds. Efforts are also being made to remove the impact of ships (or similar objects present on ocean surface) from backscatter data.

Keywords: SCATSAT1, backscattering, ships

Abstract Id: 921
DETECTION OF UNAUTHORIZED BUILDING IN A GREEN BELT FROM UAV IMAGES USING A CONVOLUTIONAL NEURAL NETWORK AND A DIGITAL MAP

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The green belt is an area to preserve undeveloped land around suburban areas in Korea. To prevent such a preserved area from environmental damage and fire hazard, it is important to detect unauthorized buildings in the area by interpreting aerial images especially taken with UAVs (Unmanned Aerial Vehicles). However, as the interpretation of aerial images has been accomplished manually, it made the task very costly and time consuming. In this study, we developed a system to automatically detect unauthorized buildings from aerial images. First, we detect buildings from UAV images using a CNN (Convolutional Neural Network), where it has been trained and validated with high-resolution aerial images and digital maps. We then compare each detected building with the buildings officially registered based on a national digital map to identify whether it is authorized or not. Through this study, we could develop a methodology to process the aerial images and digital map suitable for training, train CNN with the processed data, and use the CNN as a drone image feature classifier.

Keywords: Convolutional Neural Network, UAV, Object Detection, Green Belt, Digital Map

Abstract Id: 922
Assessment of timber growing stock is essential for proper scientific management of forests. In the past it was done with extensive ground survey of forest with limited use of forest maps. With the availability of improved ground resolution of earth observation data, the preparations of forest maps at larger scales are possible and with this the ground survey for enumeration of forests has been greatly reduced. Management of growing stock for sustainable development, both economic as well as ecological perspective, always has an added advantage at microwatershed level considering them as hydro-ecological unit. Compartment boundaries (99-374 ha) for the division were prepared by delineating microwatershed boundaries using Survey of India toposheets and Carto DEM 10m resolution. Based on stratification, sampling points were distributed randomly within a buffer of 500 m to 2000 m on both sides of road network. Stratification of forests was done based on crown density and elevation categories. Based on field enumeration data, mean timber volume and stem density for each stratum was determined and subsequently the growing stock for each stratum area within a compartment was estimated. Stock maps for assessing the spatial distribution of growing stock and stem density were finally prepared at compartment level for the entire division. The timber volume density at compartment level in the study area ranged from 23.9 m$^3$/ha to 373.2 m$^3$/ha.

Keywords: Forest Stratification, Growing Stock, Microwatershed, Forest Working Plan

Abstract Id: 924
Estimation of Water Quality Parameters Using Mobile Phone Application: A New Avenue in Citizen Science

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Water quality monitoring is an essential practice which should be carried out across the globe to provide empirical evidence to support decision making on health and environmental issues. Laboratory analysis of water samples to assess the quantitative indicators of water quality is an expensive method which demands for trained personnel to operate the equipments and analyse the results. Furthermore, they also suffer from instrument calibration errors. Remote sensing of water bodies using Satellites for water quality determination emerged as an alternative in last decade, but it suffers from high cost, atmospheric distortions, low spatial and temporal resolution.

To bridge the gap, an attempt has been made in this study to assess the capability of smart phones to act as three band radiometer. Motivated from fact that smart devices have become the significant source for wireless data access, data generation, computing and storage, we present a water quality sensor to conduct measurements of water quality variables using a mobile application deployed on smart phones. Hence, offering a CROWD SOURCING enabled cost effective solution creating CITIZEN SCIENTISTS from common people. The application has the capability to quantify water quality variables such as Color, Turbidity, concentration of suspended particulate matter and Chlorophyll.

The measured data is uploaded to remote servers hence creating a global database of water bodies (lakes and rivers) on real time basis. Tabular, graphical and GIS based analytical reports are generated on server side which can be of different use to different stake holders of this application. The citizens can use to it to check usability of water, environmentalists can use to understand its effects on ecology and governments can use it for decision making. Validation experiments have been carried out using field testing followed by laboratory testing of collected samples and comparing them with the results obtained from application.

Keywords: Citizen Science, Remote Sensing, Water Quality variables

Abstract Id: 926
DISEASE VULNERABILITY AND CONTROL MAPPING USING GEOSPATIAL TECHNOLOGY - A CASE STUDY FOR TRIBAL BLOCKS OF RAYAGADA DISTRICT, ODISHA

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Importance of health with respect to all living beings needs no special mention in the contemporary Society. Despite the scientific advancement and growing communication system, still many of our villages are affected by several diseases which are controllable with proper understanding of the factors that cause the diseases. This situation is more grave in tribal villages. In this context, a study has been carried out in selected tribal blocks of Rayagada district of Odisha to identify the parameters that cause the diseases and also such of the parameters which can control the spread of the disease. These parameters are assigned weightage (in 1 to 10 scale) depending upon their potential either for causing prevalence of the disease or its control. Later the relative impact of these parameters in different villages in the study area is assessed with the help of data collection through a questionnaire and physical observation. The impact of the parameters is converted into ratings and the product of the rating in a village and the weightage will reveal the influence of the parameter at the selected village. The sum of all such products has been obtained and GIS layers for each parameter are prepared for the entire block. The integration of these layers has lead to the development of a Disease Vulnerability Map for the selected block specific to the disease considered. A similar approach with the parameters that can control the spread of the disease has resulted in the Disease Control Map. These two maps w.r.t each of the blocks will help in identifying the villages within a block where the vulnerability is severe and the steps to be taken for control.

Keywords: Disease Mapping, Disease vulnerability, Disease Control

Abstract Id: 928
APPLICATION OF REMOTE SENSING AND GIS FOR SPATIOTEMPORAL VARIATION IN MORPHOLOGICAL STUDY OF YAMUNA RIVER

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Integration of Remote sensing and Geographic Information System (GIS) technologies exhibits the great capability to study the morphological variation of the river. It provides temporally and spatially variable satellite data over the years that have been used for different applications in water resources management studies. In this study, the Yamuna river course from Yamunotri mountain ranges to Allahabad locations has been rigorously studied for changes in morphological parameters such as the shift in river course, sinuosity index, erosion/deposition, etc. Landsat 8,7,5,1 satellite data of 2016, 2000, 1990, 1975, respectively and IRS-P6 satellite data of 2010 has been utilized for analyzing the morphology of the river. ERDAS IMAGINE 2015 software has been used for performing different image processing techniques and ArcGIS 10.1 software has been used for evaluation and comparative study of all morphological parameters of the river. The study has indicated that the satellite imageries easily discern the morphological study of the river over a large spatial area as well as also monitor long term changes in it. The pre-requisite study of morphology and behavior of Yamuna river has resulted in the scientific and rational approach to identify different river problems so that it can be utilized effectively in proper planning and designing of river management strategies.

Keywords: Remote Sensing, Geographic Information system, Spatiotemporal, Morphological, Sinuosity, Yamuna.

Abstract Id: 929
A FRAMEWORK FOR INTEGRATION OF CITIZEN SCIENCE IN MONITORING, MANAGEMENT, AND PREPAREDNESS FOR FOREST FIRE IN THE HIMALAYA

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For the countries of the world, a lack of preparedness for climate variability has been observed while impacts of extremes events are consistent. In recent years, incidences of forest fire are increasing globally, and also in the Himalayan region leading to disasters where mountainous topography and insufficient state resources are bottleneck to respond fire disasters timely. Due to expanding network, market competition (aggressive advertising), easy use of technology (touch screen), and affordability (economical price), mobile phones are in common access throughout the country. A framework has been proposed for integration of ground based observation network (field inputs) and prevailing technologies (satellite based observations) with effective use of mobile phone application to develop an ‘early preparedness’ before such conditions exist to prevent a possible event. Geo-spatial locations connected with picture or text messages may play a pivotal role in providing prevailing conditions and local knowledge in preparedness and resource management as well as broadcasting the commands from central mitigation centre to the field. This mechanism is also useful for resource optimization during the fire event, and also in case of fire occurrence at multi-locations to reduce the vulnerability and exposure to human societies. A mobile application for users (citizen) of android based phones have been developed which provides real time reporting and dissemination of information to scale down the socio-, economical, and ecological consequences and adverse effects of forest fire. Community groups and vigilant citizens are important part in preparedness for forest fire and management to conserve biodiversity rich landscape of the Himalaya by reducing the vulnerability to impacts of climate change.

Keywords: Citizen Science, Mobile Phone Application, Forest Fire, Climate Change

Abstract Id: 931
The forest of western Himalaya are prone to forest fire every year during the summer season, mostly due to anthropogenic activities. In the year 2016, a combination of dry spells coupled with less than average rainfall during the preceding year has resulted in extensive forest fires in Uttarakhand state which could not be controlled effectively resulting in huge loss to the forest wealth. A rapid damage assessment of the forested areas in Uttarakhand was carried out to identify the extent of damage to the various ecosystem level components in the state using satellite remote sensing and GIS. Digital classification was carried out to extract the burnt areas in the forested regions of Uttarakhand. The burnt areas, which were confirmed using ground truth were further overlapped with the forest type and biological richness map to assess the extent of damage to the ecology of the area. The results show that 3774.14 km², representing 15.28% of the total forest area of the state of Uttarakhand showed indications of damage to the vegetation due to forest fire. Taking advantage of the high repetivity of AWiFS sensor aboard Resourcesat 2A, the progression of forest fire was also mapped from 23rd May 2016 to 2nd June 2016. District level analysis of the forest fire affected areas indicate that pine dominated areas of Tehri Garhwal, Pauri Garhwal and Nainital districts were the worst affected areas. The burnt areas in the state covered around 2.62% of the natural forest areas which had been categorized as very high biologically rich area and around 13.3% as high biologically rich area. Since the area fall under biological hotspots, such extensive damage to ecosystems can have serious impacts on the genepools in the region as well as cause other ecosystem level changes such as incursion of Pine into Oak habitats.

Keywords: Forest Fire, Remote Sensing, GIS, Natural Disaster

Abstract Id: 932
ASSESSMENT OF THE RELATIONSHIP BETWEEN WATER SURFACE TEMPERATURE AND DISSOLVED OXYGEN TO IDENTIFY AQUATIC VEGETATION DISTRIBUTION - A STUDY IN BATTICALOA LAGOON, SRI LANKA

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Most of the natural water bodies in Sri Lanka are infested with aquatic weeds and algae possibly due to high nutrient levels in water. Batticaloa Lagoon is the second largest lagoon in the country which is frequently affected by algae and aquatic weeds mainly Eichhornia crassipes. This problematic situation is an indicator of lagoon pollution. The present study aims to develop a regression model that can satisfactorily detect and map the spatial distribution of Aquatic weeds (Eichhornia crassipes) and Algae in Batticaloa Lagoon, using both surface temperatures derived with Thermal Infrared (TIR) band of Landsat 8 satellite data and field measurements of Dissolved oxygen (DO). The TIR band 10 was chosen for the study and it was converted to Lagoon water surface temperature (°C) (LWST) image. Field measurements of LWST and DO (mg/l) were obtained in 30 locations in one month interval for the period from April to June, 2017 where the distribution of aquatic plants is at peak. The values were graphed in a scatter plot and a linear inverse relationship was observed between LWST and DO. The near real time LWST map was converted to DO map using the equation \( y = -2.0888x + 75.332 \). With more field sample collection to improve the accuracy, the combined water surface temperature - DO map can be used as a model in the lagoon to identify the locations which are affected by aquatic weeds and algae and can be used as an indicator of lagoon pollution.

Keywords: Algae, Aquatic weeds, Dissolved oxygen, Regression model, TIR band

Abstract Id: 933
Small satellites provide less expensive ways to monitor the earth. This enables developing countries like Malaysia to launch small satellites. Malaysia launched two micro satellites namely Tiungsat-1 (50 kg) and Razaksat (180 kg) in September 2000 and July 2009 respectively. Although these satellites were designed to be operational for several years but, their operation ended shortly after the launch due to high usage of electrical power by on board computer systems. This caused the computers to be malfunctioned and communication with the ground station could not be established. Consequently, imaging of the earth surface could not be conducted and images could not be downloaded by the ground receiving station located in Peninsular Malaysia. Nevertheless, these satellites captured ~80 scenes (Tiungsat-1) and 1300 scenes (Razaksat) respectively. Several user group seminars and workshops were held to not only identify and fix the technical problems with the data but also to understand the potential use of these satellites for various applications in Malaysia. Despite these efforts of Malaysia venturing into small satellite activities no systematic review is available on the remote sensing microsatellites, their potential applications and problems related to the technicalities and image qualities. Analyzing issues related to the limitations of the satellites and their data will provide useful lessons in the design and launch of future satellites and user requirements of the datasets generated by the satellites. This is highly needed as the government aims to launch another Near Equatorial Orbit (NEqO) satellite called Razaksat 2 (continuation of Razaksat) soon.

Keywords: Small satellites, Tiungsat-1, Razaksat, Remote sensing, Malaysia

Abstract Id: 934
CHALLENGES IN DEVELOPMENT OF SIGNAL EXTRACTION METHODOLOGIES FOR THERMAL INFRARED IMAGING SPECTROMETER (TIS) FLOWN ON INDIAN MARS ORBITER MISSION

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India’s maiden Mars Orbiter Mission, popularly known as Mangalyaan, carries a Thermal Infrared Spectrometer (TIS) based on Uncooled Micro bolometer detector array for generating thermal map of Martian surface. The associated processing electronics provides 20 bits digitized data containing both signal and background information. Extraction of useful signal from such a highly digitized data, poses great challenges in development of data processing methodology.

Various approaches have been studied to extract useful signal from the TIS instrument data and suitable methodology was implemented in the TIS image processing chain. The main challenge in the processing was to remove the background signal from the data. Detector case temperature (Tcase) correlation with the instrument data was determined using lab data and similar observations were confirmed with the onboard data also. Adequacy of Tcase dependence was studied from multiple data sets and finally image based correlation methodology was developed. A robust algorithm has been designed and developed for compensating the background and removing the pixel to pixel inherent non-uniformities. As a part of processing chain, image enhancement filtering techniques were also developed. The algorithm was verified over the simulated data sets, and subsequently implemented in the TIS data processing chain.

This paper covers the challenges involved in the instrument data processing methodologies to derive the useful signal. It also describes various steps involved in the processing chain, and discusses the algorithm validation processes involved and results obtained.

Keywords: Spectrometer, TIS, bolometer, Tcase, Non-uniformity

Abstract Id: 935
A NOVEL METHODOLOGY FOR RADIOMETRIC CALIBRATION OF REMOTE SENSING IMAGES

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One of the most important calibration in remote sensing is sensor radiometric calibration that means computing physical values of radiance of the investigated targets. Radiometric calibration usually relies on pre-flight and vicarious calibration or on indirect approaches. This paper introduces an experimental approach that makes use of on-board calibration techniques to perform the radiometric calibration of the Landsat 8 data. This approach relies on the use of a calibration methodology which developed to convert the raw output from the instrument into an accurate at-aperture radiance. The radiometric accuracy was estimated to be approximately 1.4%. The calibration parameters were updated during the post-launch checkout period by using ground targets. In addition, the absolute calibration performance determined from vicarious measurements have revealed a time-varying error to the absolute radiance. Analysis of results seems to point out limitations of traditional radiometric calibration methodology based only on pre-flight approaches, with important implications for data quality assessment.

Keywords: Landsat 8; radiometric calibration; data quality

Abstract Id: 937
Land cover changes, greatly affected by the global climate change, are the main concern for the living environment of living beings. Many factors influence land cover changes such as physical, social and economic development. West Java Province is one of the provinces in Indonesia with high dynamics of change. Moreover, the high socioeconomic activities in this province also give an impact on land cover change. Due to many factors that have a role in land cover change, many of those have not been studied well, as in West Java. Finding the main factors that influence the land cover changes in West Java and how these factors affect land cover change became the aim of this research.

Land cover changes, in a certain location and in a certain period of time, can be studied as a dichotomous phenomenon. Binary Logistic Regression (BLR) was used, so that its model would predict whether the driving factors such as slope, height, distance, population, or the central business district that affected on land cover changes. The results indicate that if binary logistic regression analysis was done partially, all predictor variables have significant effect with different properties on the probability of changes in land cover. Meanwhile, from overall regression analysis, slope has no significant effect on it.

Keywords: Land Cover, Binary Logistic Regression, Driving Factor

Abstract Id: 938
COMPARATIVE ANALYSIS OF SFM BASED CRP AND TLS FOR 3D MODELLING OF VARIOUS TYPES OF SURFACES

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Close Range Photogrammetry (CRP) and Terrestrial Laser Scanning (TLS) techniques have been widely used in 3D modeling applications. Due to recent development in computer vision algorithms CRP is also seen to provide same level of details (point cloud density) as that of TLS. This paper deals with the Comparative analysis of the point clouds generated by the CRP and TLS to access the accuracies. In this work, point cloud is generated from multiple overlapping sequence of images using Structure from Motion (SFM) photogrammetry and TLS for a building which planner, cylindrical and curved surfaces. GCPs (Ground control points) were collected by total station to georeferenced the point cloud from CRP and TLS. Overlapping photographs were processed in Agisoft photoscan along GCPs to generated photogrammetric point cloud. TLS point cloud was generated from Riegl vz 400 and same GCPs were used to georeferenced it in Riscan pro software. Flat and curved surfaces area of same region are segmented from both the point clouds and compared with the reference plane in Cloud Compare software. In case of CRP, More than 90% of the points are at zero distance from the actual surface. This study has shown that 3D model generated using CRP is denser in comparison to the point cloud generated using TLS. The fraction of points closer to the reference plane is relatively greater in case of Terrestrial Laser Scanning and mean error value obtained was much closer to zero. The mean error in case of CRP and TLS is 0.026m and 0.016m respectively. It is also observed that higher accuracy of the points is achieved in case of TLS when compared with that of CRP. From the analysis it was found that CRP has almost the same level of accuracy as that of TLS, so CRP could be used as an alternative low cost technique of TLS for 3D modeling.

Keywords: Close Range Photogrammetry, Terrestrial Laser Scanning, Structure from Motion Photogrammetry, 3D modeling, point cloud,

Abstract Id: 939
The impact of climate change on water availability and hydrological extreme over the Krishna River Basin, the second largest river basin of India, under the different climate change scenarios has been analyzed in the present study. Variable Infiltration Capacity (VIC) model has been used to simulate the hydrological response of the basin under observed climatic data and future predications. The soil, vegetation, topographical and meteorological inputs for the model are derived from remote sensing based and observed data/products. The model calibration has been performed using observed discharge data of 4 gauging stations. The coefficient of determination (R2) of order 0.81 - 0.87 were achieved during calibration process and R2 of 0.82 has been achieved during validation process. The meteorological forcing consisting future climatic inputs for the entire century (2006-2100) have been extracted from RCP 4.5 and RCP 8.5 scenarios of IITM-RegCM4-4. Hydrological response of the basin to future climatic inputs has been simulated using calibrated VIC model. The analysis of future meteorological inputs indicates increasing trend in annual minimum and maximum temperature and precipitation over the basin under RCP 4.5. Under RCP 8.5, the percent increase in these parameters over RCP 4.5 was in the range of 1.41% - 8.19%, 0.59 - 5.43%, 4.06% - 8.53%, respectively. The analysis of hydrological response of the basin indicates the increasing trend of 13.8 and 27.8 cumec/year in annual discharge in RCP 4.5 and RCP 8.5, respectively. The hydrological extremes events were found to increase from 73 to 586, 487, 628, 666 and 582, 712, 790, 906 during the period of 2020 - 2039, 2040 - 2059, 2060 - 2079 and 2080 - 2099 under RCP 4.5 and RCP8.5, respectively as compared with past records from year 1985-2005. The percentage increase in peak discharge was observed in the range of 57.67% -76.78% and 68.48% -77.53% under RCP 4.5 and RCP 8.5, respectively. The study highlights the increase in annual water potential and hydrological externs in the basin under future climatic scenario. This knowledge can be of use for proper planning and adaptation activities.

Keywords: Climate change, variable infiltration capacity model, RCP 4.5, RCP 8.5, Krishna Basin.
IBIN MOBILE APPLICATION: COUNT FOR BIODIVERSITY

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It is argued that a large fraction of species is facing the threat of extinction without any accurate estimation of how many of them are discovered. With the advantage of information and communication technology and crowdsourcing, a mobile application is designed and developed based on the idea of user-generated content, web-based crowdsourcing application by integrating the location as a parameter and android mobile devices as a small effort for increasing the digitized inventory of country’s bioresources. This mobile application is developed for the Indian Bioresource Information Network (IBIN) to integrate the end user data along with the bioresource database. IBIN is a digitized inventory of the biological resources of India that serves as a common platform to access spatial and non-spatial information about the bioresources and data holders can host their data through this gateway with full privileges. The IBIN mobile application is based on the crowdsourcing approach, to collect data on plant, animal, marine, spatial distribution and microbial resources from a large group of crowd to increase the repository of IBIN database which will helps us in the conservation of nature. The biggest advantage of using crowdsourcing is timely data integration at a very low cost but may suffer in data quality. For data verification, an information system would be developed through which the experts will verify the crowdsourced data and then, it is available for the potential users to visualize through the IBIN portal. This will surely increase the datasets available under the IBIN repository.

Keywords: Crowdsourcing, mobile application, conservation, bioresources, location services

Abstract Id: 943
DESIGN AND DEVELOPMENT OF VACUUM COMPATIBLE LARGE APERTURE INFRARED CALIBRATION SOURCE

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Current worldwide trend of large aperture (>700mm) Infrared Electro-Optical Imaging Systems for remote sensing and weather forecasting applications are in high demand. ISRO is also developing large aperture IR payloads in the spectral range from 3.5μm to 15μm for its current and future missions such as GISAT and CartoSat-3 series of satellites. The characterization and calibration of Large Aperture Infrared payloads is of great challenge because of thermal self-emission (IR background) of the payload and therefore it requires specialized characterization test benches and Infrared Calibration Source (IR Blackbody) with low self-emission. Considering the telescope aperture of 700mm, field angle and separation between Electro-Optical Module and Blackbody Source, the dimension of 900mm with scene dynamic range from 180K to 340K is required for full aperture calibration source. In order to meet the above requirements, design and development of a large aperture Infrared Calibration source has been taken up.

Thermal uniformity across the radiating surface, Effective Emissivity and temporal Thermal Stability are the three main performance parameters of the IR calibration Source. Major challenge in realization of large aperture blackbody calibration source is to achieve the thermal uniformity better than ±0.5K over a large aperture of 900mm. A specifically designed segmented interface plate, kept between the radiating plate and Liquid Nitrogen cooled sink plate will be required to control contact thermal resistance. A Proportional Integral Derivative Controller (PID Controller) along with Distributed heaters and Platinum Resistance Thermocouple (PRTs) pairs is proposed to be used for achieving the required thermal uniformity. For a calibration source emissivity of the surface is to be maximized and should be near to unity. Different design options such as pyramidal, conical and hexagonal honeycomb shapes with different aspect ratio is considered for the development. High conductive Al alloy is selected for better thermal conductivity and uniformity.

Keywords: IR Background, Blackbody, Emissivity, PRT, PID controller

Abstract Id: 946
FOREST FIRE PREDICTION USING BACK PROPAGATION ALGORITHM BASED ON MODIS TERRA DATASETS

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Forest fires are one of the major causes for the loss of vegetation in the forests. There is a need of a model to predict the forest fires in real time, so that necessary actions can be taken to mitigate the fires. This study discusses with the application of Artificial Neural Networks (ANN) and the use of the MODIS sensor (MODerate resolution Imaging Spectroradiometer) TERRA datasets for the prediction of high fire risk areas. The 8 day datasets MODIS TERRA Land Surface Temperature (MOD11A2) & surface reflectance (MOD09A1) and the ASTER GDEM have been used to compute the two parameters Potential Surface Temperature (PST) and Normalized Multiband Drought Index (NMDI). The potential surface temperature has been used as the temperature varies with the elevation and the Uttarakhand state has hilly terrain, whereas the NMDI represents the moisture condition in forest vegetation. We have tested the potential of Artificial Neural Networks (ANN) to build up the fire risk model and Backpropagation Algorithm has been used to train the algorithm. It has been used as a part of algorithms that optimize the performance of ANN by calculating the derivatives of performance with respect to the weight and bias variables. Each variable is adjusted according to gradient descent. Input parameters are NMDI and PST whereas the fire historical data has been used as the outputs to train the algorithm. Fire risk maps were categorized as No risk, low, medium and high risk. Generated Fire risk maps will facilitate the tasks of reducing the fire prevention and extinction.

Keywords: Forest fire, Back Propagation algorithm, ANN, NMDI, PST.

Abstract Id: 947
MANGROVE COVER DYNAMICS IN KACHCHH, GUJARAT, INDIA

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Mangroves are intertidal communities of vegetation. India has nearly 3% of global mangrove vegetation. Gujarat and West Bengal together have approx. 68% of India’s mangrove cover. Nearly 70% of mangrove cover in Gujarat is located in Kachchh district. The intertidal areas of Kachchh around Kori Creek, Mundra, Kandla and Satsaida bet support dense patches of mangrove.

In spite of their ecological and economical significance, mangroves today are categorised as an endangered ecosystem. Major threats to them are transformation of mangrove habitats into agricultural landscapes and industrial development zones, human habitations, construction of salt pans, shrimp farming and reduced freshwater availability due to construction of dams in the upland catchment areas.

The growing pressures on mangroves require that these coastal habitats be continuously monitored so as to plan a suitable conservation strategy for them. Ground-based monitoring and survey techniques are costly, time-consuming and often difficult to implement as these plants grow in intertidal areas which are difficult to access frequently. With the advent of space-borne remote sensing technologies it has become possible to get a synoptic coverage of a larger area, at cost-effective and repetitive manner which is extremely useful for mangrove mapping and inventorization as well as to identify temporal changes occurring in mangrove environment. In this paper, we report mangrove cover dynamics of Kachchh district of Gujarat state of India using satellite remote sensing techniques. We have mapped mangroves using satellite datasets of 2011 and 2017 period and compared the changes with the mapping done by earlier studies. Landsat 8 OLI (Optical Land Imager) and Landsat 5 TM (Thematic Mapper) data were used for the year 2017 and 2011 respectively. Results show that mangrove have increased in 2017 compared to 2011. In particular, the mangrove cover has substantially increased around Satsaida bet in the inner Gulf of Kachchh.

Keywords: Mangroves, Kachchh, Gujarat, Remote Sensing, Landsat

Abstract Id: 948
INTEGRATION OF SPATIAL ANALYSIS AND PIXEL-BASED CLASSIFICATION TO IMPROVE CLASSIFICATION ACCURACY OF MAPPING PERENNIAL CROPS IN BẢO LÂM DISTRICT, LÂM ĐÔNG PROVINCE

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Perennial crops deliver strong economic, social and ecological benefits to many tropical countries. Accurate maps acquired through the remote sensing of the perennial crops are not yet available in the Central Highlands. The main objective of this study is to improve classification accuracy when mapping perennial crops in Bảo Lâm district, by integration spatial analysis the ancillary data (elevation, slope, soil type, NDVI, crops calendar and growing cycle of perennial crops) and pixel-based classification. The results suggest improvements in the coffee and tea crop classification accuracy as compared to earlier work, and the overall accuracy increases from 71% to 75% and the Kappa coefficient improves from 0.66 to 0.71. The input parameters that most strongly impact the classification accuracy are NDVI and slope. This paper offers a comprehensive study on the accuracy gains through the integration of pixel-based classification and spatial analysis when mapping perennial crops.

Keywords: Agriculture, remote sensing, accuracy assessment, land use, mapping perennial crops

Abstract Id: 950
FIELD-SCALE SPATIAL CORRELATION BETWEEN HYPERSPECTRAL IMAGING OF IRON ORES MINERALS AND ENVIRONMENTAL VARIABLES IN HILLTOP MINING AREA

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The prime contribution of this assignment was to examine the hyperspectral remote sensing based iron ores minerals identification using Spectral Angle Mapper (SAM) technique. Correlation analysis between iron minerals and environmental variables (soil, water, and vegetation) has been performed. Spectral Feature Fitting (SFF) and Multi-Range Spectral Feature Fitting (MRSFF) methods use the accuracy assessment in extracting iron ores minerals from Hyperion EO-1 data. Spectral inspections as a reference used in SAM technique to image classification for the identity of same iron ores minerals (hematite (24.26%), goethite (32.98%) and desert (42.76%). Iron ores minerals classification is validated by the USGS spectral library and field sample points. The regression analysis of spectral reflectance result from USGS (United States Geological Survey) and Hyperion shows the moderate positive correlation. The regression analysis between iron content and environmental parameters (soil, water, and vegetation) shows the moderate negative correlation. The examination was significantly effectual in extracting iron ores minerals (Hematite SFF RMSE ≤ 0.51 MRSFF RMSE ≤0.48, goethite SFF RMSE ≤ 0.047 MRSFF RMSE ≤0.438 and desert SFF RMSE ≤ 0.063 and MRSFF RMSE 53 ≤0.50), and the MRSFF RMSE histograms indicate an upper result likened to a conventional SFF RMSE. MRSFF RMS error result is best because multiple absorption features typically characterize spectral signatures. This analysis demonstrates the potential applicability of the methodology for iron minerals identification framework and iron minerals impact on environmental parameters.

Keywords: Hyperspectral Remote Sensing, SAM, Spectral matching, SFF, MRSFF, Iron ores mineral, Geochemical analysis

Abstract Id: 951
BENTHIC COVERAGE AND BOTTOM TOPOGRAPHY OF CORAL REEF ENVIRONMENT

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Remote sensing measurements in coral reef environments commonly confront the problem of overlying atmosphere and modification of spectral signal due to water column over the bottom substrates. Remote sensing of shallow coral reefs becomes quite challenging due to these problems. In order to correct these problems hyperspectral observation offer an advantage over multi spectral observations. A study was carried out with an objective to map benthic coverage and bottom topography in the coral reefs located in the Gulf of Kutch. The coral reefs of Gulf of Kutch lie within intertidal zone, which get exposed during low tide condition. Airborne hyperspectral remote sensing data from AVIRIS-NG sensor was acquired during low tidal condition with an average flight altitude of 8km on 14th Feb 2016 at Pirotan reef located in Gulf of Kutch (Gujarat, India) for mapping the benthic coverage and the bottom topography. The methodology involved atmospheric correction, simultaneous retrieval of water parameters and bathymetry, water column correction and mapping. Atmospheric correction was done by removing path radiance calculated from aerosol retrieved using 2 near infrared channels used as dark object over deep clear water. The calculated surface radiance at sensor was divided by atmospheric transmittance and incoming solar irradiance to obtain remote sensing reflectance. Model derived error minimization technique was used for simultaneous retrieval of water parameters like water column, water absorption and backscattering coefficients which in turn was used to derive chlorophyll concentration, suspended sediment concentration and colored dissolved organic matter in water column. Derived water parameters were used to account for water column attenuation and retrieve concomitant true bottom signature. An increased classification accuracy for coral reef mapping was achieved. The results obtained in the present study highlight the importance of water column correction and retrieval of bottom substrate signatures for coral reef mapping.

Keywords: Atmospheric correction, Coral reef mapping, Water parameters, Water column correction.

Abstract Id: 953
COMPARATIVE RESULTS OF SOME AIR POLLUTANTS BASED ON AEROSOL EXTRACTED FROM SINGLE AND DUAL IMAGE METHOD USING LANDSAT DATA

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Disturbance in atmospheric concentrations by aerosol from gas emission is a direct source of scattering and absorption of solar radiation, which has a significant impact on the climate, particularly on a regional scale. Aerosol is a major factor affecting the Earth’s radiation budget and affecting the biosphere and hydrosphere cycle, which is one of the greatest uncertainties in climate research, as well as its effects on air quality and human health.

This paper presents the results of our study which identified some air pollutants such as SO2, CO, PM10, NO2 from aerosol extracted from Landsat satellite images (Green channels) for Hanoi area by two methods of single image (absolute method) and dual images (relative method). The accuracies determining some air pollutants of the single-image method are 13% higher for SO2 and 25% for PM10 than for dual image one. The paper firstly deals with the selection of the appropriate resolution image to better determine the components of SO2, CO, PM10, NO2 in the single-image method that is of 90m in Ground Sampling Distance.

Keywords: kvinh

Abstract Id: 954
The accurate estimation of satellite-based global terrestrial latent heat flux (LE) at high spatial and temporal scales remains a major challenge. In this study, we introduce the Bayesian Model Averaging (BMA) method to improve satellite-based global terrestrial LE estimation by integrating five process-based algorithms. The validation at 265 globally distributed flux tower sites illustrates that different LE estimation algorithms have variable uncertainties and the BMA method enhances the annual LE estimates significantly with the smallest bias (3.8W/m2 and 2.3W/m2) than any single algorithms driven by tower and GMAO-MERRA meteorological data, respectively. Importantly, the integrated estimates for LE based on the BMA method have lower root-mean-square errors (RMSEs) and higher coefficients of determination (R2) than the best individual LE algorithm at different land cover types. The average RMSEs decrease by approximately 3 W/m2 at most crop and grass flux towers sites, and by approximately 4 W/m2 at most forest, shrub and savanna flux towers sites. The average R2 value increase at most flux towers sites by more than 0.03. In addition, we have used the BMA method, along with the MODIS data and GMAO-MERRA meteorology, to map the global terrestrial LE in 2004 with 0.05 degree spatial resolution. It has provided a basis to generate a long-term global terrestrial LE product with well-quantified accuracy for characterizing the global energy, water and carbon cycle.

Keywords: Latent Heat Flux, Evapotranspiration, Remote Sensing

Abstract Id: 957
STUDY OF SHOREFACE SEDIMENT DYNAMICS AND SEDIMENT CELL BEHAVIOR USING SATELLITE REMOTE SENSING DATA AND NUMERICAL MODELLING

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A coastal sediment cell holds the key to the sediment budget of the coastal belt. A part of the West Bengal coast from the Subarnarekha estuary mouth to Rasulpur estuary mouth and its shoreface waters was chosen as the study area. This coast has its dynamic nature attributed to dual influence by the tidal current and wave energy. Numerical modeling using MIKE 21 Flow modeling and Spectral wave modeling coupled with sand transport and mud transport was used to understand the shoreface sediment dynamics for the month of October, 2015 and January, 2016. Both field result and model output reflected the trend of increasing suspended mud concentration and decreasing suspended sand concentration towards Rasulpur, thereby indicating the strong influence of Hughli estuarine flow till Mandarmani from Rasulpur. Reduced wave energy and increased tidal frequency supported the depositional environment in this belt. While the rest of the study area under influence wave energy underwent erosion. The U velocity of the current speed and x-wave vector dominated the longshore current in south east direction in lower shoreface zone, while V velocity of current speed and the y-wave vector influences the cross-bed transport of sediments in upper shoreface. Suspended load is transported towards south while the bed load has a south east direction flow enhancing the longshore transport in that direction. Coastal sediment cell boundary delineation mainly depends upon the direction of x-vector of bed load magnitude (BLM) and its value. The direction is controlled by the local bathymetry, flow speed and direction. Shoreline assessment study and coastal geomorphological study for the decade 2005-2015 indicated an erosional regime in the western sector of the study area while the eastern sector suffered erosion. Predicted shoreline for the year 2025 indicated an increased erosion throughout the study area.

Keywords: Coast, Erosion, longshore transport, shoreface, bed load.

Abstract Id: 959
Raman lidar is one of the active remote sensors of atmospheric water vapour. This method also provides reliable information on microphysical parameters of aerosol particles in the atmosphere. Raman lidar uses elastic and inelastic backscatter to derive the profiles of key atmospheric parameters. The prime advantage of this method is the direct determination of particle backscatter and extinction coefficients along with atmospheric water vapor simultaneously. We describe an indigenously developed Raman lidar system that profiles atmospheric water vapor and aerosol covering the lower atmosphere. The optical part of lidar system employs a set of wavelength separating mirrors and high-spectral-resolution interference filters to separate the vibrational Raman signals from the strong elastic backscattering signal. The elastic and Raman signals are detected using a set of photomultiplier tubes and the detected signals are recorded simultaneously using a data acquisition system that employs analog and photon counting electronics. The atmospheric water vapor mixing ratio is derived using the corrected and processed Raman signals. Using the lidar data, we obtained profiles of aerosol backscatter and extinction coefficients. We examined the extinction-to-backscatter ratio (lidar ratio) with the derived WV mixing ratio. We present the results of comparison.

Keywords: Raman lidar, backscatter, extinction coefficients, lower atmosphere

Abstract Id: 960
QUALITATIVE ASSESSMENT OF GEOSTATISTICAL AND NON-GEOSTATISTICAL FUSION TECHNIQUES

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Broadly satellite images are available in two categories i) high spectral resolution but less spatial resolution ii) high spatial resolution but less spectral resolution. But in certain applications, images with high spatial as well as high spectral resolution are required. To meet such kind of requirement, Image fusion is widely accepted and increasingly being used. In this study satellite image fusion is done using geostatistical methods (Cokriging, Regression Kriging) and non-geostatistical methods (Intensity Hue Saturation, Principle Component Analysis). And aim of this paper is to perform qualitative assessment of selected image fusion techniques.

In this case, primary variable is RGB bands of Landsat 8 OLI (Operational Land Imager) and panchromatic band is chosen as the secondary variable. Output of these selected methods are compared to access spectral and spatial quality. Spectral quality is accessed by finding the correlation between primary variable and the output however spatial quality is accessed via texture analysis method named entropy. Overall assessment of loss of correlation, luminance distortion, and contrast distortion is done using Image quality index. Average correlation index between primary variable and secondary variable is maximum for PCA whereas spatial quality of fused output is highest in case of regression kriging. Hence regression kriging can be concluded as the best fusion technique out of the compared techniques.

Keywords: Kriging; Landsat; OLI; PCA; IHS

Abstract Id: 961
Nitrogen (N) is the most limiting factor to coffee development and productivity. Therefore, development of rapid, spatially explicit and temporal remote sensing based approaches to determine spatial variability of coffee foliar N are imperative for increasing yields, reducing production costs and mitigating environmental impacts associated with excessive N applications. This study sought to assess the value of Sentinel-2 MSI spectral bands and vegetation indices in empirical estimation of coffee foliar N content at landscape level. Results showed that coffee foliar N is related to Sentinel-2 MSI B4 (R²=0.32) B6 (R²=0.49), B7(R²=0.42), B8(R²=0.57) and B12(R²=0.24)) bands and to Inverted Red-Edge Chlorophyll Index - IRECI (R²=0.66), Relative Normalized Difference Index - RNDVI (R²=0.48), CIRE1 (R²=0.28), and Normalized Difference Infrared Index - NDII(R²=0.37). Vegetation indices veg indices in full if used for the first time. These variables were also identified by the random forest variable optimisation as the most valuable in coffee foliar N prediction. Modelling coffee foliar N using vegetation indices produced better accuracy (R²=0.71 with RMSE= 0.27 for all and R²=0.73 with RMSE= 0.25 for optimized), compared to using spectral bands (R²=0.57 with RMSE= 0.32 for all and R²=0.58 with RMSE= 0.32 for optimized). Combining optimized bands and vegetation indices produced the best results in coffee foliar N modelling (R²=0.78, RMSE=0.23). All the three best performing models (all vegetation indices, optimized vegetation indices and combining optimal bands and optimal vegetation indices) established that 15.2 ha (4.7%) of the total area under investigation has low foliar N levels (<2.5%). This study demonstrates the value of Sentinel-2 MSI data, particularly vegetation indices in modelling coffee foliar N at landscape scale.

Keywords: Nutrient management, random forest, canopy nitrogen, precision agriculture

Abstract Id: 962
High resolution data acquired by space borne systems is subjected to quality issues like noise, reduction is sharpness, oblique imagery etc due to inherent aberrations on the acquiring platform systems and the dynamic atmosphere which might have bearing on the interpretability of the natural terrain information. The study conducted to measure the image quality metrics of IRS (Indian remote sensing satellites) high resolutions for different terrain conditions and seasons is helpful in understanding the quality of imageries and arriving at NIIRS. The image quality metrics were computed based on the power spectrum using different complexities of images for multispectral and panchromatic data sets for different resolutions 0.6m, 1.6m, 2.5m and 5m data and arrived average resolution wise NIIRS. The rating depends primarily on the power spectrum, signal to noise ratio (SNR) and modulation transfer function(MTF). The logarithmic values of IQM can be linearly related to NIIRS. For comparison and validity of the results obtained by this method for IRS sensors NIIRS is also estimated on contemplating global sensors. The ratings obtained for different resolutions are closely matching with expected ratings mentioned by the Imagery Resolution Assessments and Reporting Standards (IRARS) Committee. The ratings obtained for different resolutions with different complexities of imageries are between 2 to 5

Keywords: NIIRS(National Imagery interpretability rating scaling), IQM(Image quality metrics), Complexity, MTF(Modulation transfer function)
POINT SPREAD FUNCTION (PSF) ESTIMATION OF HIGH RESOLUTION SPACE BORNE IMAGING SENSORS USING STELLAR SOURCE AND GROUND BASED TARGETS

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PSF is one of the key characteristics of an optical system on which the performance of optical systems depends. More accurate assessment of on-orbit PSF and derived MTF are useful in enhancing the image quality. Cartosat-2S platforms carrying high resolution imaging sensors in the optical bands namely Multi spectral camera (MX) with 1.6m and Panchromatic camera (PAN) with 0.6m spatial resolution. During the early orbit phase stars were acquired at various locations of the array to arrive PSF characterization of the system. PSF estimated by taking 16x16 pixels energy around the star position into consideration after compensating the dark current. Integrated PSF was derived using multi star occurrence at different locations of the detector array. PSF and MTF was also estimated in the earth observation mode using edge response from the image by ground based artificial targets at a contrast difference of 50% reflectance in the VNIR (Visible Near Infra Red) wave length regions to estimate the system response. The PSF found to be within 2 to 2.5 pixels by all these observations. Image quality was observed for the images obtained at different terrains over a period with the PSF correction and found to be improved.

Keywords: PSF (Point spread Function), MTF (Modulation Transfer Function)

Abstract Id: 965
Radiometric calibration of sensors is an important activity performed by remote sensing data providers to ensure accurate & reliable data products. The current work describes the post launch radiometric calibration of Resourcesat-2 (RS-2), Linear Imaging Self Scanner-3 (LISS-3) sensor operated in four bands: B2 (0.52-0.59 μm), B3 (0.63-0.69 μm), B4 (0.77-0.86 μm) and B5 (1.55-1.7 μm) with a spatial resolution of 24m over very well maintained targets in Calibration/Validation (Cal/Val) site in Shadnagar. The calibration coefficients were computed using the satellite image data acquired between January 2015 & April 2017. The radiances obtained from sensor were compared with simulated satellite radiances using 6S radiative transfer code, whose inputs are ground measured surface reflectance in sensor spectral response, synchronous AOD (Aerosol optical depth) measurements, and Ozone and Water vapor measurements. Mathematical relation is modeled for the LISS-3 Digital Numbers (DN) & simulated radiances and band wise calibration coefficients were obtained. Calibration coefficients applied on the validation data sets show considerable improvement and an overall agreement of better than 15% with Landsat8 (L8), Optical Land Imager (OLI) data.

Keywords: Radiometric Calibration, Cal/Val site, Shadnagar, 6S model

Abstract Id: 966
MULTI-FREQUENCY SAR CAPABILITIES FOR FOREST BIOMASS AND CARBON INVENTORY FOR REDD MONITORING


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Greenhouse gas inventories and emissions reduction programs require robust methods to quantify carbon sequestration in forests. Proper inventory of forest aboveground biomass (AGB) is required for accounting carbon emissions that forms the most vital part of the carbon cycle modeling and climate change mitigation programs in context to Reducing Emissions from Deforestation and Forest Degradation (REDD). Remote Sensing (RS) technology provides cost and time effective means for accurate temporal monitoring over large synoptic extents at local to global levels, and hence, is beneficial over conventional methods. The study presents a suitable approach for estimating AGB and C through the integrated use of multi-frequency X-, C- and L-band Synthetic Aperture Radar (SAR) data over tropical deciduous mixed forests of Munger (Bihar, India). Backscatter values generated from the raw SAR images were correlated with field-based AGB values and were regressed using Multiple Linear Regression (MLR) analysis to generate best-fit models for AGB estimates with single and combined frequencies of COSMO-Skymed (X-band), Radarsat-2 (C-band) and ALOS PALSAR (L-band). The integrated model for AGB estimation involving X-, C- and L-bands achieved an accuracy of 75.3% with r²=0.90 and RMSE=15.29 t/ha. On validating the above-said models, the integrated model involving X-, C- and L-bands showed the best results amongst all other models with r²=0.95, RMSE=14.81 t/ha and Willmott’s index of agreement of 0.95. Resulting modeled AGB were converted to carbon (C) and carbon dioxide (CO₂) equivalents using conversion factors. Hence, the study proposed L-band for single frequency analysis and the combination of X-, C- and L-bands for multi-frequency analysis for tropical forest AGB estimation. The study revealed information regarding the spatial distribution and quantification of forest AGB and C required for REDD monitoring.

Keywords: ALOS PALSAR, RADARSAT-2, COSMO-Skymed, Forest, Biomass

Abstract Id: 967
Lakes are important land resources and indispensable part of the ecosystems where we live in. They play a key role in flooding. In this paper, the lake and impervious surface areas in Wuhan were extracted by using the Landsat images since the late 1980s. The temporal and spatial changes of the lake and impervious surface areas in Wuhan were investigated and analyzed with the help of social and meteorological data to provide valuable information for the government about lakes comprehensive management and urban development planning and alert the importance of protecting lakes and water resources. The results show that the lake area and quantity are decreasing and the impervious surface area is increasing in Wuhan. The social factors and human activities are the main reasons for the decrease of lake area. The decrease of lake area reduces the water storage capacity of the city. With the rapid development of Wuhan urbanization, the increase of the impervious surface area also aggravated the occurrence of urban waterlogging.

Keywords: remote sensing; water extraction; lake area; impervious surface

Abstract Id: 968
Water is vital to health, well-being, and food security and socioeconomic development of mankind. Therefore, the presence of contaminants in natural freshwater continues to be one of the most important environmental issues in many areas of the world, where a significant part of population are far away from potable water supply. Availability of good quality water will ensure the sustainability of socio-economic development. However, a large population in India still lives in absolute poverty in both urban and rural areas, lacking access to clean drinking water and basic sanitation. Water quality indices (WQI) are one of the most effective tools to give information on the quality of any Water body. WQI aims at giving a single value to the Water quality of a intercede reducing great of parameters into a simpler expression and enabling easy interpretation of monitoring data. The present paper focus in brief methodology for finding out water quality indices (WQI) and also assessing the suitability of water quality for drinking purposes using GIS techniques. The study of water quality during pre-monsoon gave relative information by which we can step forward to improve the quality of water using new technologies.

Keywords: Water quality index, GIS, Ground water, Physical and chemical parameter

Abstract Id: 969
SLOPE MOVEMENT ESTIMATION IN NAINITAL TOWN: DETERMINED BY PSINSAR TECHNIQUE USING SENTINEL-1 DATASET

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The purpose of this research was to investigate the potential of Persistent Scatterer Interferometric Synthetic Aperture Radar (PSInSAR) technique, using radar imaging satellite Sentinel-1 dataset to estimate slope movement at landslide prone Nainital town in Kumaun Himalayas.

Sentinel 1A and 1B SAR dataset of 36 images acquired in Interferometric Wide Swath mode with HH polarization, is used for the PSInSAR processing. The initial sets of Persistent Scatterers were identified on the basis of normalized amplitude stability index. Mean Velocity map and time series plots have been produced for the study period from December 2015 to May 2017. Mean velocity maps of study area evidently revealed that there is noticeable movement along the slopes at many locations. Time series plots have been also generated for the selected locations, to determine the temporal behaviour of movement in satellite Line of Sight (LoS) direction.

At the NW and SW slopes, areas in proximity to Naini Lake have shown no movement and are stable during the study period of 18 months. On the N-NE slopes many locations at Sher ka Danda ridge and at Snow view peak are identified as instable and maximum velocity is measured upto -23 mm/year in satellite Line of Sight (LoS) direction. Slow movement has been detected at the dense urbanized area of Lower Mall Road near Naini Lake and mean velocity around -10 mm/year has been measured. On the Southern slopes, displacement has been estimated at Balia Nala Landslide area, which shows velocity around -30 mm/year for some identified points. The S-SW slopes area, slopes near Government College area and slopes nearby Raj Bhawan golf course has also undergone displacement at the rate of -25 mm/year. The study clearly illustrates the usefulness of PSInSAR technique using Sentinel-1 dataset for estimation of slope movement in Kumaun Himalayas.

Keywords: PSInSAR, Slope movement, Sentinel-1, Velocity map, Kumaun Himalayas

Abstract Id: 970
Point clouds produced from overlapping aerial imagery using dense-matching such as implemented by the photogrammetry software suites from SURE, Pix4D, or Photoscan can include a fair amount of the kind of "low noise", namely error points well below the true terrain. Such low noise causes trouble when attempting to construct a Digital Terrain Model (DTM) from these photogrammetric points as common algorithm for classifying points into ground and non-ground points tend to "latch onto" those low points, thereby producing a very poor representation of the terrain. In this article we describes one possible workflow for eliminating excessive low noise on one particular example data set from a region in Italy that was generated it with the Agisoft Photoscan software.

The original file contains 87,261,083 dense-matching points and covers an area of roughly 12.8 square kilometers with an average spacing of 38 cm between the points. We describe a pipeline that generously marks all low points as noise by first breaking the points into smaller 500 by 500 meter tiles, then selecting the highest point of every 2.5 by 2.5 meter grid, then removing isolated points from those, then temporarily classifying the remaining points into ground and non-ground, then constructing a temporary ground surface that is only used to mark all points that are 0.5 meters of lower as noise. These points are then ignored and a standard ground classification algorithm can be used to create a reasonable DTM that is not impacted by the excessive low noise points.

Both the data set as well as the software modules used to remove the low noise will be available to the attendees so that they may reproduce this processing pipeline on their own after the conference.

Keywords: photogrammetry, noise, ground classification, bare-earth, DTM

Abstract Id: 972
PARALLEL COMPUTING BASED WEB GEOPROCESSING SERVICES FOR DERIVING FOREST FRAGMENTATION INDEX IN THE HIMALAYA

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Mapping and assessment of the extent of forest fragmentation index is one of the key requirements for undertaking any eco-restoration work. Commercial-Off-The-Shelf (COTS) based desktop softwares have certain limitations such as limited computation resources at user end, complexity in software deployment, platform depended solution, software/algorithm updation issues etc. To overcome these limitations, a web processing service (WPS) based fragmentation index algorithm is developed and implemented during this study using free and open source geospatial solutions. The proposed algorithm is derived by using the multi-layer moving window based approach on geospatial data. The algorithm is based on parallel computing environment for better performance and efficiency when dealing with large geospatial data in multi-user environment. In order to demonstrate web geoprocessing based fragmentation algorithm, the Indian Himalayan states are taken as region of interest (ROI) for the online geoprocessing. As an input, LULC map of the study area for different time periods is published as web coverage service (WCS) in GIS server environment. Furthermore, the WCS of LULC maps are considered as input dataset for the derived algorithm. On the basis of ROI, the algorithm automatically computes the extent of fragmentation index. As the capability of the algorithm, the derived output is automatically categorized as intact, low, moderate, high and very high fragmented regions across the study area in distributed GIS environment. From the derived results, it is observed that the large area is in very high category in spite of tremendous population pressure, indicating effective protection. At the end, parallel computing based web geoprocessing services approach and an interactive and responsive graphical user interface (GUI) provide the web environment for the computation of forest fragmentation index which can be utilized in the conservation of forest and associated biodiversity.

Keywords: web processing service, forest fragmentation, parallel processing, web coverage service, distributed GIS.

Abstract Id: 973
MASS BALANCE ESTIMATION OF DOKRIANI GLACIER IN CENTRAL INDIAN HIMALAYA USING REMOTE SENSING DATA

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Dokriani Glacier is one of the important glaciers of Bhagirathi River basin which fed river Ganges. The length of the glacier is about 4.6 km and snout elevation is about 4028 m m.s.l. The mass balance of the glacier was estimated using glaciological field based measurements for a few years during 1994 to 2000. However, due to remote and poor accessibility, the field based measurements could not continue. Remote sensing based methods provide an opportunity to estimate the long-term mass balance of the glacier. In this study, the mass balance of the glacier has been estimated using Accumulation Area Ratio (AAR) method. Remote sensing datasets (Landsat) have been used to estimate AAR for different years from 1994 to 2014. Firstly, a mathematical relationship has been developed between remote sensing derived AAR and field observed mass balance data of the glacier. This mathematical relationship has been used to estimate the mass balance of the glacier for other years using remote sensing derived AAR. Estimated mass balance was validated from ground observed mass balance for few years. A High correlation was observed between ground observed and remote sensing estimated mass balance. It has been observed that AAR for the Dokriani glacier varies from 0.64 to 0.71. The Mass balance of the glacier was observed between -15.54 cm to -50.95 cm during the study period. The study highlights the application of remote sensing in a mass balance study of the glaciers and impact of climate change on glaciers of Central Indian Himalaya.

Keywords: Mass Balance, AAR, Dokriani Glacier, Landsat

Abstract Id: 974
VALIDATION OF INSAT-3D TEMPERATURE AND WATER VAPOUR PROFILE DATA WITH COLLOCATED GPS SONDE DATA AND STATISTICAL ANALYSIS OF ERRORS


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When using satellite products for weather forecasting or atmospheric research and climate monitoring etc., it is essential to estimate uncertainties and to understand their capabilities and limitations of the data. The accuracy of most of the satellite products depends considerably on the atmospheric condition such as cloudy or clear-sky and polluted or clean and also depends upon temporal and spatial resolution of data, looking angle of the satellite, sensor characteristics, and wavelength of the radiance measured etc... Usually validation is based on comparisons with independent measurements of the same parameter with known uncertainties. A major goal of validation is to describe and to quantify the uncertainty of a satellite product in such a way that it is of direct use for the specific research or application areas. In our studies we have taken data of INSAT3D temperature and humidity profile and in situ GPS Sonde data of Delhi station between 1st Aug 2015 to 31st March 2017. Data analysis was carried out month wise and level wise starting from surface up to 100 hPa level. The results reveal that overall temperature and relative humidity of INSAT-3D are in very good agreement with GPS sonde and over all RMSE of 1-2 C, bias of less than 1 C and correlation 0.8 for temperature and RMSE of 10-20 %, bias of less than 10% and correlation of 0.6 for relative humidity is observed. Bias and RMSE is showing expected accuracy in all months except June, July and August in which middle and upper troposphere showing degraded performance in temperature and relative humidity. This degradation might be error associated with GPS sonde instrument or possibly undetected cloud condition by INSAT3D. Level and month wise statistical analysis of temperature and humidity data were discussed detailed in this paper.

Keywords: GPS sonde, INSAT3D sounder, Validation

Abstract Id: 976
SCATSAT-1 DATA PRODUCTS GENERATION AND DISSEMINATION

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The Scatsat-1 satellite was launched by Indian Space Research Organization (ISRO) on September 26, 2017. Scatsat-1 is a continuity mission for OSCAT (Oceansat Scatterometer) on board Oceansat-2 satellite which provides back scatter coefficients (sigma - 0) over entire globe and wind vectors i.e. wind speed and direction over the global oceans. The sigma - 0 products are very much useful for various land and oceanographic applications. The wind vector products are being used for weather forecasting, cyclogenesis prediction, cyclone detection and tracking services by different national and international users. The satellite covers the entire globe over a period of two days.

The most important point in this mission is to provide data products within 180 minutes of data acquisition by satellite for all 14/15 orbits for Indian / international users. For this purpose, facilities have been established at polar ground stations i.e., in north and south poles to receive data from satellite for all orbits. Facilities have been established for transfer of data from polar ground stations to NRSC (National Remote Sensing Center) shadnagar, generation of data products and dissemination of products to users with in specified turnaround time. The products are being supplied to users in operational mode from 24th April, 2017 onwards. This paper describes details of entire facility, types of products and dissemination methods. A web portal and ftp server were also established for downloading data products by users.

Keywords: SCATSAT-1, scattering, wind vectors, sigma0, cyclogenesis

Abstract Id: 977
EVALUATION OF RISAT-1 FRS-2 QUAD POL DATA TO BE FULLY POLARIMETRIC DATA

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Synthetic Aperture Radar is a promising technique for monitoring various land cover targets. Continuous day and night monitoring of different natural and manmade features is done using SAR utilizing their backscatter information. Polarimetric properties of the electromagnetic wave are used to separate different scattering elements available in single SAR resolution cell. Quad polarized SAR gives the backscatter information in all four polarization channels. Fully polarimetric SAR data is quad polarized data with phase consistency across different polarization channels. This paper focuses on evaluation of the RISAT-1 FRS-2 Quad polarized data to be a fully polarimetric data. Quad pol data should follow certain conditions to be fully polarimetric which are been evaluated. Two datasets for RISAT-1 FRS-2 and RADARSAT-2 were used for Manali region of March 2014. Pre-processing of the data included speckles filtering using ‘refined lee’ filter and the conversion of slant range to ground range. The phase coherency between Co-polarized HH and VV channels was evaluated using Co-polar phase difference (CPD). The FRS-2 phase distribution curve was compared with the same obtained from Radarsat-2 Fully polarimetric data. The Radarsat-2 showed characteristic relative phase curves matching to the theoretical PDF (Power Distribution curve). RISAT-1 FRS-2 was having incoherency in between co-polarized channels HH and VV. The RISAT-1 FRS-2 was found inconsistent for considering it as a fully polarimetric data. This made this data data not suitable for the generation of relative phase (HH-VV), generation of coherency matrix and calculating stokes parameters.

Keywords: Synthetic Aperture Radar, Quad polarization. Fully polarimetric data, Power Distribution curve

Abstract Id: 978
SNOW DEPTH ESTIMATION WITH CO-POLAR PHASE DIFFERENCE USING MULTI-TEMPORAL SPACEBORNE TERRASAR-XDATA

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Snow Depth is an important parameter which gives an idea about the thickness of the freshly fallen snow in a particular region. Hence proper estimation of the snow depth estimation is required. This study tries to estimate the snow depth using co-polar phase difference using Co-polar phase difference. When the microwave travels inside the dielectric medium phase difference between the polarisation channels HH and VV originates leading to the Co-polar phase difference (CPD). This property of the microwave has been utilised in this study. This co-polar phase difference (CPD) is highly dependent on the structural and dielectric properties of the snow pack (Parrella, Hajnsek, & Papathanassiou, 2016). For this study, six multi-temporal data sets of TerraSAR-X acquired during December 2014 and March 2015 in the strip-map mode were used to observe the variation of the Co-polar phase difference with snow depth variation. With the rise in snow depth corresponding increase in the CPD was observed. The increase in the CPD was due to the increase in co-polar phase difference experienced by the microwave travelling inside the fresh snow pack. Also, a decline in the CPD was observed due to the increase in compactness of the snow pack. The main reason of this snow pack compactness was snow melt-off which was increasing the water content of the snowpack. The rise in the water content led to the increase in dielectric constant of the snowpack, which ultimately prevents the microwave penetration inside the snow pack. This study was able to assess and the variation in the CPD with snow depth using the theoretical model.

Keywords: Co-polar phase difference (CPD), Snow depth, Dielectric constant, Microwave penetration

Abstract Id: 979
A ONE-AGAINST-ALL EXTRACTION OF COCOS NUCIFERA AT INDIVIDUAL TREE CROWN LEVEL VIA SUPPORT VECTOR MACHINE CLASSIFICATION USING LIDAR DATA

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Philippines is the second largest producer of Cocos nucifera, also known as coconut, in the world, with an average production of 15 billion nuts per year corresponding to a hundred billion pesos. Being one of the major crops in the country, coconut accounts for 26% of the total agricultural land, corresponding to at least 3.5 million hectares. As significant declines in the production have been charted since 2016 due to climate-related incidents and infestations, it is high time that we introduce efficient and accurate data as inputs to resources management in the country. However, managing these much of coconut resources scattered on a large geographic area is inefficient if we use data gathered through manual counting, and inaccurate if we resort to rough estimations. As the Philippine government embarks on the acquisition of LiDAR data achieving an equivalent 1 meter grid resolution, this study seeks to achieve classification of coconut trees at the individual tree crown level by performing Object-Based Image Analysis (OBIA) on a simple LiDAR-derived first-return highest-elevation model without the aid of spectral data. Support Vector Machine classification in a one-against-all approach has been implemented for the simplicity of the classification process. The methodology produces highly accurate tree count estimates on selected study sites in San Antonio, Quezon, reaching at least 90% on 16 study areas, without incorporating other remotely-sensed data and without using complex procedures. The outputs of this research suggests that agricultural resources mapping at individual tree level achieves high accuracies even when using LiDAR data alone. This study may also pioneer on “one agricultural class per classification” approach in the improvement of existing agricultural resources maps.

Keywords: Support Vector Machine, LiDAR, Remote Sensing, Object-based Image Analysis

Abstract Id: 980
IMPACT OF LAND USE/ LAND COVER ON SURFACE SEDIMENT AND WATER GULF OF KACHCHH, MANGROVE, GUJARAT, WEST COAST OF INDIA

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The coastal zone is a unique environment where interactions between terrestrial, marine and atmospheric processes take place. Mangrove forests are coastal wetland, their position between land and sea makes them critical in land-sea nutrient and material exchange. They also serve as sinks for material derived from terrestrial and marine settings. Change in land use pattern has severely affected the mangrove sediment and water which in turn affected the total productivity of the system worldwide.

Present study has been carried out in Kachchh Mangrove. Situated in west coast of India Mangrove cover along Gujarat coast is second in India after Sundarbans, covering about 23 percent of India's estimated mangrove forest. Recent studies showed that mangroves have been severely threatened by deforestation, land use change, aquaculture and other human activities. Increasing urbanization and industrialization due to establishment of various port, oil refineries and salt producing industries has showed adverse impacts on Gulf environment. There are around 40 medium and large industrial projects have been established around Gulf of Kachchh (GOI, 2002).

Mangrove water and surface sediment were collected from eight sampling locations from mundra to Mandav. The variability of anions in mangrove water has shown a trend: Cl−> SO42− > HCO3− > Si > CO3− > NO3− > NO2− > TP > F−> PO43−. The variability of cations in mangrove water shows the following trends: Na+> Mg2+ > Ca2+ > K+ > NH4+. The PLI values of the sediment samples ranged from 0.86 to 1.33 which suggests that sediment of the study area is continuously deteriorating. Besides natural processes such as weathering processes, ion exchange processes, industrial activities along with Kandla and Mundra port, agricultural runoff pose greater threat to the mangrove. This study also suggests the present state of land use change is imposing an adverse impact on the hydro-geochemistry of mangrove forest water and Sediment.

Keywords: Mangrove, Gulf of Kachchh, Land use pattern, Nutrient Chemistry, Pollution Load Index

Abstract Id: 981
A remote-sensing-based measurement strategy for rivers is emerging with radar Scatterometers which gives surface information through the measurements of backscattering coefficient. Measurements are done relatively coarse spatial resolutions 10 to 50 km since they average out pulses received over a wide area to accurately measure the return amplitude. While this does not allow detailed analyses of surfaces, it does have the advantage of covering a larger portion of the earth on a more frequent basis than synthetic aperture radar (SAR) and Altimeters. This frequent coverage is desirable for monitoring catchment scale hydrological processes to assess the regional distribution of water and its intra-seasonal and inter-annual variability.

In this study, an innovative approach has been developed for the estimation of Brahmaputra river water levels at multiple locations using the Ocean Scatterometer (OSCAT) based high resolution SIR (Scatterometer Image Reconstruction) observations. Total area of the basin in India is approximately 19 Million hectares. Ku-band (OSCAT) sigma0 data, landuse and cover data (AWIFS), Hydrometric data from various sources such as IMD, CWC, IWAI etc. have been used. Gauging sites catchments and their influencing areas were delineated using the topographic variations. SIR data was used to estimate soil wetness using the change detection algorithm. Further, soil wetness was integrated over the basin to calculate basin water index (BWI) taking into account land cover conditions. Subsequently, multi-regression models were developed between BWI and hydrometric datasets to estimate the river flow characteristics over five gauging sites (Dhubri, Guwahati, Tezpur, Nematighat and Dibrugarh). Study demonstrated that High temporal resolution (2 days) Scattermeter data has the potential to fill the gap of coarser temporal resolution (10-35 days) Altimeters and SAR data with overall RMSE of 0.7 m (11 %) with the advantage of capturing extreme events. River water level product is available in near real time over VEDAS web-portal

Keywords: river basin, Scatterometers, soil moisture, backscattering coefficient

Abstract Id: 985
OPEN SOURCE WEB INTERFACE FOR SPECTRAL LIBRARY ARCHIVAL AND ANALYSIS SYSTEM

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Hyperspectral remote sensing is a developing, multidisciplinary field diverse that expand on the standard of material spectroscopy, radiative transfer, imaging spectrometry and hyperspectral data process. In order to use the full capability of hyperspectral data, Spectral library is an essential component, gathered as collection of spectral signature in different research studies. Spectral library is a collection of spectral signature of targets collected using spectroradiometer. Spectral libraries are developed using costly proprietary software tools. These libraries are stored locally and most of the time are inaccessible for other researchers. Therefore, development of a web-assessable spectral data archive using free and open source software’s (FOSS) is necessary.

This study concentrates on the development of a web-enabled spectral library architecture for online archiving, visualization and analysis of hyperspectral spectra. The system has been developed as a three tier architecture in which database layer handles the capacity of spectral data and metadata information, application layer handles the communication of spectral database to a web interface and internet layer handles the client user input to the web interface. Different combination of open source programming languages, have been used in the development of this system. For example, cascading style sheets (CSS) for the styling of the web pages, hypertext markup languages (HTML) for organized website pages creation, JavaScript and JQuery for user input events handling and performing validation activities, PostgreSQL, a relational database framework has been utilized for the storage and management spectral data. For stored/achieved spectral data and metadata information the system provides utilities for analysis such as averaging, resampling, continuum removal, smoothing, derivative spectra, calculation of Red-Edge and spectral angle mapper. The study concludes that the FOSS approach provides excellent environment for the development of a spectral library architecture, not only for the storage but also for the analysis of spectral signature and dissemination of spectral various other studies.

Keywords: Open Source, Spectral Library, Web, javascript, spectral analysis

Abstract Id: 986
OVERSEA EMERGENCY DISASTER MONITORING BASED ON INTEGRATED APPLICATION OF REMOTE SENSING, COMMUNICATION AND NAVIGATION SATELLITES

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Satellites play more and more important role in disaster prevention and reduction. Emergency disaster remote sensing monitoring requires high time efficiency. Based on the international requirements for preventing disasters and reducing damages, a prototype system for oversea emergency disaster monitoring was established. The prototype system consists of remote sensing, communication, and navigation satellites and their ground facilities & terminal equipment. This prototype system provides a reliable and comprehensive service for remote sensing emergency monitoring.

In addition, an oversea application of prototype system is introduced for emergency flood monitoring around Lancang - Mekong River area. Two remote sensing satellites, Chinese Ocean satellite HY-1B and Venezuela Remote Sensing Satellite (VRSS-1), was worked to observe the flood area. The camera of VRSS-1 has a resolution of 2.5 metres in panchromatic mode, and 10 metres in multispectral mode. HY-1B satellite installed 10-band ocean color scanner, and spatial resolution is 280m. To serve the function of transnational communication, ChinaSat-10 communication satellite, parked over the equator around 110.5 degrees east longitude, and equipped with 30 C-band and 16 Ku-band transponders, three receiver antennas, and two transmission antennas. It was recruited to transfer the remote sensing image of flooding-affected area from Beijing to Vientiane. Furthermore, a data Operation and Management Center was developed to receive user's requirements and then arranged relevant satellites to perform various work missions. The handheld BeiDou/GPS dual-mode units were used for positioning the geographic coordinates of disaster area. A mobile antenna vehicle closed to the flood site served the function to receive and transfer the remote sensing image to hand terminal equipment.

In conclusion, with the help of comprehensive application of aforementioned multiple kinds of satellites and its ground equipment, the efficiency for remote sensing emergency disaster monitoring can be significantly improved.

Keywords: Remote Sensing, Satellite Application, Emergency Disaster Monitoring

Abstract Id: 988
SHIFTING CULTIVATION AND ITS SUSTAINABLE DEVELOPMENT IN NAGALAND: A CASE STUDY USING GEOSPATIAL TECHNOLOGY

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Shifting cultivation commonly known as slash and burn agriculture is an age-old traditional agricultural practice. According to the estimate made by the task force on shifting cultivation in India there were approximately 622.2 thousand families in India under shifting cultivation out of which 443.3 thousand families (i.e. 71.25 %) were located in the North Eastern region alone. In North-East India about 7.6 lakhs ha area is affected by shifting cultivation. Amongst North Eastern states Nagaland is the worst affected state followed by Arunachal Pradesh, Mizoram, Meghalaya, Manipur Assam and Tripura. Therefore this study is taken up in Nagaland with the objective to analyse the trend of shifting cultivation over the years from 2002 to 2012, abundance of shifting cultivation areas in respect to slope and aspect and prepare an action plan for sustainable development of the shifting cultivation areas. The study was carried out by using wasteland and LULC map at 1:50k scale of the year 2002-03, 2005-06, 2008-09, and 2011-12. Slope and aspect map generated from Carto DEM was used to study the relationship between the slope and aspect. The study shows that shifting cultivation area increases over the year 2002-03 to 2008-09. The area covered during 2002-03 was 117 Sq. Km which increased to 1239 Sq.km to 1515 Sq.Km during 2005-06 and 2008-09 respectively. The shifting cultivation area was decreased to 1286.57 Sq. km during year 2011-12. Shifting cultivation area is highest in steep slopes followed by moderately steep slope and very steep sloping. Lowest shifting cultivation areas are observed in gentle slopes followed by moderately sloping land. Shifting cultivated areas are mostly found in northern aspect and southern aspect followed by west and east aspect. Land use action plan was prepared for the shifting cultivation areas by considering slope and soil map. The soils of the study area are extremely shallow to deep in depth, loamy to clayey in texture and moderately to acidic in soil pH. Slope and soil map were integrated with shifting cultivation map of 2011-12 in GIS environment and prepared an alternate land use map suggesting plantation of fruit trees, grasses, cultivation in terraces or on contour and afforestation. Fruit trees plantation with grass cover in the inter spaces are suggested in steep slope areas with deep soil that covers maximum area (37.9%). Cultivation in bench terraces is suggested in 29.4 % area. Contour cultivation and strip cropping is suggested in 9.6 % areas in moderate slopes with slightly deep to deep soils. Afforestation (5.2% area) is suggested in very steep slopes with shallow to slightly deep soils. Grass plantation is suggested in steep to very steep slopes with extremely shallow soils.

Keywords: Shifting cultivation, geospatial technology, alternate land use, sustainable development, Nagaland

Abstract Id: 989
CLOUDBURST ALERT DISSEMINATION AND DECISION SUPPORT SYSTEM FOR DISASTER MITIGATION

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Cloudburst is one the major natural calamity which has devastating impact on western Himalayan region due to which many people lose their lives and lots of property get damaged. Need of the hour is to develop an early cloudburst alert dissemination system to save several lives and mitigate damage of goods or infrastructure in affected areas. Although it is not possible to prevent this natural disaster but its impact can be minimized by preparedness and proactive disaster management.

A web GIS based SDSS (Spatial Decision Support System) was developed to disseminate nowcast based cloudburst alerts to the administrators and common people. Open source technologies were used for developing such Web GIS based SDSS at low cost. The principal development component includes: GeoServer, Java, PostgreSQL, OpenLayers, and GeoExt. Dissemination system includes visualization of centroid and precise locations of cloudburst over Western Himalayan Region along with related information and other overlay layers like State, District and Taluka (region) boundaries, District population, Drainage, Roads, Rivers, Railway Tracks, National Highway and Digital Elevation Model as WMS Layers.

Land use/ Land cover map of Uttarakhand and Himachal Pradesh was prepared for the year 2014-2015 using multi season LANDSAT-8 OLI (Optical land imager) sensor data with overall accuracy of 83%. With every nowcast alert this SDSS provides information about the probable affected land cover and their area (sq km) in the form of pie chart and table. Drainage layer up to order 5 was prepared using SRTM (Shuttle Radar Topographic Mission) were incorporated into above application to identify the affected area near activated channels and to approximate the areas that may get flooded.

This SDSS will be very useful for local administrators, decision makers and common people and will be an effective tool for disaster mitigation. Presently, the Developed Application can be accessed via MOSDAC through URL i.e.

Keywords: Web GIS, open source, Disaster Mitigation

Abstract Id: 990
STUDY OF ATMOSPHERIC FRONTS USING RISAT-1 SAR DATA OVER INDIAN OCEAN

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Marine Atmospheric Boundary Layer (MABL) is the region where the ocean and the atmosphere exchange large amount of heat, moisture, and momentum, primarily via turbulent transport. There are several interesting atmospheric features like atmospheric gravity waves, convective cells, atmospheric fronts, rolls etc. which define and explain multi-scalar phenomena occurring in this layer. An important MABL feature, which we have considered here is the atmospheric front. Atmospheric fronts in the lower troposphere often mark regions of significant weather and those associated with extra-tropical cyclones are related to heavy precipitation events. The fronts producing extreme precipitation events are found to have stronger frontal gradients than other fronts, potentially providing some improved forecasting capabilities for extreme precipitation. The detection of atmospheric fronts is thus very important and is made possible by studying their imprints on the sea surface using backscatter radar echo. In the present study, we aim to detect atmospheric fronts over Indian Ocean using Radar Imaging Satellite-1 (RISAT-1) Synthetic Aperture Radar (SAR) data.

Atmospheric fronts are air mass boundaries that have collapsed down to near-zero order discontinuities in wind speed. They are often accompanied by a surface wind maximum along and just ahead of the front. The SAR signature of a front most often appears as a sharp gradient in SAR intensity. A typical frontal feature was captured a SAR image acquired by the RISAT-1 satellite over the Arabian Sea on 13 August 2015. In the present study, ERA data is used to compute thermal front parameter, and front points derived from them are overlaid on the SAR imagery depicting an atmospheric front. The associated wind speed exhibits a sharp demarcation between the two regions, with the wind speed difference in the range of 3-5 m/s.

Keywords: Atmospheric Fronts, MABL, RISAT-1, Synthetic Aperture Radar

Abstract Id: 992
INVESTIGATION ON REGIONAL VARIABILITY OF ATMOSPHERIC GREENHOUSE GASES USING SATELLITE DATA

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Greenhouse gases (GHGs) and other trace gases play a vital role in controlling the climate system of the lower atmosphere. Climate change arising due to the increase of GHG’s namely CO2, CH4, O3, N2O and H2O in the atmosphere since the inception of industrial activity. In the present study, we have investigated the variability of CO2 & CH4 over Punjab, Hyderabad, Assam and Ahmedabad regions covering North, South, East & Western regions of India, respectively and compared with Indian average, using 2003-2011 SCIAMACHY (SCanning Imaging Absorption spectroMeter for Atmospheric CHartographY) satellite observations. Study revealed that maximum CO2 attains its peak during pre-monsoon, while CH4 recorded maximum during post-monsoon and minimum during monsoon. Study suggests that biomass burning (active phase of agriculture) during pre-monsoon (post-monsoon) could enhance the CO2 (CH4) level during this period. Annual mean of CO2 concentrations over the India is observed as 374 ppm in 2003 and 391ppm in 2011 at an increase rate of 1.9 ppm/year. Data analysis shows that CO2 over Hyderabad region is higher compared to the other study regions as well Indian mean value. It can be attributed to urbanization and change in land use/land cover, anthropogenic CO2 emissions etc. Relatively less concentrations of CO2 are observed in the North East (NE) region due to more vegetation and less urbanization. The major sources for CH4 in the Indian region are rice, paddies, wetlands, and ruminants. The annual CH4 concentration over India is observed to be 1760 to 1795 ppb, with a maximum of 1800 ppb observed in post-monsoon and minimum of 1760 ppb in monsoon. Low CH4 during monsoon probably due to the reduction in atmospheric hydrocarbons. CH4 concentrations are observed to be highest over NE region followed by Punjab region as the CH4 sources are prominent in the respective regions.

Keywords: CO2, CH4, SCIAMACHY, seasonal variability

Abstract Id: 994
PM2.5 MAPPING WITH PORTABLE SENSOR DEVICES AND QZSS LOCATION DATA

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Air pollution is considered as one of the most serious widespread and growing issues in terms of people’s health and environment which our civilization has faced nowadays. As a result, there have been a massive study undertaken to measure and monitor air pollution, using various techniques such as: air quality measurement station, air pollution sensors or even remote sensing technology. Although these methods have achieved certain results, they are still quite expensive, inflexible or just available for large scale. PM 2.5 mapping with portable sensor device which is called Compact PM2.5 sensor might be the answer for this challenge. This sensor is supported by QZSS, a Japanese satellite-based positioning system which provides very high accuracy positioning and navigation. More than that, the sensor can be mounted on mobile phone with Wifi transmitter function provides air quality and GPS Position Data at the same time, therefore it can be noted as a novel approach in air pollution research. In this work, we take advantage of a low-cost portable PM2.5 sensor combined with multiple -satellite images to map PM2.5 content with study site is Komaba campus, Tokyo, Japan. Accuracy of the measurement was comparable to the ones provided by air quality stations.

Keywords: PM2.5, PM2.5 sensor, GNSS, air pollution, remote sensing

Abstract Id: 995
The development of morphometric techniques was a major advance in the quantitative description of the geometry of the drainage basins and its network. Watershed prioritization on the basis of morphometric parameters is necessary in order to develop a sustainable watershed management plan. The present study aims to assess the linear and shape morphometric parameters and prioritization of twenty-three sub-watersheds of Mun river basin for soil resource management. Mun river basin has an area of 116,226 km² and lies between 15°19′14″N latitude and 105°30′29″E longitude. Geographical Information System (GIS) techniques and Shuttle Radar Topography Mission Digital Elevation Model (SRTM DEM) data was used for evaluation of morphometric parameters. Watershed boundary has been prepared using Arc Hydro Tool. The prioritization was carried out by assigning ranks to the individual indicators and a compound value was calculated. Watersheds with highest compound value were of low priority while those with lowest compound value were of high priority. The highest priority zone consists of eight watersheds, medium of seven and low of eight watersheds. High priority indicates that watersheds are much more susceptible to soil erosion hence it should be provide with immediate soil resource management measures.

Keywords: Morphometric analysis, prioritization, Mun River Basin, SRTM and DEM

Abstract Id: 997
Drought is a complex phenomenon which occurs slowly and in a relatively long time can threaten the survival of the organism. In 2015, there were 47% provinces in Indonesia experienced drought. Lombok Island is one of the areas that are under threat annual drought. This is demonstrated by lack of the total water content in land surface and precipitation are distributed unevenly therefore affect the state of the ecosystem. Ecosystem has ability to store solar energy that converted into plant biomass, called primary productivity. The phenomenon of drought can reduce primary productivity by affecting the activity of photosynthesis. This study aimed (1) to describe the drought distribution of Lombok Island in 2010-2015, (2) study the role of land cover against drought phenomena, and (3) describe the relation between phenomenon of drought and the gross primary productivity (GPP). This study brings an overview of the relationship of drought with the ecological processes such as land cover types and primary productivity in ecosystems. The level of drought is expressed by the Vegetation Health Index (VHI) which calculated by data products, Normalized Difference Vegetation Index (NDVI) and Land Surface Temperature (LST), from Moderate Resolution Imaging Spectrometer (MODIS) satellite imagery. The result shows that during 2010-2015, Average of area affected by drought in the island of Lombok is 624 km² and the distribution are mostly found in the region of Central Lombok and East Lombok. Land cover type which less likely to experience drought is Evergreen Broadleaf Forest while Croplands is type of land cover which is prone to drought on the island of Lombok. During the study period, it can be shown that the drought in Lombok Island has an effect on biological productivity. Gross primary productivity tend to decrease with increasing levels of drought.

Keywords: Drought, Lombok island, Remote Sensing, MODIS, Land Cover

Abstract Id: 998
The study aims to enable the Ajmer city police towards spatial crime mapping and demarcation of hot spot zones towards better crime prevention control. This macro level research may benefit and assist the police officials towards generating their surveillance plan and crime control strategy in the region. Its basic objective is to identify crime prone zones through crime mapping with probability of occurrence based on the past incidence of various crime locations. Then provide spatial crime hot spots so as police can plan better surveillance plan and scheduling so as to minimize crime incidences and take preventive action in short time based on minimum distance maps. As per the scope, it provides a spatial decision making system to Ajmer city police for better surveillance scheduling. The study also presents alarming results for the concerned administrative departments as it indicates some strong correlations between the socioeconomic parameters and crime sprawl.

Keywords: Spatial Crime Mapping, Hot Spot Analysis, Geospatial Techniques, Surveillance Plan

Abstract Id: 999
The health of Himalayan glaciers has been a cause of prime concern for the scientific community as well as policy makers. The state of glacier dynamics is considered a significant indicator of glacier health. Surface ice velocity is one of the important parameters which determines the glacier dynamics. Surface ice velocity is driven by several factors which include changes in hypsometry and slope, mass load, orientation of the glacier, basal sliding, debris cover and the variation in meteorological parameters. Further, as remote and inaccessible location of mountain glaciers inhibits their field based monitoring, remote sensing with repeat and synoptic coverage offers the best alternative. In present study, we have used multi-temporal satellite images from Landsat Thematic Mapper (TM), Enhance Thematic Mapper (ETM+) and Operational Land Imager (OLI) sensors for past two decades (1992-2016) to ascertain the variations in the surface ice velocity of the Pensilungpa glacier, Suru sub-basin, western Himalaya. For estimation of glacier velocity, the standard procedures using image to image cross-correlation technique have been employed. The spatial pattern of fluctuations in surface ice velocity clearly indicate an overall glacier-wide slowdown which may be linked to the persistent mass loss. Analysis of supraglacial debris cover extents shows an increase of ~ 40% in past 23 years. The supraglacial debris cover over the glacier ablation and terminus considerably affects the surface ice velocity by restricting its flow. Thus, noticeable slowdown of the glacier together with significant increase in supraglacial debris cover suggest a persistent mass loss scenario and indicates towards the negative health of the glacier.

Keywords: Glacier health, Glacier dynamics, Surface ice velocity, Supraglacial debris, western Himalaya

Abstract Id: 1000
TIMBERLINE OF SIKKIM HIMALAYA IN CHANGING ENVIRONMENT:
GEOGRAPHICAL INFLUENCE ON DISTRIBUTION AND CONSERVATION PRIORITIES

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The Himalayan region presents the highest timberline in the northern Hemisphere which is sensitive to changes (climatic and anthropogenic). The present study analyzes timberline and topographical influences of mountainous terrain along altitudinal gradient in eastern Himalayan region. To analyze these influences watershed approach was adopted and timberline mapping was carried out using different satellite images to realize the impact of resolution at large scale mapping. In situations where difficult topography poses challenges to auto-extraction of features, use of visual interpretation and associated knowledge is more appropriate. Thus visual interpretation was employed. Total length of timberline mapped (at 30m resolution) was 828km in the state of Sikkim, however, and only 5% increase was observed mapping on finer scale (5.8m resolution). Thus, for regional or state level mapping (medium resolution) is efficient. In Sikkim, timberline at rare locations descends below 3200m amsl (negligible but present), however occurs in a considerable span of elevation (2.2 km) from 2600 to 4800m amsl altitude. Presence of timberline is more visual from 3200m onwards which scarcely reaches upto 4800m. More than half (56.8%) of the total timberline in the state exists in the narrow range of 400m elevation zone (3600-4000m amsl) which emphasizes most favourable environment for occurrence of timberline in eastern Himalayan region. Nearly one fourth (24.7%) extends above 4000m and only less than 1% above 4400m. Trees prefer moderate slopes thus 71% timberline is on the slopes <35 degree. Largely of the timberline was on warmer aspects (66%). Occurrence at island habitats (summit trap) without scope to escape from threats of global warming, makes timberline and species vulnerable. Topography of a watershed plays an important role in occurrence of natural timberline and various locations in different watersheds are critical for timberline conservation; an entity important for human sustenance, wildlife ecology, and species.

Keywords: Timberline, Eastern Himalaya, Topography, Altitude, Conservation

Abstract Id: 1001
DERIVING SURFACE TEMPERATURE OF NAAMEH LANDFILL AND ITS SURROUNDINGS USING LANDSAT 8 OLI AND TIRS ACQUISITIONS

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Solid waste disposal in landfill sites should be monitored continuously to prevent any potential threats to the environment. Since the stability assessment of landfill biodegradation processes demands intensive labor and high monitoring costs, researchers have attempted to use alternative and preferably non-destructive techniques, such as remote sensing. Furthermore, in many developing countries, like Lebanon, access to information is limited with restrictions on in-situ data collection. Thermal remote sensing, specifically, can be very helpful for landfill monitoring since biogas generation leads to an increase in temperature during the aerobic and anaerobic digestion processes. The objective of this study is to derive the land surface temperature (LST) of Naameh Landfill in Lebanon and its surroundings in different seasons using Landsat 8 acquisitions. At sensor temperature requires correction for emissivity and atmospheric effects to reach high-quality LST. Various approaches for such corrections exist with diverse difficulty and data requirements. Emissivity was estimated using normalized difference vegetation index (NDVI) that was calculated using Landsat 8 OLI (Operational Land Imager) multispectral acquisitions. Then, atmospheric correction of Landsat 8 TIRS (Thermal Infrared Sensor) data was carried out while considering the derived emissivity. This sensor includes two thermal infrared bands which allow the application of relatively simple atmospheric correction algorithms such as the split window algorithm (SWA). Three SWA were tested in this paper; however, the use of the single channel (SC) technique, although complicated and requires atmospheric data, is considered to be more accurate. Thus, one SC was also used for band 10 of Landsat 8. Finally, an assessment of the consistency of the derived LST with respect to such approaches was carried out along with an assessment of the impact of emissivity on this temperature.

Keywords: Landsat, Emissivity, Landfill, Temperature, Thermal Infrared

Abstract Id: 1002
INTEGRATING EXTERNAL GROUND POINTS IN FORESTS TO CREATE DTMS FROM DENSE-MATCHING PHOTOGRAMMETRY

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The biggest problem of generating a Digital Terrain Model (DTM) from the point clouds produced from aerial imagery with photogrammetry software is dense vegetation: when plants completely cover the terrain not a single point is generated on the ground. The complete lack of ground points in larger vegetated areas such as closed forests or plantations means that the many processing workflows for vegetation analysis that have been developed for LiDAR cannot be used for photogrammetric point clouds unless we are getting those missing ground points some other way. In the following we describe how to integrate external ground information with dense matching point clouds such that a reasonable bare-earth terrain model can be created and tree heights can be measured.

Our dense-matching example input has 35,338,368 points covering 3.4 square kilometer with an average point spacing of 31 centimeter. Attempts to ground-classify this point cloud directly are futile as there are no ground points under the canopy in the forested area. Therefore 558 ground points were manually surveyed in the forest of interest. They are spaced around 50 to 120 meters apart from another.

We first “densify” the manually collected ground points by interpolating them onto a two meter raster that is then clipped against a polygon delineating the forest of interest. We merge the result with the dense matching points and mark the lowest point per one meter grid cell. The marked points are then classified into ground and non-ground. Then the height of each point above the triangulation (TIN) of ground points can be computed. In all areas where external ground information was available we can now compute a reasonable Canopy Height Model (CHM) and measure tree heights.

All data and software modules will be available to the attendees so that they may reproduce the presented methodology after the conference.

Keywords: photogrammetry points, dense-matching, ground classification, data fusion, canopy height model

Abstract Id: 1003
DEMARICATION POTENTIAL AVALANCHE PRONE SITES USING MULTI CRITERIA DECISION MAKING ANALYSIS: A CASE STUDY OF BADRINATH REGION

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Avalanche sites are poorly studied and mapped in India due to their occurrence in deep Himalayan rugged terrain and fatal weather conditions. A case study is carried out to map the potential avalanche prone sites in Badrinath region. To map the avalanche sites Analytical Hierarchical Process (AHP) of Multi-Criteria Decision Making analysis (MCDM) is used. AHP is a decision aiding method developed by Saaty in 1980; it is most flexible and easily implemented MCDM technique. It is most applicable to solving problems that are characterized as a choice among alternatives. Here in this case study, static factors like aspect, ground cover, slope, curvature etc., which cause avalanches, are considered to map the potential avalanche prone sites. Advance Spaceborne Thermal Emission Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) 30m is used to derive the different factors and ground cover map is used. Rating and preference are subjective in nature and given on the basis of literature reviewed. Pairwise Comparison Matrix prepared and weights are generated. The maximum importance was given to the layer for which the degree in the avalanche occurrences was the utmost amongst its classes. The generated avalanche prone map show that 38.36 percent of total area lies in very high and high risk zone. To validate the result some existing avalanche sites polygons are overlaid on resulted map.

Keywords: AHP, MCDM, Avalanche, ASTER GDEM

Abstract Id: 1004
PRELIMINARY RESULTS ON VIIRS DETECTION OF POWER OUTAGES IN INDIA

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We present a methodology for the automatic identification of power outages using data collected by the Visible Infrared Imaging Radiometer Suite (VIIRS) day/night band (DNB). The method relies on the VIIRS cloud-mask to identify pixels that are confidently clear of cloud cover. A full year of low-moon data are analysed to derive: 1) areas with detectable lighting with radiance mean and standard deviation, and 2) the radiance mean and standard deviation for background areas having no detectable lighting. The background values are then used locally to identify incidences where the radiance in a known area of lighting dips into the background radiance range. Examples are provided from India.

Keywords: VIIRS, nighttime lights, power outage, low light imaging, DNB

Abstract Id: 1007
DISCRIMINATION OF IR EMITTER TYPES USING NIGHTTIME VIIRS DATA

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The VIIRS nightfire product is unique in providing the only daily near-real time global satellite mapping of IR emitters with estimates of temperature, source area, and radiant heat. Using temperature and persistence it is possible to distinguish three basic types of IR emitters. The two most widespread types are biomass burning and gas flaring. Biomass burning typically has a temperature range from 600-1400 K and low temporal persistence. Gas flare have higher temporal persistence and temperatures in the range of 1400-2200 K. Industrial and volcanic IR emitters are in the same temperature range as Biomass burning, but occur with a higher level of persistence. Taking a full year of nightfire data we have created a data base of gas flares and industrial IR emitters. This can be used to label and screen incoming IR emitters in near-real time, a key capability for identifying hazardous events such as wild fires and industrial disasters.

Keywords: VIIRS, nightfire, biomass burning, gas flaring, IR emitters

Abstract Id: 1008
At night, the Visible Infrared Imaging Radiometer Suite (VIIRS) has a remarkable capability for the detection of combustion sources and other IR emitters. The standard fire detection band is in the mid-wave infrared, near 4 μm. The VIIRS has two spectral bands in this range. In addition, VIIRS has four daytime imaging bands, in the near-infrared (NIR) and two short-wave infrared (SWIR) bands, that detect IR emitters against a dark noise background. The day/night band, straddling the visible and NIR, has extremely low detection limits that detects many IR emitters. In this study we report on an inter-comparison of detections from three sets of spectral bands (DNB, SWIR, and MWIR) in terms of source size and temperature.

Keywords: VIIRS, nightfire, biomass burning, gas flaring, IR emitters

Abstract Id: 1009
STUDY OF CLOUD MICROPHYSICAL PARAMETERS FOR TROPICAL CYCLONE VARDAH USING INSAT-3D DATA

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The formation and growth of clouds is controlled by several processes occurring at the micro scale which define the cloud microphysical properties (CMP) such as cloud optical thickness (COT) and cloud effective radius (CER). There are several studies showing the effect of CMPs on climate change but there are only very few which show their impact on short term weather events such as tropical cyclones. Moreover, studies which have been carried out for extreme weather events are limited to oceans in the mid-latitude regions but there are none reporting over the Indian Ocean. Keeping this in mind, we aim to analyze the cloud microphysical properties and investigate its effect over cyclone Vardah which was formed as a depression in Malay Peninsula intensified into a severe cyclonic storm and made landfall near Chennai dissipating on 13 December, 2016. In order to carry out this study, we have used geostationary satellite INSAT-3D retrieved COT and CER data. These parameters are derived every half hourly, using INSAT-3D visible and shortwave infrared (SWIR) radiances. Using this data, we have traced the COT and CER for each stages of cyclone Vardah. It was found that the range of COT varies from 18-75 and the range of CER varies from 15-50 microns. It can also be seen that during the initial stages, cloud droplets are distributed randomly throughout the area covered by the cyclone. But as it reaches its mature stage, due to system organization, droplets of larger sizes are found mainly over the rain bands. The micro-scale characterization of a tropical cyclone helps in identifying potential areas of heavy precipitation.

Keywords: Cyclone, Vardah, INSAT-3D, cloud microphysics

Abstract Id: 1010
DETECTION OF FOREST COVER CHANGES USING MULTI-TEMPORAL SATELLITE IMAGES

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Rapid development in Kuantan, Pahang has transformed it into a modernized city, as one of the social and commercial hubs for East Coast of Peninsular Malaysia. Many forests have been cut down throughout the development and causes serious forest destruction. This awakens local populations’ attention to the forest, because they realize the importance of the forest to the nature and environment. This study was conducted to detect the forest cover changes in Kuantan, Pahang for a period of 28 years, starting from year 1988 to 2016. In this regard, the multi-temporal Landsat satellite images were processed and classified for identification of forest and non-forest areas. Thereafter, post-classification change detection were adopted to detect the forest cover changes with 7 years interval within the study period. Results of this study reflected that there is a significant declination of forest cover within year 2002 to 2016, where the deforestation rate of year 2002 to 2009 is 5.32 thousand hectares/year whilst for year 2009 to 2016 is 4.48 thousand hectares/year. These results are vital as an input for the review of the deforestation track record in Kuantan, Pahang. It can be employed to mitigate the reduction of forest cover and its valuable forest resources to ensure better conservation and management of forest in Kuantan, Pahang. With such good forest management, is crucial to sustain the social, economic and ecological services in Kuantan for ensuring its development as the first Special Economic Zone in Malaysia under the East Coast Economic Region.

Keywords: Deforestation, change detection, forest cover changes

Abstract Id: 1011
GEOSPATIAL TECHNIQUES FOR HERITAGE SITE MONITORING AND EVALUATION OF TOURISM POTENTIAL IN UTTARAKHAND

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India is culturally rich country known for its cultural heritage through its nationally important archeological heritage sites and monuments. Monitoring of the heritage sites/monuments is essential as they face increasing risk due to unplanned urbanization, tourism, natural and man-made disasters, etc. In this study, geospatial techniques have been used for monitoring six national monuments / heritage sites (for eg. Kalinga monument in Dehradun, old cemetery in Roorkee) in Uttarakhand which are located in diverse geographic and economic conditions with different religious backgrounds. Multi-temporal high resolution satellite images viz., Landsat ETM+ (2000-2001), Cartosat-1 & LISS IV (2009-10) and other ancillary data have been used to monitor the development/expansion around the heritage sites within a specific buffer area encompassing its management zones viz., prohibited and regulated boundary. Landuse / Landcover (LU/LC) change analysis indicated changes in vegetation and built-up area categories, especially in the sites located within a city/town viz., Dehradun and Kashipur as compared to others located in remote areas, providing an important input for authorities for effective management. Evaluation of the tourism potential of these sites has been carried out to suggest planning strategies for overall area improvement including economic development. The tourism potential of the sites have been evaluated based on physical, social, and environmental parameters using weighted ranking method, a popular multi-criteria decision making tool. Based on the total tourist potential scores, the sites have been classified into four categories very high, high, medium and low potential and the planning strategies for improvement has been worked out. The methodology adopted in the study for monitoring can be extended to other nationally important monuments in Uttarakhand region for efficient management and conservation. The weighted ranking approach can be used to prepare a tourism developmental plan for improving the tourist inflows for other important heritage sites and monuments.

Keywords: CARTOSAT-1, LISS-IV, Landuse/Landcover, weighted ranking method, monitoring

Abstract Id: 1012
Mahabubnagar is one of the drought districts in Telangana. Major portion of the District is underlain by the Oldest Geological formation i.e. Archeans. The district groundwater level depends on many factors which is a combination of both the surface drainage area and the parcel of subsurface solid and geologic formations that underlie it. Groundwater occurs in all the geological formations in the district. The major rock types in the district are peninsular gneissic crystallines, limestones, conglomerates, sandstones, shales, basalts and alluvium. The occurrence and behaviour of ground water is an outcome of combined interplay of hydrological, geological, structural, climatological factors, which together form dynamic integrated system. All these factors are inter-dependent and inter-related, each adding its contribution in functioning of the dynamic system. An algorithm is developed for finding the relation between the groundwater and surface water for the Mahabubnagar district. Surface water maps from Resourcesat-2 LISS-3 sensor 25m resolution, district lithology maps, rainwater maps and evapotranspiration maps were used and generated 1 km groundwater products for the years 2014, 2015. These products were validated using Central Groundwater Board observatory water well values.

Keywords: Groundwater, Surface-Water, Resourcesat-2, Rock types, Mahabubnagar district

Abstract Id: 1013
SIMULATION OF BRIGHTNESS TEMPERATURE FROM MARTIAN ANALOGUE SURFACE/SUB-SURFACE FOR A STRATIFIED MODEL

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It has been established through flow structures that water flowed on Martian surface in the ancient times. Due to the very low temperatures (average temperature of Mars is about 218 K with a range of 140 K to 300 K) and very low atmospheric pressure the liquid water is not present on the surface of Mars. Subsurface ice has also been identified at the Mars Phoenix landing site. It has also been proposed that the shallow subsurface ice can remain stable on Mars in higher latitudes. The study of subsurface ice is very important for understanding the past and present water cycles. Water is also essential for life as we understand it. Therefore, the exploration for shallow subsurface water ice is an important endeavor.

A microwave radiometer is well suited to study the shallow subsurface which has not been explored by optical (which can only observe the surface) instruments or very low frequency radar (for which the shallow subsurface is a blind zone). A microwave radiometer measures the brightness temperature (BT) of the surface/subsurface. This BT can be used to estimate the physical temperature, layer thickness, dielectric properties, etc. of the subsurface using a model.

Keywords: Mars, microwave radiometer, brightness temperature, simulation

Abstract Id: 1014
PERFORMANCE EVALUATION OF FUSION TECHNIQUES FOR HIGH RESOLUTION SATELLITE IMAGERY

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Image fusion is being used since last two to three decades in Remote Sensing for various useful applications such as image classification, feature extraction, digital change detection, and many more. In the last decade various spatial and spectral resolution remote sensing satellites have been launched by many space agencies which has made the image fusion techniques more relevant for the remote sensing image based multi temporal and multi scale land use change detection and other applications. Acceptability of a fusion method for a particular application depends upon various factors; one of them is quality of fused image. Before using the fused image for any application, if quality of fused image is not assessed properly then final results which are deriving from it may not be correct.

Quality or content of an image is related to spatial and spectral properties. In this research paper the commonly used ten different image fusion techniques namely Brovey, Gram-Schmidt, Ehlers, HPF, IHS, Modified IHS, PCA, Wavelet based, ESRI pan-sharpening and FuzeGo have been evaluated. For the above investigations satellite images from the sensors IRS-P6 (Cartosat-1), RESOURCESAT-2 (LISS-IV) and OrbView-3 have been used. Study area is located in the Bhopal city, India. Quality of fusion results is assessed by performing visual analysis between fused image and multispectral (MS) image. Visual comparison is done based on better visibility of different land cover features such as roads, buildings, waterbody and sharpness of edges present in image. For successful evaluation of fusion process, five standard statistical parameters i.e. standard deviation (SD), correlation coefficient (CC), entropy/noise, RMSE and ERGAS have been used. Visual comparisons of fusion results obtained for test site have shown that FuzeGo algorithm has given comparatively better results than other algorithms. Statistical parameter CC & SD are found highest for IHS method. RMSE and ERGAS are found highest for Brovey method.

With respect to noise addition due to fusion, least noise is added by FuzeGo algorithm. Overall visual and statistical analysis indicates that FuzeGo has given better results which is followed by IHS as compare to other methods.

Keywords: Image Fusion, Quality assessment, Spatial quality, Spectral quality, IRS

Abstract Id: 1015
CHALLENGES IN DESIGN AND DEVELOPMENT OF VERY HIGH RESOLUTION CARTOSAT-2 SERIES IMAGING SYSTEMS FOR EARTH OBSERVATION

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Ever increasing national demand for cartographic applications from spaceborne platforms has led to the design and development of Cartosat-2 series imaging systems. Three satellites in this series are already launched and they are providing excellent imageries. The system is providing daily coverage of point of interest on ground from 505 km orbit sitting on an agile platform. This is the first time that a high resolution imaging system maps the earth surface in Panchromatic and Multispectral bands simultaneously with 0.65 meter and 1.65-meter resolution respectively and provides 10 km swath. State of the art techniques have been employed for their development and it has resulted in providing imageries which are best in this class and have proven to be highly beneficial for our country in various cartographic applications such as urban and rural development, town planning etc. The main challenge was in the design and realization of complex focal plane unit wherein large number of optical and electro-optical components required critical alignment of the order of sub-micron and equally stringent alignment stability under severe environmental conditions. These new techniques implemented successfully in Cartosat-2S paves way for the realization of many upcoming and future high resolution imaging systems for various missions of ISRO.

This paper aims to discuss various challenges faced in design and development of the high resolution high performance complex payloads. It provides the configuration details which meets the user requirements. Also it deals with the challenges in the realization of optical systems, focal plane assembly incorporating TDI detectors, miniaturized high speed, low noise electronics systems, thermal control aspects, ground test setups, performance testing and characterization aspects in detail. At the end it discusses the results obtained in performance evaluation of electro-optical parameters under various test conditions.

Keywords: Cartography, Focal plane assembly, electro-optical, TDI detectors

Abstract Id: 1016
DESIGN, DEVELOPMENT AND CHARACTERIZATION OF OPTICALLY BUTTED FOCAL PLANE OF CARTOSAT-2 SERIES PAYLOADS

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Complexity in focal planes of very high resolution spaceborne optical imaging systems for cartographic applications are ever increasing, with the demand of sub-meter ground sampling distance (GSD) having reasonably long swath coverage on the ground. Meeting these conflicting requirements with small format detectors and restricted real estate availability makes the realization of focal plane assemblies (FPA) very challenging task. In Cartosat-2 Series Payloads, these challenges have been met with innovative design of focal plane assembly using Optical butting technique. Optical butting technique links required number of CCDs together to form a continuous image line without occurrence of any gaps. An optical device like a flat mirror or a prism can be used to divide the image line into segments, which are then imaged on the individual CCD sensitive areas. All the sub images are composited to form a high resolution large format image. In Cartosat 2S, two detectors in Panchromatic (PAN) chain and five detectors in Multispectral (Mx) chain meets user requirement of 10 km swath with 0.65-meter GSD in Panchromatic and better than 1.6m GSD in multispectral chains from 505 km orbit.

The optical butting technique developed was successfully implemented in realizing the complex focal plane of Cartosat-2S that involves precise placement of fold mirrors and detectors within sub-micron accuracy inclusive of meeting the highly stringent stability requirements over the specified operational loads. These kind of complex FPAs pose great challenges in alignment and characterization of their components. A comprehensive realization approach was worked out for Cartosat-2S focal plane assembly. Sensitivity of each component in the focal plane assembly, which can lead to misalignment of detectors, were studied and suitable optimization process was identified. Passive and active mode of alignment methodologies, requiring the development of high precision test benches, were used in ensuring the alignment of all focal plane components. A novel methodology was developed for final characterization of FPA for which the TDI detectors were required to be operated in area array mode facilitating the active alignment of multiple detectors. The optical butting technique implemented successfully in Cartosat-2S paves way for the realization of many upcoming and future high resolution payloads for various missions of ISRO.

This paper presents the overall configuration of the focal plane, sensitivity studies on misalignment factors, performance optimization and characterization methodologies and test setups. The paper also discusses the results obtained and accuracies achieved in the detector alignment process.

Keywords: Cartosat-2S, Cartography, Optical butting, FPA, GSD

Abstract Id: 1018
The Assam is endowed with rich forests resources. The luxuriant evergreen and deciduous forests of the state consist of variety of valuable timber species, plants of medicinal, food, ethnical and commercial value. Schima wallichii is an important timber yielding species which is occurring mostly in the mixed moist deciduous forest in the state. However, at present, the forest in the state is highly fragmented due to encroachment and deforestation. Thus, predicting the potential occurrence of the species is important for conservation of its habitat. The paper presents the potential distribution of Schima wallichii using Maxent model. A total of 180 occurrence records of plant species from Assam were collated and used in the Maxent analysis along with the environmental input variables from the Worldclim bioclimatic variables, slope, aspect, elevation, soil and the forest types and predicted the potential distribution of the species in the study area. Response curves and jackknife measures of variable importance were created to provide additional descriptive data and graphs to help interpret the Maxent model. The model was highly accurate with the area under ROC curve (AUC) value of 0.98. The model provides an ideal tool for regional and state-wide assessments of the potential distribution of species and their habitats.

Keywords: Schima wallichii, AUC, habitat, Jackknife, Maxent model

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OPERATING TEMPERATURE STABILITY REQUIREMENTS OF SWIR
DETECTOR: DARK CURRENT & RESPONSIVIVITY VARIATION

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Semiconductor (HgCdTe or InSb, InGaAs) based photonic Infrared detectors are used for the realization of space-
borne Infrared imaging systems. These Infrared detectors are required to be cooled to cryo temperatures for their
operation. Without cooling detectors will be blinded. Two approaches are there for cooling of Focal plane array
(FPA) detector: (a) Passive cooling, which achieve operating temperature using heat pipes and radiator. (b) FPA
housed in a vacuum Dewar and attached to the tip of closed cycled He based cooler (Integrated Detector Dewar
Cooler based assembly, IDDCA). Operating temperature of the FPA is governed by the spectral band of interest.
Detector working in Short Wave Infrared (SWIR upto 2.5µm) generally requires nominal cooling of ~150K, whereas
Mid-Wave Infrared (MWIR -3-5µm) band IR detectors requires cooling of the order of 90K. In contrast detector
working in Long Wave Infrared (LWIR-7 to 14µm) band required to be cooled to very low temperature of the order
of 50K in order to reduce dark current and background signal. Apart from absolute temperature requirements of the
FPA, temperature stability of FPA is very much critical for stable detector output. FPA output variation shall remain
within the noise floor of FPA.

HgCdTe based SWIR (500 x 256 element) Array is used to conduct measurement for dark current, responsivity and
noise with varying temperature of the detector material. This FPA is in IDDCA configuration and cooled to 90K using
Closed cycle cryo cooler. FPA temperature is varied to study the behavior of detector output under varying
illumination and in dark. Black body is used for illumination of the IDDCA. Measurements are also conducted to
observe detector behavior under stable temperature region. Preliminary observations show that temperature
stability of better than 200mK is required so that output variation remains within the noise floor.

Keywords: Responsivity, Dark Current, SWIR, IDDCA, Focal Plane Array, HgCdTe

Abstract Id: 1021
FLOOD INUNDATION MAPPING AND DAMAGE ASSESSMENT IN LAKHIMPUR DISTRICT, ASSAM USING FREELY AVAILABLE SAR DATA AND OPEN SOURCE GIS SOFTWARE

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Flood is a perennial problem plaguing large parts of the country. Assam is one of the worst affected states that is suffering from flood and Lakhimpur is one of the districts in Assam which experiences frequent floods because of the river Subansiri and its tributaries, which emerged from Arunachal Pradesh, create flood havocs during monsoon period. Floods cause large-scale damages to the socio-economic life of the people as well as to the ecology and environment of the study area to a certain extent. Remote Sensing is a very reliable and expeditious techniques for assessment and mapping of flooded areas. This study introduces to generate flood inundation maps using combination of Synthetic Aperture Radar (SAR) imagery and Geographic Information Systems (GIS) for flood event of Lakhimpur District, Assam, India. Damage assessment of the study area due to the flood was also performed. The flood inundation areas were extracted from SAR images (Sentinal-1A, ALOS PALSAR-1) by several image processing techniques. Histogram or radiometric thresholding techniques was used in this study to extract the flood extent from SAR images. Band ratio based Normalized Difference Water Index (NDWI) was used to extract the water bodies from Lansat-8 imageries. Thresholding of NDWI for optical image and SAR images was done using respective histograms to distinguish water and terrestrial features. To extract the actual flooded area, the water body maps generated from Landsat-8 was multiplied with their respective water maps generated from the SAR imagery. Assessment of damage due to flood was performed using flood inundation and land use land cover changes by QGIS. The result shows that crop land (200 km²) and around 85 villages are under the flood affected area. This study shows that integration of SAR data and GIS environment can be exploited in an efficient way to predict and map the flood areas.

Keywords: Flood, SAR, NDWI, GIS, Assam

Abstract Id: 1022
REGION GROWING BASED CLUSTERING FOR FLOODED AREA EXTRACTION IN SAR IMAGE

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This study presents a method to capture the flood affected area in SAR image. It initially locates a pixel in SAR image whose intensity value is equal or close to minimum intensity value in that image. This is adapted since, SAR reflectance values of flooded area is less than the other regions due to higher dielectric constant in those regions. Thereafter the identified seed point is confirmed locally based on two parameters corresponding to intensities and percentage of occurrence of intensities around the seed. Densely populated range around the seed point is computed in the second step. Subsequently in third step, from the seed point, regions are grown till the intensity value of that point is within the range. These three steps are continued till all flooded regions are captured in SAR image. The algorithm works with minimum human interaction and is validated by applying on RADARSAT-2 data.

Keywords: Synthetic Aperture Radar; Flood area extraction; seed; region growing; clustering

Abstract Id: 1025
DEVELOPMENT OF ARTIFICIAL NEURAL NETWORK BASED MULTI MODEL ENSEMBLE TECHNIQUE TO IMPROVE RAINFALL FORECASTS OVER THE INDIAN REGION

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A new multi model ensemble (MME) approach using the artificial neural network (ANN) technique is developed to predict 24-120 hours’ monsoon rainfall over the Indian region. The developed nonlinear ANN-MME technique accounts for nonlinear correlation between member models to produce skillful forecast. The weights of all the neurons used in the input layer, hidden layer and output layer of ANN architecture are computed separately for all the grids to include the different relationships at all the geographical regions. The forecasts skill of ANN-MME technique is compared with the simple ensemble mean, regression based multi-model ensemble approach, and with the participating member models. The ANN multi-model ensemble shows improvement over ensemble mean, regression based multi-model ensemble and the member models. The developed technique is a generic approach that can be applied to other multi-model ensemble fields as well as to single model ensembles.

Keywords: Artificial neural network, Multi-model ensemble, Global models, Rainfall forecast

Abstract Id: 1026
SCATTERER DETECTION USING FAST SUPPORT DETECTOR FOR WIDE AREA PROCESSING

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SAR tomography [1] is a multi-baseline and multidimensional technique that localizes the scatterers on the ground surface and generates accurate 3D profile of a scene. Among many tomographic techniques, Fast Support Generalized Likelihood Ratio Test (Fast-Sup-GLRT) [2] is a multi-step statistical hypothesis test based on Constant False Alarm Rate (CFAR) approach, that detects the presence of scatterers with a fixed probability of false alarm (PFA). Low PFA controls the occurrence of outliers and achieves super resolution in the elevation direction, with significant reduction in computational cost for detecting the multiple scatterers in the single resolution cell. With its ability to deal with the computational complexity, the test has been extended further to obtain deformation and thermal dilation estimates [3] (5D reconstruction). The computational burden is mainly due to the size of the unknown vector that depends on the orthogonal and temporal baseline spans, on the temperature range of the acquisitions and on the scene under study. In order to retrieve the scatterer position and their temporal and thermal displacements, the measurement matrix has to be traversed sequentially to find the best signal support which maximizes the generalized likelihood ratio test. As an add-on to the detection method, the MapReduce framework, which has been built on parallel computing model, is adopted to optimize the computational cost and extend the method for the monitoring of wider areas.

Keywords: SAR, tomography, Big data, parallel processing

Abstract Id: 1027
EXTRACTION OF SEAGRASS BIOPHYSICAL PARAMETERS USING UNMANNED AERIAL SYSTEM

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Carbon dioxide concentration in the atmosphere is drastically increasing every year because of continuous development of industrial activities of today’s society. An active research regarding carbon sequestration and carbon storage is progressing, demanding for more investigation and analysis of carbon sinks. Recent studies found out that coastal wetlands - mangroves, saltmarshes, and seagrass, are far more capable of carbon sequestration and carbon storage than terrestrial ecosystems. In this study, the RGB aerial images using Unmanned Aerial System (UAS) will be utilized for classification of seagrass and extraction of seagrass density and percent cover. UAS survey was conducted in Anda, Pangasinan to gather RGB images and field samples were also collected. The images were mosaiced to produce an orthophoto. To classify seagrass from non-seagrass areas, object-based classification (OBC) and pixel-based classification (PBC) were used and compared by implementing the Support Vector Machine (SVM) and Maximum Likelihood method. Mixture Tuned Matched Filtering was performed for derivation of the percent cover and density. Results showed that OBC having an overall accuracy of 93% produced higher accuracy than PBC which yields 86%. Meanwhile, most seagrass areas are categorized with dense and continuous density. The study proves that Unmanned Aerial System (UAS) is an effective approach for seagrass cover mapping because it produces high resolution images resulting to more accurate maps.

Keywords: UAS, Seagrass Mapping, Classification, Biophysical Parameters, Density

Abstract Id: 1028
The Nalsarovar Lake, a Ramsar site, is a beautiful bird sanctuary on the borders of Ahmedbad and Surendranagar districts of Gujarat. Hundreds of species of birds and other flora and fauna can be experienced here in a mere single visit. It is not only full of life but also gives life and livelihood to people living around this lake. Bustling with activities and roosting of birds, this lake is also quite fragile and vulnerable to damage and degradation even with the slightest of change in its environment. This is why it becomes important to study this lake and look at the aspects which can harm it. Nal Sarovar being a seasonal lake shrinks considerably during pre-monsoon period and inundates large area post-monsoon. Changes in lake area from season to season is a normal phenomena but temporal changes in lake area over the years is important to study as it might indicate adverse impact on monitoring healthy environment in a shallow lake like Nal Sarovar. In this study satellite imageries covering three decades from Landsat 5-TM (Thematic Mapper), Landsat 7-ETM+ and Landsat 8-OLI were used from years 1989 to 2016. To study the changes in lake area time steps used were 1989, 1996, 2006 and 2016. From the imageries taken for four years (1989, 1996, 2006 and 2016) the pre and post monsoon changes in lake surface area were found out which included deep and shallow water with submerged and emergent vegetation. However, increase in lake surface area in October, 2016 (127 sq km) from December, 1989 (79 sq km) and October, 1996 (63 sq km) with almost similar rainfall range is an important event attracting attention in the study. Despite having average rainfall in these three years, the lake water is seen to have increased significantly by 60.70 per cent in 2016. The current situation of Nal Sarovar Lake with increased water level threatens its ecological balance. Many bird species have lost their habit as the water has become too deep for them to nest and hunt. This situation can be alarming as it directly leads to a drop in the number of migratory birds. Nal Sarovar is more likely to become home to diver and swimmer birds which favour deep water, whereas, other birds are losing their habitat and flying to other sites. This situation is not only affecting birds but is also altering the vegetation cover in the shoreland area. The satellite data for monitoring and estimating changes in lake area and its environment have been very useful. Constant monitoring of such environmentally important regions becomes important in order to take the necessary steps to protect water resources.

Keywords: Lake Nal Sarovar, Water Area Changes, Landsat Imageries, expanding lake, endangered wetland

Abstract Id: 1029
CREATION OF THE LAND USE SUSTAINABILITY ASSESSMENT TOOL

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Measuring the comparative sustainability levels of cities, regions, institutions and projects is an essential procedure in creating sustainable urban futures. The aim of the research is to do Multi-Criteria Decision Analysis based land use sustainability assessment tool and use open source software. The research has following objectives: to formulate sustainability indicators in land use sustainability assessment and criteria by comparing on previous Mongolian and international published researches, to observe GIS-based open source software, to create land use sustainability assessment tool use the python programming language, to test the tool to do land use sustainability assessment at the Khushigiin khundii, Tov aimag, to do field survey, to check sensitivity of integrated sustainability model compatibility with ground true references through error matrix calculation. The weighted linear combination of factors presents following values:

\[ S = \text{slope} \times 0.374 + \text{subsidence} \times 0.231 + \text{permafrost} \times 0.14 + \text{elevation} \times 0.117 + \text{density of ravine} \times 0.018 \]

To observe GIS-based open source software and select the QGIS (Quantum GIS). Using Qt application development framework which is doing plugin for QGIS. It is written by python programming language. To test the tool, doing land use sustainability assessment at the Khushigiin khundii and assess the 5 type. It can be concluded that sustainability modeled is field survey correct according to the result of overall accuracy 0.73 and Kappa coefficient 0.65.

Keywords: sustainability assessment tool, QGIS, python

Abstract Id: 1030
MULTITEMPORAL SATELLITE IMAGES FOR URBAN CHANGE DETECTION

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Remotely sensed imagery is a type of data that is compatible with the monitoring and mapping of changes in built-up and bare land within urban areas as the impacts of population growth and urbanization increase. In this study, a new index for transforming remote sensing data for mapping built-up and bare land areas is proposed. The Built-Up Index is able to map built-up and bare land areas using a single calculation and to contain Normalized difference built-up index (NDBI), Normalized difference bareness index (NDBaI), Index-based built-up index (IBI), Urban index (UI) and Enhanced built-up and bareness index (EBBI). The first built-up and bare land index that applies near infrared (NIR), short wave infrared (SWIR), and thermal infrared (TIR) channels simultaneously.

The research has following objectives: to calculate Enhanced built-up and bareness index (EBBI), Index-based built-up index (IBI), Normalized difference built-up index (NDBI) and Urban index (UI) to use Landsat TM images from 1988 and 2002, Landsat OLI images from 2015 at the Ulaanbaatar, Mongolia. To do density slicing, image classification and calculate indices. Result, the most suitable index is Enhanced built-up and bareness index (EBBI) in Ulaanbaatar. To calculate EBBI in 1988, classification accuracy 82%, user's accuracy 85% and overlay accuracy 87%. In 2002, classification accuracy 92%, user's accuracy 91% and overlay accuracy 90% and in 2015, classification accuracy 94%, user's accuracy 93% and overlay accuracy 91%. To field survey, comparing by calculate indices using Landsat images and Worldview 2 satellite images in Baga Toiruu. And comparing by calculated EBBI and Worldview 2 satellite images are accorded in 98.6%.

Keywords: change detection, built-up area, Ulaanbaatar Mongolia

Abstract Id: 1031
PHENOLOGY-BASED SPECTRAL STUDIES OF THE MANGROVE ECOSYSTEMS OF SOUTH EASTERN INDIA - IMPLICATIONS FOR SPECIES LEVEL MAPPING

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The Coringa, Pichavaram and Muthupet mangrove ecosystems along the south-eastern India coastal tract have high species diversity. Though remote sensing proves to be a viable tool to continuously assess the distribution and dynamics of such mangroves and the associated species, a major issue is the lack of details on the phenology of the mangrove species in the ecosystems. Phenological parameters that describe foliation and senescence periods are pertinent for accurate delineation of the species. This study proposes a novel approach to characterize the VNIR-SWIR spectra of the mangroves based on species-phenology. Sentinel-2 data with an optimal spatial (20m), spectral (13 bands) and temporal (10 days) resolution, acquired in the 443nm to 2190nm range formed the ideal data set used to study the spectral characters of the three mangrove ecosystems for the foliation and senescence periods. Additionally, the spectra of the associated vegetation viz. Prosopis, Casuarina, Paddy and Groundnut are derived. The signatures of the different phenological periods are compared using the spectral matching algorithms: Spectral Angle Mapper (SAM), Jeffries-Matusita (JM) distance, Spectral Correlation Mapper, combined JM-SAM and JM-SCM. The spectra-based matching is extended to a supervised classification system resulting in species-wise delineation for the different phenological periods. The two bands centred at 705nm and 740nm around the red-edge position in the Sentinel-2 data contribute to the distinct spectra of the same species across different time periods. Further, this study accurately captures the distribution of common species of the Avicenniaceae and Rhizophoraceae family, which possess differing ecological characteristics. The phenological difference in the dominant species of Coringa region (Excoecaria agallocha) is reported. The influence of deltaic freshwater on the growth of the mangrove species is also analysed. Thus, this study highlights the wavelength regions and the phenological parameters required for accurate delineation of the mangroves.

Keywords: spectral matching, mangroves, phenology, Sentinel

Abstract Id: 1032
COMPARISON OF DIFFERENT DATA SOURCES FOR REGIONAL CROPLAND MAPPING ACROSS AGRICULTURAL SYSTEMS OF DIFFERENT GEOGLAM JECAM SITES

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Agricultural lands are changing continuously and intensively under the context of global warming and human-induced transformation. Accurate annual cropland information is of significant importance for agricultural monitoring and food security. However, cropland mapping at large scale is always costly and labor intensive to collect ground truth data. This activity seeks to test the feasibility of calibrating a generalized classification algorithm by other sources, mainly crowd source data and existing land cover maps. Given the variability of agricultural systems worldwide, the paper includes several study areas located at different countries which will greatly strengthen the results of this attempt. Within the GEOGLAM-JECAM collaboration network, 5 JECAM sites including China Shandong, Russia - Stavropol Kray, Argentina - San Antonio de Areco, Canada - Ottawa, and Ukraine were selected to represent different agricultural systems. Each site covers six tiles of Landsat 8 OLI imageries. The acquisition date for Landsat 8 images for Argentina site (Southern Hemisphere) is from July 2015 to June 2016 while for other four sites (Northern Hemisphere) is from January to December 2016 in order to cover the full growing season. Locally-adaptive Random Forest algorithm will be applied to all sites for classification. In situ, crowd source (CS) and land cover derived (LC) input data sources will be compared indirectly based on the accuracy of regional large-scale cropland maps. CS data will be generated by independent collaborators using multi-temporal high resolution images (Sentinel 2 / Landsat 7/8) by visual interpretation. LC data will be derived from GlobeLand 30. Another point is to assess the applicability of three data sources for regional large-scale cropland mapping across the globe. It is found that crowd source data is sufficient for large scale cropland mapping and tackles a central logistic and economic burden of global cropland mapping: gathering ground truth data.

Keywords: Cropland mapping, JECAM, Remote Sensing, Crowd source

Abstract Id: 1033
TO ASSIGN APPROPRIATE CLASS LABELS TO REPRESENTATIVE SPECTRA DERIVED FROM GEOREFERENCED REMOTE SENSING IMAGE HAVING HETEROGENEOUS NEIGHBORHOODS

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The present study implemented to assign appropriate class labels to spectra after georeferencing the image having heterogeneous neighbourhood for crop classification. Conventionally spectra derived from georeferenced image from the location where field data were collected used as representative spectra for classification. Representative spectra derived from georeferenced image may provide a good approach if neighborhoods of 9 pixels (3X3) have same crop class if data recomputation was carried out by nearest neighbour resampling. If not the pixel may lose its original location values due to resampling hence it cannot relate accurately to image data which is required to be classified. As a solution to this an attempt has been made to assign appropriate class labels to spectra from neighborhoods of 9 pixels (3X3) based on spectral similarity with collected field spectra. The effectiveness of labeled spectra based on spectral similarity was evaluated by spectral discrimination measures and found higher discrimination values compared to spectra directly extracted from georeferenced locations. Image classification is separately carried out using spectra developed by spectra directly extracted from georeferenced locations and spectra assigned by Spectral Information Divergence (SID) spectral similarity measure. To test the classification accuracy classified images were cross validated against ground truth collected during field study. Overall classification accuracy of the image classified by spectra derived from georeferenced image is 85% and for the image classified by spectra assigned through spectral similarity based approach is 91 %. Reasonable higher classification accuracy shows effectiveness of SID based spectral similarity to develop representative spectra in heterogeneous field condition.

Keywords: Spectral similarity measure, Spectral Information Divergence, hyperspectral, modified minimum noise fraction, pixel purity index

Abstract Id: 1034
In this presentation I shall provide a short review of the properties of Narrow-line Seyfert 1 (NLS1) galaxies across the electromagnetic spectrum and of the models to explain them. Their continuum and emission-line properties manifest one extreme form of Seyfert activity. NLS1 galaxies may hold important clues to the key parameters that drive nuclear activity. Their high accretion rates, close to the Eddington rate, provide new insight into accretion physics, their low black hole masses and perhaps young ages allow us to address issues of black hole growth, their optical Fe II emission places strong constraints on Fe II and perhaps metal formation models and physical conditions in these emission-line clouds. To study the properties in the long-term (optical variability) we are using CCD photometry. Observations of one particular object (B2 1111+32) will be discussed.

Keywords: Narrow Line Seyfert, variability, photometry

Abstract Id: 1035
The share of global population in metropolitan areas has grown from 29% in 1950 to well over half today, and it is predicted to reach 66 percent by mid-century (UN Habitat, 2016a). As the population, economic activities, social interactions, as well as environmental and humanitarian impacts, are increasingly concentrated in cities, this poses massive sustainability challenges (UN-Habitat 2016). With 50% of the world’s population already in cities, and substantial urban population growth projected over the coming decades, there is a pressing need for new tools and approaches that strengthen local administrations and citizens to better protect human, economic, and natural assets of our towns and cities.

Urban green space (UGS) constitutes critical biodiversity hotspots in crowded, concrete-dominated city environments. Despite the importance, UGS remain little researched (Nagendra and Gopal 2010). Mapping and monitoring the changes in UGS are important tasks because of the role of UGS in promoting air, climate and water quality, the reduction of noise, the protection of species and the development of recreational activities (Puissant, Rougier et al. 2014).

Very high resolution imagery and object-based image analysis (OBIA) offer a viable semi-automatic solution in mapping the UGS in a greater detail. In this study, GeoEye image is used to map the spatial distribution of UGS in Kalaburagi, India. Normalised Difference Vegetation Index (NDVI) values are used including fuzzy rule sets in classifying the image in OBIA environment. The UGS extraction results are highly accurate (> 90%). The results are crucial to urban planners as the results are critical to the Kalaburagi city where 22 administrative wards out of 55 in Kalaburagi have less than 10% of UGS and 25 out of 55 wards have less than 9m² Per Capita Green Space (PCGS). Priority has to be given to these areas to build healthy city through green planning.

Keywords: Urban Green Space, Object based Image Analysis, Kalaburagi, Per Capita Green Space, Green planning

Abstract Id: 1036
PREDICTING POTENTIAL INVASION OF LANTANA CAMARA USING SPECIES DISTRIBUTION MODELLING IN THE PART OF CENTRAL HIMALAYA : CASE STUDY OF GARHWAL DIVISION OF UTTARAKHAND

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The impact of climate change in climate impinges on various mechanisms and components of the earth ecosystem to the species level. The increasing atmospheric GHG concentrations change the various individual components of the system with a broad range of response with times. The combined effect of spatial and non-spatial climate and environmental variables of species interaction dynamics helps in assessing the potential consequences of climate change for plant invasion. The threat posed by invasive species to biodiversity may be exacerbated by climate change. Lantana camara L. (lantana) is a woody shrub that is highly invasive in many countries of the world. It has a profound economic and environmental impact worldwide. Knowledge of the likely potential distribution of this invasive species under current climate will be useful in planning better strategies to manage the invasion. Predicting potential geographic distribution of the species is important from species occurrence and management planning purpose. This paper fact the results of a study carried out in Garhwal division of Uttarakhand State in India on potential distribution modeling for Lantana camara using MaxEnt model. The Worldclim bioclimatic variables, slope, aspect, elevation, forest type data and spatially well-dispersed species occurrence points were used to predict the potential invasion distribution of Lantana camara. Jackknife test was used to evaluate the importance of the environmental variables for predictive modeling. The approach could be promising in knowing the potential invasion of species and thus, can be an effective tool in its management and other appropriate planning. This will not only help in distribution but its extend of proliferation in global climate change scenario

Keywords: Invasion, Climate change, Lantana camara, MaxEnt Model, WorldClim

Abstract Id: 1037
EXTRACTION OF LANDSCAPE ELEMENTS IN HASAMI RICE TERRACE WITH UAV

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Onigi rice terraces were collapsing by the abandon of cultivation and crop diversification at present. Immediate preservation of rice terrace landscape is required. In this study, the authors tried to analyze the structure of rice terrace landscape and extract the characteristics of the landscape. Then, land uses, the state of slopes, the elements of landscapes, and their locations were obtained by the field work and collection of materials. In extraction of landscape elements, two types of classification for land uses were carried out with UAV. As a result, the characteristics of Onigi rice terraces were different land uses depending on the elevations, old stone structures remained, and three different watersheds in landform. Moreover, point elements of landscapes were houses and temples, while areal elements were stone structures and settlements in landscape of rice terraces. As a total, three rivers form different landscape structures

Keywords: Classification, Land use, Remote sensing

Abstract Id: 1038
Changes in the of tropical cyclones developing over the Bay of Bengal have been studied using multi sensor data. The role of cyclones and variations of ozone and relative humidity (RH) are investigated for two severe cyclones Vardah and Nanda (2016) over the Bay of Bengal. Ozone concentration from Microwave Limb Sounder along with RH profiles obtained from Sounder for Probing Vertical Profiles of Humidity from NPP Suomi and GPSRO profiles, upon analysis at different pressure levels, revealed a rapid increase in RH and ozone concentration from lower troposphere to upper troposphere one day before to the landfall for both cyclones. It is mainly used to estimate mass and momentum exchanges between troposphere and stratosphere which suggest the drastic increase in RH and ozone concentrations in UT and relative change in tropopause height due to high convective activity. Variations in the vertical profiles of ozone and RH during cyclonic period acts as a tracer for stratosphere-troposphere exchanges during the study period.

Keywords: Cyclones, Vardah, Nanda, GPSRO, Bay of Bengal

Abstract Id: 1039
SPATIO-TEMPORAL ANALYSIS OF HUMAN MOBILITY IN CAIRO USING PERSON TRIP SURVEY DATA

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The rapid growth rate of urban populations may outpace the development of needed urban infrastructure, such as related to transportation, therefore, resulting to inadequacy of public transportation services and traffic congestion. Such as the case of Cairo, the capital of Egypt and which is considered as an economic and political hub for North Africa. Accordingly, in order to come up with a solution to this traffic congestion problem in Cairo, initially there is need to acquire a better understanding of the urban dynamics and people flow in the capital. As such, this study aims to investigate people flow in Cairo on a macroscopic scale by utilizing person-trip (PT) survey data provided by the Japan International Cooperation Agency (JICA) in 2001. The PT survey covers daily commuting routine of a large sample size of the city population. The data was able to provide a good representation of people flow in the city despite its low temporal and spatial resolution. Preprocessing and validation of the PT dataset was initially carried out to remove errors and inconsistency. Land cover was then created so that spatial smoothing in the geocoding step can be applied in order to obtain a probabilistic origin and destination of each trip. Using transportation network extracted from OpenStreetMap, the shortest route was determined for each trip following Dijkstra algorithm, and finally the position of the user along the route was interpolated for one-minute intervals. The peak hours were found as 6:00-8:00 am and 2:00-3:00 pm, which correspond to the official working hours in Cairo (8:00 am-2:00 pm), and the most used mode of transportation is shared taxi, followed by public bus. Finally, the output of this study may be further analyzed for planning and designing more efficient transportation infrastructure with the goal of improving urban mobility in Cairo.

Keywords: People flow, human mobility, spatio-temporal analysis

Abstract Id: 1040
Semi Automatic Rule Set Based Feature Extraction Approach For Change Detection In Coastal Ecosystem - A Case Study Across Kochi Region

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Change detection of coastal ecosystem plays a vital role in monitoring and managing natural resources along the coastal regions. The present study mainly focuses on decadal change in Kochi islands connecting the urban flatland areas and the coastal regions where sand deposits have taken place. With this in view the change detection has been monitored in the Kochi area to apprehend the urban growth and industrialization leading to decrease in wetland ecosystem. The region lies between 76°11'19.134"E to 76°25'42.193"E and 9°52'35.719"N to 10°5'51.575"N in the south-western coast of India. The IRS LISS-IV satellite image has been processed using rule based algorithm to classify and to interpret the changes between 2005 & 2015. The approach takes two steps i.e. extracting features as a single geographic information system (GIS) vector layer using different parametric values and to dissolve them. The multi-resolution segmentation has been carried out at scale ranging from 10-30. The different classes like aquaculture, agricultural land, built-up, wetlands etc... were extracted using spectral, geometric and textural parameters using threshold values based on rule set algorithm. The objects obtained in the segmentation process were visualized to be overlaying the satellite image at a scale of 15. This layer was further segmented using the spectral difference segmentation rule between the objects. Result shows a rapid increase in industrial area of 40% based on industrial area statistics of 2005. There is a decrease in wetlands area which has been converted into built-up. New roads has been constructed which are connecting the islands to urban areas as well as highways. The increase in coastal region has been visualized due to sand depositions. The outcome is well supported by quantitative assessments which will empower rich understanding of land use land cover change for appropriate policy intervention and further monitoring.

Keywords: Segmentation, IRS, LISSIV, Land Use Land Cover

Abstract Id: 1041
DEVELOPMENT OF STATE-OF-THE-ART CHARACTERIZATION TEST BENCH FOR INTEGRATED DETECTOR DEWAR COOLER ASSEMBLY BASED INFRARED FOCAL PLANE ARRAYS

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Large format Infrared Focal Plane Arrays (IRFPAs) are envisaged to be used in ISRO’s future remote sensing programs for multispectral and hyperspectral imaging applications. These IRFPAs consists of two dimensional (2D) photodiode array hybridized with high performance Read-out Integrated Circuits (ROICs). An Integrated Detector Dewar Cooler Assembly (IDDCA) is essential to characterize such IRFPAs at desired cryogenic temperature in lab conditions. In an IDDCA, the FPA sits over the cold tip of an active cryo-cooler and the detector cooler assembly is vacuum sealed in a thermally isolated Dewar. Characterization of such IDDCA based IRFPAs require tremendous expertise in the fields of optics, thermal, mechanical and electronics. A high performance state-of-the-art test bench is developed to characterize electrical, electro-optical, mechanical and thermal characteristics of IDDCA based IRFPAs. The setup is designed with a modular approach whereby the required equipments can be connected depending on the parameter to be measured. Major features of the developed test bench are: (i) Cooler vibration isolation to the FPA and to the mounting platform, (ii) FPA operating temperature and Cooler skin temperature control, (iii) Cooler cool down curve and thermal characteristics measurement, (iv) Generation of low noise tunable bias and programmable timing and control clocks for FPA operation, (v) ROIC on-chip register programming for gain, integration time, frame rate and windowing control, (vi) Multi-port video data digitization, (vii) Digital data acquisition and (viii) Online data processing. Validation of the developed test bench was carried out by characterizing a large format SWIR IDDCA where the FPA is operating at 150K. This paper gives design details and validation test results of the developed IDDCA characterization test bench.

Keywords: Infrared, IRFPA, Cryocooler, IDDCA, Characterization

Abstract Id: 1043
MODELLING OF SUITABLE TIGER HABITATS USING PREY BASE DISTRIBUTION AND ANTHROPOGENIC PRESSURE IN TERAI-ARC LANDSCAPE OF UTTARAKHAND

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Wildlife conservation is a long term commitment to the ecosystem structure and function and hence the landscape. The Tiger (Panthera tigris) population in India has undergone a sharp decline during the last few decades. Habitat evaluation and its scientific management is a foremost task of wildlife manager for Tiger conservation. In the present study evaluation of potential habitats was carried out through Habitat Suitability Index model using Remote Sensing, Geographic Information System using Multi-criteria analysis. The current study evaluates habitat suitability for tigers (Panthera tigris tigris) and its prey species in Terai arc landscape of Uttarakhand, India. Tiger distribution mainly depends on distribution and availability of sufficient prey species. Tiger's preferred prey includes in the study area, were Chital (Axis axis), Sambar (Cervus unicolor), Wild-boar (Sus scrofa), Barking deer (Muntiacus muntjak), and Nilgai (Boselaphus tragocamelus). Different variables such as vegetation type and land use, forest density, measures of proximity to disturbances and water resources and a digital terrain model were taken into consideration. Based on these variables habitat suitability map of tiger and its prey was generated. All these variables were considered as input data for developing the model. Secondary data, expert’s views and field experience were considered while allotting values to variables for Analytical Hierarchy Process to generate final weight. The model revealed that out of 21940.61 km² of total area, 14.58% of forest area was very highly suitable for tiger, whereas, 21.41% highly suitable, 16.38% moderately suitable and the remaining 47.63% was least suitable. The study shows around 11,490.2 sq.km of potential tiger habitats lies outside the tiger reserves of Uttarakhand. This research provides information about potential areas that can be declared as Tiger Reserves, a federal designation of protection.

Keywords: Multi-criteria analysis, Remote sensing, GIS, Tiger habitat suitability

Abstract Id: 1045
The utility of Geostationary active fire detection and surveillance has recently been supplemented by two new algorithms developed by our group: the AHI-FSA (Advanced Himawari Imager - Fire Surveillance Algorithm) and the Broad Area Training (BAT) method (Wickramasinghe et al., 2016, Hally et al., 2017). Here we present results from a large area validation of these products to support wildfire surveillance and mapping using the geostationary Himawari-8 satellite.

Presently, the AHI-FSA/BAT algorithms have only been tested on a number of case study areas in Western Australia. Initial results demonstrate a high potential as a wildfire surveillance algorithm providing high frequency (every 10 minutes) fire-line detections. However, the AHI-FSA and BAT products need to be validated over a large area to quantify the performance of the algorithms. This paper validates their performance in the Northern Territory of Australia (1.4 million km2) over a 10 day period by comparing AHI-FSA/BAT to well-established products from LEO satellites: MODIS (Moderate Resolution Imaging Spectroradiometer) and VIIRS (Visible Infrared Imaging Radiometer Suite). This paper also discusses difficulties in validating high temporal resolution products with existing low temporal resolution LEO satellite products. Results indicate that the multi-resolution approach developed for AHI-FSA/BAT significantly improve the fire detection. When compared to the MODIS thermal anomaly products, AHI-FSA/BAT omission error was only 2%. High temporal frequency data results in AHI-FSA/BAT detecting fires, at times, three hours before the MODIS overpass with much-enhanced detail on fire movement.


Keywords: Himawari, Fire detection, Wild fire surveillance, validation

Abstract Id: 1047
INFLUENCE OF WINDS ON ATMOSPHERIC CO$_2$ CONCENTRATION MEASURED AT SHADNAGAR

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Atmospheric carbon dioxide (CO$_2$) has been continuously measured at the premises of NRSC, Shadnagar (17.02 N, 78.11 E, 560 msl), a sub-urban site of central India, using an off-axis integrated cavity output spectroscopy (OA-ICOS). In the present study, influence of local and long range winds on hourly averaged CO$_2$ concentration is analysed using 2014 data sets. Study suggested that CO$_2$ variation is influenced mainly by prevailing surface wind and also long-range transport from source areas. Hourly CO$_2$ concentration is segregated by wind direction merged by season over the entire study period. Study revealed that the wind direction of NW-NE in pre-monsoon contributes to rise of CO$_2$ concentration by approximately 2 %. On the other hand, except NE, rest of the wind direction contributes a decline of ~1.4 % during winter over the study area. The NOAA-HYSPLIT model run and meteorological fields from NCEP reanalysis data were used to study the possible transport of air mass (CO$_2$) over the study area using every 5 days air mass back trajectories. Study suggests that majority of the long range air mass trajectories (3 km) are coming from NW direction of the study site, respectively during pre-monsoon (64%) and winter (44%). The segregation of local and long range wind influence on CO$_2$ will be done in future study.

Keywords: Carbon dioxide, OA-ICOS, wind direction

Abstract Id: 1049
IMPROVEMENT OF FORMOSAT-5 AUTOMATIC CLOUD COVERAGE ASSESSMENT ALGORITHM FOR CLOUD STATISTIC ESTIMATION

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An essential sector in FORMOSAT-5 (FS-5) Image Processing System (IPS) is the cloud statistic estimation of received imagery based on Automatic Cloud Coverage Assessment (ACCA) algorithm. The FS-5 ACCA method is presented by Hsu et al [Hsu, ISRS2015]. Cloud statistic represents the information of percentage of cloud-cover areas of an image. That is recorded as one of the metadata for image product catalog. In order to obtain accurate cloud statistic result, FS-5 ACCA method shall take into account image noise and low image contrast features. In this paper, we present not only the development of preprocessing for FS-5 ACCA, but also its complete performance evaluation using a series of real images from the FORMOSAT-2 (FS-2) imagery database. Gaussian noise reduction and global contrast enhancement techniques are implemented as the preprocessing methods to firstly improve image quality for further analysis. Secondly, FS-5 ACCA separates the imagery into two distinct classes, such as land-cover and cloud-cover regions, corresponding to intensity values located below and above a determined threshold value, respectively. The results indicate that the proposed approaches can more effectively reduce the noise, eliminate unwanted details (for instance, artificial buildings in urban region), improve contrast, and estimate cloud statistic compared with our previous work.

Keywords: FORMOSAT-5 imagery, noise reduction, contrast enhancement, cloud detection, thresholding method

Abstract Id: 1052
TOBACCO CROP DISCRIMINATION AND ACREAGE ESTIMATION USING REMOTE SENSING AND GIS TECHNIQUES

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Tobacco is an important commercial crop grown in India. It occupies the third position in the world with an annual production of about 800 Million Kgs. India stands 3rd in production of tobacco. Thus, monitoring of tobacco planted acreage is a very important step for tobacco's management and monitoring. Remote sensing technology serves as a low-cost but highly efficient method for accurate extraction of crop planting regions over large coverage area. In this paper, the potential of optical and synthetic aperture radar (SAR) data are investigated for tobacco crop discrimination and acreage estimation over West Godavari district in Andhra Pradesh. In order to understand spectral signatures at various growth stages of tobacco crops, three intensive Ground Truth (GT) survey was conducted during December’2016 and January&February’2017. Various crop and soil parameters such as, crop stage/condition, variety, height, leaf length/width, number of leaf picking, soil type/condition etc. were collected using an in-house developed android mobile app. In the present study, Landsat-8 Operational Land Imager (OLI) data acquired on 20/January/2017 was used for tobacco crop acreage estimation. The tobacco and other crop signatures were extracted using GT points. Based on the extracted signatures, the tobacco and non-tobacco crops are classified using the maximum likelihood supervised classification method. An accuracy assessment was carried out to ensure the accuracy of classification. An overall accuracy of 87.14% has been achieved using the single date OLI data. It has been observed that maize and plantation show less accuracy as compared to tobacco crops. Finally, comparison of village/mandal-wise area statistics with the statistics provided by the tobacco board has been carried out. Moreover, analysis on temporal C-band RISAT-1 dual-pol SAR data indicates that Sigma-0 is not linearly correlated along with crop growth stage as it depends on many target parameters. Further analysis on RISAT-1 data for tobacco crop discrimination is under progress.

Keywords: Remote sensing, Landsat-8, RISAT-1, Tobacco, classification, maximum likelihood

Abstract Id: 1053
ASSESSMENT OF MANGROVES HEALTH NEAR PURNA RIVER, NAVSARI, SOUTH GUJARAT

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In the coastal environment, Mangrove swamps are considered as one of the most valuable resources. Their ecological and economical importance is very well known. Ecologically, they provide habitat to different faunal species; protect the coasts from erosion and tsunamis and help in removal of pollutants. Economically, they are useful in producing fuel, fodder, medicines, etc. Due to spurt in anthropogenic activities as well as increased frequency of natural episodic events, mangrove coverage and health gets vastly affected. Thus, keeping in mind the importance of mangroves it is of utmost importance to monitor the health of existing mangroves. The main objective of this study is to assess the ecological health of various mangrove species. Mangrove health assessment model developed by Space Application Centre (ISRO), Ahmedabad, is simulated by analyzing the important indicators such as Canopy cover, Tree height, Drainage density, Reclamation activity and anthropogenic stress. Each and every parameter is given a weightage based on its relative importance in mangrove health. The entire study area is overlaid with a grid of 1 × 1 hectare. Each parameter is calculated and mapped using Resourcesat-2 satellite imagery of different time frames between 2007 and 2015 as well as in-situ measurements. The final output of the model is in the form of the map which shows present health of the mangroves. The study area is also classified based on retrieved index into pristine, vulnerable, degrading and degraded. Such studies can give us an accurate idea of the depleting mangrove health and further, the reasons and causes of this may be worked out. At such places, it can be safely said that the possible causes for mangrove degradation are aquaculture practices and high turbidity in this region. This, in turn, can lead to the decision makers as well as community developers to plan such activities.

Keywords: Mangroves, Health Model, Resourcesat-2, Purna River

Abstract Id: 1054
AN INNOVATIVE MOBILE BASED GEOSPATIAL SOLUTION FOR GROUND TRUTH ASSISTANCE AND CITIZEN SERVICES

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The data and information services from online geo-data repositories and geoportals are increasing significantly. Today, variety of geoportal applications are available such as Google maps, Openstreet Map, ISRO Bhuvan Geoportal, ESA geoportal, geoportals of respective government agencies and other service providers. These portal applications are publishing data as information or data services with various geo-visualization and query tools. Today thousands of GIS layers are published using web service specification for variety of applications. For effective utilization of geo-web services at user end, a very specific skills sets are required to operate these tools. Sometime the users are confused with various technical terms, mode of operations, number of GIS layers, classification scheme etc. To simply the access mechanism of online geo-web services, a mobile based solution is designed and developed during this study for integrated thematic information services. This innovative approach of geospatial data and information access from remote server is very helpful in ground truth assistance and many citizen services. The developed application provides a dynamic integrated thematic service based on user request or automatically using location coordinates retrieved using location sensor of mobile device. The mobile app is an android application which utilizes the Web Feature Service and GeoJSON from Open Geospatial Consortium (OGC). This mobile application parses GeoJSON data, which is a light weight and popular data exchange format over web. The system uses various open map libraries and APIs such as openStreet map for information representation whereas at the backend it uses nodejs webserver and MongoDB geospatial database for geospatial data management. The app interact with the location sensor (GPS) and fetches the geographic coordinates. Based on location coordinates the thematic information is automatically extracted from server as GeoJSON and presented to the user dynamically.

Keywords: Mobile GIS, LBS, integrated thematic services, API

Abstract Id: 1055
FLOOD VULNERABILITY AND RISK ASSESSMENT VIS-À-VIS URBAN-RURAL BUILT-UP DEVELOPMENT IN KASHMIR VALLEY (J&K), INDIA USING GEOINFORMATICS

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Flooding are among the most devastating natural hazards resulting in the largest amount of deaths and property damage. The unplanned urban expansion of cities developed along river valleys are highly prone to flood risk with increasing vulnerability due to climate changes with erratic rainfall patterns. The present study investigate flood vulnerability and impact of devastating Kashmir flood of 2014 over Srinagar city in Kashmir valley in context of build up development and land use changes over the period of 35 years (1979-2014). Satellite images of 1979 and 2014 was acquired to delineate urban areas and to quantify urban expansion in Srinagar city. The total area of Srinagar city municipal boundary is 306 sq. kms. The area covered by urban built-up was 24.98 sq. km in the year 1979 which increased to 78.37 sq.km in 2014. This indicates three times increment in the urban area within in the city during the last 35 years. The vertical built-up expansion accommodating high population density occupies regions along the Jhelum river banks. The flood inundation mapping using post flood satellite image of September 2014 was analyzed in GIS environment. The flood inundated areas were draped over the built up areas mapped using satellite images of 1979 and 2014 for assessment of effects of recent flood on urbanized area of Srinagar city to deduce the increment of flood vulnerability in the urban areas in the city. The area effected by the flood inundation during floods in 2014 in the city was 86.47 sq. kms. Comparing the flood vulnerability of Srinagar city during 1979 with reference to devastating flood of 2014 it was calculated that only 9.28 sq km area could have been inundated out of 24.98 sq km of built up area then present in the Srinagar city in 1979. In contrast 22.99 sq km area was

Keywords: Flood Vulnerability, Urban-Rural development, Srinagar city, Satellite images

Abstract Id: 1058
ESTIMATION OF SNOW GRAIN SIZE AND TEMPERATURE USING HYPERSPECTRAL AND MULTISPECTRAL DATA

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Snow undergoes constant change becomes essential matter in earth’s climate and hydrological system. In India snow covered areas found in rugged/mountainous region in the Himalayas. For such a terrain satellite data provide timely and efficient information. A study was undertaken to integrate estimation of physical parameters of snow based on ground truth data collection and satellite data. The SOI toposheet at 1:50000 scale was used. DEM was generated using ASTER data to for elevation and slope. For physical parameter estimation, multispectral and hyperspectral satellite data were digitally processed using ERDAS Imagine, ArcGIS and ENVI software. Landsat-8 data of October 2016 were used for generating Land use/Land cover map and surface temperature map. Also, Hyperion data of January 2016 were used for snow grain size studies. Out of 220 bands, selected bands only used for processing. Preprocessing involves removal of bad bands, bad column and removing the influence of the atmosphere. FLAASH atmospheric correction model is applied on hyperion data to retrieve surface reflectance in ENVI 5.1 software. Snow grain size has been estimated using spectral angle mapper (SAM) and grain index (GI) method. Spectral reflectance for different grain size was collected in field, using optical spectroradiometer and compared with satellite derived spectra during February 2017. Snow has high reflectance in visible and low in SWIR. Comparing results of SAM and GI it is revealed that GI shows higher percentage of fine grained snow than SAM and this could be attributed to cloud covered areas getting misclassified in SAM. The results obtained by the GI classification method appear to be more factual as snowfall being maximum during the month of January. Thus, it is concluded that by integrating field based observations and image processing methods applied on satellite data provide more accurate estimation for snow studies

Keywords: Snow grain size, surface temperature, hyperspectral, Multispectral

Abstract Id: 1060
The existence of vegetation cover and wind corridors are regarded as effective indicators to measure urban ventilation (UV) conditions. Most of the cities compact with dense buildings and have kept less space for air movement. Accordingly, the heat that accumulates during the day often cannot escape at night due to its retention, by buildings and the lack of wind. Also, better ventilation is considered crucial for improving the inferior outdoor thermal environment, where Colombo Metropolitan Area (CMA) is not exceptional. CMA is one of the cities experiencing rapid urbanization that has resulted in remarkable Urban Heat Island (UHI) effect, which will be undisputable to influence the regional climate. Estimating changes in Land Surface Temperature (LST) in par with UV patterns (wind corridors & vegetation cover) has become a prominent topic to address the increasing heat levels of cities.

In order to understand the spatiotemporal changes in UV patterns on LST, research incorporates Landsat TM images acquired in 1995, 2005 and 2017. Further, the research incorporates frontal area index (FAI), least cost paths (LCP) to identify the wind corridors and Normalized Differentiate Vegetation Index (NDVI) to identify the vegetation cover changes. The research findings emphasize a significant, strong negative correlations between LST and NDVI. It confirms the strong influence of reduction of vegetation cover on the formation of UHI in the CMA. In analyzing the spatiotemporal changes in wind corridors, it reflected that most of the wind corridors have decreased over time with the built structures. Concentrating urban planners’ attention, the findings emphasize certain areas with low LST within the UHI of CMA, where its roads and building configuration act as a magnet to all the wind corridors to interact with a high NDVI. These results suggest the importance of studying wind corridors and vegetation cover prior initiating a development project.

Keywords: Urban Ventilation, Land Surface Temperature, Normalized Differentiate Vegetation Index

Abstract Id: 1061
THE EFFECT OF SWITCHING OF NAVIGATION ALGORITHMS ON THE NAVIGATION PERFORMANCE

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The geophysical database referenced navigation (DBRN) system is being studied as an alternative way to compensate the error of inertial navigation system (INS) when the global navigation satellite system (GNSS) is not available. In various DBRNs, a profile matching and filter based algorithm are broadly applied. In the case of a profile matching, the navigation error could be reduced to the few hundreds of meters but the stability dramatically decrease when the geophysical data does not show large variation. On the other hand, the filter-based algorithm is time-effective on the computation but it could diverge if the geophysical DB changes abruptly. Therefore, new attempts to combine geophysical DBs or algorithms are being studied to construct more robust navigation algorithm. In this study, a switching of the navigation algorithms is constructed as a new attempt to combine heterogeneous navigation algorithms. To realize the switching algorithm, the INS errors are estimated based on the extended Kalman filter (EKF) using both terrain and gravity gradient DBs. Also, the horizontal error is computed using a profile matching. When two candidate solutions are available, the final solution is determined based on the switching algorithm which selects one solution considering local characteristics and the reliability indicator of the algorithm (i.e. P matrix of filter based algorithm). The effect of switching of algorithms is evaluated based on the simulation tests by supposing high-resolution terrain and gravity gradients DBs and sensors (altimeters and gravity gradiometers). To verify the effect of switching navigation algorithms, the navigation performance is compared to the solution from EKF or a profile only. Also, the final solution is calculated by combining both candidates as a form of weighted average and compared to the one from the switching algorithm.

Keywords: database referenced navigation, extended Kalman filter, profile matching, switching of navigation algorithm

Abstract Id: 1063
Biomass is essential to estimate the forest carbon stock. Reliable biomass estimates with uncertainty analysis are necessary in the context of REDD+. In this paper, we present a study on the uncertainty of biomass estimation in relation to plot size variability over central Indian deciduous forests in Madhya Pradesh. First, we analysed uncertainty in biomass estimation using field inventory data with varying plot size to understand the influence of plot size in biomass estimation. Second, we have carried out spectral modelling with multispectral satellite images (Sentinel2 & Landsat 8) with varying plot sizes to establish a minimum field plot size for reliable spatial biomass estimation. Field Inventory for 13 large plots (1ha) are carried out at Betul, Madhya Pradesh (teak dominated deciduous forest). Biomass is estimated using species wise allometric equations at tree level. Plot level biomass varied from 63 t ha\(^{-1}\) to 185 t ha\(^{-1}\). Tree density varied from 164 ha\(^{-1}\) to 501 ha\(^{-1}\). In each of the large plots, small plots of different sizes (viz., 0.08, 0.125, 0.18, 0.24, 0.32, 0.41, and 0.5 in ha) are randomly constructed and relative biomass errors with large plots are estimated. In addition, uncertainty was also analysed with respect to plot shape (square and circular). The relative error decreases ~31% to ~14% from the plot size of 0.08 to 0.5 ha respectively irrespective of the plot shape. For satellite data based analysis, spectral models relating NDVI and field biomass were constructed at different plot sizes (from 10m to 100m in the interval of 10m). Results state that with the increase in plot size, RMSE of biomass spectral model decreased while an overall R\(^2\) increased. Relative RMSE of the spectral model decreased from ~55% to ~19% with the increase of plot size range from 0.04 to 1 ha.

Keywords: Biomass, Uncertainty, Plot size, Satellite image, NDVI.

Abstract Id: 1065
USING VIIRS NIGHTTIME IMAGE IN ESTIMATING GDP AT THE STATE LEVEL FOR INDIA

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The use of DMSP-OLS nighttime stable lights and radiance-calibrated images for the estimation of socio-economic variables at different administrative levels is well established. The onset of low light imaging data collection by SNPP-VIIRS since October, 2011, which are of superior spectral and spatial resolution compared to DMSP-OLS, have stimulated further interest in the use of nighttime images as proxy variables for socio-economic research. In this paper, we examine the relationship between the ‘Sum of Lights (SOL)’ extracted from the 2015 VIIRS Nighttime Lights Annual Composite and official state level Gross Domestic Product (GDP) for India. A simple log-linear model between the SOL as explanatory variable and the official GDP as the dependent variable provides a coefficient of determination (R²) of 0.9. The result suggests that the VIIRS nighttime lights data alone can serve as a proxy measure of GDP at the state level for India. A comparative analysis with the SOL extracted from the latest DMSP-OLS radiance calibrated image of 2010 will be conducted for quantifying the superiority of the VIIRS data in making economic estimations. In addition, the model established for 2015 will be used to predict the GDP for the states of India for 2016, and compared with the official GDP data of 2016. This will help in further validation of the model.

Keywords: Nighttime lights, official Gross Domestic Product, predicted economic estimates

Abstract Id: 1066
GEOSPATIAL APPROACH FOR LANDSLIDE INVENTORY AND SUSCEPTIBILITY MAPPING OF RUPIN WATERSHED IN TONS VALLEY, GARHWAL HIMALAYA, UTTARAKHAND

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The study area extends between 31°21’23" N to 31°21’54" N latitude and 77°57’39" E to 78°18’36" E longitude covering area of 545 km² which is part of Lesser and Higher Himalaya. Geologically, the Rupin watershed comprises of Vaikrata, Almora, Dudhatoli Jaunsar and Garhwal group containing granite, quartzite, limestone, shale, phyllite and basic rocks. In present Study Landslide Inventory map is prepared on the basis of pre and post Uttarakhand disaster of June 2013 using High resolution Remote Sensing Data (LISS-IV). Total 150 landslides have been identified in pre-disaster (2011) and 221 in post-disaster (2014). Then Information Value method is applied for preparing Landslide Susceptibility Map, considering these thematic layers viz Geology, Geomorphology, Lineament Density, Drainage Density, Drainage Frequency, Drainage Texture, Slope, Slope Aspect, Curvature, Relative Height, Soil Erosion, Soil Depth, Vegetation (NDVI) and LULC Built-up, road etc. Damage assessment emphasized was carried out with respect to settlement, road and agricultural land. Landslide Susceptibility map shows four susceptibility zones, Very low (37%), Low (36%), High (21%) and Very High (6%) while Vulnerability Map has very low (33%), low (26%), high (35%) and very high (6%) classes. The final risk was obtained by multiplying the susceptibility and vulnerability map in the raster calculator of Arc GIS. Four risk zones viz. very low (58%), low (31%), high (7%) and very high (4%) have been identified. Landslide Susceptibility Zonation (LSZ), Vulnerability and Risk Mapping are important for disaster management and planning development activities in the Himalayan regions.

Keywords: Garhwal Himalaya, Rupin Valley, Landslide Inventory, Susceptibility Mapping, Information Value Method.

Abstract Id: 1067
SPATIOTEMPORAL EVALUATION OF REANALYSIS AND IN-SITU SURFACE AIR TEMPERATURE OVER ETHIOPIA

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Water resources management and modelling studies are often constrained by the scarcity of observed data, especially of the two major variables i.e., precipitation and temperature. Modellers, hence, rely on reanalysis datasets as a substitute; though its performance heavily vary depending on the data availability and regional characteristics. The present study aims at examining the ability of frequently used reanalysis datasets in capturing the spatiotemporal characteristics of maximum and minimum surface temperatures over Ethiopia and to highlight the biases, if any, in these over Ethiopian region. We considered ERA-Interim, NCEP 2, MERRA and CFSR reanalysis datasets and compared these with temperature observations from 15 synoptic stations spread over Ethiopia. In addition to the long term averages and annual cycle, a critical comparison of various extreme indices such as diurnal temperature range, warm days, warm nights, cool days, cool nights, summer days and tropical nights are also undertaken. Our results indicate that, the performance of CFSR followed by NCEP 2 is better in capturing majority of the aspects. ERA-Interim suffers a huge additive bias in the simulation of various aspects of minimum temperature in all the stations considered; while its performance is better for maximum temperature. The inferior performance of ERA-Interim is noted to be only because of the difficulty in simulating minimum temperature.

Keywords: ERA Interim; NCEP Reanalysis; MERRA; CFSR; Diurnal temperature range; reanalysis performance.

Abstract Id: 1068
A COMPARATIVE STUDY ON THE FUSION RESULTS OF SENTINEL-1 / GF3 SAR IMAGE AND GF1 OPTICAL IMAGE

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The fusion of SAR image and optical image can complement each other and improve the ability of image interpretation. In this paper, the fusion results of Sentinel-1 and GF3 SAR images fused with moderate-resolution GF1 images respectively are compared and analyzed by using Brovey, Gram-Schmidt Pan Sharpening, PCA and wavelet transform methods. In the meanwhile, the indexes of mean, standard deviation, information entropy, average gradient and correlation coefficients are constructed to evaluate the fusion results. The results show that the fusion results of Sentinel-1 and GF1 using different fusion methods are better than the results of GF3 and GF1. Different fusion methods adopted have different fusion results of Sentinel-1 and GF1 images. For image information, texture and spectral fidelity, the fusion results adopting PCA and Gram-Schmidt Pan Sharpening methods are optimal, the fusion result by using wavelet transform method contains more plenty of image spectral information, and the fusion result obtained by Brovey method presents significant color distortion. However, the fusion results of GF3 with GF1 are not satisfied for the heavy speckle noises of GF3.

Keywords: Sentinel-1; GF3; SAR image; fusion result; moderate-resolution image

Abstract Id: 1069
COMPREHENSIVE ASSESSMENT OF TEMPORAL CHANGE IN THE RIVERINE LANDSCAPE OF BHAGIRATHI CATCHMENT, WESTERN HIMALAYA

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Riverine landscapes exhibit unique ecological characteristics and species assemblages, while also being one of the most vulnerable natural eco-systems due to their linear structure. The river Ganges, rising from the Gaumukh glacier and draining a major portion of the Indo-Gangetic floodplains is subject to large-scale over-exploitation for its resources. To understand this phenomenon in the mountainous section of the river, we quantified landscape level changes on either bank of the river Bhagirathi (Headstream of river Ganges) for a stretch of almost 242 km till Rishikesh. Patch properties were analyzed spatially and temporally on 121 units created by dividing the river at 2 km longitudinal and 1 km horizontal sections including both the banks. Landsat images for the years 1993 and 2013 were processed to detect landscape changes while Fragstats was used to quantify change in landscape configuration. Fragmentation events were quantified using class metrics in the riverine buffer units. Data pertaining to key anthropogenic variables i.e. expansion of cities, population growth, upcoming of hydropower projects and roads were analyzed to understand landscape integrity. The most prominent trends included the conversion of dense forests (30.93%) to open forests (11.09%) and agricultural expansion in the catchment. Results show that forests in the study area have undergone severe fragmentation events across space and time, increased patch density (1993-24.93; 2013-94.75) and decreased large patch index (1993-22.20%; 2013-17.9 %). Riverine forests at a buffer width of 1 km showed a decline in Large Patch Index from 5.63% in 1993 to 3.71% in 2013 and a drastic increase in patch density from 27.35 to 100.60 patches/m2 in 2013. The combination of remote sensing and GIS enabled riverine landscape pattern analysis by providing a synoptic view of the entire river, its catchment and riverine buffer.

Keywords: Change detection, Bhagirathi river, Landscape configuration, Riverine landscapes

Abstract Id: 1071
MULTI TEMPORAL URBAN GROWTH CHARACTERIZATION USING GEOSPATIAL TECHNOLOGIES

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World, after the industrialization in the 18th century has experienced dynamic change in terms of land use change. With the development of machines, came the scenario of rapid and mass production, forcing more and more job seekers to stay closer to working environs. Cities developed, with production dependent economy led to evolution urban cities. Cities growth with advancing technologies promised a better standard of living, which however remained limited and thus acted as a strong catalyst for migration of the rural population to urban area. This global drift of the rural population towards these growth poles overcrowded cities and forced them to sprawl in the absence of any efficient and foreseen planning strategies. This has been also a case with India. Unconstrained and unplanned city growth have threatened the ecological balance and have paralyzed the bio-diversity, challenging the endurance. Government, planners are challenged to meet the basic service needs of the residing population and with influx in rural population. Each city has varied growth pattern based on its demography, economy, etc. Changes in the land use pattern need to be understood for advance geo-visualization of likely growth pockets. Analysis would present temporal land use change in Chandigarh based on pattern, density, size, neighbors etc., and using gradients. Key findings of this research highlights the dynamic growth near the periphery and increased size of monotonous patch with in the municipal boundary indicates densification of core urban area. Results also indicate sprawl near the periphery and increased uneven size and patch indicate the urban sprawl. This would provide vital insights to the spatial patterns of development and planning sustainable development goals for a city. Consequently, it would empower the decision makers to loop in environment sensitive policies and mandatory adjustments for shaping and revitalizing growth trends.

Keywords: Urbanisation, Sprawl, Spatial metrics, SDG

Abstract Id: 1072
The study examined the variability of aerosol optical properties and radiative effects over northwest Himalayan region using synergy of ground-based and satellite observations. The spectral aerosol optical depth (AOD) measurement was carried out by using Microtops Sunphotometer and MODIS&MISR over Dehradun, part of Northwest Himalayas during January-December 2015. It is observed that during pre-monsoon, region experiences high mean AOD500 (0.34±0.09 to 0.63±0.12) along with low mean Ångström exponent (α) (0.46±0.09 to 0.66±0.10) attributing to the dominance of mineral dust aerosols while moderate mean AOD500 and α during monsoon and post monsoon season are (0.38±0.08 to 0.54±0.16) and (0.78±0.1 to 0.91±0.11) respectively indicating mixed type aerosols. During winter season low mean AOD500 (0.29±0.06 to 0.46±0.12) and high mean α (1.12±0.09 to 1.30±0.1) is observed due to domination of fine mode aerosols coming from anthropogenic activities and agricultural biomass burning. Aerosol transport pathways were analyzed & complimented with Hysplit air mass back trajectory. Comparison of satellite derived AOD agrees well with ground based Microtops (MT) measurements (R=0.80 and 0.71 for MODIS and MISR respectively) over Dehradun. MODIS level-2 data was used to generate spatial & seasonal distribution of AOD over northwest Himalayans and validated over selected stations in the region. The results shows that AOD values are in agreement within an error of 11-14% over entire region. The monthly & seasonal aerosol radiative forcing (ARF) was estimated over selected stations in the region. The annual mean ARF ATM over Dehradun was estimated to +25.83 Wm−2, while +30.83 Wm−2 over Patiala and +14.97 Wm−2 over Kullu. The ARF ratio was found to be ~2.4 to ~3.7 at TOA and SUR respectively indicating absorbing nature of aerosols predominantly existing over Northwest Himalayas and IGP region.

Keywords: Aerosols properties, Radiative Forcing, MODIS, MISR, OPAC, SBDART
POST-PROCESSING-BASED SOLAR PHOTOVOLTAIC DETECTION IN HIGH RESOLUTION AERIAL IMAGERY

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In recent decades, solar photovoltaic (PV) arrays constitute a significant portion of the rapidly increasing renewable energy systems. As a result, high quality information about PV, such as quantity, location, area and power capacity, has obtained substantial interest from the public. Existing imagery-based automatic PV detection research are rare and accuracies are rather poor. In current PV detection classifications, shadows and buildings are easily classified as PV, due to their spectral similarity. In this context, our work presents a post-processing-based PV automatic detection framework to further enhance the original classification accuracy. Firstly, automatic PV detection is applied by a SVM classifier, and then a post-processing framework is designed to improve the original classification result. In detail, the post-processing framework is based on a two-level processing approach. In the first level, shadow and building features are adopted to refine the classification commissions. Specifically, shadow features are calculated from image brightness, while buildings features are developed from spectral reflectance. In the second level, an objected-based approach is applied to decline the PV boundaries, by means of maximum voting fusion strategy. Experiments are evaluated by two high resolution aerial datasets, and results are further evaluated by the ground truth image from visual interpretation. The original classification produces a serious commission error with overall accuracy is 97.14% and kappa coefficient is as low as 0.11. However, the post-processing approach achieves a lower commission error (almost half of the original classification) with overall accuracy is 99.78% and kappa coefficient increased to 0.63. Overall, our results underline the spectral-based post-processing framework can effectively enhance the original classification accuracy.

Keywords: solar photovoltaic, aerial imagery, SVM, post-processing

Abstract Id: 1074
POLINSAR BASED MODELING FOR SCATTERING CHARACTERIZATION AND FOREST PARAMETER RETRIEVAL

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SAR remote sensing has already proven its capability to retrieve forest structural and biophysical parameters. The prime focus of the present study was to evaluate the potential of PolSAR, PolInSAR and PolInSAR tomography (PolTomSAR) for forest structural and biophysical parameter retrieval. This work includes the utilization of ALOS PALSAR, RADARSAT-2, RISAT-1 and TerraSAR-X data for scattering characterization and coherence estimation of different locations of the forest. Tree height retrieval was performed with the model inversion using PolInSAR data and signal compression techniques of SAR tomography. Potential of PolTomSAR was evaluated to retrieve forest height and variation in backscatter power at different height levels. Fourier transform, beamformer and capon algorithms were compared for vertical profile of forest patch. Fully polarimetric capon showed best forest height result with RMSE of 2.58 m and an average accuracy of 88.64%. PolInSAR RVoG model, three stage inversion (TSI) and coherence amplitude inversion (CAI) techniques were implemented on PolInSAR data to generate forest height map. PolInSAR data was also used for AGB retrieval of the forest with the help of coherence based Interferometric Water Cloud Model (IWCM). PolSAR based EWCM model was developed for L-band ALOS PALSAR data for Dudhwa National Park, India and the modeled output for AGB estimation showed 0.43 R2 and 119 (t/ha) RMSE. IWCM based modeling for forest AGB retrieval showed the R2 value of 0.5, RMSE of 62.73 (t/ha) and a percent accuracy of 51%. TSI based PolInSAR inversion modeling showed the most accurate result for forest height estimation. The correlation between the field measured forest height and the estimated tree height using TSI technique is 62% with an average accuracy of 91.56% and RMSE of 2.28m. The obtained results showed that PolSAR and PolInSAR remote sensing based modeling approach have capabilities to provide structural and biophysical parameters of the forest with reliable accuracy.

Keywords: PolSAR, PolInSAR, PolTomSAR, Forest Height, Extended Water Cloud

Abstract Id: 1076
LANDSLIDES INTERPRETATION USING AERIAL PHOTOGRAPH AND SATELLITE IMAGERY IN PULAU BANDING, MALAYSIA.

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Tropical country such as Malaysia with an average annual rainfall of 2450 mm and average temperatures of 22°C to 32°C is always prone to landslide occurrence. Landslide is becoming a common problem in Malaysia, especially when development encroach steep terrain. The main objective of this paper is to map landslide occurrences in Pulau Banding, Perak, Malaysia. Landslide interpreted from aerial photographs were field-checked and development history of the study area was obtained from archived Landsat imagery. The results from the study showed that most of the landslides occurred in metaargillite rocks and along the road alignment. Development history of the study area from Landsat interpretation revealed that as early as 1994, the western part of the island were logged but had since been revegetated.

Keywords: Landslides, Aerial photograph, Landsat

Abstract Id: 1077
SURFACE REFLECTANCE RETRIEVAL FROM AVIRIS-NG AND ITS VALIDATION USING GROUND BASED SPECTRO-RADIOMETER MEASUREMENTS

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Hyperspectral sensors or Imaging spectrometers, unlike multispectral sensors, acquire images in many contiguous spectral channels such that for each pixel a complete reflectance spectrum can be derived from the wavelength region covered. AVIRIS-NG (Airborne Visible / Infrared Imaging Spectrometer-Next Generation) measures the reflected sun's radiation in the wavelength range from 380 nm to 2510 nm with 5 nm sampling. Spectra are measured as images with 600 cross-track elements and spatial sampling from 0.3 m to 4.0 m from a Twin Otter platform. The solar radiation is subjected to absorption and scattering, while reaching the earth's surface and reflecting to the satellite sensor. The major atmospheric water vapor bands are centered at approximately 0.94 µm, 1.14 µm, 1.38 µm, and 1.88 µm, the oxygen band at 0.76 µm, and the carbon dioxide bands near 2.01 µm and 2.08 µm. Approximately half of the 0.4-2.5µm region is affected by atmospheric gas absorptions. In order to infer the surface reflectance’s from AVIRIS-NG data, accurate correction of atmospheric absorption and scattering effects is necessary.

After the geometric correction using Internal Geometry Model (IGM), FLAASH, which is a model-based radiative transfer program, is used to convert radiance data to reflectance. FLAASH uses MODTRAN4 radiation transfer code to correct images for atmospheric water vapor, oxygen, carbon dioxide, methane, ozone absorption, and molecular and aerosol scattering.

In the present study surface reflectance retrieved from AVIRIS-NG is compared with Jet Propulsion Laboratory (JPL) provided reflectance for AVIRIS-NG scene (ang20160203t055731) covering an agricultural site in Bhukia, Rajasthan and found that correlation coefficient is 0.99 and slope is 0.9. Further surface reflectance retrieved for different targets at the Shadnagar CALVAL site using AVIRIS-NG scene (ang20151219t091521) reveals very good agreement with coincidentally measured reflectance using Ground based spectroradiometer for different targets namely red soil, black soil, black stone, white stone and gravel. The methodology for the retrieval and validation results will be presented.

Keywords: AVIRIS-NG, Surface reflectance, Validation, Atmospheric correction

Abstract Id: 1078
RESEARCH ON REMOTE SENSING MEASUREMENT OF THE CROPS PLANTING SPATIAL DISTRIBUTION IN TAIHE COUNTY OF ANHUI PROVINCE

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We carried out the planting spatial distribution of the main autumn harvest crops through remote sensing measurement in Taihe, including corn, soybean, sweet potatoes. For that purpose, we used GF1(16m) images to implement crop information extraction and result production, combining crops related planting rule and phonological information, and take the relevant provisions of the third national agricultural census as the guiding principle. This work involves a series of technology processes, including phenological information research, data preparation and preprocessing, interpretation knowledge base establishment, measurement area division, training sample extraction, crop spatial distribution extraction, etc. At last, we evaluate the measurement results, and get the total area precision, the producer precision and the user precision of three kinds of crops, the results were all above 95%. The results indicate that, this set of crops distribution remote sensing measurement process has good practicality, normative and high accuracy. So it can provide a practical and effective technical process and implementation plan for the third national agricultural census provincial crop planting space distribution remote sensing survey work, as well as provide a scientific basis for the structural adjustment of major crops in the region.

Keywords: Agricultural census remote sensing spatial distribution Crops information extraction

Abstract Id: 1079
Land use and Land cover play a significant role in the flow of sediments, including pollutants into water bodies in their vicinity. Recently there have been in-situ lake water quality studies that have shown the potential impact of land use, whether it is agricultural or urban landscape. While in-situ studies are useful, scaling these to the entire areas of large water bodies or across them is both time consuming and very expensive. So, there is a need for methods that can help assess the water quality across the water surfaces. Given the increasing availability of multispectral data at multiple and narrow spectral and finer spatial resolutions, it provides a potential to test these out to study the contaminant spread over the water bodies. This paper is focussed on the estimation of the levels of water body contamination and relating it to the land use and land cover in the catchment area across seasons. The current focus is only on detection of the organic and mineral contamination (OMC) using LANDSAT8 data for the year 2015. The study area is chosen as Nagarjuna Sagar reservoir, a large multipurpose reservoir spanning 285 Sq. Km and surrounded primarily by forest lands and agriculture fields and is found to be polluted by varying levels of algal population throughout year. The satellite imagery based study shows that the spatial distribution of the contamination across the seasons indicate that the changes in the water inflow quantities and inflow of agricultural chemical inputs like fertilizers and other organic wastes into these water bodies hold the key to level of pollutant loading. In the case of Nagarjuna Sagar reservoir, it was found that the maximum spread of contamination across seasons varies between 30 and 75%. Also, it shows a lag between these anthropogenic activities and contaminant levels in the water bodies. The study gives some important clues on the relationship of the land use and its intensified uses affecting the water bodies in its neighbourhood.

Keywords: Remote sensing, LANDSAT 8, water body contamination, Land use practices

Abstract Id: 1080
ANALYSIS OF EXTREME TEMPERATURE EVENTS OVER CENTRAL INDIAN REGION USING SATELLITE DATA

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An analysis of Characteristics of Heat Waves (HW) or Extreme Temperature events (ETE) during the months of March, April, May was conducted over the Central Indian Region for the years 2003-2016 using remotely sensed AIRS level 3 version 6 (1 degree x 1 degree) Air Temperature at surface data. A high positive correlation of 0.84 was found between the AIRS and ground based IMD gridded temperature data, supporting the use of AIRS data for the study. A histogram analysis, to identify the ETE was done, which showed that the HW can be considered when the Air temperature is higher than the 99th percentile of the Daily Mean Temperature (TDM).

To know about the frequency, duration and intensity of the ETE, a Heat Index (HI) was calculated using the difference between the TDM and Long Term Mean (TLM) i.e., the anomaly and dividing it by the Standard Deviation of TLM. The TLM of the study area showed a minor rise in temperature around end of March and beginning of April which indicated possibility of HW. The anomaly along with the HI values and intensity from sensitivity analysis were studied yearly and the days which had a HI value above 0.3 and anomaly above 0.8 were considered as ETE for that year if the duration was of two or greater than two days. Though the study area was too big and the time period too small to conclude a trend, it was inferred that the extreme events are happening early i.e. in March for some years and also increasing during May along with their duration. The number of ETE of duration more than 5 days was seen to be large as well. The spatial analysis of the study area helped to visualize the region that is more affected by ETE in Central India.

Keywords: ETE, AIRS, HI, TLM

Abstract Id: 1081
Mapping of different facies of sedimentary provinces using spectral data is a challenge as sedimentary units are known for gradational composition variation and different sedimentary rocks may have different textures but very close mineralogical composition. In the study, we have attempted spectral mapping method to map different components of sedimentary provinces of Vindhyan rocks. In this regard, we have implemented and compared the results obtained using deterministic spectral mapping method (Spectral angle Mapper (SAM)) and probabilistic spectral mapping method (Spectral information divergence (SID)) in ASTER (Advanced Space borne thermal emission and reflection radiometer) image for mapping sedimentary units. We used image spectra of the each rock type as spectral end member for spatial mapping of sedimentary units of Vindhyan Group after confirming their similarity with respective laboratory spectra. Lithological maps derived using spectral mapping methods were compared with the lithological map derived using conventional field survey. It was observed that the maps derived using SAM method had over all accuracy of 67.41% and the map derived using SID had overall accuracy of 69.67%. Result shows that the spectral mapping algorithm may derive moderate accuracy lithological maps using spectral signature as criteria. This is due to the fact that the sedimentary rocks are known for close mineralogy and also have larger variance in pixel spectra of same rock due to gradational facies variation and weathering impacts.

Keywords: Confusion matrix, spectral angle mapper, spectral information divergence, spectral absorption feature, Vindhyan Group of rocks

Abstract Id: 1082
FLOOD RISK ASSESSMENT OF PANCHGANGA RIVER (KOLHAPUR DISTRICT, MAHARASHTRA) USING GIS-BASED MULTICRITERIA DECISION TECHNIQUE

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Flood hazard causes great loss to lives and properties leading to disturbance in human society. Flood is the single most hydrometeorological hazard causing substantial losses. To gain better understanding of the flood phenomena especially for planning and mitigation purposes, flood risk analysis is often required. For the present study, the middle part of Panchganga river of Kolhapur district, Maharashtra was selected. The main objective of the present study was to evaluate the potential flood risk areas of Panchganga River using GIS-based multicriteria decision analysis. The flood scenario across the Panchganga River was analysed using Radarsat SAR data of 5th August 2005. To remove the speckle of SAR image, a median filtered technique was used. Thresholding technique was applied on Radarsat SAR data to segregate flooded areas from non-flooded areas. Factors considered for evaluation of the flood risk analysis were flood layer, elevation, infrastructure, and land use / land cover analysis. The spatial multicriteria analysis with ranking, rating and AHP (analytical hierarchy process) method was used to compute the priority weights of each criterion. Accuracy assessment reveals that AHP is the most accurate technique to assess flood risk of Panchganga river.

Keywords: Flood risk, multi criteria decision, GIS, Radarsat SAR data, photogrammetry

Abstract Id: 1088
THREE DECADES OF LANDCOVER CHANGE ANALYSIS IN CHILIKA AND ITS NEIGHBOURING AREAS USING LANDSAT DATA

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To understand how an area changed over time, change detection analysis using multi-decadal satellite remote sensing can be quite useful. Our study uses 30m Landsat data acquired during December 1987 and December 2016 over a period of 30 years to understand the landscape dynamics in the Chilika Lake and neighbouring areas. ISODATA classification technique was used in ArcGIS 10.4.1 in our analysis. The Landsat images of our study area were categorized into barren, grass, shrubs, forests and water body. Our analysis showed that during the last thirty years, barren and grass classes decreased by 7.6% and 8.3% respectively while shrub and forest classes both increased by 20.3% each. The total area for the water body in the study area decreased by 13.8% while the Chilika Lake surface water within the Chilika lake boundary reduced by 2.5%. The results from our study help us to develop a baseline understanding of the overall landcover dynamics of the area and thus provides a basis to investigate the drivers causing these change.

Keywords: Chilika, Landsat, Coastal Change, Landcover dynamics

Abstract Id: 1089
Classification of SAR data is a challenging as well as essential task for continuous monitoring of the earth surface due to its all-weather capability. This paper investigates PolSAR and PolInSAR coherence concept for the extraction of the earth features. The methodology integrated Polarimetric decomposition models, PolInSAR Coherence and Knowledge based classification for land use and land cover (LULC) classification using fully polarimetric RADARSAT-2 data. Polarimetric decompositions help to investigate and understand the scattering mechanism patterns of different features to extract the information of the earth’s features. Freeman, Yamaguchi and H/A/Alpha decomposition models were used to extract different scattering mechanisms. The results shown overestimation of the volume scattering in highly dense and oriented building, misinterpreted the dense and oriented buildings as forest in PolSAR classification. This issue is addressed by incorporating PolInSAR coherence, which is sensitive to both volumetric structure and temporal change of the scatterer. Forest regions were strongly affected by the temporal and volume decorrelation with time, which show low coherence value compared to the permanent scatterers like built-up areas. The backscatter response and the coherence patterns of vegetation and urban area are different, helped to classify built-up regions more accurately. Therefore, PolInSAR coherence is utilized for extraction of the features by combining polarimetric and coherence information. The PolInSAR coherence extracted from the repeat-pass RADARSAT-2 images of 24 days temporal baseline for distinguishing vegetation and built-up areas. Mahalanobis classification algorithm was used for extracting different features. To further improve the results Knowledge based classification was executed by forming rules based on the statistical analysis of the features. The overall accuracy and kappa statistics of the PolSAR and PolInSAR classification are 79.17% and 0.75, 86.67% and 0.84 respectively. This states that PolInSAR coherence classification helped to characterize discrete and volume scatterers more accurately than the PolSAR classification.

Keywords: PolSAR, PolInSAR Coherence, Polarimetric decomposition model, Mahalanobis classification and Knowledge based classification

Abstract Id: 1090
ROLE OF REMOTE SENSING AND SPECTROSCOPY FOR CU-MINERALIZATION IN ALWAR BASIN, NORTH EASTERN RAJASTHAN, INDIA

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In spite of the dominance of traditional mineral exploration methods that demand physical characterization of rocks and intense field work, remote sensing technologies have also evolved in the recent past to facilitate mineral exploration. The area of interest in this study is Mundiyawas - Khera in Alwar basin, north-eastern Rajasthan, India. Geologically, the area comprises rock types belonging to Thanagazi Formation of Ajabgarh Group within the North Delhi Fold Belt of Proterozoic age. A recent study by Geological Survey of India (GSI) reveals the presence of felsic volcanic hosted thick copper mineralization in the area. Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) L1B data has been used in this study owing to its 3 VNIR and 6 SWIR bands spanning the electromagnetic spectrum in the range of 0.52 - 2.43 µm. Mineral classification is done using Spectral Angle Mapper (SAM) technique which takes into account the angle between the observed and reference spectra plotted as vectors in n-dimensional space. SAM has an advantage over other techniques in that it remains unaffected by illumination differences due to topographic effects. The SAM result shows the presence of minerals such as galena, chalcopyrite, malachite, andalusite, and pyrite in the area. The presence of malachite is an important finding as it is a promising pathfinder for copper. The other minerals indicate presence of altered minerals which in turn helps to get cues about ore forming system. The presence of malachite is validated in the field as well. X-ray diffraction of malachite further refined its geochemistry. Apart from the mineral mapping results, several other evidence layers such as lineament density, bouger gravity anomaly and geochemical maps that give clues to sub surface copper occurrences are also included. Finally, the mineral mapping results along with these evidence layers are integrated using weighted sum overlay technique to generate a favorability index map for potential copper deposits. The weights are assigned to the layers on the basis of their relevance and reliability to the present study. The results help to identify additional areas with potentially enriched but still unexplored ore zones. Hence, the remote sensing derivative products integrated with other ancillary information prove to be complementary to the conventional field based exploration techniques. This study thus establishes the importance of remote sensing in mineral exploration to zero in on potentially ore rich but unexplored zones. The potential ore-rich zones can further be explored using geophysical data.

Keywords: mineral exploration, ASTER, SAM, Cu-ore, favorability index.

Abstract Id: 1091
DELINEATING ECO-SENSITIVE ZONES USING GEOSPATIAL METHOD- A CASE STUDY OF JHILMIL JHEEL CONSERVATION RESERVE

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Habitat loss and habitat fragmentation are the major issues facing biodiversity and wildlife conservation. Creation of a protected area network has been the approach to protect and conserve till now. But with the increasing anthropogenic pressures, peripheral areas become integral for conservation. The peripheral or transition or buffer or eco-fragile areas are important not only as corridors for maintaining connectivity but also for preventing loss and degradation of biodiversity. Eco-sensitive zone (ESZ) delineation is a solution to prevent loss due to anthropogenic pressures and to regulate development in these areas. India is one of the countries with the concept of ESZ but the implementation of the same is still a challenge. In this paper, a novel geospatial approach has been presented to delineate ESZ. A species centric approach using Swamp deer (Rucervus duvaucelli duvaucelli) has been used to delineate ESZ. Protected area Jhilmil Jheel Conservation Reserve (JJCR) located in Northern India is the study area. Maximum entropy or Maxent model has been used to identify habitat suitability. Normalised difference vegetation index (NDVI), altitude, land cover and distance to roads were used as parameters. Seasonal variations for habitat suitability were also considered. A larger area of ESZ could be identified based on habitat suitability. But due to habitat fragmentation and management limitations, a lesser area was delineated as ESZ. This methodology of species centric approach for delineation of ESZ can be very useful and is the need of the day especially in India where the legislation exists to back it.

Keywords: Eco-sensitive zones (ESZ), buffer areas, Swamp Deer (Rucervus duvaucelli duvaucelli), Jhilmil Jheel (JJCR), Maxent

Abstract Id: 1092
DESIGN OF VIGNA RADIATA (MUNGBEAN) SPECTRAL SIGNATURE FOR ESTIMATION OF PHOTOSYNTHETIC PIGMENTS

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Development of spectral signatures of crops is very tedious task because of its growth. Recently non imaging hyperspectral remote sensing sensors are widely available for capturing the spectra of various objects on the earth surface. In the present study, experiment of non imaging hyperspectral spectra was conducted for Vigna Radiata (Mungbean) for different growth stages of Aurangabad region located at Latitude 19°55'21.6"N Longitude 75°22'38.2"E. The objectives of this research were to develop and evaluate spectral signature of vigna radiata crop as a basis to improve nutritional diagnosis of crop. Sample collection was based on different stages of crop by ASD FieldSpec4 non-imaging Hyperspectral device. Parabolic correction technique was applied for pre-processing of hyperspectral data which was in the form of (.asd) files. Stepwise multiple regression models were implemented by open source tool. Spectral Indices such as Normalized Difference Vegetation Index (NDVI), Pigment Specific Normalized Difference (PSSR a), Pigment Specific Normalized Difference (PSSR b), Pigment Specific Normalized Difference (PSSR c), Water Index (WI), Normalized Difference Lignin Index (NDLI), Xanthophyll (X1), Cellulose Absorption Index (CAI), Cartenoid Reflectance Index 2 (CRI2), Anthrocyanin Reflectance Index 2(ARI2) were computed using multiband spectral signature for pigment analysis. Among the different phonological phases of crop growth, the best correlations were observed between different growth parameters and vegetation indices at jointing stage of Vigna Radiata. The experimental results of NDVI and PSSRa were varied between 0.91 and 0.99 R2 values at the jointing and maturity stages as compared to other stages of Vigna Radiata. It is concluded that, spectral indices along with correlation study for hyperspectral datasets are the promising way to identify the photosynthetic pigments of crops. The developed spectral signatures of Vigna Radiata crop at different stages can be useful for crop identification.

Keywords: Spectral Signature, Vegetation Indices, Biochemical Parameters, ASD spectroradiometer

Abstract Id: 1093
CHARACTERIZATION OF HIGH CATASTROPHE DANGER ZONES ADJOINED TO EURASIA RELATED REGIONS OF GLOBAL IMPORTANCE WITH OPTIMIZED COMBINATION OF NETWORK OF GROUND-BASED LASER INTERFEROMETER STRAINMETERS, ADVANCED RADIOPHYSICAL, OPTICAL REMOTE SENSING SYSTEMS

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The optimized combination of:
A) Network of spatially distributed ground-based laser interferometer strainmeters;
B) Additional geophysical equipment, advanced radiophysical, optical remote sensing systems is proposed for more trustworthy multiparametric geodynamic, geophysical monitoring of high catastrophe danger zones adjoined to Eurasia related mega-regions of global economic importance, of strategic economic infrastructure development such as:

1. The mega-region of prospective transEurasian transport infrastructure routes including:
   a) the European countries - Russian Federation - China "Great Silk Route", including the recently proposed TransEurasian China-Kazakhstan-Russia-European Union express railroad transport systems zone (proposal of China) (This mega-region includes the seismically dangerous territories (5-6% of world's earthquakes) - the Alpide belt (from Mediterranean region (Spain, Italy, Serbia, Greece, Romania,…), eastward through Turkey, Syria, Iran, northern India, Nepal…);
   b) Russian Federation Trans-Siberian Route (Moscow - Vladivostok), etc.

(The significant part of Russian Federation territory is related to seismically dangerous zones (North Caucasian region, Southern part of Siberia from the Altai region to Far East, Far East);

2. the region of prospective trans-Asian oil/gas pipelines systems development such as China- Russia "Power of Siberia" - largest gas transmission system in the Russia’s East;

3. The “Ring of Fire” mega-region including the largest extra seismically, volcano dangerous ring zone around the Pacific ocean (about 90% of world's earthquakes and significant part of volcanos activity).

This mega-region is characterized with:
1) Specific tectonic structure determining the very significant relief varying from deepocean trenches to high mountains;
2) Earthquakes, volcanos high danger;
3) High danger of relief, whole landscapes destructive changes, damages at the up to catastrophic level.

The significant areas of “Ring of Fire” mega-region are subjected to frequent powerful (super powerful) tropical cyclones, storms impact.

The multiparametric geodynamic, geophysical monitoring of these mega-regions environment may be realized effectively at the basis of mutually beneficial, fruitful international collaboration.

Special Design Bureau, IRE RAS can provide stationary, mobile laser interferometer strainmeters; monitoring systems design, production.

Keywords: high catastrophe danger zones, remote sensing, network of spatially distributed ground-based laser interferometer strainmeters

Abstract Id: 1094
In this paper, we are proposing a K-means clustering technique for content based remote sensing image retrieval. Here k-means clustering is used for indexing the images from the database. This technique helps to retrieve images from the large database. First, in this paper, a method is used to extract color and texture features of remote sensing images. Here first HSV color space is used to extract the color feature. Then color moment and color AutoCorrelogram is also used to extract color feature. Initially, color feature extraction techniques used to generate the feature vector of images. The individual and combined color feature extraction techniques are compared and analyzed for CBRSIR (content based remote sensing image retrieval). Then Color features and texture features are compared and analyzed for remote sensing image retrieval. Based on this work CBRSIR system is designed using color and texture fused feature vector. The relevant retrieval brings better results than single feature retrieval. Initially, Manhattan Distance is used for indexing. Then k-means clustering technique is used. In this process, clustering concepts use features like texture, color to find similarity among the images. Based on similarity value the images are divided into clusters, then the new image which is to be verified with the database is compared with these clusters and based on its similarity in cluster image is retrieved. The Experimental results show that the combined features of images can provide better retrieval performance than a single feature of the images.

Keywords: Remote Sensing Image Retrieval, K-Means clustering, Color Moment, Color AutoCorrelogram

Abstract Id: 1097
PERFORMANCE TESTING OF HIGHLY EXPLOITED GRIDDED DATA PRODUCTS FOR RUNOFF PREDICTION USING UNCALIBRATED HYDROLOGIC MODEL: A STUDY ON A SEMI-GAUGED RIVER BASIN

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Accuracy of the outputs of hydrologic modelling largely depends upon the intensity and quality of input data. The process of parameterisation of complex models becomes difficult for an ungaged river basin, where precipitation data is scarce and the rain gauge stations are very few to help modelling the distributed nature of runoff. There are certain alternatives to the precipitation data sources being exhaustively used by hydrologists, namely satellite derived TRMM and gauge data derived interpolated products like Aphrodites. However, their efficiency in estimating runoff is questioned and proved to be seemingly condition specific. The present work focuses to test the performance of both the data in predicting runoff condition of Kangshabati river basin in Eastern India, based on an uncalibrated hydrologic model using 5 years of data. The accuracy of the predicted values were tallied with reference to the observed runoff values of three Discharge stations and Nash sutcliffe test was done on them to assess the model performance with both the inputs individually. The results were quite interesting as the accuracy level of the model outputs using two different types of input precipitation data is distinguishable. Comparing the discharge magnitude as predicted by two simulations using statistical parameters, it is apparent that the accuracy level of TRMM based discharge prediction is more in upper catchment and Aphrodite based discharge prediction is more in lower catchment. In other words, TRMM is more effective than Aphrodite’s in recording higher precipitation or high intensity discharge than that of lower precipitation or low intensity discharge and vice versa.

Keywords: Hydrologic Modeling; TRMM; Aphrodites; Ungauged basin; Nash-Sutcliffe

Abstract Id: 1098
PERFORMANCE TESTING OF HIGHLY EXPLOITED GRIDDED DATA PRODUCTS FOR RUNOFF PREDICTION USING UNCALIBRATED HYDROLOGIC MODEL: A STUDY ON A SEMI-GAUGED RIVER BASIN

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Accuracy of the outputs of hydrologic modelling largely depends upon the intensity and quality of input data. The process of parameterisation of complex models becomes difficult for an ungaged river basin, where precipitation data is scarce and the rain gauge stations are very few to help modelling the distributed nature of runoff. There are certain alternatives to the precipitation data sources being exhaustively used by hydrologists, namely satellite derived TRMM and gauge data derived interpolated products like Aphorodites. However, their efficiency in estimating runoff is questioned and proved to be seemingly condition specific. The present work focuses to test the performance of both the data in predicting runoff condition of Kangshabati river basin in Eastern India, based on an uncalibrated hydrologic model using 5 years of data. The accuracy of the predicted values were tallied with reference to the observed runoff values of three Discharge stations and Nash sutcliffe test was done on them to assess the model performance with both the inputs individually. The results were quite interesting as the accuracy level of the model outputs using two different types of input precipitation data is distinguishable. Comparing the discharge magnitude as predicted by two simulations using statistical parameters, it is apparent that the accuracy level of TRMM based discharge prediction is more in upper catchment and Aphrodite based discharge prediction is more in lower catchment. In other words, TRMM is more effective than Aphrodite’s in recording higher precipitation or high intensity discharge than that of lower precipitation or low intensity discharge and vice versa.

Keywords: Hydrologic Modeling; TRMM; Aphrodites; Ungauged basin; Nash-Sutcliffe

Abstract Id: 1099
TROPICAL FOREST DEGRADATION ASSESSMENT; A CASE STUDY USING CLASLITE

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A detecting and monitoring forest degradation have implications for forest conservation and management. Mapping and monitoring deforestation have been an operational activity using satellite remote sensing. However, the mapping disturbance and degradation of forests is a major challenge. The present study attempted to quantify the forest disturbances in the Lachhiwala forest range situated in foothills of Himalaya in Uttarakhand state, India. The study utilizes optical satellite data (Landsat TM, 2010 and Landsat 8, 2015) and spectral unmixing of these datasets gave fractional cover (proportion of vegetation, non-photosynthetic vegetation, and bare soil). An automated tool CLASlite was used to generate fractional cover which adopts Monte Carlo Spectral Unmixing techniques that combine spectral and spatial information was used to enhance the detection and mapping of canopy damage, exposed soil, and dead vegetation. Results show that study area has 86.82% intact forest, 1.33% less degraded forest, 6.28% moderately degraded forest and 5.57% high degraded forest. Root mean squared error (RMSE) images were used to assess the performance of the Model. Landsat 8 OLI/TIRS has low RSME (i.e. 0-7%) than Landsat 5TM Landsat 5 TM (i.e. 1-10%).

Keywords: Landsat 8, Spectral Unmixing, Fractional Cover, Deforestation, Degradation

Abstract Id: 1100
COLOR BALANCE IN REMOTE SENSING IMAGE MOSAICING WITH THE ITERATIVE RE-WEIGHTED MAD TRANSFORMATION

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As a basic step of remote sensing image preprocessing, image mosaicing has always been an important research topic for years. However, the remote sensing images we could obtain are always multitemporal and from different sensors. After mosaicing, the color difference between the images is still obvious, which is not convenient for observation and analysis. Therefore, color balance after mosaicing attracts lots of attention. In this paper, color balance for remote sensing image mosaicing is divided into three steps: appropriate pixel pairs selection in overlap areas, image color adjustment and seam-line elimination. First step is essential in our method, which has significant effect on the results of color balance. To extract appropriate pixel pairs in overlap areas of two input images, we employ a method named the Multivariate Alteration Detection (MAD) transformation, which is extended by using an iterative re-weighting scheme. Due to the affine transformation invariance for the MAD variates, we could utilize an iteration scheme, in which the pixels are re-weighted by the probability of no change. After extracting appropriate pixel pairs, linear-regression analysis is utilized to calculate the gains and offsets, which are used to adjust one image to the other. Finally, seam-line elimination could make the seam crossing more uniform. Experiments demonstrate that the method of the iteratively re-weighted MAD (IR-MAD) transformation outperforms the classics method of histogram matching and statistical approach. This method has many advantages, such as good uniform color effect, less detail loss, not affected by cloud and mist interference. After the algorithm in this paper, we can obtain an image mosaic with consistent color, smooth transition and small loss of details.

Keywords: color balance; remote sensing image mosaicing; iteratively re-weighted MAD; seam-line elimination; cloud and mist interference

Abstract Id: 1101
Coal fire has become an international problem which causes environment issues such as toxic gas emissions, land subsidence and cracks, threat to human health and regional landscape degradation. Therefore, detection and monitoring of coal fire is an essential study to understand the dynamics of coal and its controls. Coal fire thermal anomaly detection from the coarse as well as medium spatial resolution Thermal infrared (TIR) data is scientifically more challenging as coal fire occupies small fraction of pixels, so only subtle temperature difference may be observed between anomalous pixels and background pixels. Therefore retrieval of accurate land surface temperature and development of robust algorithm for detection of coal fire thermal anomalous pixels is required. In the present study, land surface temperature was estimated by single channel radiative transfer model using atmospheric correction parameters estimated from satellite based and in situ data, and land surface emissivity (LSE) derived by a hybrid LSE model coupled with field-based emissivity inputs. Here, land surface temperature based statistical algorithm was developed to detect thermal anomaly related to coal fire. This study showed some prominent coal fire locations such as Bhulan bararee, Tisra, Kujama, Jharia rocp, ENA, Kusunda, Sendra bansjora, tetulmari, Gaslitand, Angarpathar, Shatabdi and Block-2 and its validation with ground truth data. This study also characterized the nature of coal fire in Jharia coalfield, Jharkhand, India which will be further useful for understanding dynamics of coal fire and its controls.

Keywords: Land surface temperature, Radiative transfer model, Statistical algorithm, Jharia coalfield, India

Abstract Id: 1102
ANALYSIS OF TEMPORAL VIIRS NIGHT LIGHTS IMAGERY TO CHARACTERIZE ELECTRIFICATION PATTERNS IN INDIA - A COMPARATIVE CASE STUDY FOR URBAN AND RURAL ELECTRIFICATION SCENARIOS

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In the present study, we used temporal night lights information derived from Visible Infrared Imaging Radiometer Suite (VIIRS) Day-Night Band (DNB) data, to characterize spatio-temporal patterns of urban and rural electrification in India. The main objectives of the study are - 1) to derive consistent, transient and enhanced night lights pattern for selected urban/rural areas and 2) to evaluate the potential of VIIRS DNB night lights data in identifying and monitoring newly electrified villages. VIIRS nighttime monthly light composites pertaining to the years 2012-2016 (available at https://www.ngdc.noaa.gov/eog/viirs/download_dnb_composites.html) were used to study change in electrification pattern. Preliminary results suggest that temporal VIIRS night lights data is very useful in characterising urban electrification pattern. However, night lights data provided very minimal and often inconclusive information on rural electrification, specifically for newly electrified villages. Reason for this is primarily attributed to the satellite overpass time (~ 0130 hrs mid-night), during which time electrical consumption in rural households is negligible. Other possible reason is the probability of missing village level information in the monthly composites, where-in only qualified noise-free data is considered in the generation process. We presume that newly electrified villages are very much spatio-temporally localised in terms of consistency of electrical power supply as well as the electrical power consumption, which may vary significantly on day-to-day basis. Therefore, in the present study following method is presented. First step is to use daily DNB nighttime lights data and analyse rural electrification with respect to intensity (dynamic range), village size, spatial distribution of settlements and type of light sources. Secondly, small spatial windows around the targeted villages/districts are to be considered to generate customised time composites. To address this, VIIRS DNB nighttime data is acquired and processed on daily basis at National Remote Sensing Centre (NRSC), Hyderabad India. Analysis is presented.

Keywords: Night light imagery, Day-night Band, Rural Electrification

Abstract Id: 1103
EVALUATION OF SNPP-VIIRS NIGHT FIRE PRODUCTS FOR ENHANCED SPACE BASED FOREST FIRE MONITORING - A CASE STUDY ON INDIAN FORESTS

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Forest fires are one of the critical natural and/or manmade episodic events that cause adverse effects on the ecology, climate, environment, human health and economy. In India, forests experience fires every year with varying diurnal patterns across space and time. The present study aims at evaluating Visible Infrared Imaging Radiometer Suite (VIIRS) night fire products for possible enhanced space-based forest fire monitoring in Indian region. Current operational fire products of Moderate Resolution Imaging Spectroradiometer (MODIS) and VIIRS are based on contextual fire algorithms, which extract the sensitivity of middle infrared channels (centered at ~4µm) to active fire hotspots relative to that of the background non-fire pixels (centered at ~11µm). On the contrary, the use of multi-channel night-time emitted radiances of VIIRS data (including the day-night band (DNB), which operates in visible-near infrared region) for extracting combustion sources was also demonstrated and corresponding fire products are available at https://www.ngdc.noaa.gov/eog/viirs/download_viirs_fire.html. In this study, we present a comparative assessment of 2 night time fire products of VIIRS which are based on a) contextual algorithm and b) plank curve fitting based method to multi-channel VIIRS data, to check the suitability of the products for fire monitoring. The comparison was carried out for 5 major fire prone regions in India viz., Western Himalayas, Western Ghats, Eastern Ghats, Central Plains and northeast India. Active fire locations from both the methods (products) were verified with post-dated fire burn scars of Landsat-8 data sets for spatial association. Results suggested that the ‘plank curve fitting’ based method showed more (also reliable) night fires compared to the contextual tests based method. Reasons are primarily attributed to the potential of extracting multi-channel sensitivity (including the DNB) to night fires vis-à-vis the typical forest fires characteristics in India with respect to size, intensity and duration of fire. Results are discussed.

Keywords: Forest fires, contextual fire algorithm, day-night band, plank curve fit

Abstract Id: 1104
DEVELOPMENT OF WEB BASED SPATIAL DECISION SUPPORT SYSTEM USING PROBABILISTIC BASED MODEL FOR THE ESTIMATION OF BIOLOGICAL RICHNESS

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Forest fires are one of the critical natural and/or manmade episodic events that cause adverse effects on the ecology, climate, environment, human health and economy. In India, forests experience fires every year with varying diurnal patterns across space and time. The present study aims at evaluating Visible Infrared Imaging Radiometer Suite (VIIRS) night fire products for possible enhanced space-based forest fire monitoring in Indian region. Current operational fire products of Moderate Resolution Imaging Spectroradiometer (MODIS) and VIIRS are based on contextual fire algorithms, which extract the sensitivity of middle infrared channels (centered at ~4µm) to active fire hotspots relative to that of the background non-fire pixels (centered at ~11µm). On the contrary, the use of multi-channel night-time emitted radiances of VIIRS data (including the day-night band (DNB), which operates in visible-near infrared region) for extracting combustion sources was also demonstrated and corresponding fire products are available at https://www.ngdc.noaa.gov/eog/viirs/download_viirs_fire.html. In this study, we present a comparative assessment of 2 night time fire products of VIIRS which are based on a) contextual algorithm and b) plank curve fitting based method to multi-channel VIIRS data, to check the suitability of the products for fire monitoring. The comparison was carried out for 5 major fire prone regions in India viz., Western Himalayas, Western Ghats, Eastern Ghats, Central Plains and northeast India. Active fire locations from both the methods (products) were verified with post-dated fire burn scars of Landsat-8 data sets for spatial association. Results suggested that the ‘plank curve fitting’ based method showed more (also reliable) night fires compared to the contextual tests based method. Reasons are primarily attributed to the potential of extracting multi-channel sensitivity (including the DNB) to night fires vis-à-vis the typical forest fires characteristics in India with respect to size, intensity and duration of fire. Results are discussed

Keywords: SDSS, AHP, Bayesian Modelling, Open Source, WebGIS

Abstract Id: 1105
EMPIRICAL MODEL FOR ESTIMATING LEVEL OF CONGESTION USING NEAR REAL-TIME TRAFFIC DATA FROM WIRELESS SENSORS

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There is a rapid increase in the number of vehicles as compared to the development of road network in Indian cities. This has resulted in increased congestion on the roads with longer travel times for the travellers. The congestion occurs mostly during peak hours which obstruct the flow of vehicles. In this paper, the behaviour of road traffic congestion in Dehradun city is studied. Inductive loops are installed at different locations in Dehradun city from which traffic data is collected. Many different models are given in literature for estimating levels of congestion (LOC) on the road. Most of these models only consider vehicle speed and density for determining congestion. In this study a new empirical model is developed to quantify the congestion levels on the road as low, medium and high. This model uses free flow speed and real-time traffic parameters from the loops which includes vehicle speed, density, vehicle class and headway. This model is location independent and can be applied anywhere with the inductor loops. The congestion value also helps in estimating the time required to travel a road segment. The performance of the model is validated with the ground data using manual observations and video clips. The results obtained shows that the model is suitable for near real-time applications.

Keywords: LOC, Congestion Model, Inductive Loops, Travel Time

Abstract Id: 1106
Ionosphere Total Electron Content and its deviation from average concentration has been studied for number of earthquakes worldwide using Global Navigation Satellite System (GNSS) data. These studies are limited to statistical analysis for TEC variations prior to events from GNSS observations near to epicenter or at least falling within the earthquake preparatory zone. In this study, TEC variations prior to 2015 Mw 7.8 Gorkha earthquake were analysed from number of permanent GNSS stations installed at Nepal. TEC time series analysis with 15 days mean±1.34 standard deviation limit reveals negative TEC anomaly on 11 April 2015 whereas positive anomaly on 24th April 2015. Maximum TEC on 11th April 2015 from 14 GNSS Stations distributed 50 to 350 km around the epicenter shows that TEC concentration decreases linearly towards the epicenter. In case of positive anomaly on 24th April 2015, TEC concentration increases linearly towards the epicenter. Thus continuous ionospheric TEC monitoring may open up new avenue towards possible precursor and epicenter detection of impending earthquake.

Keywords: Total Electron Content; Gorkha earthquake; TEC monitoring.

Abstract Id: 1108
Spectral Analysis Of Eo-1 Hyperion Data For Snow Grain Size Mapping In A Part Of Himalayan Region

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Snow is the part of atmosphere in the climate system of the Earth, and its physical parameters play an important role in hydrological and climate models. The present study concerns with the imaging spectroscopy to produce the snow cover maps and to estimate snow grain size in the North-Western Himalayan region. It is necessary to develop an approach to accurately map the snow cover, snow grain size spatially using advance remote sensing data and technique. Remote sensing techniques can provide spatial and temporal information of a large extent, economically and efficiently. In the present study, one of the important snow physical parameters (i.e., snow grain size) has been estimated using Spectral Angle Mapper (SAM) classification method and Grain Index (GI) method. The study has been carried out by using Hyperspectral EO-1 Hyperion sensor data of 12th January and 23rd January, 2016 to map the grain size of snow. The FLAASH (Fast Line-of-sight Atmospheric Analysis of Spectral Hypercubes) atmospheric correction model has been used to apply atmospheric correction from satellite images. The spectral reflectance of different types of snow grain size has been collected in the Hyperion image using spectral library. The important wavelengths are found for the retrieval of snow parameters, such as grain size. The snow cover maps were produced using Normalized Difference Snow Index (NDSI) technique. The snow maps were generated for dry snow, small grain size snow, medium grain size snow, large grain size snow and wet snow classes. This study is important for mapping of snow-cover characteristics which can provide valuable input for climatology, hydrology, and mountain hazard applications

Keywords: Spectral, Hyperion, Snow, Grain Size, NDSI

Abstract Id: 1111
Forest fire is one of the major sources of air pollution due to direct emissions of pollutants and also due to the formation of different constituents through secondary chemical and physical processes. Pollutant emissions from forest fires influence tropospheric chemical composition and hence can alter radiation balance of the earth atmosphere system. During April-May 2016, richly forested Indian state of Uttarakhand had experienced widespread forest fires. The current study examines dispersion of carbon monoxide (CO) from the source regions of forest fire to distant places using the Lagrangian particle dispersion model, FLEXible PARTicle dispersion model (FLEXPART). Aqua satellite based observations reveal considerable enhancement in the columnar concentration of CO during the burning period, compared to that in previous years. In the present study, concentrations of CO at different pressure levels and columnar CO over Uttarakhand during the forest fire event (April 24, 2016 - May 02, 2016) are simulated. Area averaged profiles of model derived CO compare well with the profiles from the space-borne sensor, Atmospheric Infrared Sounder (AIRS) onboard Aqua. Comparison between model derived columnar CO and satellite observations shows good agreement with coefficient of correlation ($r$) ~0.91, over the burnt areas. Further analysis using FLEXPART reveals transport of pollutants towards north-eastern and eastern regions, from the locations of forest fire events. Model derived vertical distribution of CO over Tibet, which is at north-east of Uttarakhand, shows significant increase of CO concentration at higher altitudes ~3km from the mean sea level surface during the fire event. The observed enhancement in CO over Tibet is attributed to long range transport from the forest fire regions in Uttarakhand.

Keywords: FLEXPART, carbon-monoxide, transport

Abstract Id: 1112
Hyperspectral remote sensing is an emerging tool suited for the detection of target resources. It can distinguish the target resources by narrow spectral features. The hyperspectral sensors are mainly categorized into two types; they are airborne sensors and space-borne sensors. The airborne sensor, AVIRIS-NG and the space-borne sensor which is EO-1 Hyperion are used in this project study. The hyperspectral data is preprocessed due to the presence of a noise, zero bands, and water absorption bands. The data preprocessing of EO-1 Hyperion includes bad band removal, across track destriping, and atmospheric corrections. For AVIRIS-NG data, the data preprocessing includes bad band removal which contains noise. After data preprocessing, both the hyperspectral data further proceed to reduce the dimensionality of data with the help of Minimum Noise Fraction (MNF). The pure pixels are selected with the help of Pixel Purity Index (PPI). The endmembers classes were generated by n-Dimensional Visualizer (n-D). Spectral Angle Mapper (SAM) algorithm helps in identification of minerals of AVIRIS-NG and EO-1 Hyperion. The objective is to compare the AVIRIS-NG and EO-1 Hyperion for mineral identification. The comparison of AVIRIS-NG and EO-1 Hyperion is mainly done on the basis of the mineral map generated by SAM algorithm. Mineral spectra of AVIRIS-NG interpret better than the EO-1 Hyperion.

Keywords: Hyperspectral Remote Sensing, EO-1 Hyperion, AVIRIS-NG, Minimum Noise Fraction, Pixel Purity Index

Abstract Id: 1116
Landslide occurrences are quite common in the Sikkim region. The main reasons for this phenomenon in the Sikkim state are attributed to the complex geological, tectonic setting and the high intensity of rainfall, besides the anthropogenic factors. Most of the earlier studies in this region are limited to Landslide hazard zonation, mitigation measures. Slope stability assessment of this region was carried out using SINMAP (Stability Index MAPping) in ArcGIS by using Digital Elevation Model (DEM), geotechnical parameters and rainfall information. Rainfall thresholds for selected major landslides of this region, are also estimated using daily rainfall data of Indian Meteorological Department stations and information related landslide events. In the present study, an attempt has been made to generate slope stability index maps at different rainfall rates 10, 20, 40, 100 mm/day by calibrating the model, based on geotechnical information to assess slope stability at the regional level in response to different rainfall rates. Thus these maps provide insight into spatial distribution of slope stability, in response to different rainfall rates at a regional scale. Probable Landslide Initiation Points are derived along each flow path having least stability index value using the stability map generated for the rainfall rate of 40 mm/day. Most Probable Landslide Initiation Points (MLIP) are derived from these points with a distance of 300, 400, 500 and within 1 km from the roads. MLIPs are comparable with an inventory of landslides carried out in this study. High-resolution DEM, rainfall from a dense network of rain gauges, more geotechnical information of landslides in future, will provide a better understanding of the behaviour of shallow landslides in response to different rainfall rates. Field survey of landslides is also carried out during November 2011 after the major earthquake occurred on 18th September, 2011.

Keywords: Landslide, Sikkim, Rainfall threshold, Slope stability modeling

Abstract Id: 1118
AQUACULTURE FEATURE DETECTION USING PCA AND OBJECT BASED IMAGE ANALYSIS

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In 2016, Diwata-1 - Philippines’ First Microsatellite, built under the government project Philippine Scientific Earth Observation Micro-Satellite was successfully launched into space and was able to capture images that can be used for weather observation, environmental monitoring and disaster risk management. Being the first Filipino made and co-developed microsatellite, Philippines are now expected to benefit from its capability to assess and monitor environmental changes, one of which is the country’s coastal areas.

Over the decades, Philippines’ coastal areas have experienced rapid and dynamic changes due to the increasing demands in aquaculture fisheries. With the advent of different remote sensing techniques in feature extraction and classification, a methodology was developed to extract fish pens, fish cages and fish ponds using the available 60m-resolution Near Infrared and Red Bands of Diwata-1 Satellite Image. Different image enhancement techniques were applied to improve the quality of the image layers. One of which is using an Independent Component Analysis feature detection algorithm in order to eliminate non-aquaculture features (tidal flat, seawater, land etc) around target features (aquaculture) effectively. A mixture of image enhancement operations like linear stretching, histogram equalization and adaptive filtering were further tested and applied. Experimental results demonstrated that these contrast adjustments and image enhancements techniques supports considerably the detection of targeted features. Thresholding using image’s gray level was also found effective in isolating objects of interest from the rest of the objects in the image. The techniques presented in this paper demonstrated the potential of Diwata-1 Satellite Image to detect and identify Aquaculture features which can be a framework to utilize Philippines’ First Microsatellite Data for studying and monitoring Aquaculture areas and its effect to the environment.

Keywords: Aquaculture, Feature Extraction, Image Enhancement, Microsatellite Image

Abstract Id: 1119
CLASSIFICATION OF HYPERSPECTRAL REMOTE SENSING IMAGES BY AN ENSEMBLE OF SUPPORT VECTOR MACHINES UNDER IMBALANCED DATA

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It is found very often that training data contains unequal number of representative samples for classes. Some of the classes might be represented by a larger number of samples while the rest with lower number of samples. Classification of remote sensing images with imbalanced class distribution could result in a significant drawback in the classification performance attainable by most standard classifier learning algorithms which assume a relatively balanced class distribution and equal misclassification costs. So it is worth exploring if ensemble method could give an improved performance under the condition of imbalanced training data.

In the proposed work, Support Vector Machine (SVM) will be used as base classifiers in the ensemble committee. An ensemble of SVMs will be constructed using popular Bagging method. Standard Hyperspectral data such as Indian Pines will be used as test data. The proposed work will explore the efficiency of ensemble technique in improving classification accuracy, even in cases of robust classifier such as SVM.

Keywords: Ensemble method, SVM, Bagging, Classification, imbalanced data.

Abstract Id: 1121
MERIDIAN, PARALLELS, AND MAP PROJECTION: EDUCATIONAL APPLICATION OF AUGMENTED REALITY TECHNOLOGY

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Augmented Reality (AR) projects virtual objectives into the real world and enables users to gain information from the environment on the scene. AR offers further learning information with animations, audio files, and interactional games, which helps users to understand some complex concepts or some invisible scenes. Compared to 3D animation, AR offers stronger interactive possibility which impresses users with an immersive experience. These characteristics of AR technology are exactly appropriate for educational purpose.

As Augmented Reality (AR) technology constantly advances, education-related academic research has been increasingly growing in this decade; however, it is still limited that scholars create AR technological devices or applications for educational purposes. Recently, AR has been utilized in the instructions of biology, geography, and earth science in the field of education. In the field of geography, cartography is one of the most suitable subjects for employing AR for geographic pedagogy. Consequently, our goal is to create an AR technological education application for learning meridians, parallels and map projection.

Meridians, parallels and map projection are considered almost one of the most abstract concepts to most high school students. No matter lines of latitude and longitude or the types of projection like cylindrical projection or stereographic projection are difficult to be illustrated from a solid sphere to a picture in a plane. AR technological application allows students to observe a stereoscopic virtual earth and enjoy its interactive functions. For instance, the Globe rotates and shows the parallels on the surface while we sliding the screen, or the light source can be moved on the screen to create different forms of map projection. We expect this application will help students effectively learn these geographic concepts.

Keywords: Augmented Reality (AR), Virtual Reality (VR), Cartography, Education, Map projection

Abstract Id: 1122
QUANTIFYING GROSS PRIMARY PRODUCTIVITY OF AN INDIAN MANGROVE FOREST USING GEO-LEO SATELLITE DATA

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Gross primary productivity (GPP) is total carbon assimilation by plants through the process of photosynthesis. In view of increasing anthropogenic influences and global changes, quantification of carbon assimilation through photosynthesis has gained tremendous significance. Precise estimation of GPP is essential part of several ecosystem models. Mangrove ecosystem, that offers significant protection to coastal environment, is governed by changes in salinity and other micro-environment factors. Globally mangroves are facing serious threat and are undergoing degradation due to anthropogenic pressure. In view of global changes, an assessment of carbon assimilation potential of mangroves is required for developing into a carbon sink and conservation of this fragile ecosystem is highly essential.

In the present study, estimation and validation of mangrove GPP was carried out in Bhitarkanika national park (Odisha, India). Light Use Efficiency (LUE) was modelled from seasonal, diurnal in-situ photosynthetic rate observations on 11 dominant mangrove species. For estimation of GPP, ‘vegetation photosynthetic model’ framework was modified using water, temperature and salinity scalars derived from IRS Resourcesat 2 LISS-4, a Low earth orbit (LEO) satellite data. The incident Photosynthetically Active Radiation (PAR) was derived from insolation product obtained from Geostationary (GEO) satellite KALPANA-1 VHRR.

Amongst all the species, highest LUE was found in Excoecaria agalocha in winter and summer (5.53 and 0.55 g C/m²/MJ, respectively), and in Aegiceras corniculatum in post-monsoon season (0.58 g C/m²/MJ). Seasonal 8-day average GPP was found to vary from 3.41 g C/m² to 14.4 g C/m², with the highest in winter. Comparison of modelled estimates showed fairly good agreement with MODIS GPP (r = 0.89; n=118) having comparable coefficient of variation (41.8% in modelled and 49.5% in MODIS GPP). The present modelling approach of estimating GPP through GEO-LEO satellite can be used to quantify carbon sink in other Indian mangrove regions.

Keywords: Gross primary productivity, Light use efficiency, Mangroves, Bhitarkanika, Vegetation photosynthesis model

Abstract Id: 1123
United Nations, Department of Economic and Social Affairs has projected the world's population is to grow to 9.8 billion by 2050, and 11.2 billion in 2100. The increasing population create a massive demand for food. In Sri Lanka, rice is the staple food of the inhabitants; hence, the paddy crops are cultivated in all the districts of Sri Lanka with total of about 708,000 hectares at present. However, to address the food security issues with growing population, it requires data and information including crop monitoring, modelling, cultivated crop area and yield estimation and yield forecasting, etc. In Sri Lanka, most of the strategic planning and decision making regarding rice yield is based on its seasonal production estimated by a conventional method known as “crop cutting survey”. However, it has several practical limitations. Due to the synoptic and repetitive nature of satellite observations, the use of satellite images have the unique advantage of providing timely information on crop statistics at local, regional to global scales. Therefore, this study is focused on estimating paddy cultivated area and yield in polonnaruwa district of Sri Lanka by using freely available satellite data collected by the MODIS and Landsat sensors. Complementing each other, the temporally-rich MODIS data are used to capture rapid phenological transitions of paddy crops, whereas the moderate-resolution Landsat data are used to delineate more spatial details for accurate area estimation. Preliminary results suggest that MODIS data alone underestimate paddy area considerably, whereas Landsat data can provide accurate estimate on paddy area. However, rice yield can be predicted using MODIS-based yield estimation models. These results indicate that the use of MODIS and Landsat data is efficient and accurate for paddy area and yield estimation at national scales.

Keywords: Rice yield, MODIS-(MOD09Q1) image product, Landsat, NDVI

Abstract Id: 1124
A STUDY ON THE GENERATION OF GIS BASED PERVIOUS/IMPERVIOUS MAP TO SECURE FUNDS FOR IMPLEMENTING GREEN INFRASTRUCTURE POLICY

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Green infrastructure policies have been introduced recently to solve various problems of cities. In order to expand green infrastructure policies, sustainable financial resources should be secured first. One of ways to secure new financial resources is a method for estimating impervious area, which is essential to accurately calculate the costs. Hence, this study aims to establish a proposal for producing a Pervious/Impervious Map with high accuracy based on GIS in order to estimate the new green infrastructure resources, and to create basic data for the green infrastructure policies.

In order to estimate the new financial resources for the green infrastructure, it is necessary to update Land Cover Maps for reflecting actual land use status, and to produce a Pervious/Impervious Map with high accuracy by linking the maps. The land cover maps are updated with an irregular period of 4-5 years, which makes it difficult to detect changes in the latest land use. Therefore, it is necessary to update the land cover maps by year using various spatial data, and to produce a Pervious/Impervious Map using property information of the updated land cover maps. Sejong Special Self-Governing City was selected as a study area as it is expected that land cover changes will be large due to relocation of administrative capital and urban development plan. A land cover map produced on a small-scale classification and in 2015 has been provided to the Sejong city by the Ministry of Environment, but land cover changes have been made due to continuous development, which requires a updating procedure of the land cover map using various spatial data. The procedure for updating the land cover map consisted of preprocessing, first and second updating land cover information, and quality inspection process.

This study aims to create basic data for the green infrastructure policies

Keywords: Green Infrastructure, pervious/Impervious Map, GIS, Land Cover Map

Abstract Id: 1125
DELINEATION OF GROUNDWATER POTENTIAL ZONES IN SHAHZAD RIVER BASIN, BUNDELKHAND (INDIA) USING REMOTE SENSING AND GIS TECHNIQUES

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Shahzad River basin in Lalitpur district of Uttar Pradesh, (India), covering about 1100 sq km forms that part of Bundelkhand region, which has remained backward socio-economically over the decades. The status of natural resources especially the water resources have faced tremendous pressure, since water requirements for irrigation and drinking have been rising. The region faces acute water shortages especially during summer since it has hard geological formations which are poor in terms of groundwater occurrence. An attempt has been made to analyze and assess the drainage characteristics, hydro-geomorphology, slope, DEM and land use/land cover of the river basin so as to integrate them in GIS environment for delineating groundwater potential zones for future development. IRS LISS III FCC data has been used for preparation of various thematic maps based on visual interpretation, field knowledge and ground truth surveys. In hard rock terrain such as the present study area, interpretation of satellite data for delineation of lithological units, weathered zones, mapping of fracture zone and their trends as well as intensity, land use/land cover are discriminatory features and form a valuable aid for delineating potential groundwater areas. Different maps i.e. land use/land cover, hydro-geomorphological, geological, drainage, DEM and slope etc. and their integration in GIS have proved that the inter-relationship amongst the parameters are an important task to draw inference about the infiltration, runoff and ground water potential zones. Morphometric analysis reveals that the drainage basin has not been much affected by any major structural and tectonic disturbances. The geomorphic units and landforms such as denudational hills, linear ridges, and pediments act as run off zones, whereas, the south east oriented linear ridges which are intersecting perpendicular to each other act as recharge zone. The other geomorphic units i.e. valley fill and buried pediment constitute promising zones for further groundwater exploration and development. The basin has been classified into four promising areas/zones for groundwater prospects, i.e. poor, poor to moderate, moderate to good and good to excellent. Based on the results of the study micro level planning on water resources of the basin may be undertaken to utilize the enormous amount of surface water potential available annually in the basin. Check dams, artificial recharge structures, percolation ponds may be constructed in zones of poor to moderate ground water potential, especially in the southern, central and northern parts of the basin. Since the basin has predominant agriculture land, hence emphasis on water resources (surface and groundwater) and their optimum utilization based on the watershed approach may be adopted by local planners and decision makers.

Keywords: GIS, hydro-geomorphology, DEM, land use/land cover

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RETRIEVAL OF SNOW GRAIN SIZE AND SNOW COVER OF LOWER HIMALAYA USING HYPERION DATA AND COMPARISON WITH FIELD MEASUREMENTS

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The Himalayan mountain system lies with strike NW-SE for about 2400 km, holds one of the largest concentration of snow and glaciers outside the polar regions. India sustain on the perennial melt of snow and glaciers meeting the water requirements of agriculture, industries, and domestic sector even during summer. Therefore, it is important to monitor and assess the state of snow and glaciers. Information pertaining to Himalayan snow is difficult and time consuming by conventional means because of harsh weather and rugged terrains. This can overcome by using remote sensing techniques providing synoptic view, repetitive coverage and effective for snow studies.

The Hyperion provides continuous narrow 220 spectral bands (from 357 nm to 2576 nm with a 10 nm bandwidth) with a 30-meter resolution. The present study demonstrates the potential use of Hyperion dataset (L1R digital images) for the mapping of snow cover and grain size in lower Himalayan region covering area from Solang to Dhundi, Himachal Pradesh. Hyperion dataset downloaded from the USGS and were processed using ENVI 5.1 software. The main objective was to derive spectral signatures of different size of grains collected by field spectroradiometer in field and compared with extracted spectral signature from hyperion dataset and available spectral library. A good correlation is observed. The wavelength 1240 was found to be best for grain size retrieval. The mapping of snow grain size was also attempted using the spectral angle mapper (SAM) method.

Before extracting the spectral signature from the EO1 dataset requires pre-processing and atmospheric correction. In pre-processing bad band and bad column were removed. And atmospheric correction is done by Fast Line of sight Atmospheric Analysis of Spectral Hypercubes (FLAASH) to convert radiance into corresponding reflectance. Thus, this methodology proved its usefulness in retrieving snow grain size and mapping spatial variability.

Keywords: Snow grain size, hyperspectral, spectrometer,

Abstract Id: 1130
WSN BASED NATURAL DISASTER ALERT AND ANALYSIS SYSTEM

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Analysis of Natural disaster like Landslides, Earthquakes and Tsunamis are possible but Alert of these disasters before occurrence is more difficult than analysis. WSN plays most important role to get live digital data regarding geological changes like temperature, humidity, rain water intensity. There are three fundamental ways for monitoring natural disasters viz visual, surveying and instrumentation. Ground based visual inspection and sampling of these on regular basis may be one of the effective ways of monitoring the disaster. Surveying includes all type of physical measurements. Instrumentation may include installing equipment for periodic reading of the different monitoring sensors such as inclinometer, strain gauge, rain gauge, clinometers, extensometer, pore pressure sensors etc. WSN based natural disaster alert system capable to inform the geological changes in digital form and also provides digital and numerical data wirelessly to the control room in real-time with disaster category, its strength, and the exact geographical location (GPS data) and also provides the SMS to concern registered officer for quick decision of rescue operations. WSN based natural disaster alert system is currently in active state in Nashik,Maharashtra and providing the live geographical information from Kadwa Dam, Ghoti, Nashik, Maharashtra(GPS Locations: 19.768536, 73.793108) and Varwandi Village, Nashik,(GPS Location: 20.069680, 73.837865) for data validation purpose.
Interactive software “VKz GeoInfoSys” (Version: 1.0.0.4) is in active mode to collect data generating from these two locations. It has capability provide live geographical information from sensors available from these two locations. And also message database in MS-Access (for testing mode) .
After validation of WSN based natural disaster alert system, near about 630 villages, towns, cities in Sahyadri Mountain areas are covered by these types of Sensor node

Keywords: GPS,GIS,WSN

Abstract Id: 1131
ANALYSIS OF EROSION ON LAND AND ITS RELATIONSHIP WITH THE SUSPENDED SEDIMENT CONCENTRATION IN THE ADJACENT RIVER MOUTH

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It is obvious that the eroded top soil from upland catchment area contributes to the Suspended Sediment Concentration (SSC) in the adjoining river mouth, which can be clearly distinguished as a sediment plume in remotely sensed images. The seasonal analysis of erosivity and the SSC can provide insight into the response patterns with a clear view on the onset and offset of rainfall events. A watershed which is a part of Godavari river basin in Andhra Pradesh with an area of 774300.025 hectares was generated and used for the study. Satellite multi-sensor data like TRMM and MODIS-NDVI were used for the generation of monthly rainfall runoff erosivity maps and cover management maps (temporally varying factors) respectively, was fed into the USLE model for obtaining monthly erosivity. Amidst the coarse spatial resolution, the high temporal frequency of the satellite data provided a better overview on the seasonal behaviour of erosivity. For the estimation of average monthly SSC over the estuarine sediment plume at Narasapur region of Andhra Pradesh, Oceansat - OCM (Ocean Colour Monitor) data was made use of in this study. The scatter plot of monthly erosivity against monthly SSC gave a strong linear correlation with $R = 0.64$ for $n = 22$. The estimates from the literature (Reddy et al, 2005) were used for validation of erosivity estimates obtained in this study. (Reddy, R. S., Nalatwadmath, S. K., & Krishnan, P. (2005). Soil Erosion Andhra Pradesh. NBSS Publication, (114)). In future, with the use of improvised RUSLE (Revised Upper soil Loss Equation) with Trap - Efficiency (TE) (sediment - yield) models with ground truth and increased number of years of study providing more ‘n’ value for the correlation analysis, will result in enhanced accuracy of the linear expression obtained in this research.

Keywords: USLE, monthly erosivity, monthly Suspended Sediment Concentration (SSC), Seasonal analysis of erosion, cyclonic impact

Abstract Id: 1133
IMPACT OF CULTIVATED LAND CHANGES ON AGRICULTURAL PRODUCTION POTENTIAL IN INDO-GANGETIC PLAINS, INDIA

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There is a growing interest to understand the role of cultivated land conversion on food security. Assessing the agricultural production potential and its response to cultivated land changes could deliver a scientific basis for strategic decision-making and thus to ensure sustainable food production. This study uses time series MODIS enhanced vegetation index (EVI) images (250m) from 2001-2016 to examine the changes in the cultivated land area and its production potential over the entire Indo-Gangetic Plains (IGP). The MODIS land use land cover (LULC) products were developed for 2001, 2006, 2012 and 2016 using unsupervised (ISODATA) and supervised (maximum likelihood) classification and the cropland area was retrieved. The retrieved area data was validated through Govt. statistics on the land use (with 0.3% RMSE for ISODATA classification and 0.1% RMSE for maximum likelihood classification). Temporal change analysis in LULC over the IGP suggests a decrease (2.52 %) in cultivated land over the periods (2001-16) with increase in area under forest or plantation (0.81 %) and built up (0.83 %). Areas under major crops were estimated from MODIS EVI images through spectral angle mapper classification, and actual productivity was calculated. Hot spots have been identified where substantial changes in LULC were recorded.

Keywords: LULC, MODIS, IGP, cropland

Abstract Id: 1134
The appearance of black-odor water body belongs to the extreme phenomena of water organic pollution. Resulting from the discrepancy of constituent contents, the spectral responses of black-odor water body differ from those of clean water body, which lays the foundation for monitoring black-odor water body with remote sensing methods. With the pretreatment of TripleSat constellation remote sensing data and object-oriented technique process, the extraction rule set of black-odor water body was carried out based on the corresponding apparent characteristics. Consequently, the distribution information of black-odor water body was acquired. The typical small and medium river channels in rural area were selected as the research objects, and the measurements of water quality parameters were conducted in the channels. According to the authoritative water quality criteria, 8 of the sample points were confirmed to be black-odor water body. With the object-oriented extraction process, all the 8 black-odor water bodies were extracted accurately. 127 objects were extracted from water areas, which embodied the consistency with the black-odor sample points in the relative location, tone, and texture. Furthermore, the method was then applied to the typical river channels in urban area, and the producer's accuracy of extracted black-odor water body reached 88%. With the combination of TripleSat constellation remote sensing data and the object-oriented technique process, the macroscopic and rapid monitoring of black-odor water body was realized, providing a reference for the black-odor watercourse modification and natural ecology restoration.

Keywords: TripleSat constellation; remote sensing data; black-odor water body; object-oriented technique; rule set

Abstract Id: 1135
Hydrological Response To Spatial And Temporal Changes Of Impervious Surface In Qinhuai River Basin Of Southeastern China

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The annual runoff response to spatial and temporal changes of impervious surface urbanization was analyzed in the Qinhuai River basin, an urbanized basin located in southeastern China, over the period from 1986 to 2013. Impervious area data were derived from the Landsat images using superior ensemble learning method of rotation forest. The percent impervious area and number of impervious patches were calculated to measure the spatial configuration of the watershed urbanization. The Mann-Kendall test, Sen’s estimator, Pettitt test and double mass curve method were applied to examine gradual trend and abrupt change for hydro-meteorological data series. Hydrological model based on stepwise regression analysis was built and used to explore the relation among annual runoff and precipitation, potential evapotranspiration, impervious area and number of impervious patches. The results showed that annual runoff, and runoff coefficient had significant increasing trends, and changed abruptly after year 2001 when the watershed impervious area reached 8.6%. The average annual runoff increased by 60%, of which, urbanization was responsible for 59% of the increase, while precipitation changes were responsible for the remaining 1%. The annual runoff response to impervious area showed a nonlinear relationship, dry years are more sensitive to urbanization than are wet years. The change of impervious area and number of impervious patches showed that, starting in the early 2000s, urbanization consisted more of already existed impervious areas than of developed new ones, which increases the watershed’s conveyance capacity and results in the change of annual runoff response.

Keywords: spatial pattern, impervious surface, hydrological impact, rotation forest, statistical methods

Abstract Id: 1136
In an agricultural country, water consumption information is very important to managing agriculture. Thailand is not enough water for the rice plant in the past, so this paper studies the way to find rice crop evapotranspiration for the future planting plan. Remote sensing was used to determine the rice crop evapotranspiration in Hargreaves method. The Hargreaves method is one of several methods, which employs maximum, minimum and average temperature data to calculate the Reference Crop Evapotranspiration (ETo). The conception of this paper used Land Surface Temperature (LST) instead of air temperature in Hargreaves equation. The Land Surface Temperature (LST) was extracted from Visible Infrared Imaging Radiometer Suite (VIIRS) satellite imagery of the Suomi NPP weather satellite. The Land Surface Temperature (LST) was different from air temperature, so linear regression is a modeling to find the relationship between theirs. The maximum and minimum temperatures for each pixel were interpolated from the maximum and minimum temperature of automatic weather stations. All pixels were calculated by Python codes. The result of rice crop evapotranspiration using VIIRS satellite imagery was compared with using constant temperature in the study area.

Keywords: Crop Evapotranspiration

Abstract Id: 1138
EXPLORING THE NATIONAL RIVER WITH LAND USE PERSPECTIVE-A GIS APPROACH

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The land along which the river flows has been linked to the river since 1900s by several researchers. Very recently adding to these landscape and riverscape studies is the use of remote sensing and GIS for preparing the land use and land cover (LULC) map of the river basin and subsequently linking it to the water quality of river. After seeing our National River Ganga being untouched exploring such linkages, the present study was designed so as to investigate the effects of land use and land cover on the water quality of the river Ganga. For the purpose of the study the river Ganga stretch of Varanasi region was selected and LULC analysis for buffer radii of 1km along the bank was prepared using Arc GIS 10.2. Further parameters measuring the health of the river were linked to the LULC data obtained. The LULC data revealed that there are two predominant land use type in Varanasi viz. urban and agriculture and there are no forested areas near the river riparian zone. The water quality of the river Ganga near the agricultural land use was comparatively better than the stretches lined with built-up area. The source apportionment analysis conducted via principal component test revealed urban land as principal contributor of metals on the other hand agriculture land contributed organic matter into the river. The present research thus is a first and small initiative to direct the riverine research spatially suggesting its expansion over the entire river stretch so as to come up with different approach to rejuvenate the river Ganga.

Keywords: Arc GIS; agricultural; land use and land cover; principal component analysis urban; water quality

Abstract Id: 1139
REMOTE SENSING AND GIS BASED SITE SUITABILITY MODELING OF RAUVOLFIA SERPENTINA IN DEHRADUN DISTRICT OF UTTARAKHAND

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The state of Uttarakhand, located in the foothills of Himalaya, is a home to various rare, threatened and endangered species of medicinal plants. Rauvolfia serpentina, is one of the important species belonging to family Apocynaceae. It is one of the finest remedy that is widely used for high blood pressure and is also as sedative and tranquillizing agent. Keeping its importance in view present study is based on its distribution and suitable site identification for Sustainable development and livelihood generation for the people of the area. Remote sensing and GIS can play an important role in the identification of the suitable zones for conservation of Rauvolfia serpentina lower Shiwalik hill of Dehradun District. A total of 100 GPS points of the Rauvolfia serpentina were recorded in the study area. Digital Elevation Model (DEM) of the Cartosat satellite data was used for deriving topographic parameters like altitudinal zones, slope angle, slope aspect, which are important for the modeling of plant. Linear Image Scanning Sensor LISS IV & Cartosat fused satellite data was used for deriving land use / land cover, Normalized Difference Vegetation Index (NDVI), Normalized Differential Water Index (NDWI), Soil Brightness Index (SBI), etc. Apart from that, the climatic parameters i.e. annual average rainfall, annual average temperature and annual average humidity were used. The whole raster data cube was submitted to Spatial Multi-Criteria Evaluation (SMCE) module for suitability modeling of targeted species. The final results were validated from the remaining 30 % of GPS points gathered during field for verifying the results. The use of RS and GIS data shows highly useful in suitability studies as the results was incompetence with the ground validation. It shows the technological intervention can help to a greater extends for sustainable development and livelihood generation option in hilly areas for marginal farmers.

Keywords: Site suitability, Rauvolfia serpentina, Dehradun, Remote Sensing and GIS, Sustainable development

Abstract Id: 1141
OBJECT BASED CLASSIFICATION USING MULTISOURCE IMAGES FOR FOREST MAPPING


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The purpose of this paper is to conduct the forest mapping using the remotely sensed optical and synthetic aperture radar data sets. For the image fusion the principal component transformation (PCA) has been applied. Advanced satellite images classification represents an accurate and cost effective for land cover mapping at regional scale. For this purpose object oriented segmentation approach has been used for the forest mapping. eCognition software can be used to detect and discriminate forest by describing NDVI. This software is completely object oriented and uses a patented, multi-scale image segmentation approach. The generated segments act as image objects whose physical and contextual characteristics can be described by means of fuzzy logic. As a test site Bogdkhan mountain has been selected and ALOS 2 radar and Landsat 8 satellite optical images have been used.

Keywords: Bogd Khan mountain, classification, forest mapping

Abstract Id: 1143
"Geographic Names Information System" (GNIS) is an online website with Taiwan Gazetteer written by historians and geographers, which allows users to retrieve geographic names information with GIS tools. This project of Taiwan Gazetteer has been developed for almost half a century and has covered almost all of historical and modern geographic names in Taiwan and its affiliated islands.

While searching from the system, scholars deduce that some of similar geographic names in Taiwan show their similar topographic features or cultural characteristics from their spatial distribution. In this paper, we want to evidence this phenomenon in a view of quantitative study. However, only 20 percent of records on Taiwan Gazetteer have their coordinates since lack of GPS equipment in the early phase of the project. This weakness results a challenge to do further quantitative research. In order to solve this problem, we introduce an idea from geocoding. We give each record without coordinate an approximate result, based on its administrative area. We expect this approach can be an alternative way before exact coordinates being completed.

Keywords: Taiwan Gazetteer, Geographic Names Information Systems (GNIS), GIS, coordinates, quantitative research

Abstract Id: 1144
VISIBILITY ANALYSIS APPLICATION IN VULNERABILITY ASSESSMENT: ARMED FORCES OF THE PHILIPPINES IN THE CONDUCT OF HUMANITARIAN ASSISTANCE (CARMEN, BOHOL, PHILIPPINES)


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The Philippines, being a nation that is commonly at risk to various geohazards, is in need of an effective delivery of humanitarian assistance through its Armed Forces. However, various armed groups are opposing the Philippine Military for different reasons. Therefore, even these non-combat operations of the Military are under threat from these groups. Ambush attacks against Military convoy conducting relief operations in remote areas are common and cause problems in the delivery of humanitarian assistance. Loss of Military personnel and civilian life, serious injuries, damage of equipment and theft of relief items are the usual outcome. The concepts of visibility, line of sight and terrain are important factors on the success of these attacks. Integrating these concepts in planning the relief operations can help determine the optimal route in terms of ambush attack vulnerability. Visibility and terrain analysis cannot predict where the members of a certain armed opposition will position in an event of an ambush attack. However, it is determinable which areas are advantageous and disadvantageous in case of an ambush attack in that area. In this study, the municipality of Carmen in Bohol province, an island in Central Philippines, is chosen as the area where the relief items are intended to be delivered. Carmen is the epicentre of the 2013 Bohol Earthquake and is also susceptible to flooding and landslides. Geographically, it is at the center of Bohol Island, where the Tagbilaran Airport and Ubay Airfield are approximately 62 and 48 kilometers away, respectively. There is also presence of armed rebel groups in the island of Bohol, causing threat to relief operations. This study aims to apply Visibility and Terrain Analysis to determine which segments of the roads from either airport to Carmen are visibly and topographically disadvantageous for the Military convoy in an event of an ambush attack.

Keywords: visibility analysis, vulnerability assessment, humanitarian assistance, Armed Forces of the Philippines, Digital Elevation Model

Abstract Id: 1146
Humans are an integral part of ecosystems and influence the ecosystem services obtained from them. Ecosystem services (ES) represents both tangible and intangible benefits provided by the environment for sustaining and fulfilling human needs. The objective of this study is to map the ecosystem services viz. carbon sequestration, fuelwood and fodder, emanating from the forests in the Paligad MWS of Tehri district in Uttarakhand state of India. The forest of two periods are mapped using moderate resolution satellite images of LANDSAT ETM+ (2002) and OLI (2016). Future LULC was predicted by using CA-MARKOV model. Additionally, InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) Model was used for mapping carbon sequestration using the LULC maps as input along with the biomass measurements from the field data. For mapping the ecosystem services of the fuelwood and fodder, the forest type maps were complemented with the socio-economic data and the distribution of the fuelwood and fodder providing species based on abundance maps in the GIS domain. Finally, an integrated output was generated showing the multiple ecosystem service map of the forests in the study area. 54% of total study area are unable to flow multiple Ecosystem Services (Fodderwood + Fuelwood+ Carbon Sequestration) while 42% of the area are showing good flow of ES. On the other hand, 4% of total area neither sequestered the carbon nor provide any fodder and fuelwood services. According to result of this project, it is suggested to stakeholders of Paligad MWS to take necessary action and conduct reforestation, afforestation and cleanliness program in Thatyur, Kyari, and in MaituliSera villages. This research assumes to be useful for all stakeholders and organization working on the watershed, forestry and livelihood improvement sector of the Paligad MWS region. The major output of this research is Multiple Ecosystem Service representing their economic value Map.

Keywords: Biomass, Carbon storage, Ecosystem Services, Fodder & Fuelwood, GIS & RS, InVEST model

Abstract Id: 1147
DEEP - LEARNING APPLICATION FOR AERIAL LIDAR POINT CLOUD CLASSIFICATION

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Ever since, points contained in raw LiDAR point clouds gathered through aerial surveys are classified as either part of ground, vegetation or man-made structures by following an established rule set. A rule set is composed of step-by-step instructions segregating each point on various classifications. These classifications are defined by how they are perceived by the human mind. For example, the human mind defines that points belonging to ground classification form a planar surface in general while vegetation points resemble a more chaotic pattern. The computer is then forced to classify points based on how humans define them. This prohibits the computer to give their own definition of these classifications. One of the newest innovations today in the field of computer science is deep-learning. Deep-learning allows computers to seek and define patterns from the input data. Large amount of data is needed in order for the computer to seek meaningful patterns and make inferences with acceptable accuracy. Deep-learning is already applied in LiDAR but only for mobile LiDAR used in self-driving cars. It is used to recognize obstacles in front so that the car can make a proper response. However, researches on use of deep-learning for classification of Aerial LiDAR are extremely few. The Department of Science and Technology (DOST) in the Philippines is highly promoting for the participation of Filipino scientists and researchers in the development and application of deep-learning. Also, the Philippine government had the initiative on establishing a project utilizing LiDAR technology for surveying disaster-prone areas through the Phil - LiDAR Program, funded also by DOST and implemented by various state universities and colleges (SUCs) throughout the Philippines. This provides opportunity for the Philippines to pursue research on deep-learning application for aerial LiDAR data classification.

Keywords: Aerial LiDAR, deep-learning, artificial intelligence, point cloud classification

Abstract Id: 1148
A CASE STUDY ON USE OF SPACE TECHNOLOGY IN CROP INSURANCE

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Space technology with its advancement in the recent few decades can play an important role to crop insurance activity at different levels viz. estimating actual acreage-sown at insurance unit level to check the discrepancy of ‘over-insurance’, investigating anomalies / discrepancies in acreage sown, monitoring crop health and investigation on ground for advance intimation of yield reduction. Space input based weather data for servicing Weather Based Crop Insurance, rapid and detailed damage assessment after disaster such as floods, cyclone, drought etc. Geomatics can also be used for developing Geographic Information System (GIS) of insurance unit for user friendly viewing, querying and analysis of agricultural situation.

A case study was carried out under the pilot project called “KISAN -K/crop Insurance using Space technology and geoinformatics” pre-launch of Pradhan Mantri Fasal Bima Yojana (PMFBY) with an objective to test various technology based inputs to a crop insurance scheme. Gulbarga district in Karnataka was selected for study on rabi sorghum. Multi- sensor remote sensing data were used to generate the products like crop mask, crop phenology etc. PAR was computed from Insolation product available at MOSDAC. Crop vigour and stress based stratification into four different classes (A, B, C & D) was generated and more than 200 geo-location sites were selected for Crop Cutting Experiment(CCE) in proportion to their strata. CCE data were collected using mobile application with two field photographs and was sent to ISRO-Bhuvan server. Analysis of remotely sensed data corresponding to CCE was carried out. Combination of yield models, empirical as well as semi physical process based, were used to estimate the yields at district and block level. Coefficient of determination ($R^2$) was ranged from 0.25 to 0.56 between modeled and CCE yields. Optimized sampling size estimated to be required for district level CCE was about 80 per district.

Keywords: Crop Insurance, Space Technology, Yield models, Crop Cutting Experiment

Abstract Id: 1149
DROUGHT MONITORING USING MODIS DATA IN CENTRAL AMERICA

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Drought is generally defined as an extended period in which available water is insufficient for agricultural needs, consequently causing losses of agricultural production and enormous effects to human societies. Central America is one of the world’s regions most vulnerable to impacts of climate change, including droughts and floods. Changing climate patterns in form of increasing temperature and rainfall deficits has triggered more intense droughts causing dramatically reduced production of key crops that millions of farming households depend on for their daily subsistence. The objective of this study is to delineate drought-prone areas in the region using the Moderate Resolution Imaging Spectroradiometer (MODIS) data. We processed the data for 2014 using the simple vegetation health index (VHI) calculated from the temperature condition index (TCI) and vegetation condition index (VCI). The VHI results were compared with the Advanced Microwave Scanning Radiometer 2 (AMSR2) precipitation data, indicating close relationship between these two datasets with the correlation coefficient ($r$) value of 0.78. The VHI results were then categorized into five classes to depict the drought status in the region. The results showed that the larger area of severe drought was generally observed during the dry season (January-April), and it was, however, declined in the rainy season (May-November), except for July and August that the area of severe drought increased again due to the interruption of a short dry spell. This study demonstrates the application of MODIS data for drought assessment in Central America. The results obtained from this study in form of spatiotemporal distributions of droughts could be useful for agronomic planners to devise strategies in respect to mitigating negative effects of droughts on crop production while enhancing food security for the region.

Keywords: Drought, MODIS, cropland, VHI, Central America

Abstract Id: 1150
APPLICATION OF DEEP LEARNING IN COLORIZATION OF LIDAR - DERIVED INTENSITY IMAGES

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Most aerial LiDAR systems have accompanying aerial cameras in order to capture not only the terrain of the surveyed area, but also its true-color appearance. However, there are surveys wherein only LiDAR information is available. Usual causes of absence of aerial photographs are presence of atmospheric clouds during survey, poor lighting conditions are aerial camera problems. These leave areas having terrain information but lacking aerial photographs. Intensity images can be derived from LiDAR data but they are only grayscale images. A deep-learning model can be developed to create a complex function in a form of deep neural networks from the pixel values of LiDAR-derived intensity images and true-color images. This complex function can then be used to predict the true-color images of a certain area using intensity images from LiDAR. The predicted true-color images do not necessarily need to be accurate compared to the real world. They are only intended to look realistic so that they can be used as base maps.

Keywords: deep learning, artificial intelligence, intensity images, true-color images

Abstract Id: 1152
In 2012, Mongolia made a successful effort to further develop the environmental law sector and improve legal implementation procedures with the introduction and implementation of a new environmental law package. The practical use of the current environmental damage estimation method is restricted by its many variables, unreliable constants in the formula defined by possibly inaccurate and inconclusive studies, a complex process and a lack of supporting database. Biotopes as specific environment for plant and animal species and reflect mainly biodiversity aspects of biotope type consider diversity, their rareness and vulnerability. In Mongolia the biotope valuation method can be used after the differences in habitat and values are taken into account. The main variables that should be modified are landscape capacity to be restored, carrying capacity of resources, whether or not the landscape is under redevelopment, environmental assessment of soil, fauna and flora, possibility of reutilization of the landscape in post-reclamation and the abundance and diversity of the landscape. The current method in use by Mongolia, which was adopted in 2010, though well-grounded in theory and detailed, in practice, it involves a very detailed and complex process which has been proven to be vulnerable to a high degree of subjectivity and thus resulting in different assessment values depending on who is conducting the calculations, parameter variables being used, any assumptions made in the absence of data that is not always available, and the time consuming procedures the assessment. In the case of Mongolia, modified indicators need to be developed by taking into account the diversity of landscapes. The objective of this study is to improve and amend the environmental damage and compensation assessment method for landscape projects in Mongolia by evaluating its shortfalls and necessary improvements using the biotope valuation method as a benchmark.

Keywords: environmental damage, biotope value, Mongolia

Abstract Id: 1153
Carbon Monoxide (CO) distribution has been simulated over the Indian subcontinent for 2015 using WRF_Chem model and compared with MOPITT CO observations and in-situ measurements. CO concentration has been moderately overestimated by WRF_Chem model at all pressure levels. Better model performance is evident during winter. WRF_Chem simulated CO mixing ratios show moderate correlation with MOPITT observed CO mixing ratios. Correlation coefficient is found to be maximum over West India (0.43) and minimum over East India (0.20). Model shows significant overestimation with respect to MOPITT retrievals with greater MB value which varies between 41.07 ppbv (South India) and 66.06 ppbv (West India). WRF_Chem performance in terms of seasonal cycle is fairly good during June to December. Maximum amount of overestimation is found during spring season (March-May). Over Pune, Chennai and Ahmedabad, WRF_Chem model is able to reproduce the entire seasonal cycle of CO. The contributions of different CO sources to the total surface CO over Indian region has been quantitatively analysed using CO tracers in the WRF_Chem. The anthropogenic emissions (~35%) and the CO coming from the lateral domain boundary (~60%) are the major contributors of surface CO over the Indian landmass region. Anthropogenic emission sources show maximum contribution (~65%) over the East India. Over the Arabian Sea and the Bay of Bengal, maximum CO concentration (~81% and 76% respectively) has been contributed by the CO transported from regions outside the model boundary. During spring season, high contribution of surface CO (~25%) is contributed from the biomass burning emission sources over North-East India and Myanmar region. Maximum contribution of anthropogenic emission sources has been found over Delhi (~82%) and Kolkata (~83%). Over Ahmedabad, Bengaluru and Mumbai, moderate concentrations of surface CO (~42%, ~50% and ~42% respectively) are contributed by the CO coming from the lateral domain boundary.

Keywords: India, Carbon Monoxide, WRF_Chem, In-situ observation, CO tracer
VARIABILITY OF TROPOSPHERIC CARBON MONOXIDE AND OZONE OVER INDIA USING IASI/METOP SOUNDER AND AIRCRAFT (MOZAIC) WITH THE SIMULATIONS OF MOZART-4

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In the present study, tropospheric ozone (O3) and carbon monoxide (CO) have been simulated using MOZART-4 (Model for Ozone and Related chemical Tracers-Version4) for 2008. The model simulated O3 and CO are evaluated against the IASI (Infrared Atmospheric Sounding Interferometer) observations and MOZAIC (Measurement of Ozone and Water Vapor by Airbus In-Service Aircraft) measurements. The IASI observed and model simulated tropospheric (920-220hPa) column and surface mixing ratios of O3 and CO have been compared over six most populated locations of India. The simulated tropospheric column O3 is found to be in fairly good agreement with the IASI, with coefficient of determination (r2) close to 0.95. Similarly simulated tropospheric column CO also shows good agreement with observation (r2 ~ 0.79-0.87). Model overestimated tropospheric column amount for O3 and CO over all urban locations with mean bias (MB) of 4 - 6 DU and 3x1016 molec./cm2 - 15x1016 molec./cm2 respectively. The simulated surface O3 and CO mixing ratio show moderately good agreement with IASI observations. The modeled vertical distributions of O3 and CO agree well with the MOZAIC observations over central Indian site, Hyderabad. The mean of the simulated O3 mixing ratio is 51±10 ppbv for LT (lower troposphere) while 57±12 ppbv for MT (middle troposphere). The corresponding observed O3 mixing ratio is 43±15 ppbv and 49±15 ppbv respectively. The mean of the simulated CO mixing ratio is 137±54 ppbv for LT while 96±20 ppbv for MT. whereas the corresponding observed CO mixing ratio is 151±60 ppbv and 109±25 ppbv respectively. Results show good agreement between the modeled and observed mixing ratios of O3 and CO with correlation coefficient of 0.69 and 0.80 respectively in the LT whereas 0.60 and 0.39 in MT respectively. Detailed results will be presented.

Keywords: Ozone, Carbon monoxide, global chemistry transport model, IASI, vertical distribution

Abstract Id: 1155
Land surface albedo is one of the essential climate variables for surface energy balance and climate modelling. Changes in land cover lead to the changes in land surface albedo. Land Surface albedo is a critical parameter to assess the climate change over a period of time. This work discusses the changes in land surface albedo due to cropland changes from 2001 to 2012 over the Indian region. It has been found in literature that remote sensed Moderate Resolution Imaging spectrometer (MODIS) data have been used to access the variability of surface albedo over different vegetation type [Gao et al. 2005]. In the current work, change in the cropland area has been assessed for 2001 over 2012. It has been found out that cropland area has been significantly increased 0.14 million km² over Indian region. To establish the change in surface albedo due to land cover change, MODIS annual land cover data have been used. Spatial resolution of land cover data is 8×8 km over Indian region. MODIS black sky and white sky albedo product MCD43C3 have been considered in the present analysis. These products are 8 day data product based on a 16 day cycle’s observed data. Black and white sky albedo values have been estimated from BRDF values based on Ross-Li BRDF kernel driven model. Seasonal and annual black sky and white sky albedo values of shortwave and visible band have been estimated over the Indian cropland region for 2001 and 2012. It has been found that mean black sky and white sky albedo values for shortwave and visible band over cropland area has been decreased more than 15 %, with respect to the respective mean albedo values of 2001. These results indicates the warming effect i.e. increase in the temperature due to depletion of vegetal cover over Indian region.

Keywords: cropland, MODIS, shortwave, visible, broadband albedo

Abstract Id: 1156
ANALYSING THE CAPABILITY OF SENTINEL-1 SAR DATA FOR FLOOD MONITORING AND MAPPING IN IDUKKI DAM RESERVOIR, SOUTHERN WESTERN GHATS OF INDIA

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Efficient monitoring and prediction of floods and risk management for large reservoir is impossible without the use of Earth Observation data from space. One of the most important problems associated with flood monitoring is the difficulty to determine the extent of the flood area as even a dense network of observations cannot provide such information. The flood extent information is used for damage assessment and risk management. The use of optical imagery for flood monitoring is limited by the presence of clouds. In turn, Synthetic Aperture Radar (SAR) measurements from space are independent of daytime and weather conditions and can provide valuable information to monitor flood events. This is mainly due to the fact that smooth water surface provides no return to antenna in microwave spectrum and appears black in SAR imagery.

This study explored large inundation areas in the Idukki Reservoir in Kerala state. Sentinel-1A image with C-band and dual-polarization capability (HH+HV or VV+VH) was used in the study. This study aims to analyse Sentinel-1 SAR data for its potential to map standing water in the Idukki reservoir. 30 SAR images of Level-1 Ground Range Detected (GRD) C-band (5.405 GHz) collected in the Interferometric Wide Swath (IW) mode - during the period from October 2015 to June 2017 - were used to develop a procedure for reliable processing. These time-series SAR images were utilized to investigate the multi-temporal backscatter properties (e.g. mean) for different water extent across the Idukki reservoir area and to classify the water from land area. Field verification carried out on 26th May, 2016 and 6th June 2017 to find the current standing water in the reservoir. The permanent water body extent line vectorised from Google earth image dated 2nd March 2013 on which the lowest flood extent was recorded for the last ten years.

Keywords: Flood Extent, Sentinel-1, Backscatter Analysis, Polarization, SAR Images

Abstract Id: 1157
Shalbatana Vallis located on the Oxia palus quadrangle at 7.8° N latitude and 42.1° W longitude is quite significant among the Martian vallis by its origin morphology structure etc. Formation of the valley is still unknown, it is considered to be tectonic volcanic or both. These South-North flowing valley is having a length of approximately 1300 km and width up to 20 km. The valley is considerably deeper and narrow than the other Martian vallies. Origin of Shalbatana is thought to be at a zone of linear chaotic terrain north of Ganges Chasma and ends in the Chryse Planitia. In this study, we attempt to map the geomorphological features in and around Shalbatana Vallis in order to understand the role of tectonics or volcanism using MRO CTX image and HRSC DTM. The visual examination of CTX image showed 21 linear features in the upland, most of them are oriented in a North South direction, which is almost parallel to the main Shalbatana valley and some of them seemed to be joining the main valley. Some of the tributaries of main channel also start from these features. This hints towards a possible connection between the main valley and the linear features. These kind of linear features are common on Martian surface and could be either wrinkle ridges or lava tubes or tensional cracks. Wrinkle ridges, are very common on the Martian surface showing a similarity to the lava tubes in its overall shape, the main difference separating this two features is its relief itself; unlike lava tubes which represent topographic low, wrinkle ridges are marked by linear asymmetric topographic high across the feature. Wrinkle ridges are structurally controlled features while lava tubes are volcanically controlled. These offset may be due to the overflow of lava or fold or fault underneath it. Some of the lava tubes also characterised by these elevation difference. To understand the nature of the linear features, topographic profiles are constructed across these features as well as main Shalbatana Vallis channel. Maximum and minimum depth of the lava tube is 337.93 m and 10.91 m respectively. Average depth of the lava tube is 85.66 m and it having an average width 0.74 km. Even if each profiles are characterised by distinct shape and size they still sharing some common characters. Topographically, these features show a lower elevation than the surrounding, marking a linear depression, which rules out possibility of wrinkle ridge. Instead, they resemble that of lava tubes. There might be a possibility that the main valley itself is a large lava tube and later it modified by ice or water action.

Keywords: Shalbatana Vallis, CTX, HRSC DTM, Lava tubes, Wrinkle ridges.

Abstract Id: 1158
The present study estimates Convective Available Potential Energy (CAPE) over the entire Indian region in different seasons, using satellite based measurements of temperature and humidity profiles. The study made use of the vertical profiles from Suomi-NPP CrIS soundings during the period Dec 2014- Sep 2016. The estimated CAPE showed significant spatial variations and seasonal changes depending on the prevailing meteorological conditions. Highest values of CAPE are observed in pre-monsoon over most of the Indian landmass and, whereas the lowest are in winter. Comparison with the CAPE values estimated using radiosonde ascends showed similar seasonal variations. The study also examines the dependence of CAPE on surface level air temperature and humidity over different regions of Indian land mass in different seasons. CAPE showed better correlation with surface level air temperature in summer monsoon. Highest correlation with RH is observed in post-monsoon over north-west and central India and moderate correlation in pre-monsoon in most of the Indian landmass. Further analysis shows improvements of correlation between CAPE and temperature with increase in surface level RH, whereas the correlation between CAPE and RH is observed to get better in the temperature range, 295°K -300°K. The satellite derived CAPE with large spatial coverage has tremendous application in the prediction of extreme weather events such as thunderstorms. Vertical profiles of temperature and humidity from INSAT-3D and 3DR at better temporal resolution are useful to understand the diurnal evolution of CAPE, which would improve the predictions of extreme weather events. The analysis carried out reveals strong dependence of CAPE on near surface air temperature. It also indicates strong convection, highest vertical spread of atmospheric constituents such as aerosols and associated impacts in pre-monsoon, as CAPE over the Indian land mass is highest during this season.

Keywords: Convective Available Potential Energy, Suomi NPP

Abstract Id: 1159
EVALUATION OF SATELLITE-BASED RAINFALL DATA PRODUCT TRMM’S APPLICABILITY FOR LANDSLIDE RISK ASSESSMENT IN HILLY AREAS OF INDIA

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Landslides are causing huge losses in terms of fatalities and property in hilly areas. Worldwide, rainfall thresholds are in use for assessing the risk of landslide on a regional scale. With the development of rain data related predictive algorithms comes a need for verification of data source and credibility. Since the major contributing factor of Indian climatic conditions is the onset and offset of monsoon, study of rainfall data becomes imperative. The paper focuses upon comparing two major sources of rainfall data i.e. Tropical Rainfall Measuring Mission (TRMM) by NASA and JAXA (Japan Aerospace Exploration Agency) and Indian Meteorological Department (IMD). The study is conducted along the National Highway 58 (Rishikesh to Badrinath) due to excessive bouts of rain received by this region. Precipitation rate for the study area of latitude 30° N - 30.75° N and longitude 78.25° E - 79.75° E is extracted using both sources. Seven grids of dimensional division 0.25° X 0.25° are formed within the range of given latitude and longitude to support the extraction. Daily rainfall data is then subjected to statistical techniques to find the correlation between TRMM and IMD data. Preliminary analysis of 10 years of data reveals poor correlations among datasets on daily temporal scale. However, monthly analysis of the rain datasets for the months of June to September (Monsoon period) gives a good correlation of the order of 0.7-0.9. Conclusive results can provide a strong bias for data source and facilitate the national versus international source credibility for hilly regions of India.

Keywords: Tropical Rainfall Measuring Mission, IMD, Correlation, Z-index, Statistical analysis

Abstract Id: 1161
SPATIAL EXTENT AND DYNAMICS OF SHIFTING CULTIVATION - A CASE STUDY FROM MEGHALAYA, INDIA


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Shifting cultivation is a common agricultural practice in North East India. It is known as jhum cultivation in different parts of the region and is in practice by the tribal communities on the hill slopes. This practice provides a mean of living at subsistence level for the population depending on it. The present study covering the state of Meghalaya, examines the dynamics of shifting cultivation in relation to slope parameters. Satellite data were used for identifying the extent of shifting cultivation areas in different temporal scale and also for deriving slope parameters. The pattern of change from current jhum (220.28 km² in 1980 to 87.49 km² in 2016) to regenerating jhum (99.28 km² in 1980 to 90.03 km² in 2016) shows a decreasing trend. The study reveals that there is a shift of current jhum cultivation during the 1980 - 1995, from gentle slopes towards extreme slopes. The trend is showing a reverse from 2000 to 2016. East and Southeast facing slopes are more preferred for current jhum cultivation.

Keywords: shifting cultivation, jhum, current jhum, regenerating jhum, change, slope

Abstract Id: 1162
TERRESTRIAL LASER SCANNING FOR DIGITAL DOCUMENTATION AND DAMAGE ASSESSMENT OF CULTURAL HERITAGE

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Historical structures are one of the most essential element of cultural heritage. They reflect history, lifestyle and tradition of a country and society. They are damaged through the years due to human activities and natural hazards and, therefore, digital documentation of structures and monuments is critical for preservation, sustainability and protection of cultural heritage. Documentation of cultural heritage requires simple, quick and easy to use multi-sensor approaches to determine the state of conservation of monuments and heritage sites.

There are a lot of damages that can affect built heritage. The recognition of these damages and their evolution over time is an important task in the documentation work. Manual mapping of these damages is expensive and time-consuming. Besides, data capture depends either on the accessibility of the building, its emplacement and dimensions, and on the way of inspection and analysis. Therefore, the use of terrestrial laser scanning combined with terrestrial images can assist in the task and provide damage maps of the monuments. The study demonstrates practical use of TLS in documentation of heritage monument. The study also focuses on damage detection using TLS point cloud and terrestrial optical data. The study was carried out on two date TLS data of Buddha statue located in the Mindrolling monastery, Dehradun, India. The laser data was collected from multiple scan points to cover the entire statue. The individual scans were coregistered and projected onto a 2D plane using equirectangular projection. Hierarchical database was generated and stored for further query. The TLS point cloud and terrestrial images were subjected to various image processing operations for crack identification and damage detection. Depth data was combined with the photographs for crack detection using rule based semantic classification. The results were compared with classified photographs. It was found that crack detection improved significantly by including depth image. Also the carvings and other features of the structure which were getting classified as cracks were improved.

Keywords: Cultural heritage, damage assessment, crack detection, terrestrial laser scanning

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CHANDRAYAAN-1 LLRI SPARSE LIDAR DATA FOR SURFACE CHARACTERIZATION OVER THE LUNAR SOUTH POLES: COMPARATIVE STUDY WITH LRO LOLA DATA

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Lunar poles are considered to have one of the most unique planetary environments which are known to be the new frontier of lunar exploration missions. The permanently shadowed regions inside craters close to the poles are prime candidates for locations of deposits of water ice. Similarly, regions that receive near-constant solar illumination are possible sites for future lunar bases. Terrain characterization near poles is a necessity to preserve the landing sites so that future lunar landers could navigate past rugged moonscape of the South Polar Region. An attempt has been made to utilize LLRI data for lunar South Pole to create a surface model by interpolating the first return of laser. The data was projected into an azimuthal stereographic projection system. The elevation values at unknown locations were predicted using interpolation techniques. Kriging technique, which assumes that the distance or direction between the sample points reflect a spatial autocorrelation and can be used to explain the variation in surface, was used for interpolation. Point cloud data for Scott, Shoemaker and Zeeman south polar craters were extracted separately and surfaces were generated for them. The profiles for the crater surfaces were extracted along the eight cardinal directions i.e N-S, NE-SW, E-W, SE-NW. Point cloud of LLRI was then compared with that of LRO LOLA data for overall point density; differences in elevation values, if any, for sample points; contour maps; slope maps and differences between the slope values at sample points. In conclusion of the study, LLRI elevations showed high correlation with LOLA elevations over flat areas with an overall elevation difference varying from 1.25 to 133 m. Slope variations were found to be similar to that of the LOLA utilizing LLRI for applications involving the use of terrain gradients.

Keywords: LLRI, Interpolation, Spatial Autocorrelation, Terrain gradients, LOLA

Abstract Id: 1164
POSSIBILITIES OF USING INEXPENSIVE DIGITAL CAMERAS FOR VEHICLE DAMAGE ASSESSMENT USING CLOSE-RANGE PHOTOGRAMMETRY

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Vehicle damage assessment have been typically done using either offset methods or survey methods such as using total station. Police investigators, insurance company and forensic scientist face challenges in documenting accident scenes through conventional methods which is impractical to map the scene due to traffic jam and the conditions of road. The photogrammetric approach has an advantage in accident site reconstruction and vehicle damage assessment by recording the scene in a very short time using digital camera (Fraser et al., 2008). The revolution in digital technology has geared up production of mobile phones with built-in digital cameras. Mobile phone cameras which have 10 mega pixels have appeared in the market. Such products give us the opportunity to take photographs of any object, at anytime instantaneously. In these circumstances, one has to analytically study whether mobile phone cameras are able of taking place of consumer grade digital cameras in vehicle damage assessment at the time of accident. The full potential of the technique can be explored once its accuracy has been evaluated.

The study evaluates the accuracy of 3D models obtained from digital terrestrial images acquired using different image capturing equipments (Nikon D-80 DSLR camera, Point & Shoot camera and Mobile Phone camera). All the image capturing instruments were calibrated to estimate the optical parameters and distortions. The 3D model of damaged and undamaged car was generated for each set of digital terrestrial images acquired from different digital image capturing equipments. The wheelbase distance provided by the manufacturer was used as reference for scaling the damaged and undamaged 3D models.

Dimensions were extracted from 10 different positions of DSLR, point & shoot and mobile phone model and compared with survey measurements. It was reported that difference percentage between these dimensions were 1.3%, 2.4% and 8.9 % respectively. The result shows that DSLR and point & shoot model gives more comparable results with survey measurements as compared to mobile phone model. The mobile phone model measurements also gives comparable result with DSLR and survey measurements until the length of any dimension is below 40 cm. Digital Close Range Photogrammetric has been found useful for measuring crush in a damaged vehicle for more economic, accurate and faster analysis of crush as it allows

- Instantaneous image acquisition resulting in less time required at field.
- A lesser amount of cost required for analysis and processing
- Non-photogrammetrists are also able to measure crush in a damaged vehicle easily having slight knowledge of photogrammetry.

Keywords: Vehicle Damage assessment, Close Range Photogrammetry, Digital Camera

Abstract Id: 1165
Real-time monitoring of forest ecosystems plays an important role in assessing and accounting for biodiversity, carbon studies and socio-ecological process. Advancements in remote sensing made larger availability of long-term satellite imagery which enable the spatio-temporal phenological change detection using long-term time series satellite data. Different types of forest cover changes can be classified by decomposing the time series into changes in trend (e.g., fires) and changes in season (phenological changes). In the current study, we illustrate an approach that identifies forest cover loss using spatio-temporal analysis. The study uses BFAST (Breaks For Additive Season and Trend) algorithm for change detection using NDVI time series data from Landsat imagery for land cover change in parts of Telangana and Maharashtra states. BFAST decomposes the time series into trend, seasonal, and remainder components for change identification. BFAST detects the phenological change by exploiting the full time series and can be applicable to any time series data without the need to normalize for land cover types. It was found that the performance of the algorithm was satisfactory with less false alarms. The detected forest cover loss areas are validated with corroborative high resolution imagery and are found to be highly accurate.

Keywords: NDVI, BFAST, Spatio-Temporal Change Detection, Forest Cover loss, Landsat
The nationwide mapping and inventory of coastal resources from LiDAR surveys and other remotely sensed data in the Philippines provided a number of applications, mainly in the management and protection of these resources. A method for assessing the vulnerability of coastal resources to climate change was developed using existing coastal vulnerability assessment tools together with remote sensing data, and implemented by different partner institutions on selected study sites throughout the country. This paper describes the vulnerability assessment framework, its implementation, and synthesis of the results from the different studies to come up with a summary of issues that increase the sensitivities of coastal resources to climate change hazards and the recommendations to increase the adaptive capacity of these resources and the communities that engage with them. The vulnerability of the resources was evaluated in three general aspects, namely Intrinsic Characteristics and Governance, Anthropogenic Activities, and Habitat Characteristics. These aspects were integrated to produce an overall vulnerability assessment for each type of coastal resource. Using this framework, the implementing institutions were able to identify the areas of concern for each study site and were able to recommend the necessary management actions for stakeholders to mitigate the effects of climate change to these resources.

It was found that majority of the coastal resources in the study sites have moderate to high vulnerability to climate change hazards. The most at risk are the mangroves, since these are found within close distance to coastal developments. Seagrasses and corals have medium to high vulnerabilities; however, these have higher adaptive capabilities than mangroves as Marine Protected Areas are commonly focused on these resources. The recommendations for the study sites include increasing the communities' awareness on the importance of these coastal resources and intensifying the implementation of policies aimed at the conservation and protection of these resources.

Keywords: Vulnerability Assessment, Coastal Resources, Remote Sensing, GIS

Abstract Id: 1167
SEASONAL VARIATIONS OF GEODETIC STRAIN DISTRIBUTION USING GNSS AND CORRELATION WITH SEISMIC ACTIVITY IN THE HIMALAYAN REGION

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Global navigation satellite system (GNSS) stations mainly IISC, HYDE and LCK3 on Indian plate indicates strong seasonal variations observed on the vertical components. This study shows that seasonal variations of surface loading (due to continental water storage) is most probably the primary cause for these geodetic seasonal variations. We used the integrated land water mass determined from the global time variations of the Earth’s gravity field measured by the Gravity Recovery and Climate Experiment (GRACE) satellite, to estimate surface load variations. To validate the secular deformation across the Himalayan thrust we take advantage of a larger dataset from 2000 to 2017 of GNSS time series in the Indian plate area and a longer time period from 2002 to 2016 of GRACE water storage data and other components derived from GLDAS. Further, CORS and campaign mode GNSS stations data were used to estimate the strain distribution along the fault systems of HFT and MCT. Triangulation based strain algorithm has been used to provide information on active deformations along the Himalayan arc. In order to understand the present deformation across the Himalayan thrust, we collected GNSS data during 2015-2017 at 12 sites in the Himalayan region. Horizontal velocity vectors estimated in ITRF2008 are found to be in the range of 33-50 mm/yr with an uncertainty level of the order of 0.50-2.79 mm/yr. The velocity field indicates that the present convergence of around 13.25±0.6 mm/yr takes place in the Garhwal Himalaya. Further, we estimate the strain components in between the stations for understanding the currently active tectonic process and seismicity of the region.

Keywords: GRACE, GLDAS, Strain, GNSS, Himalayan fault

Abstract Id: 1168
FULL SEASONALITY DIFFERENCE OF RICE CROP BACKSCATTERING VALUES USING DUAL-POLARIZATION RADARSAT-2 DATA: A CASE STUDY IN SAWAH SEMPADAN, TANJONG KARANG, SELANGOR

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To investigate the capability of Radarsat-2 dual-polarization data in identifying the different growth stages of rice crop, full seasonality of rice crop backscatter values from 2016 time-series imagery were extracted from ongoing research area in Sawah Sempadan, Tanjung Karang, Selangor. The rice crop season in the study area are separated into two seasons (based on hydrological irrigation schedule); i) first season: from July until October and ii) second season: begin in January until April every year. Significant anomaly in the backscatter values between the same growth stages of the two seasons were also analyzed to determine the factor(s) of the irregularity which might be the product of pest infestation or rice crop related diseases. Majority of the processing was done in ENVI SARscape software covering all the basics SAR processing stages; 1) range and azimuth multi-looking; 2) image co-registration; 3) radiometric calibration and geocoding and; 4) multi-temporal image filtering. The results showed that multi-temporal Radarsat-2 dual-polarization backscatter values were able to differentiate each growth stages of rice crop. The results confirm the usefulness of C-band data in rice crop monitoring especially in tropical region covers by thick clouds such as South-East Asia. Reliable rice crop information is also important for the purpose of hydrological simulations to improve irrigation planning in the context of future food security and government policy.

Keywords: SAR polarimetric, rice growth stage, & backscatter.

Abstract Id: 1170
EFFECT OF CLIMATE CHANGE ON PRIMARY PRODUCTIVITY IN MARINE REGION OF INDIAN SUBCONTINENT

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Understanding the effects of climate change on marine ecosystem requires a thorough knowledge of the distribution and dynamics of phytoplankton, which accounts for half of the primary productivity in the ocean. Future projections indicate an increase in sea surface temperature (SST) which is major concern to scientific society as SST and Chl-a hold an inverse relationship in both Arabian Sea (AS) and Bay of Bengal (BoB). Increase in SST was always been associated with decrease in phytoplankton throughout the years 2003-2015. Phytoplankton concentration in AS showed two peaks- one in winter and another in post monsoon whereas in BoB only post monsoonal peak was observed. Primary Productivity (PP), which is directly dependent on Chl-a concentration showed a similar inverse relationship with SST. PP showed large temporal and spatial variation in both AS and BoB. In AS, two seasonal peaks of PP one in winter and another in post monsoon was obtained for every year whereas in BoB, only one post monsoon peak was prominent. ENSO transition was found to affect primary production of BoB to a large extent. Achieved inverse relationship between Multivariate ENSO Index (MEI) and PP further proved this phenomenon. Overall a weak decreasing trend in PP was derived for AS and increasing trend was shown by BoB between the time frame 2003-2015.

Keywords: Phytoplankton, Primary Productivity, Sea surface Temperature

Abstract Id: 1171
SYNYGIUM CUMINI PLANT PHOTOSYNTHETIC PIGMENT DETECTION FROM HYPERSPECTRAL DATASETS USING SPECTRAL INDICES

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The photosynthetic pigment identification of synggium cumini plant species is essential for many applications such as plant species classification along with its current status and yield estimation. In the present study, we have investigated the study of photosynthetic pigment identification of synggium cumini plant species using spectral indices derived from hyperspectral data. The samples of synggium cumini plant were collected from the university campus area of Dr. B. A. M. U., Aurangabad positioned on 19°05′3.7944″ N latitude and 75°02′18.9208″ E longitude. The variations of leaf chlorophyll content, Chl a, Chl b and Carotenoid along with Water Content, Xanthophyll, Anthocyanin were calculated of healthy leaves of plant based on spectral indices. The linear regression models were developed for the calculation of correlations between spectral indices and pigment contents using open source approach i.e. python. The results of the regression models illustrate the positive correlation between spectral indices and photosynthetic pigment contents in all species (mND; \( R^2 = 0.1349 \), PSNDa; \( R^2 = 0.4962 \), PSNDb; \( R^2 = 0.2858 \)). There were neutral correlation between some spectral indices and species contents (mSR; \( R^2 = 0.2523 \), BIG2; \( R^2 = 0.0046 \) PSNDc; \( R^2 = 0.0395 \), WI; \( R^2 = 0.0304 \), NDVI; \( R^2 = 0.232 \), X; \( R^2 = 0.2727 \), ARI; \( R^2 = 0.6577 \)). In the conclusion, spectral indices and designed regression model is accurate for estimating pigment and other contents using hyperspectral data.

Keywords: Hyperspectral data, plant species, Spectral Indices, Correlation, regression

Abstract Id: 1172
WOODY VEGETATION AS AN INDICATOR OF CLIMATE CHANGE IN THE HIGH ALTITUDES OF HIMALAYA: CASE OF PINDAR RIVER VALLEY

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Altitudinal shift in upper limit of vegetation is associated with impacts of global warming as evident in many parts of the world, and are poorly understood in the Himalaya. In higher altitudes of Himalaya continuous forest, ascending from lower altitudes, terminates and form ‘forest line or timberline’. Woody vegetation (krumholtz and straight trunk trees) occur in patches above this timberline. High resolution satellite images were used to map occurrence of woody vegetation and analyze distribution pattern towards high elevation beyond the timberline in Pindar River valley (running in S-N direction; two major sides of eastern and western flanges) terminating towards north at Pindari Glacier. Major occurrence (number) of woody patches, above forest line, were dominantly krumholtz of Rhododendron campanulatum (less common species were Betula utilis and Sorbus accuperia) on warm sunny flange of east facings slopes of valley (66.3% of total patches). Similarly, elevational gradient for presence was also higher in warmer slopes (3300-4050m amsl) than on western facing slopes (3200-3850m amsl), however distance of farthest woody patch from forest line on both the sides was almost same (~4.5km) but slightly higher on west facing slopes (100m). Most of the patches have area less than 1ha (73.4%), while only few were more than 10h in size (1.8%). Consistence with the findings of number of woody patches area occupied on east facing slopes was almost double (67.7%) of the western facing slopes, indicating warming has influence of occurrence and growth of timberline woody species. Monthly average temperature and rainfall data (medium-resolution, 1901-2010) for Pindari region indicates substantially increase in annual temperature (1°C) while no significant increase in rainfall. Spatial and vegetation attributes of these extended woody patches provides important clue as proxy indicator of climate change, shift in species range, and conservation priorities for human sustenance in changing environment.

Keywords: Himalaya, Climate Change, Timberline, Woody Vegetation, Species range

Abstract Id: 1175
TOPOGRAPHICAL INFLUENCES ON HIGH ALTITUDE FOREST LINE IN THE INDIAN CENTRAL HIMALAYA: CASE OF PINDARI GLACIER VALLEY

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High altitudes of the Himalaya have been realized to more prone towards temperature increase due to global temperature rise while decrease in temperature limits the plant growth there. Altitudes in high mountains do not support tree growth beyond an elevation and termination of continuum of forests is often termed as forest line/timberline. This is a dynamic state which is influenced by local topography and geography on which a very little knowledge exists for the Himalayan region. This study focuses on the mapping of timberline, using high resolution satellite images, in a glaciated valley (Pindari Valley covering an area of 397.35 km2) having three glaciers (three valleys) in the Indian Central Himalaya. Three valleys exhibit a variation of ~1 km in highest elevation (3050-3970m amsl) of timberline which shows a buffering range for temperature escape for the tree species of timberline. Impact of robust topography will limit this expansion and limit of forest growth as apparent by the fact that about 62% of the area does not have vegetation (snow, glacier, rivers, rock, etc.) in an elevational zone of 4 km (2000-6600m amsl). Presently, vegetation (alpine, forest, and shrubs) are limited to 38% of the area. Timberline also varies considerably (570-700m) in three sub-watersheds of Pindar valley. Expansion of tree vegetation is further limited by the availability of soil and suitable habitat as apparent from fragmented occurrence of alpine meadows (203 fragments of <1ha in size). Globally observed evidences, a gradual shifting of timberline towards higher altitudes as an impact of global warming, may not hold true in some Himalayan situations where influence of local topography within valleys is more prominent even buffer capacity of species is present to absorb impacts of climate change.

Keywords: Himalaya, Watersheds, Treeline, Satellite Image

Abstract Id: 1176
FULL INDIA NDVI MAP GENERATION USING RESOURCESAT-2 AWIFS DATA

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To measure and map the density of green vegetation across the Earth's landscapes, scientists use satellite sensors that observe in the distinct wavelengths of visible and near-infrared sunlight that is absorbed and reflected by the biomass. Reflectance and vegetation indices have been used as basic quantities being integrated into interactive biosphere models as part of global climate modeling and production efficiency models apart from variety of land applications including land natural resource management, agriculture and operational famine warning systems. Resourcesat borne Advanced Wide Field Sensor (AWIFS) data having a spatial resolution of 56 m at nadir and a swath of 740 km after combining data from two heads promises to be utilized for various resource monitoring activities. These characteristics of AWIFS sensor makes it suitable for vegetation studies on a national scale. AWIFS has a repeatability of 5 days, and it takes eight AWIFS full swath strips to cover full India region with the defined and configured side lap between adjacent paths. Processing huge volume of data to produce full India vegetation maps involve employing several radiometric and geometric correction steps, and deriving top of atmosphere reflectance values. Radiometric normalization, seamless mosaicing of long strips of data are detailed in this work. We have realized an operational system to produce full India normalized difference vegetation index (NDVI) map every five days in a completely automatic manner with satisfactory radiometric and geometric characteristics, technical details of which are planned to be reported in this paper.

Keywords: AWIFS, NDVI, geometric correction, radiometric correction, reflectance, mosaicing

Abstract Id: 1179
This work addresses the development of few geospatial applications essential for the semi-automatic extraction of scientific information in the cryospheric environment by using high-resolution satellite remote sensing data. We have focused on 5 geospatial applications for such information extraction; (a) blue ice mapping, (b) cryospheric vegetation mapping, (c) applications of RISAT-1 for cryospheric surface classification, (d) applications of Cartosat-1 stereopair for constructing DEM in the Antarctic environment, and (e) derivation of cryospheric lake bathymetry. The paper evaluates these applications for rapid information mining, which would be useful for various polar research applications such as glaciology, environmental and land-cover change monitoring, limnology studies, supraglacial processes, etc. Nevertheless, the semi-automatically extracted information would also be useful for planning Antarctic logistic activities and for providing advisories for safe field campaigns. The results indicate that the use of the geospatial methods on high-resolution satellite data can significantly improve the semi-automatic extraction of cryospheric features, which can ultimately contribute to an enhanced perspective of the Antarctic geospatial information in the context of climate change. This work also demonstrates the improvements in geospatial feature extraction of cryospheric surface features by employing more than one dataset synergistically. Our approach focuses on the strength of each geospatial data source to extract accurate geospatial information in complex cryospheric areas.

Keywords: Polar remote sensing, high resolution, Antarctic

Abstract Id: 1181
ACCURACY COMPARISON BETWEEN GENETIC ALGORITHM-BASED CLUSTERING AND SUPERVISED MAXIMUM LIKELIHOOD CLASSIFICATION OF LAND COVER GENERATED FROM KOMPSAT-3 DATA

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Due to the little a priori knowledge of the multispectral (MS) data in land cover classification, methods of clustering often called unsupervised classification have been developed for generating classes (i.e., clusters) in such a way as to maximize the MS similarity between the individual pixel values in each cluster and minimize the similarity between the pixel values in discrete clusters.

This paper presents evaluating the thematic accuracy of unsupervised land cover classification maps derived from KOMPSAT-3 data by using the genetic algorithm (GA)-based clustering in comparison to the supervised maximum likelihood (ML) classifier. The four different selection methods (i.e., tournament selection, proportional roulette wheel, elitism selection, and ranked-based selection algorithms) of GA applied to clustering performance are validated through Kappa coefficient and normalized accuracy values based on the error matrix. Although all unsupervised classifications employing the four GAs represent lower accuracy values as compared with the supervised ML classification, the four selection-based GAs achieve the normalized accuracies above 84% and are useful for classification applications of KOMPSAT-3 data.

Keywords: Genetic Algorithm, Clustering, KOMPSAT-3, Normalized Accuracy, Error Matrix

Abstract Id: 1182
CONVERGING RESOURCE PLANNING AND APPRAISALS FROM GROUND INVENTORIES TO EARTH OBSERVATIONS WITH DECENTRALIZED PARTICIPATION IN RURAL INDIA


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Paradigmatic shifts have been witnessed in governance of development initiatives in various sectors across India due to infusion of Earth Observation (EO) and Information Technology (IT). Especially in the rural India, numbers of flagship programmes such as Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Integrated Watershed Management Programme (IWMP) and Rashtriya Krishi Vikas Yojana (RKVY) etc. buoyed on large scales have been monitored through use of strengthened technologies for developing futuristic plans. Earth observation datasets available at high spatial-temporal scales have been used for precise mapping and regular monitoring of various development schemes. The recent availability of high resolution indigenous satellite data on board Cartosat-2 series missions having imaging capabilities of around 2 meter multi-spectral and less than 1 meter panchromatic has higher potential for mapping and monitoring related to micro level governance. A substantial amount of ground inventoried Geo-tagged assets has been also generated by involving the trained filed functionaries at grassroots level for monitoring these development schemes. The scale at which Geo-tagging of the assets created under the MGNREGA and IWMP schemes, to the tune of 1.5 Crore and 6 Lakh respectively indicates the degree of acceptance of such technological approach. Geo-information on infrastructure assets for agriculture production created under RKVY used in conjunction with assets created under MGNREGA and IWMP has the ability to further strengthen the rural livelihoods and income generation initiatives. The overall response of the state machinery in this exercise has been overwhelming. However, there are challenges in analyzing the asset durability and using this information for supporting sustained rural employment generation. Nevertheless, the convergence of resource planning and appraisals from ground inventories to EOs as evidenced from the magnitude of decentralized participation in these flagship programmes would play a crucial role towards spatially explicit micro-governance in rural India.

Keywords: Resource Planning, Appraisal, Earth Observation, Geo-tagging, Decentralized Participation

Abstract Id: 1183
MAPPING MULTIPLE HORTICULTURE CROPS USING OBJECT ORIENTED CLASSIFICATION TECHNIQUES

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India is the second largest producer of fruits and vegetables in the world. The fundamental requirement for proper planning in the horticultural sector is the availability of reliable statistical database in terms of area and production at different spatial hierarchies (tehsil, district, state). Remote sensing and Geo-ICT tools offer a simple, fast, efficient and cost-effective method of not just updating the horticulture crop inventory but also integrating the database, thus making it conducive for easy retrieval, analysis and decision-making. Medium and high resolution remote sensing data like LISS-IV and PAN prove to be effective in inventorying crops like mango, citrus and oil palm. Object oriented techniques work best in identifying and mapping fruit orchards as against per pixel classifiers, which are more useful for field crops. This is because the information needed for image analysis and classification is represented in meaningful image objects and their mutual relations. This study aims at mapping multiple crops, viz. mango and oil palm in Krishna district of Andhra Pradesh. Multi-resolution segmentation has been done after assigning scale parameter and weightages to various parameters like shape, compactness, color, smoothness and NDVI. Subsequently, the potential mango and oil palm areas have been delineated based on texture and shape/geometry information obtained from high resolution PAN data. Field validation of the crop map indicated 85% agreement with field data. Hence multiple high resolution datasets have the potential to map the spatial distribution of mango and oil palm plantations at district and mandal level. Object oriented classification techniques use the form, texture and spectral information in a sequential manner to delineate the multiple horticulture crops. In a similar way, citrus plantations can also be mapped.

Keywords: Horticulture, Multi-resolution segmentation, Object oriented classification, Segmentation

Abstract Id: 1184
EVALUATING THE QUALITY OF FREE AND OPEN SOURCE SOFTWARES FOR DIGITAL PHOTOGRAMMETRIC RECONSTRUCTION OF BUILDINGS

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Application of computer vision algorithms in photogrammetric approaches has been the recent trend, which makes the photograph based point cloud and 3D model generation comparable to laser scanning technology. Moreover, photogrammetric 3D model has few advantages and conveniences such as higher accuracy for shorter imaging distances (< 5 m), relatively easy data collection even in difficult terrain, high radiometric resolution of final point cloud and relatively low purchase costs. There are a many commercial off the shelf software (COTS) with the capability of 3D view generation. However they are usually expensive, generic and complex for non-experts. Currently users have access to few free and open source photogrammetric software, or algorithms containing sub-steps of image processing, as well as multiple web services enabling object reconstruction from images through the internet and/or remote services. Thus, one needs to analytically study the potential of free and open source software in comparison to professional photogrammetric software for close range photogrammetric applications.

A 3D model of heritage site is constructed using both open source and commercial software. The study will demonstrate the qualitative and quantitative analysis of both algorithms for heritage site documentation. Mindrolling Monastery or Buddha Temple in Dehradun, India was taken as the study site. Terrestrial Laser Scan of the monastery was taken as reference for evaluating accuracy of the generated 3D model. PhotoModeler Scanner and Autodesk’s 123D catch softwares are used for generating 3D point cloud.

It was observed that the point density of PhotoModeler Scanner is more as compared to Autodesk 123D still some portion are missing and there are more holes in the point cloud in PhotoModeler Scanner. The point density of Autodesk 123D catch is lowest as compared to terrestrial laser scanner and PhotoModeler Scanner but the points are evenly distributed and the overall features of the structure are documented well. The internal and external accuracy was also measured. The study depicts that Autodesk 123D web-based software is able to model most of the structure accurately as compared to professional PhotoModeler Scanner software. Although the PhotoModeler Scanner point cloud data is more dense but it is more labour intensive as compared to Autodesk 123D.

Keywords: Cultural heritage, 3D Model, Open source software, close range photogrammetry

Abstract Id: 1185
MAPPING POST KHARIF-RICE FALLOW LANDS AND ASSESSING THEIR SUITABILITY TO GROW SHORT DURATION PULSE CROPS TOWARDS CROP INTENSIFICATION IN CHHATTISGARH STATE, INDIA

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Rice is the principal food crop of India, also occupying the largest area under food grains. It is seen that about 30% of kharif rice area is left fallow post the rice crop. Such areas offer great prospects for expanding the crop area in rabi season. The direct benefit of using these under-utilised crop lands by growing legumes is towards (a) food security and farmers' livelihoods, (b) effective utilisation of residual soil moisture, (c) improvement in soil health by nitrogen fixation and (d) quality of nutrition.

The present study aims at mapping and inventory of kharif rice area, rabi crop area and post kharif -rice fallows using temporal microwave and optical data. Suitability of these post kharif-rice fallows have been assessed for growing short duration rabi pulses in Chhattisgarh state, India. Various climatic and edaphic factors such as Land Surface Wetness Index (LSWI), surface water bodies map, slope (%), temperature, NBSSLUP soil map and drainage network were used to assess suitability of these rice fallows for pulses on the basis of multi-criteria decision rule approach.

In Chhattisgarh state, it was found that only 13.07 lakh ha of total kharif rice area (35.59 lakh ha) are cropped in rabi season. Thus, approximately 74% (26.35 lakh ha) of kharif rice area are left as rabi fallows, and it is these areas that require immediate attention to bring them under double crop areas. Maximum extent of post kharif-rice fallow lands are observed in Janjgir-Champa (2.31 lakh ha, 85.39%) and Rajnandgaon (1.9 lakh ha, 67.97%) districts. The villages and tehsils in each district were prioritized for crop intensification based on the extent of kharif rice area and its rabi fallows. These critical areas with high scope for crop intensification need to be given precedence to bring additional area under crop. Suitability analysis indicated that 29% (7.62 lakh ha) of post kharif-rice fallow lands have potential to grow rabi pulses.

Thus, remote-sensing data and techniques are used to identify and map rice fallow lands and their potential to grow legumes in Chhattisgarh, with the overall aim of providing information to decision makers for sustainable development of agriculture through crop intensification. This study was carried out in an on-going Crop Intensification project (funded by Ministry of Agriculture).

Keywords: Intensification, Rice fallows, NDVI, Multi-criteria approach

Abstract Id: 1186
ENHANCED SEA FLOOR SURFACE RECONSTRUCTION BY NON-UNIFORM ILLUMINATION CORRECTION ON UNDER WATER IMAGES USING OPEN SOURCE TOOLS


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With advancement in computer vision algorithms like SFM (Structure from Motion), photogrammetry can be used widely to map the seafloor with higher level of details. A camera (RGB) is attached to a remotely operated vehicle (ROV) for acquiring the video footage of seabed and a GPS mounted over ROV to record the trajectory of the vehicle. The aforesaid multi-sensor data can be integrated together to generate a georeferenced ortho mosaic image of the sea floor. The frames extracted from the underwater video footage are not directly usable for photogrammetric processing due to movement of aquatic organisms, large scale variation in stereo pairs and non-uniform illumination. These need to be rectified before applying photogrammetric solution to derive DEM and ortho-mosaics. In this paper an attempt is made to address the aspect of non-uniform illumination correction before generating ortho-mosaic from video frame and GPS data. The underwater images were corrected for non-uniform illumination effect using various approaches: contrast stretching, histogram equalization, CLAHE (Contrast-limited adaptive histogram equalization) and Laplacian filtering. The corrected images were geotagged using GPS data and SFM based surface reconstruction technique was applied for generating point cloud, DEM and georeferenced ortho mosaic. The results of before correction and after illumination correction was made to evaluate the radiometric and geometric quality of DEM and Ortho mosaics. The analysis highlighted that the illumination corrected image were seen to provide better quality radiometric and geometric output. An attempt is also been made to develop a package on python using open source tool for non-illumination correction based seafloor mapping.

Keywords: ROV, Underwater photogrammetry, opensource tools

Abstract Id: 1187
Lunar poles are considered to have one of the most unique planetary environments which are known to be the new frontier of lunar exploration missions. The permanently shadowed regions inside craters close to the poles are prime candidates for locations of deposits of water ice. Similarly, regions that receive near-constant solar illumination are possible sites for future lunar bases. Terrain characterization near poles is a necessity to preserve the landing sites so that future lunar landers could navigate past rugged moonscape of the South Polar Region. An attempt has been made to utilize LLRI data for lunar South Pole to create a surface model by interpolating the first return of laser. The data was projected into an azimuthal stereographic projection system. The elevation values at unknown locations were predicted using interpolation techniques. Kriging technique, which assumes that the distance or direction between the sample points reflect a spatial autocorrelation and can be used to explain the variation in surface, was used for interpolation. Point cloud data for Scott, Shoemaker and Zeeman south polar craters were extracted separately and surfaces were generated for them. The profiles for the crater surfaces were extracted along the eight cardinal directions i.e N-S, NE-SW, E-W, SE-NW. Point cloud of LLRI was then compared with that of LRO LOLA data for overall point density; differences in elevation values, if any, for sample points; contour maps; slope maps and differences between the slope values at sample points. In conclusion of the study, LLRI elevations showed high correlation with LOLA elevations over flat areas with an overall elevation difference varying from 1.25 to 133 m. Slope variations were found to be similar to that of the LOLA utilizing LLRI for applications involving the use of terrain gradients.

Keywords: LLRI, Interpolation, Spatial Autocorrelation, Terrain gradients, LOLA

Abstract Id: 1188
Urban planning is essential to build a harmony between the urbanization processes and the resultant consequences on the environment. Urban flooding and water logging is one of the commonly witnessed problems in many cities around the world, which is for the most part a lacunae in the planning process of the urban areas. In the present study, the issue of flooding caused by heavy rainfall events in Bhubaneswar city has been evaluated considering the hydrological and hydraulic characteristics. Storm Water Management Model (SWMM) has been used to estimate the runoff depth, extent, peak flow and extent of flooding taking into consideration the elevation, slope, land use and land cover (LULC), rainfall conditions and the designed storm water drainage (SWD) infrastructure of the city. Very high resolution satellite data have been utilised to extract the hydrological and spatial information such as watershed delineation using CartoDEM (10 m); slope, elevation and micro-watersheds using LiDAR DEM (1 m); imperviousness according to the land use character of the city from Cartosat-2 (PAN) and Resourcesat LISS-IV fused product and soil map (1:50,000); in-situ hourly rainfall data from Indian Meteorological Department (IMD) and the SWD network from the design plan. It has been assessed that a very heavy rainfall instance of 122 mm in 24 hours can cause average water accumulation of about 0.3 m - 0.6 m with some areas even reaching 1.5 m of depth. The study emphasises the implications of geospatial techniques to better assess the urban flooding problem in Bhubaneswar city and identify the most vulnerable areas.

Keywords: Urban Flooding, SWD, SWMM, Runoff, DEM

Abstract Id: 1189
INTERDEPENDENT HEALTHCARE CRITICAL INFRASTRUCTURE
ANALYSIS: A CASE STUDY

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Interdependent Healthcare Critical Infrastructure refers to the complex network of Healthcare Critical Infrastructure (HCI) (e.g. Hospitals), Water supply Critical Infrastructure (Water Pumping station), Electric Supply Critical Infrastructure (Electric substations), and Transportation (road network), and Telecommunications systems, sometimes also referred to as lifeline systems. Natural disasters such as Flooding can have severe implications on the Interdependent Healthcare Critical Infrastructure. A major challenge that arises for the HCI is to respond to this crisis in a timely manner in an uncertain and variable environment. To address this issue the HCI should be disaster prepared by fully understanding the complexities and interdependencies that exist in a hospital, to respond to the emergency event. To address this issue, we analysed a real life flood disaster event in December 2015 at Chennai, TamilNadu, India, and related its affect on the interdependent Healthcare Critical Infrastructure at the onset of flood. This event had caused extensive damage to many HCI facilities and the interdependent Critical Infrastructure (CI). This paper describes the results from the analysis of interdependencies related to HCI based on Coloured Petri Nets (CPN) modelling and simulation approach. The entire model is being integrated with Geographic information based decision support system to visualize the dynamic behaviour of the interdependency of the Healthcare and related CI network is modelled in a geographically based environment. Such Modelling and simulation of Flood disasters can help in training and providing an opportunity for all the stakeholders to work together in a coordinated response to a disaster.

Keywords: Critical Infrastructure Interdependency, Disaster Preparedness, Modelling and Simulation, Healthcare Critical Infrastructure, Pe

Abstract Id: 1192
SPATIALISATION OF DSSAT CROP GROWTH SIMULATION MODEL FOR COTTON CROP IN JALGAON DISTRICT USING REMOTE SENSING DERIVED START OF THE SEASON INFORMATION

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The use of crop growth models on large areas for monitoring crop growing conditions or predicting crop yield is limited by the lack of sufficient spatial information about model inputs. Remote sensing techniques have the potential to provide information on crop growth and condition quantitatively, instantaneously and, above all, non-destructively over large areas. Remote sensing can also be used to derive crop phenological information required for running a crop growth simulation model. Therefore, many different studies have attempted to estimate crop yield with integration satellite data into crop growth model. Thus, spatialisation often requires some kind of scale compatibility, and in this aspect remote sensing plays an important role in providing spatialised inputs for crop growth simulation on regional scale. In this context, spatialisation of cotton crop simulation is carried out during 2015-16 and 2016-17 using satellite derived inputs. CROPGROW simulation model on DSSAT platform was calibrated and validated for Jalgaon district using NASA POWER derived long term daily weather variables like solar radiation, maximum and minimum temperature and rainfall. It was observed that the start of the season information is very critical for initialising the model and also for yield prediction. Time series optical images derived from LANDSAT Optical Land imagers are used to delineate cotton crop area where as MODIS derived Short Wave Angle Slope Index (SASI) is used to initialise the crop growth simulation Model. Cotton crop condition was assessed by time series analysis of Normalised Difference Vegetation Index (NDVI) and Land surface wetness index (LSWI) derived from Landsat and MODIS images. The study demonstrates the potential use of satellite derived information for crop growth simulation and generation of yield proxies to support crop insurance studies.

Keywords: NDVI, LSWI, SASI, DSSAT, CROPGROW

Abstract Id: 1193
Soil erosion is a serious problem arising from agricultural intensification, land degradation and other anthropogenic activities. Decreasing rainfall trend and Soil erosion within watersheds results in increase of level of sedimentation in the streams and reservoirs and thus reducing their storage capacity and life span. Assessment of soil erosion is useful in planning and conservation works in a watershed or basin. Modelling can provide a quantitative and consistent approach to estimate soil erosion and sediment yield under a wide range of conditions. The current investigation objective to quantify sediment yield of Upper Karha watershed of Pune districts in Maharashtra, India by different models and using RS and GIS techniques. The sediment yield assessment by Garde model (2009-2013), USLE model and RUSLE model (1980-2016) is done and the annual Runoff observed is 137.68mm, 493.63mm and the sediment yield observed is 902.5 t/acre/year, 219.87 t/acre/year and 212.91 t/acre/year respectively. After field visit and ground truthing it is proved that the calculated sediment yield given by RUSLE model is more accurate.

Keywords: Erosion, Remote sensing, GIS, USLE, Garde, USLE, RUSLE, Soil conservation

Abstract Id: 1194
RETRIEVING LEAF CHLOROPHYLL AND NITROGEN CONTENT OF MANGO LEAVES FROM LEAF LEVEL HYPERSPECTRAL MEASUREMENTS


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Chlorophyll is one of the main constituent determining leaf reflectance in the visible region. It is vital for photosynthesis in plants. Nitrogen is key element in chlorophyll and its shortage results in sub optimal photosynthesis. Determining the chlorophyll content and its relation with nitrogen content through remote sensing will help in realising efficient management nutrient status of horticulture plantations and orchards, resulting in improved productivity. In this study, leaf reflectance of mango crop was measured using ASD field spectroradiometer and chlorophyll content index (CCI) using chlorophyll concentration meter. The measurements were carried out during dormancy period as well as flowering and fruit set of mango crop at Indian Institute of Horticultural research (IIHR) farm, Hessaraghatta, Bengaluru. Results showed that chlorophyll was strongly correlated in the visible region and nitrogen is correlated with chlorophyll content with an r² of 0.6 to 0.9 from dormancy to fruit set period. CCI showed strong correlation with lab measured leaf chlorophyll content both in dormancy as well as fruit set stage with an r² of 0.63 and 0.57 respectively. CCI was then compared with chlorophyll indices derived from the leaf spectra, the first derivative based index BmSR was the best performing index with and accuracy of r² = 0.72 and 0.93 during dormancy and flowering to fruit set stage, respectively. Lab measured chlorophyll was also highly correlated with chlorophyll indices with an r² of 0.50 during dormancy stage and improved to 0.6 during flowering to fruit set in mango crop. The results reveal that nitrogen is highly correlated with chlorophyll content in leaves and chlorophyll content can reasonably be estimated from narrow band indices and CCI.

Keywords: Narrow band indices, CCI, Chlorophyll, Mango

Abstract Id: 1195
UTILIZING DECISION TREE-BASED_THRESHOLDS IN RECONSTRUCTING TRAINING DATASETS FOR SINGLE-CLASSIFICATION_BINARY SUPPORT VECTOR MACHINE PROBLEM FROM POINT CLOUD DATA

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In some cases of agricultural features extraction, the binary Support Vector Machine (SVM) classification problem only requires the objective of mapping a single class across a relatively large geographic area, without the need to identify other land use and land cover classes. While the conduct of ground truthing to collect field data samples is a requirement to achieve high accuracy levels, sometimes it is impractical considering the labor and cost of conducting field surveys that necessitates single species only. As such, the Cocos nucifera or coconut, which is an agricultural class that is visually discernible through LiDAR-derived Canopy Height Model (CHM), may be classified without the need for in situ data collection. This is done by exploiting the threshold values calculated via Decision Tree (DT) algorithm in reconstructing training datasets. In comparison, classification outputs from in situ training samples and from the DT-derived samples achieve similar accuracy levels, hence this study introduces a classification methodology that eliminates the need for field data gathering and manual training data selection in mapping coconut species. A single-classification binary SVM has been implemented using LiDAR-derived CHM, utilizing only the elevation information contained in the point cloud data, with a grid resolution of one meter. The results suggest that automatic selection of samples is tolerable given that a representative calibration site is identified.

Keywords: Support Vector Machine, Decision Tree, LiDAR, Canopy Height Model

Abstract Id: 1198
PHILIPPINE HYDROLOGICAL DATASET MAPPING IN BATANGAS PROVINCE USING LIDAR DATA AND DISTANCE VALIDATION USING LASER RANGE FINDER

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The Philippines experiences at least 20 typhoons that causes flood to cities every year. Areas near the body of water are mostly populated which became more vulnerable when a disaster strikes. Disaster monitoring and management plays a critical role in disaster mitigation. Remote sensing and Geographic Information System (GIS) has been widely used to manage and identify hazard areas. Most approach to automatically creating a hydrologic model is using the geometric neighboring features. The Philippine Hydrologic Dataset (PHD) for Watersheds from LiDAR Assessment is one of the five components of the Nationwide Detailed Resources Assessment using LiDAR (Phil-LiDAR 2) to build a nationwide database for the Philippines to have a standard hydrological datasets such as streams, irrigation, wetlands, and watershed boundary. However, accuracy can be affected by spatial resolution of image and the classification method. This study presents the automated standard procedures in delineating three types of water bodies which are vital in urban planning such as: stream network, irrigations, and wetlands from LiDAR surveys. Acquisition of ground truth data using laser range finder done using SF-11c laser sensor connected to the Gizduino 4.1 microcontroller is also applied to validate the width from LiDAR data and actual feature using two-tailed equal variance t-test. Experiments compared the width of the classified objects from automated extraction using LiDAR Digital Elevation Model data versus ground truth using manual measurement as well as the ground truth data acquired using Gizduino 4.1 microcontroller versus the ground truth using manual measurement. Results show that the average values taken using the prototype and the Lidar have no significant difference in comparison to the actual measured data.

Keywords: LiDAR, Geographic Information System, Gizduino 4.1 microcontroller, Hydrologic Dataset, Laser Range Finder

Abstract Id: 1200
UTILIZING LIGHT DETECTION AND RANGING TECHNOLOGY FOR WATERSHED DELINEATION AND MAPPING OF PHILIPPINE HYDROLOGIC DATASETS IN QUEZON WITH DEPTH VALIDATION USING ULTRASONIC SENSOR AND MOBILE APPLICATION

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Addressing the problems arising from poor flood management and water budgeting, as well as from the outdated map of watershed features, this paper introduces the development of a map showing the stream and drainage networks, irrigation systems, and inland wetlands located in the province of Quezon in the Philippines. The development of mapping hydrological features such as streams, inland wetlands, as well as irrigation using commercial software is presented on this paper. The study performed standard process of automated delineation of features using one meter by one meter-size per tile LiDAR Digital Elevation Model, where manual intervention is performed preventing the complexity of the sub-components of the image processing that reduces the personal errors that may be committed along the process. The developed map is tested to be accurate through ground truthing. Inasmuch as irrigation systems are concerned, the created maps yielded 97.47% for completeness, 96.25% for correctness, and 93.90% for quality. On the other hand, the map for inland wetlands has shown 93.83% completeness, 95.00% correctness, and 88.37% quality. Lastly, for streams and drainage systems, the accuracy assessment gave values of 96.15% for completeness, 93.75% for correctness, and 90.36% for quality. In addition, a depth finder system developed using MB7386 HRXL ultrasonic sensor is used to investigate on the levels of water depth correlating the depth acquired using LiDAR data. Regression analysis was used in order to obtain a relationship between the predictor and response variable. The depth finder developed system was calibrated and found to be working successfully under water at different turbidities as the results show a little difference as compared with the actual depth measurements. The uncertainties of the device for each component above are 0.013 m, 0.046 m, and 0.031, respectively.

Keywords: Remote Sensing, LiDAR, Digital Elevation Model, Ultrasonic Sensor, Depth Finder

Abstract Id: 1202
HYPERSPECTRAL IMAGE ANALYSIS FOR MINERAL EXPLORATION IN BADUSH REGION OF IRAQ

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The absorption in visible, near and short wave infrared is an effective region for mineral identification and mapping. This paper reports the mineral identification using Hyperion data set over part of Badush area from Iraq. Removal of bad bands and bad columns were performed. The data is converted from radiance to reflectance and to remove the atmospheric effects we have used the fast line of sight atmospheric absorption for hyper cube (FLAASH). Noise and spectral dimensionality reduction using minimum noise fraction transform from which few bands have been considered as noise free bands. Pixel purity index (PPI) for spatial dimensionality reduction and few hundred spectrally pure pixels were taken into account. The n-dimensional visualizer used to locate and group the purest pixels for end member extraction. The cluster of end members is identified by comparing the spectra with the available United State Geological Survey (USGS) spectral library. The end members are used for classification using mixed tuned matched filtering and spectral angle mapper algorithm which helps to discriminate and identify the occurrences of the same minerals. The area from Iraq is considered for study which shows the potential of remotely sensed data where the areas are extremely inaccessible in other ways. The study reveals the feasibility and potential of hyperspectral data in mineral exploration.

Keywords: Hyperspectral imaging, minimum noise fraction, pixel purity index

Abstract Id: 1203
Thailand has adopted MODIS-based vegetation indices (VI) as proxy data for monitoring vegetation and drought condition for years. It is now entering into a new era of using VIIRS products from Suomi-NPP satellite. In order to seamlessly use long-term historical MODIS and VIIRS dataset suitable for the environments of Thailand, empirical regression models were performed to translate this cross-sensor VI products especially Normalized Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI). The 16-day VI composite with 500 meters resolution, obtained from LAADS DAAC, was used in the analysis. The consistency and validation of the cross-sensor transformations were investigated through the root mean square error (RMSE) and statistical analysis of t-test. The analysis shows a high agreement of both datasets. The continuity of composite NDVI time series from MODIS to VIIRS can be obtained by using the derived translation equations. It would be beneficial for Thailand to further use of such optimized VI data in term of time series.

Keywords: Cross sensor Vegetation Index

Abstract Id: 1204
LAND USE/LAND COVER DYNAMICS STUDY AND PREDICTION IN GARHWAL REGION OF WESTERN HIMALAYA

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Land use and land cover change (LULCC) is ubiquitous and is a reflection of the anthropogenic activities shaping the land cover. LULCC apart from changing the landscape feature result in ecosystem level change both structurally and functionally. In this study, LULC change analysis was carried out for Garhwal covering 7 districts of Uttarakhand, India in western Himalaya for 1995, 2005 and 2015. The LULC maps were prepared using on screen digitization technique at 1:50,000 scale using LISS III satellite data. It was categorised into 12 classes viz. Build Up, Cropland, Plantation, Evergreen forest-dense, Evergreen forest-Open, Deciduous forest-dense, Deciduous forest-Open, grassland, Snow cover, Scrub land, Barren land and water bodies. The current LULC change trend was extrapolated and used to predict LULC map of years 2025 and 2035 using Cellular Automata-Markov Chain Model (CA-Markov). The validation of the method was done by predicting LULC change for 2015 and comparing it with the actual LULC map of 2015. Analysis of LULC change revealed that there is a decrease in evergreen forest-dense (4.57%), deciduous forest-open (9.38%), plantation (12.77%), scrub forest (4.92%) and snow cover (35.08%). on the other hand, area under built up (30.98%), cropland (6.64%), evergreen-open (1.33%), deciduous-dense (8.84%), grassland (38.70%), barren land (34.69%) and water bodies (14.16%). The study of LULC dynamics extracts the negative and positive changes which may be natural or anthropogenic. It will help to prioritize the areas of management and conservation.

Keywords: Land Use Land Cover Change, Visual interpretation, Prediction, CA-Markov

Abstract Id: 1205
LAND USE-LAND COVER INFORMATION EXTRACTION FROM HIGH RESOLUTION AIRBORNE HYPERSONTRAL DATA

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Urban areas exhibit spectral heterogeneity at smaller scales leading to inaccurate land use-land cover (LULC) classification. Detailed LULC classification requires both high spatial and spectral resolution. Hyperspectral remote sensing or imaging spectroscopy captures information in a large number of contiguous bands for each pixel in an image. High resolution hyperspectral data, rich in both contextual and spectral information, can be used to generate detailed information about various materials and entities on the Earth’s surface. Traditional pixel-based classifiers fail to distinguish between different features such as building roof types or vegetation species owing to similarity of spectral signatures leading to merging of classes. This difficulty is overcome by object based classification approach which divides the image into several homogenous objects considering the textural and spatial properties along with spectral characteristics thereby yielding a more effective, efficient and accurate classification of surface features. This study assesses the potential of airborne hyperspectral data for LULC information extraction using pixel based and object-based approaches. The data used is a 356-band reflectance image in the visible near infrared (VNIR) and short wave infrared (SWIR) range captured by the commercial airborne hyperspectral sensor ProSpecTIR for a portion of the city of Reno in United States of America. Spectral Angle Mapper (SAM) and Support Vector Machine (SVM) have been used for pixel based classification while multi-resolution segmentation followed by hierarchical classification using nearest neighbor algorithm has been adopted for object based approach. From the obtained classified outputs, object-based approach was able to classify urban features in a much better way than pixel based classification approaches, i.e., SAM and SVM.

Keywords: LULC, Airborne Hyperspectral Imagery, SAM, SVM, OBIA

Abstract Id: 1206
INTEGRATION OF VERY HIGH RESOLUTION SATELLITE AND SPACEBORNE LIDAR DATA FOR ABOVEGROUND FOREST BIOMASS ASSESSMENT USING NEURAL NETWORK APPROACH

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Assessment of aboveground biomass (AGB) at ICESat/GLAS footprint level was done by integrating datasets from spaceborne LiDAR (ICESat/GLAS) and WorldView-2 data using neural network approach. The forest height was predicted with an RMSE of 1.35m and $R^2$ value of 0.97 by the GLAS waveform derived parameters. The biomass estimation accuracies of Multilayer Perceptron (MLP) were studied. Multiple Linear Regression equations were developed from the most important variables found using MLP algorithm. The 10 best parameters derived from GLAS waveform and WorldView-2 data were able to explain 72.8% variability of the AGB. The study also shows that the best 15 parameters were able to explain 83.2% of variability to predict AGB. This study further showed that the combination GLAS waveform, spectral and texture parameters provide much better AGB estimation accuracies compared to those obtained by GLAS waveform, spectral and texture parameter individually. Abstract

Keywords: ICESat/GLAS, LiDAR, WorldView-2, Multilayer Perceptron, aboveground biomass

Abstract Id: 1208
INTERSEISMIC COUPLING AND STRAIN FIELD IN NEPAL HIMALAYA PRIOR TO THE 25 APRIL GORKHA, MW 7.8 EARTHQUAKE FROM SPACE GEODESY

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Assessment of aboveground biomass (AGB) at ICESat/GLAS footprint level was done by integrating datasets from spaceborne LiDAR (ICESat/GLAS) and WorldView-2 data using neural network approach. The forest height was predicted with an RMSE of 1.35m and $R^2$ value of 0.97 by the GLAS waveform derived parameters. The biomass estimation accuracies of Multilayer Perceptron (MLP) were studied. Multiple Linear Regression equations were developed from the most important variables found using MLP algorithm. The 10 best parameters derived from GLAS waveform and WorldView-2 data were able to explain 72.8% variability of the AGB. The study also shows that the best 15 parameters were able to explain 83.2% of variability to predict AGB. This study further showed that the combination GLAS waveform, spectral and texture parameters provide much better AGB estimation accuracies compared to those obtained by GLAS waveform, spectral and texture parameter individually.

Keywords: Interseismic Deformation, Himalaya, InSAR, GPS

Abstract Id: 1209
A CASE STUDY ON THE DETECTION OF ILLEGAL DUMPS WITH REMOTE SENSING IMAGES

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This paper presents a case study about the detection of illegal dumps from optical satellite images in a large territory falling in the provinces of Naples and Caserta, Southern Italy. This location is also known with the term "Terra dei Fuochi" because in this area is particularly widespread the phenomenon of waste burning and, over the past decades, there have been many landfills of hazardous waste of industrial origin. As part of a project with SMA Campania, the in-house Campania Region company for environmental protection, CIRA, the Italian Aerospace Center, and MAPSAT, a remote sensing company, proposed to support the periodic monitoring inspection of the patrols with multi-temporal satellite images. The detection has been performed via expert photo-interpretation in order to achieve a high level of accuracy and reliable maps. Detected sites have been then classified according to 4 major characteristics of the dumps. Moreover, a multi-temporal analysis allowed to follow the evolution of the phenomenon. This approach was effective in both finding new illegal spills (with associated macro classification) and to follow the evolution (in terms of extension and persistence) of landfills already found in the past.

Keywords: Classification, illegal dumps, multi-temporal, remote sensing

Abstract Id: 1210
APPLICATION OF THERMAL IMAGING TO MONITOR THE CROP STRESS CONDITION

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Monitoring the crop stress condition using proximal remote sensing technique is an imminent requirement for abiotic stress characterisation. In this study, non-destructive and non-invasive characterisation of crop canopy status of wheat (Triticum aestivum) grown under moisture and temperature stress, was analysed under proximal remote sensing using thermal imaging technique. When wheat crop is under abiotic stress there is a decrease in latent heat flux at the crop canopy surface, a complementary increase of sensible heat occurs and creates a larger temperature difference between crop canopy and air. Recent thermal imagers can instantly detect minor differences in crop canopy temperatures which correlate to changes in transpiration, thus revealing differences in crop stress condition. The major interest in the application of thermal sensing of field crop was the development of indices of crop stress as guidance for crop management. In this study a crop canopy stress index (CCSI) was derived from the image analysis of the thermogram of the crop. A significant correlation was observed between the CCSI derived from the thermogram with the plant stress indicators like stomatal conductance, Relative Water Content, Water Potential and Leaf Area Index. In addition a high correlation was found between yield and CCSI at different growth stages indicate that thermography can characterise the crop stress status in wheat. These indices are mostly presumed to reveal variations in stomatal opening and evaporation rate as cellular water becomes the stress regulating factor. Thus proximal thermal remote sensing as observed in this study can be an efficient tool to characterise the crop responses to abiotic stress conditions.

Keywords: Thermal Remote Sensing

Abstract Id: 1211
RESPONSE OF INDIAN CORAL REEF REGIONS DURING MASS CORAL BLEACHING YEARS

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Coral reefs are the one of the most ancient, highly productive and marine bio-diverse ecosystem on the earth. Coral reefs are major features of tropical coastal environments between 30° N and 30° S Latitudes and coincide with SST ranging from 16° C to 30° C. The Sea Surface Temperature (SST) variations in the Indian Seas are mainly influenced by El Niño Southern Oscillations (ENSO). During 1997-1998, 2010 and 2015-2016, ENSO events elevated SST of tropical ocean. This elevated SST increased the level of thermal stress on coral reefs. Coral reefs are the most sensitive ecosystem of all ecosystems due to temperature change and exhibiting bleaching when SST exceeded their normal summer maxima and remained high for more than 28 days. Bleaching Threshold (BT), Positive SST Anomaly (PA) and Degree Heating Weeks (DHW) are commonly used indices for calculating thermal stress. The major coral reef formations in India are in Gulf of Kachchh (GOK), Gulf of Mannar (GOM), Lakshadweep, Andaman and Nicobar Islands. Sea surface temperature data from National Oceanic and Atmospheric Administration (NOAA) Optimum Interpolation Sea Surface Temperature (OISST) v2 high resolution data set which is available daily at 0.25° global grids from 1982 to present was used for this study. This study focuses on monitoring seasonal variations of SST for Indian coral reef regions. A severe warming was experienced by Indian seas during 1998, 2010 and 2016 that resulted large scale as well as most intense coral bleaching and mortality.

Keywords: SEA SURFACE TEMPERATURE, BLEACHING THRESHOLD, CORAL BLEACHING

Abstract Id: 1215
INVESTIGATING THE SCATTERING MECHANISM IN LOW CALCIUM PYROXENE ZONES OVER THE BULLIALDUS CRATER ON MOON USING M3 AND MINI-RF DATA

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Remotely sensed spectroscopic and radar data have been studied for characterising the mineralogy and scattering properties of lunar surface with a primary goal to understand the geologic evolution of lunar crust. The spectral signature of pyroxenes, having characteristic absorption bands at 1 and 2 micro metre, has particularly been used by various researchers to understand the composition and evolution of lunar crust. In this study, we investigate the scattering mechanism in the low calcium pyroxene (LCP) mineral bearing zones occurring over lunar surface. Bullialdus crater on Moon, located in the south-western part of the moon having 61 km diameter and 3.5 km depth, has been taken as the test site. The data obtained from Moon Mineralogical Mapper (M3), a payload on ISRO’s Chandrayaan-1 lunar orbiter mission, are used to find LCP zones using a spectral index, called as LCP index. The data from Miniature Radio Frequency (Mini-RF) instrument, onboard NASA’s Lunar Reconnaissance Orbiter (LRO), are used for characterising the scattering properties of the lunar surface using the Stokes parameters and different decomposition techniques, viz. m-chi, m-delta and H-alpha. The spectrally dominant LCP zones are mainly found in and around the central peak of the Bullialdus crater as also observed by previous researchers with LCP index ranging from 0.01 to 0.13, majority within 0.08. Modified Gaussian Model (MGM) applied on the spectra indicated that 1 µm band is centred between 910-950 nm and 2µm band is centred between 1830-1890 nm. Regression analysis indicated weak but statistically significant negative relation between LCP index and surface scattering, double bounce scattering, volume scattering and circular polarisation ratio (CPR); whereas, no relation is observed between LCP index and entropy (H) and mean alpha. Such study at different sites across the lunar surface is needed to gain better insights into understanding the scattering mechanism vis-a-vis lunar mineralogy.

Keywords: Moon Mineralogy Mapper, Mini-RF, Chandrayaan-1, Lunar Reconnaissance Orbiter, Bullialdus crater

Abstract Id: 1216
IMAGE DE-NOISE TECHNIQUE DEMONSTRATED BY FORMOSAT-5 IMAGE

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To increase the image quality especially in Signal-to-Noise ratio (SNR), applying image de-noise technique is a trend in high resolution remote sensing image, especially when the optical payload is not designed with high SNR. The image noise is composed of shot noise, fixed pattern noise, thermal noise, and A/D noise etc., for simplicity, we divided the de-noise technique into dealing with pattern noise and shot noise. Analyzing FORMOSAT-5 image acquired from demonstration model, there is noise which can be observed as the differences between odd and even line in along-track direction, we noted it as pattern noise. To eliminate the noise, the adapted window Hilbert-Huang Transform was proposed; the proposed method has three processing steps: domain partition, Empirical mode decomposition and posteriori residual analysis (Tsai, 2016). The testing result shows that the method increase SNR obviously but image detail like edge will be lost. Taiwan’s first self-reliant satellite FORMOSAT-5 is to be launched on late August this year to resume the observation missions of the decommissioned Formosat-2: the proposed de-noise method is expected to be tested by the real FORMOSAT-5 image. To analysis the pattern noise more precisely, the least significant bits was eliminated for testing the noise bits number. In this paper, the noise source will be specified and benchmark test will be conducted for verification. Expected results are to modify noise eliminating method by applying total variation method for restoring image, while avoiding MTF loss or image distortion caused by over-filtering.

Keywords: FORMOSAT-5, Image De-noise, Hilbert-Huang Transform

Abstract Id: 1219
WHOSE POWER GETS CUT? USING HIGH-FREQUENCY SATELLITE IMAGES TO MONITOR ELECTRICITY ACCESS AND POWER OUTAGES

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In many parts of the developing world, access to electricity is uneven and inconsistent, characterized by frequent and long hours of power outages. Many countries now engage in systematic load shedding because of persistent power shortages. When and where electricity is provided can have important impacts on welfare and growth. But quantifying those impacts is difficult because utility-level data on power outages are rarely available and not always reliable. We introduce a new method of tracking power outages from outer space. This measure identifies outage-prone areas by detecting excess fluctuations and volatility in light output.

To develop these measures, we process the complete historical archive of sub-orbital Defense Meteorological Satellite Program’s Operational Linescan System (DMSP-OLS) nighttime imagery capture over South Asia on every night since 1993. We compute annual estimates of Power Supply Irregularity (PSI) index for all 600,000 villages in India from 1993-2013. The PSI measures are consistent with ground-based measures of power supply reliability from the Indian Human Development Survey, and with feeder-level outage data from one of the largest utilities in India. We also compare our measures against data from VIIRS.

Drawing on extensive data on India’s national village electrification program from 2005-12, we present new results showing how PSI levels are directly influenced by the intensity of village electrification efforts. Our methods open new opportunities to study the determinants of power outages as well as their impacts on welfare.

Keywords: Night lights, power outages, load shedding

Abstract Id: 1220
CHANGES OF RAINFALL ZONE IN MALAYSIAN METROPOLITAN: SATELLITE REVEALED THE EMERGING INFLUENCED OF NIGHT TIME URBAN HEAT ISLAND & OROGRAPHY

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This study analyzed the changes of annual rainfall climate zone in Malaysian metropolitan region, the Klang Valley and its surrounding areas for 35 years (1980-2015) and investigated the plausible driving factors using satellite data. The annual rainfall climate zone analysis was conducted at microscale (0.01 deg., @ ~2km) resolution using 385 rain gauge network across the metropolitan region. Four satellite variables referred as explanatory factors; daytime and night time temperature, both from Moderate Resolution Imaging Spectrometer (MODIS) satellite data, elevation data from newly released 30-meter resolution of Shuttle Imaging Radar Topography (SRTM), and built up areas from Landsat multi temporal images were used. The results showed two prominent changes; first was the annual rainfall reduction in the intense urbanized region and second is the increased rainfall in the higher elevated areas. The remaining rainfall zones were unchanged. Correlation between the annual rainfall and elevation showed an increasing relationship with 1998-2015 dataset compared with 1980-1997 dataset. Analysis with the surface temperature, a variable that associated with the urban heat island showed that the night time condition had higher influenced to the spatial rainfall distribution pattern. We hypothesized that the changes of the rainfall zones was largely contributed by local effects from urbanization. The shorter min-max daily temperature and increased aerosols signified the condition of very active convective heating, evaporation and evapotranspiration which contributes to more clouds being formed. This mechanism however was not applicable in the intense urbanized areas where the evapotranspiration were decreasing due to the removal of vegetation. The clouds were then lifted adiabatically due to the increase elevation. Because those higher elevated areas were covered by vegetation (forest, crops, etc.) and relatively having lower surface temperature, the dew point were lower and easily achieved; constitutes to frequent rainfall. This study showed that in the long term, the deforestation and vegetation removal may lead to climate change at micro-scale level; which is a hotter and drier environment for urban areas and wetter forest.

Keywords: Climate Change, Urbanization, Tropics

Abstract Id: 1221
RURAL VILLAGERS’ CROPPING STRATEGY FOR REGIONAL IMPACT ON CLIMATE CHANGE

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A vicious cycle of poverty and environmental degradation is a major issue of global environmental problems. Especially in semi-arid tropics (SAT) including Sub-Saharan Africa and South Asia where the majority of the poor is concentrated, poverty and environmental degradation is widely prevalent. People in this area largely depend on rain-fed agricultural production systems and their livelihoods are vulnerable to environmental variability. The environmental resources such as vegetation and soil are also vulnerable to human activities. In order to solve these global environmental issues, a key factor is a recovery from, or a resilience of human society and ecosystems to, the impacts of environmental variability. The general concept of vulnerability expresses the multidimensionality of disasters by focusing attention on the totality of relationships between the social situations and environmental forces, produces a disaster. The major research question is to understand villagers’ cropping strategy for regional impact on climate change. Our study area is located in Sinazongwe district, Southern province of Zambia. As for the field investigation, we set the study sites A, B and C where are located in the lower terrace, middle escarpment and upper terrace, respectively. In the rainy season of 2007/2008, our study site had a heavy rain and many crop fields were damaged. In this crop year, the annual rainfalls in site A and C were 1442mm/yr and 1332mm/yr respectively. This is about two times of long term average of rainfall 694.9 mm/yr in Sinazongwe district. Approximately 20% of maize fields were damaged by heavy rainfall in 2007_08. Here, we have analyzed and discussed how the villagers cope with serious damage to crops from heavy rain. The maize harvest varies every year depending on rainfall and topographic position. If a farmer possesses maize fields at each topographic position, they can avoid severe negative consequences of climate variability such as drought or heavy rainfall. However, not all farmers have access to fields at all topographic positions. It is important to know where each household’s fields are located when considering their adaptation to climate variability.

Keywords: Climate Change, Regional Impacts

Abstract Id: 1222
THE INFLUENCE OF ENVIRONMENTAL FACTORS ON LAND SURFACE TEMPERATURE IN TAICHUNG CITY

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Previous studies have proved that several local environmental factors (such as land use, land cover, solar radiation) can influence the daytime land surface temperature (LST). Therefore, modulating these key factors can help mitigate urban heat island effects. However, there could be some other factors from the neighboring areas rather than local areas influencing the local LST. In order to clarify the factors from the neighboring, we have to clarify the two research questions: (1) does the LST of an area influence that of its neighboring areas? (2) Does the LST of an area influenced by the environmental factors of its neighboring areas? Therefore, the purpose of this study is to explore the relationship between land surface temperature (LST) and land surface environment with spatial autoregressive models including spatial lag model and spatial error model. Taichung City, as the third largest city located in Central Taiwan, is chosen as the study area. The predisposing environmental factors which may influence LST were retrieved with the Landsat series thermal imagery and Land Use of Investigation Data. The factors significant in different periods from 2010 to 2015 were selected to predict the cooling effects after increasing green covers in the specific areas: Maple Garden, The National Taichung Theater, the People's Square, IKEA roof greening, Green Park Road and other large-scale green space planning. Future applications include optimizing green space locations to reduce daytime urban heat island effects.

Keywords: land surface temperature retrieval, spatial autocorrelation, spatial regression analysis models

Abstract Id: 1223
CLIMATE CHANGE AND MULTI-TEMPORAL VEGETATION DAMAGE ESTIMATION THROUGH SATELLITE REMOTE SENSING AT SHIVNA RIVER BASIN, MAHARASHTRA, INDIA

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The regional impact of the climate change is remarkable in some region; amongst all, Shivana River Basin (a major agro-economic part of Upper Godavari River Basin) is utmost drought prone and climate vulnerable in Maharashtra State, India. The major economy of the state depends upon the agricultural productivity of this region, from the beginning of this century. As, the climatological factors operate the agronomic activities, so it is necessary to monitor the prior and existing climatic characteristics and vegetation cover. The major objectives of this study are to characterize the rainfall at the Shivna River Basin and mapping and quantifying long-term spatio-temporal vegetation cover which includes forests, medium to highly grown plants, agricultural and scrub lands. Long-term rainfall dataset (obtained from India Meteorological Department) were analyzed for sixty years (from 1953-2012), followed by long-term LANDSAT satellite dataset (for the year 1972, 1980, 1991, 2001, 2011, 2016) are classified (hybrid classification) to show the overall vegetation damage. Thirty years, two blocks are taken from 1953-1982 and 1983-2012 respectively for evaluating the rainfall to establish the climate change. The mean value of annual and monsoon rainfall is showing a significant decrease; whereas the mean value of annual and summer temperature is showing a significant increase. So, the climate change is substantial for the study area.

There is a correlation between surface water and vegetation occurrence. The vegetation cover is densely replenished around the dams and natural water bodies which serve as the water supply stations for the agricultural irrigation purposes. The vegetation cover is linearly decreasing whereas the barren lands and other classes are proportionally filling the gaps. The variations of water content are fluctuating randomly in all the classified images depending on the local rainfall pattern resulting the water storage at the respective numerous water bodies in the study area.

Keywords: Climate Change, Satellite Remote Sensing, Vegetation Damage

Abstract Id: 1224
The present study aims to understand the urban growth dynamics in Uttarakhand state of India using Global Human Settlement Layer (GHSL) and Defense Meteorological Satellite Program/Operational Linescan System (DMSP/OLS) data. For removing the saturation in the DMSP/OLS dataset, Vegetation Adjusted Nighttime light Urban Index (VANUI) was calculated. A correlation analysis was carried out between various GHSL datasets (viz. built-up grid, population grid, and settlement model grid) and VANUI. The datasets showed a positive correlation depicting their strong interrelationship. The GHSL data was also analyzed to find out the growth character of different cities in Uttarakhand state. The growth pattern of the cities showed, increasing growth towards the peripheral regions, secondly the growth rate was negatively correlated with the VANUI, thereby showing high intensity of lights in the cities and their lessening intensity towards the peripheral areas. Thus, the growth pattern was mainly in form of, densification of existing urban areas and increasing sprawl on the periphery. The interlinking of GHSL and DMSP/OLS datasets, hence proved to be useful in recognizing the urban growth pattern in Uttarakhand state.

Keywords: GHSL, DMSP/OLS, VANUI, Uttarakhand

Abstract Id: 1225
In the last two decades, remote sensing data has become widely available leading to development of large data repositories at decent time intervals across seasons and years. This raises the potential to understand and develop land use histories at various spatial scales. These land use histories of a given pixel or land parcel can indicate very valuable information on the drivers at these spatial location across the years/seasons. If these information are well parameterized, they can become a good descriptor of the processes at play - be it climatic or hydrological or other interventions. In case of drought impacts, especially in agricultural regions of India, we plan to use this land use history captured as the vegetation profile changes across time to help understand the interplay between irrigation infrastructure and the effect of drought on crop production. The paper presented here will present a framework to help generate such data and propose an approach using change vector analysis to detect ground responses or events. Further these events in combination with the meteorological history is used to assess the scale of drought impact across a district in India.

Keywords: Drought, Change Analysis, Land use history, Framework

Abstract Id: 1226
REMOTE SENSING AND LAND CAPABILITY FOR ENVIRONMENTAL CARRYING CAPACITY BASED LAND USE PLANNING IN SUBANG, INDONESIA

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According to the existing Indonesian regulations, there are three methods which can be used to evaluate the land carrying capacity in the context of spatial regional planning: (i) land capability-based carrying capacity, (ii) carrying capacity, based on balance of land use supply and demand, and (iii) water resources balances-based carrying capacity. The objective of this study is to present the results of research in Subang Regency, West Java Province, Indonesia, using the first method, in order to give the input for spatial regional planning. Land use and land cover were delineated using SPOT-6 imagery. A soil survey was conducted to delineate the land mapping units. In each land mapping unit, soil analysis was conducted to obtain a semi-detailed land capability map. Evaluation of land carrying capacity was done by confronting land use, land capability and spatial pattern map of official spatial regional plan. Result of the research indicate that there are 8 land use/land cover in Subang Regency, where paddy field is the largest land utilization. The research area has land capability class ranged from land capability class of III to VI with land capability class of III as dominant class. The dominant limiting factor for these land capability classes were slope and soil drainage. Result of environmental carrying capacity analysis indicate that there are only 8-13% of the area, either in actual land utilization and in official spatial regional land use plan, which was meet with its land carrying capacity. The most part of the area (80%), either in actual land utilization and in official spatial regional land use plan, was conditionally meet the land carrying capacity. The result of the research can then be used as input for improving current land utilisations as well as input for future official land use plan correction.

Keywords: SPOT 6; land mapping unit; West Java

Abstract Id: 1227
Missing data in satellite images is a known phenomenon in remote sensing. There are various reasons for these gaps in satellite images e.g., shadowed area for SAR data sets, cloud coverage for optical imagery and instrument errors such as Scan Line Corrector (SLC-off) failure. The Scan Line Corrector (SLC) of Landsat 7 Enhanced Thematic Mapper Plus (ETM+) sensor failed permanently causing around 22% of pixels not scanned in each scene and this failure has seriously limited the scientific applications of ETM+ data. Reconstructing the gap regions is an important issue in remote sensing. To address this issue, we have proposed an idea to find the patch from image using Local Binary Patterns (LBP) and replace non-existing data with it by analyzing the shape features obtained from Haar Wavelet and damaged features from image texture using LBP invariants. We have used Euclidean histogram matching distance for Local Binary Patterns to find the best match for several patches in the image. Texture and color feature of the fixed image region has been determined with the limited candidate patches. To improve the restoration accuracy the approach is optimized using the LBP (local binary pattern) texture analysis technique and Mean Square Error is evaluated to optimize the overlap region between patches. We have considered several examples to show the effectiveness of the proposed approach in removing the large patches as well as recovery of small patches in various test images.

Keywords: Landsat 7, Image Processing, Local Binary Pattern, Mean Square Error, Scan Line corrector

Abstract Id: 1229
NITRATE ALGORITHM DEVELOPMENT AND REMOTE SENSING OBSERVATIONS ALONG THE NORTH-WEST BAY OF BENGAL COASTAL WATERS


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The development of nitrate algorithm has been carried out using in situ collected water samples from the coastal water along Odisha and West Bengal coast, in northwest Bay of Bengal region along the stations Digha, Chandipur, Dhamra, Paradip and Astaranga. The monthly and seasonally sampled datasets have been collected during July 2014-March 2016 period. The water samples have been analysed to retrieve the parameters; chlorophyll, nitrate and SST for algorithm development. During the summer season (March-June), the functions linear, paraboloid and gaussian have been applied to the datasets for 3-dimensional regression. For only surface samples (99 points) regression analysis, the coefficient of determination R2 value with linear, paraboloid and gaussian function fits found to be 0.457, 0.579 and 0.612. So, the gaussian function observed to be performing best regression between the 3-parameters with least standard error of estimate 15.662. So, we have attempted to generate nitrate images using satellite datasets. The Oceansat-2 OCM derived chlorophyll, Modis-Aqua SST and GHR-SST datasets encompassing the study region [16-22°N and 82-89°E] have been utilized to retrieve the modelled nitrate images during March 2017 and satellite derived nitrate data has been compared with limited number of in situ datasets during March 2017. The chlorophyll and nitrate features are observed to be matching reasonably well in the satellite images. The offshore cooler SST (<27°C) features matched to the high nitrate (>2.0 µM) features in offshore region indicating the vertical processes like upwelling and convection. The satellite derived SST, chlorophyll and nitrate ranges during March 2017 observed to be within 22-32°C, 0.11-2.66 mg/m3 and 0.027-22.02 µM respectively over the study area.

Keywords: Nitrate algorithm OCM MODIS GHR SST

Abstract Id: 1230
APPLICATION OF REMOTELY Sensed SATELLITE IMAGES FOR THE URBAN MAPPING IS ONE OF THE IMPORTANT & CHALLENGING TASKS. IN RECENT YEARS, DUE TO DRASTIC GROWTH AND DYNAMIC BEHAVIOR OF URBANIZATION, IT IS VERY IMPORTANT TO HAVE A PLANNING STRATEGY FOR UPDATING THE MAPS, DECISION MAKING, ETC. BUILDINGS FEATURES HAVE HIGH AMOUNT OF HETEROGENEOUS STRUCTURES & THEREFORE, DIFFICULT TO INTERPRET THE SHAPE & PATTERN AT COMMON LANDSCAPE AREA. THEREFORE IN THIS PAPER, GENERIC RULESETS USING KNOWLEDGE BASED APPROACH ALONG WITH OBJECT BASED CLASSIFICATION FOR BUILDINGS FEATURE EXTRACTION FROM HIGH RESOLUTION IMAGERY BY USING SPECTRAL, SPATIAL AND CONTEXTUAL APPROACH IS PROPOSED. THE ATTEMPT HAS BEEN MADE TO EVALUATE THE METHODOLOGY ON THREE DIFFERENT TEST CASES WHICH INCLUDES VARIOUS URBAN STRUCTURES (PLANNED AND UNPLANNED) DEPENDING ON SLOPE & NATURE OF THE VARIABLE TERRAIN AS- HILLY AREA AND FLAT REGIONS USING WORLDVIEW-2 IMAGERY. THE HIGH RESOLUTION DATASETS IS DIVIDED INTO THREE HIERARCHICAL SCHEME /STAGES OF CLASSIFICATION AS- IN FIRST STAGE IMAGE WAS CLASSIFIED INTO BUILT-UP & NONBUILT-UP AREA; AT SECOND STAGE, CATEGORIZATION USING LINEARITY & NONLINEARITY ON BUILT-UP AREA WAS PERFORMED TO SEPARATE BUILDINGS FROM OTHER BUILT UP FEATURES; AT THIRD STAGE, CLASSIFICATION OF BUILDINGS & ATTRIBUTE LABELING WAS IMPLEMENTED. CLASSIFICATION ACCURACY AND KAPPA STATISTIC DEPENDS ON THE TERRAIN CONDITIONS. THE EXTRACTED BUILDING ACCURACY OBSERVED WAS 86.30% FOR HILLY AREA, & 89.42% FOR PLANNED AREAS IN FLAT TERRAIN. THE DEVELOPED RULESETS ARE GENERIC IN NATURE & CAN BE TRANSFERABLE TO OTHER DATASETS HAVING SIMILAR SPATIAL AND SPECTRAL RESOLUTION.

KEYWORDS: AUTOMATIC APPROACH, OBJECT BASED CLASSIFICATION, GENERIC RULESETS, TERRAIN CONDITIONS

ABSTRACT ID: 1231
BAYESIAN BASED RAIN RETRIEVAL OVER OCEAN

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Precipitation plays a key role in hydrological cycle and its accurate and timely measurement is very important to understand global water fluxes and energy balance of the Earth’s systems. Despite its importance, it is one of the most difficult parameter to measure because it is highly dynamic on spatial and temporal scale. Although measurements of precipitation using weather radar and rain gauges are accurate, their spatial coverage is poor and limited to land. Satellite observations overcome this limitation. Satellite sensors operating at microwave frequencies (10 to 185 GHz) allow global measurement of precipitation on high temporal and spatial scale. Precipitation retrieval algorithm from space born passive microwave sensor is either based on empirical or physical methods. Empirical methods primarily applied over land are based on relation between observed radiance and precipitation. Whereas, physically based methods are applicable for ocean surface which uses radiative transfer model to calculate brightness temperature at the top of atmosphere for different atmospheric conditions. Beside these conventional methods, state-of-the art probabilistic approach for rain retrieval is presented here. To develop the algorithm, we used Liu’s Radiative Transfer Model (RTM). Using RTM brightness temperature (Tb) simulations have been performed on the same set of frequencies used by Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI), Global forecast system (GFS) atmospheric profiles (Height, Pressure, Temperature and Relative humidity) and TMI-2A12 hydrometeors profiles (Cloud liquid, Cloud ice, Rain, Snow and Graupel) are used as inputs for the simulations. A case study is performed, to classify in different clusters to get the posterior probability of rain. Statistical analysis is carried out for 8, 16, 32 and 40 clusters for the posterior calculation using Bayesian approach.

Keywords: precipitation, TRMM, GFS, probability, ocean

Abstract Id: 1232
GENERIC RULE BASED APPROACH FOR EXTRACTION OF BUILDING FEATURES IN VARIABLE TERRAIN CONDITIONS USING HIGH RESOLUTION IMAGERY

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Application of remotely sensed satellite images for the urban mapping is one of the important & challenging tasks. In recent years, Due to drastic growth and dynamic behavior of urbanization, it is very important to have a planning strategy for updating the maps, decision making, etc. Buildings features have high amount of heterogeneous structures & therefore, difficult to interpret the shape & pattern at common landscape area. Therefore in this paper, Generic rulesets using knowledge based approach along with object based classification for buildings feature extraction from high resolution imagery by using spectral, spatial and contextual approach is proposed. The attempt has been made to evaluate the methodology on three different test cases which includes various urban structures (planned and unplanned) depending on slope & nature of the variable terrain as- hilly area and flat regions using Worldview-2 imagery. The high resolution datasets is divided into three hierarchical scheme /stages of classification as- In first stage image was classified into built-up & nonbuilt-up area; at second stage, categorization using linearity & nonlinearity on built-up area was performed to separate buildings from other built up features; at third stage, classification of buildings & attribute labeling was implemented. Classification accuracy and kappa statistic depends on the terrain conditions. The extracted building accuracy observed was 86.30% for hilly area, & 89.42% for planned areas in flat terrain. The developed rulesets are generic in nature & can be transferable to other datasets having similar spatial and spectral resolution.

Keywords: Automatic Approach, Object based classification, Generic Rulesets, Terrain Conditions

Abstract Id: 1233
STUDYING THE EFFECT OF FOREST FIRES ON NIGHT-TIME LIGHTS USING SNPP-VIIRS-DNB AND MODIS PRODUCTS


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Detection, monitoring and management of forest fires are important in tropical countries like India where 55 percent of the total forest cover is prone to fires annually, causing adverse ecological, economic and social impacts. Night-time lights (NTL) captured through satellite based observations from Suomi-National Polar-orbiting Partnership - Visible Infrared Imaging Radiometer Suite - Day/Night Band (SNPP-VIIRS-DNB) contain the signals from forest fires. The present study aims to investigate the effect of forest fires on the average monthly radiance products of SNPP-VIIRS NTL generated by NOAA. Forests in Nilgiris and Kanyakumari districts of Tamil Nadu State in the southern region of India have been taken as the study area. The daily forest fire locations were derived from MODIS Near Real-Time (NRT) active fire data of February to May, 2014. It is observed that the maximum occurrences of forest fires are in the months of March and April. The ‘sum of lights’ (SOL) derived from average monthly radiance values of NTL products of February to May were plotted with the number of fire occurrences for the two study districts. Good correlation between the monthly fire occurrences and SOL is observed. Point based statistics in terms of percentage change in monthly radiance and coefficient of variance also show increase in radiance values on the locations of active fire points. These observations suggest that even average monthly radiance products of NTL are contaminated by signals from temporary fires. More investigation is required to study the effect of different time of passes of SNPP and MODIS on radiance values and other factors causing increase in radiance in forested areas (e.g. camp fire). Further, the study underscores the need to remove the effect of such temporary sources from even monthly average radiance NTL products of SNPP-VIIRS while studying the permanently lit areas for monitoring socio-economic development.

Keywords: VIIRS, MODIS, Night-time lights, Forest fires

Abstract Id: 1234
Due to lack of on-board calibration, nightlight images obtained from Defense Meteorological Satellite Program - Operational Linescan System (DMSP-OLS) cannot be directly used for time-series analysis of human development. In this study, a (semi) automatic method to extract stable luminosity regions, called as pseudo-invariant features (PIF), is developed for relative radiometric normalization of time-series DMSP-OLS nightlight images. The method for extracting PIFs, i.e. the regions that are spatially homogeneous and have low spatial variability, is based on combined use of Getis statistic (\(G^*\)) and coefficient of variation (CV). While \(G^*\) is used to determine the spatial homogeneity, CV is used to determine the spatial variability. Stable annual nightlight products (version 4) over India for 1992-2006, downloaded from NOAA website, have been used in this study. Based on various iterations and considering \(G^*>1.645\) (at \(\alpha=0.10\) restricting random clustering of bright pixels by only 10%), optimal threshold of CV<10% and window size of 3x3 were obtained as the criteria to determine PIFs across the studied time period. Taking 2001 image as the reference, nightlight images of other years were radiometrically normalized using the regression model. The quality of the calibrated images were evaluated by studying the trend of sum of lights (SOL) over India from 1992 to 2006 and also the relations between SOL and gross domestic product (GDP) and urban population. It is found that the method proposed in this research to extract PIFs without the a priori knowledge of the area can be effectively used for radiometric normalization of the DMSP-OLS nightlight images which in turn can be used for studying the socio-economic development of an area over time.

Keywords: DMSP-OLS, nightlights, radiometric normalization, pseudo-invariant feature, Getis statistic

Abstract Id: 1235
CLOUD BASED GEO-PROCESSING PLATFORM FOR ANALYZING LARGE VOLUME TEMPORAL SATELLITE DATA: A STUDY IN PART OF GHAGHARA RIVER BASIN (INDIA) FOR SURFACE WATER SPREAD ANALYSIS


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With the availability of large spatio-temporal Earth Observation satellite data and geospatial layers along with increased geo-computation requirement, the popularity of cloud based platform for accessing, sharing and processing large volume data is growing day by day among the geospatial community. Google's Earth Engine is one such platform which provides access to geospatial datasets, including satellite data, and analysis functionalities to researchers free of cost for various applications from local to global-scale. This study aims at exploring Google's Earth Engine to study the spatio-temporal dynamics of surface water during the Indian Summer Monsoon season over last three decades, from 1984 to 2016. Top of Atmosphere (TOA) reflectance images available from Landsat-5, 7 and 8 have been used in this process. A part of Ghaghara river basin covering about 8400 km² area is selected as the study site. The clouds and their shadows were masked from the TOA reflectance images using Fmask (Function of Mask) quality band. Two indices namely Normalized Difference Water Index (NDWI) and Normalized Difference Vegetation Index (NDVI) were calculated and by applying suitable thresholds, binary surface water image for each date of acquisition was generated. This process is then applied to all the multi-date images and a composite long-term surface water map is generated for the study area, wherein each pixel represents the frequency of the presence of surface water for cloud-free observations. Such composite long-term surface water map is extremely useful not only for understanding the spatio-temporal dynamics of surface water spread but also for mapping natural storage sites, flood hazard zonation, developmental planning, etc. The study demonstrates the potential of cloud based online geo-processing platform in a small area; its scalability for large-scale application may be explored further.

Keywords: Cloud platform, Earth Engine, Geoprocessing, Landsat, Surface water spread

Abstract Id: 1236
ROLE OF CLOUD BASED GIS MODEL IN MAPPING AND MANAGING DENTAL CARIES AMONG CHILDREN FROM A RURAL COMMUNITY


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Caries is one such dental condition, which is dependent on multiple factors like diet, oral hygiene, fluoride levels and other socio-environmental determinants. Opportunely, it is responsive to prevention and management at both individual and population levels. Although dental caries is a disease that manifests throughout the lifespan, prioritizing children is appropriate because caries is first established in early childhood and plays out across lifetime, and an early recognition permits timely medical interventions. Epidemiology links our understanding of various determinants of disease (Biological, Environmental, Socio-demographic etc). Factors that may be implicated in giving rise to caries in young children have been described in numerous studies. However, GIS and spatial epidemiology aids in better understanding of disease distribution and complex relationships. This paper aims at mapping dental caries among children and following up for management through a cloud based GIS platform. Rural Children in age group 5-15 years have been chosen from schools in five Mandals of Kuppam Geographical Area, Andhra Pradesh based on a random sampling. Screening for dental carries and other health examination have carried out by health professionals. Data on health condition, socio-demographics have been captured on an android platform and stored in a cloud server. Home coordinates of children have also captured by health workers. Children with dental carries are followed up through SMS alerts to both parents and school teachers, as well as through personal motivation by Hospital Health workers for treatment at health facility. Temporal trends are noted on a dynamic interactive GIS platform before and after follow up activity. Hot spots of Dental caries were distributed almost equally across all the Mandals with slightly higher concentration in Kuppam Mandal. Integrating GIS models into strategies for promoting and managing oral health, which in turn reflect general wellbeing of a child, helps to improve overall quality of life.

Keywords: Dental Caries, Cloud based, GIS, Children, Rural Community

Abstract Id: 1237
CLIMATIC CONTROL OF VEGETATION TREND SHIFTS IN NORTHWEST AND CENTRAL INDIA

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The relationships between climatic conditions and vegetation changes are not firmly established at different geographic settings. It is well established that climate phenomena strongly affects the terrestrial ecosystems. In this context, many studies have presented how climatic variations have caused major alterations in the composition and distribution of terrestrial ecosystems worldwide. There is a need to understand how ecosystem processes are influenced by the entire suite of perturbations, from climate variability owing to changes in temperature, precipitation, solar radiation, and other disturbances. The overarching objective of this study was to determine spatiotemporal responses of the terrestrial vegetation in Northwest and Central India to climate change. The GIMMS NDVI3g dataset at 0.083° spatial resolution from the AVHRR instruments were used for the years 1981-2015 to capture Normalized Difference Vegetation Index (NDVI) changes over terrestrial ecosystems. In conjunction with satellite dataset, the monthly gridded climatic dataset such as precipitation, temperature, surface solar radiation, and microwave-based soil moisture were used to determine the major driving climatic variables of large-scale change of vegetation growth. All satellite and climate fields were aggregated to a common 0.083° spatial grid to apply statistical analyses and these computations were executed using the R package “raster”. The greening and browning trends were investigated using non-parametric methods, namely, Mann-Kendall test and Theil-Sen (TS) median slope.

The prominent large-scale greening trends of vegetation during the period 2000-2015 were identified in Northwest India (i.e. Gujarat, Rajasthan states) including the Central India (i.e. Madhya Pradesh). These areas are mainly confined to arid, semi-arid and sub-humid regions. Despite climatologically drier regions, the strong positive trends were evident over these regions. This can be explained by the various driving factors in response to climate change, which will be presented in the conference.

Keywords: NDVI, climatic data, vegetation growth, greening trends, climate change

Abstract Id: 1238
Picrorhiza kurrooa Royle, a perennial rhizomatous herb, is a high commercial value medicinal plant found in the North-Western Himalayan region of India. The leaf, bark, and rhizomes are widely used in traditional Ayurvedic medicines for its anti-oxidant, anti-inflammatory, immunomodulatory and hepatoprotective properties. Due to over-exploitation and indiscriminate collection, the species has been listed as critically endangered and included in CITES Appendix II. In view of the rapidly shrinking population and habitat degradation, identifying the potential geographic distribution of the species is critical. Species Distribution Modelling is a useful tool in conservation biology which quantifies the environmental niche of species. This study attempts to model the distribution of Picrorhiza kurrooa in the Kumaon and Garhwal Himalayas of Uttarakhand, India, using Maximum Entropy model (MaxEnt). The WorldClim bioclimatic variables, elevation, slope, aspect and the soil variables, along with species occurrence points were used to predict the potential distribution of P. kurrooa in the study area. The Jacknife test was used to evaluate the variable importance for the species habitat modelling. The accuracy of the model was assessed using the area under curve (AUC) scores. The approach is fairly promising to predict the distribution of economically important and endangered medicinal plants. The potential habitat distribution map can be an effective tool in conservation planning for both in situ restoration and ex situ propagation of the species.

Keywords: Medicinal plant, endangered, species distribution modelling, potential habitat distribution

Abstract Id: 1241
THE INVESTIGATION OF LAND SUBSIDENCE ALONG THE METROPOLITAN RAPID TRANSIT SUBWAY TUNNEL (BLUE LINE), BANGKOK, THAILAND

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This work aims to investigate the land subsidence along the Metropolitan Rapid Transit subway tunnel (Blue line) using geo-informatics technology. Geographic Information Systems (GIS) are used to analyze, visualize and display the remote sensing, leveling, and groundwater data in the form of mapping. The subsidence map will aid to identify the average land subsidence rate along the blue line, and the relationship between the excavation of the underground tunnel and the subsidence of land surface. Moreover, the linear regression can be applied to predict the trend of the cumulative subsidence in long term.

It was found that the average rate of land subsidence along the blue line is 12.30 millimeters per year. For the relationship between subway tunnel excavation and subsidence, we compare the land subsidence rates on tunnel during the year prior to the construction, tunnel excavation, and during the year after subway construction completed. The results show that the average annual subsidence rate before the underground tunnel excavation is higher than the post-tunnel excavation stage. It can be analyzed here that the underground tunnel drilling has little or no effect to land subsidence because of no significant decreasing rates between before and after excavation. For subsidence trending in the next 20 years, the land along the subway line will have subsided to accumulate an average of about 25 centimeters.

In addition, the underground tunnel excavation would have a limited impact area. The position at the particular boundary is considered to be no affected by underground tunnel excavation causes subsidence. Therefore, it can be concluded that the buildings structure along the line will not be affected by the underground tunnel drilling constructions since the buildings are placed on the pillar deep down to the sand layer.

Keywords: Land subsidence, Metropolitan Rapid Transit (Blue line), subway tunnel

Abstract Id: 1242
SPATIO-TEMPORAL ANALYSIS OF PASSIVE MICROWAVE REMOTE SENSING DATA FOR RAPID DETECTION OF LARGE SCALE FLOOD MAPPING - A GEOSPATIAL APPROACH

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Land Surface Water Coverage (LSWC) is one of the critical parameters in large scale flood identification and agriculture monitoring. In this paper, a time series geospatial database of LSWC is created to analyse the large-scale flooding pattern in the Tamil Nadu state of India. Normalised Difference polarisation Index (NDPI) is computed from a daily mosaic of LSWC database. NDPI anomaly is created by using different methods such as anomalies based on a reference year, multi-annual average (absolute, relative and standardised) and seasonal anomalies (daily, monthly, and yearly). Also, image similarity is calculated by using Bhattacharya distance to extract the hidden information and similarities in the temporal images. Based on the similarity values, all the images in the database are ranked which can help in rapid flood information extraction. The data used in the research include freely available brightness temperature from AMSR-E (2002-2010) and AMSR-2 (2012-present) on board Aqua and ADEOS-II respectively. As Tamil Nadu is a coastal area, a buffer region from the coast line is created to identify the spatial variability of LSWC. The results show that there is a significant spatial variability of LSWC and also able to identify the major flood events. Also, the anomalies were helped to identify the geographic locations of flood hotspots at specific times during the flood events. Various anomalies are helped to identify the trend and pattern of flooding throughout the study area. The results are validated with the help of TRMM Multi-Satellite Precipitation Analysis (TMPA) rainfall datasets.

Keywords: Land Surface Water Coverage, Spatial variability, AMSR-E, NDPI, Anomaly

Abstract Id: 1243
URBAN PARKS, MICROCLIMATE AND RESILIENT CITIES

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The current trend in urbanization reveals that the world’s population continues to concentrate in cities, which crossed 54% in 2014 with projections to reach 66% by 2050 (United Nations, 2014). With gradual increase in global population in urban areas there is also increment in the concrete infrastructures. The cumulative effect of this increasing trend can be seen as rising land surface temperature in urban areas as seen in case of large cities where high insolation trapped within closed spaces of concrete buildings increases the local temperature. The global rise in land surface temperature which has become a prominent feature of any urban area can be considered as one of the major environmental problems of the 21st century. The higher temperatures in cities not only increase cooling energy consumption but also raise pollution levels and even may affect the habitability of the living area.

Urban ecosystem being a larger domain, addresses the concept of cities that includes both nature and humans in a largely human built environment. The importance of green patches within urban areas is vital as they counter the increment in land surface temperature and mitigate the urban warming effects. Urban parks are majorly considered as an important part of urban vegetation, which are cooler than their surrounding built-up areas. These spaces with vegetation cover can be termed as Urban Cool Islands (UCI) as the temperature is much lower than the surrounding areas. The main objective of this paper is to address the value of urban parks for well being of residents of Delhi and for the sustainability of the city. This includes; to analyse how parks serves as UCI (Urban Cool Island) in the densely concretised urban area, map the land surface temperature in and around the UCI and quantifying the impact on parks on the microclimate of the region.

Keywords: Microclimate, resilient cities, urban heat, urban cool islands and urban parks

Abstract Id: 1247
ASSESSING THE EFFECTS OF URBANIZATION ON RUNOFF USING V-I-S FRACTION MAP AND COMPOSITE CURVE NUMBER

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The progressive decrease in natural surfaces for enhancing the facilities to urban dwellers is taking its toll on environmental resources. The expansion in impervious surfaces is also altering the hydrological characteristics of urban areas. Among different methods, the Soil Conservation Service Curve Number (SCS-CN) method is widely used for surface runoff appraisal. In the present study, the Vegetation-Impervious Surface-Soil (V-I-S) fraction maps have been used to assess the urban land use/land cover (LULC) composition in parts of Dehradun city of Uttarakhand state in India. The fraction maps of the impervious surface indicate the changing scenario of the urban areas based on analysis of four different years’ image data of 1991, 1998, 2003 and 2011. During these periods, the impervious surfaces have increased in an accelerated manner due to rapid urban growth in the peripheral zone of the main urban centres. The composite CN has been calculated while incorporating the soil and vegetation types and V-I-S fraction map and adjusted with slope and five days Antecedent Moisture Conditions (AMC). During the extreme event of storm rainfall such kind of imperviousness is experienced with high surface runoff leading to water logging and related urban flooding. The extreme rainfall event during last 30 years with 164.6 mm of rainfall was used to compute the surface runoff for all 146 sub-watersheds within study area. The present study has helped to understand the relationship between V-I-S fraction map vis-à-vis the surface runoff caused due to extreme events. It is observed that surface imperviousness is very high (> 60%) in main Dehradun city and some peri-urban areas that leads to more direct surface runoff and gradually decreases outwards from the city. The urban drainage system in such areas needs proper maintenance or changes in design to prevent the water logging or urban flooding condition.

Keywords: Urbanization, Geospatial Techniques, Imperviousness, Composite CN, Urban Hydrology

Abstract Id: 1249
MAPPING OF EXISTING OIL FIELDS IN ANKLESHWAR AND PIPELINE ALIGNMENT USING RS & GIS TECHNIQUES.

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The purpose of the pipeline alignment is to display engineering data in relation to the pipeline location and land base features. To get crude oil from well and various final product from refinery, pipeline is used for the purpose of transportation. This goes to be very cheap in economic context although such linear and long network occupies large geographical area because of specific sources of oil. Due to coverage of large land there would be problem in operation. GIS is used to identify problem and Decision making system and take suitable step for the management of system. Use GIS technologies to support the Engineering department to identify the best route for a future oil pipeline in the Ankleshwar, Bharuch. Consider engineering requirements (topography, elevation, slopes) as well as legal, environmental and construction constraints.

Keywords: Optimal routing, Profiling, Oil Fields, Hybrid Criteria

Abstract Id: 1251
Cities around the world suffer from water shortages due to inadequate water supply or infrastructure. The inequities between head-end and tail-end users is a matter of concern for urban planners. In addition, the population growth and extreme weather patterns that create droughts and floods are expected to increase in the coming decades, making water an even more precious resource. The geospatial data and techniques holds promise in water utility management like the asset creation, infrastructure capital improvement, planning and analysis, optimizing field operations, water conservation, etc. In the present study, an attempt has been made to build GIS-based simulation model of water supply network of a municipal ward in Dehradun city to run real-time scenarios in terms of head-loss, nodes pressure and flow rate of pipes. The current pipeline network was considered and the pipe locations were verified using Ground Penetrating Radar (GPR) and Global Positioning System (GPS) devices. The open source software QGIS and EPANET were used to build water supply network database with attributes such as pipe diameter, material property, junctions and nodes. Different outputs were generated like flow in pipes, pressure in nodes, head-loss in pipes and nodes, etc. and the water demand based on household size and land use was computed. Most of the land use category in Dharampur ward is residential (about 68 percent) and the second most prominent land use is public and semi-public utilities which include government offices and schools. According to the model, satisfactory pressure is being provided at household levels and the pressure gets increased in pipelines during peak hours. The leakages in network are not accounted for due to insufficient data. The real time scenarios can be run through this model if the water supply constraints are incorporated. The study has usefulness to address the water supply stresses in cities.

Keywords: Urbanization, Geospatial Techniques, Imperviousness, Composite CN, Urban Hydrology

Abstract Id: 1252
MORPHOMETRIC ANALYSIS OF BOGINADI WATERSHED, ASSAM USING GIS AND DEM DATA

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The morphometric analysis of a watershed is the quantitative analysis of configuration, shape and dimension to understand the hydrological, geological and geomorphological characteristics of the watershed. The aim of the present study is to analyze the watershed morphometry of the Boginadi watershed using Geographical Information System (GIS) and Digital Elevation Model (DEM) data to evaluate the neo-tectonic domains and river course changes. The geomorphic indices such as linear, areal and relief aspect has been used to analyze the morphometry of the watershed. This geomorphic indices help to indicate the present uplifting and geomorphic set-up of the watershed. The present analyses show that neotectonism has played a major role in modifying the landscape of the Boginadi watershed.

Keywords: Morphometric, Neotectonic, River course, Gographical Information System, Digital Elevation Model

Abstract Id: 1253
COMPARISON OF 2001 AND 2015 LAND USE CHANGE OF MULETA WATERSHED, PHILIPPINES

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The Philippine government completed last year 2016 on its national reforestation program (National Greening Program or NGP) since 2011. Aside from being a reforestation initiative per se, the program will relatively rehabilitate critical watersheds of the country. In this context, the study focus on Muleta watershed. Muleta watershed is one of the major tributaries of Pulangi River in which a great factor in affecting the water quality of the bigger Pulangi River. This study primarily aims to determine land use change happened before and after the implementation of NGP. Land use change detection was conducted between 2001 and 2015. Classified image of two different years were compared using cross-tabulation applied in ArcGIS to determine quantitative aspects of change. Major land use conversions within the watershed were identified for comprehending the spatial pattern of changes from year 2001 to 2015. The study reveals the major land use in 2001 was forest cover with a total area of 426.27 km², however, this decreased to 284.67 km² in 2015 which accounts for 13.48% change of the total watershed area. The decrease of forest cover was mainly influenced with the conversion of mixed forest areas into agricultural land as observed within the watershed. This demonstrates the increasing agricultural activities within the watershed converting forest areas into bare land and agricultural land. However, there is a conversion of agricultural land in 2001 to the forest in 2015 with a total area of 9.19 km². This conversion was influenced by the reforestation activities under NGP of government within the Muleta watershed.

Keywords: Watershed, Land Use, Cross-tabulation, Forest

Abstract Id: 1255
MODELLING TRAFFIC ACCIDENT SEVERITY USING ACTUAL REPORTED CAUSES: A COMPARISON BETWEEN DEEP NEURAL NETWORKS AND SUPPORT VECTOR MACHINES

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With the significant increasing of urbanization and number of registered vehicles worldwide, traffic accidents are a global concern. This paper presents an evaluation of deep neural networks (DNN) and Support Vector Machines (SVM) for traffic accident severity modelling using actual reported causes. A case study of Malaysian North-South Expressway (NSE) was presented. Accident data for the period of 2009-2015 consisting of 1138 observations was acquired for the study area. The data contained seven explanatory variables (vehicle type, accident cause, collision type, lighting condition, zone, bound, road surface condition). The data was split into three subsets as follow: (1) training set, which contained 70% of the whole data, (2) validation set contained 15% of the data, and (3) testing set contained the remaining 15%. Using the training and validation datasets, the DNN and SVM models with optimum hyperparameters were built. After that, the trained models were tested using the testing dataset. Results indicated that the linear SVM outperformed other SVM models and DNN models. The highest accuracy on testing dataset was 71.34% obtained by the linear SVM model. In addition, the best DNN obtained 66.74%. Furthermore, the random forest analysis showed that the reported accident cause and vehicle type are the two most influential factors increasing the severity of accidents in the study area.

Keywords: Traffic accident; modelling; LiDAR; GIS; SVM; DNN

Abstract Id: 1256
GEOMETRIC ACCURACY OF KOMPSAT-3A STEREO DATA

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KOMPSAT-3A AEISS-A PAN data can be used various researched to investigate different aspects and experiments of mapping using KOMPSAT-3A data: geometric accuracy, DEM extraction, image content, extraction of planimetric features, and integration of raster and vector data. In this paper, we introduce geometric accuracy characteristics of KOMPSAT-3A AEISS-A stereo data. The analysis of stereo geometric accuracy characteristics was evaluated by three parameters, convergence angle, bisector elevation angle and asymmetry angle.

Keywords: Stereo image, KOMPSAT-3A, Geometric accuracy

Abstract Id: 1258
This study aimed to produce flood hazard map of Lasang River in Davao Region, Southern Mindanao, Philippines with the aid of the Light Detection and Ranging (LiDAR) to produce flood simulation model with at least a 6-hour early warning system and hazard exposure assessment for the aforementioned river. Particularly, this study process, validate, and model flood event for the said river. The results revealed that there were 10 LiDAR blocks for Davao Region, covering a total of 1,298.58 sq.km. The Digital Elevation Models (DEMs) were calibrated and the Lasang River were integrated with the bathymetric data gathered from the field. Salient features to flood were extracted from the generated LiDAR Digital Surface Model (DSM) such as buildings, road networks, bridges, and water bodies. The extracted features were given additional attributes taken during field validation. Hydrological measurements such as rainfall data, river velocity, and water level were gathered in the field. Subsequently, the relationship between the observed water levels and outflow known as rating curve were calculated to ensure the goodness of fit of the data. The calculated discharge, with an acceptable rating curve value, was used in calibrating the hydrologic model. Undergoing through these processes, the Lasang hydrologic model has achieved the acceptable calibration result. Simulation of hypothetical scenarios was also prepared for this river. For the development of the model, the edited and calibrated LiDAR DTM of the river floodplain along with the base flow, event flow, and simulated hypothetical scenarios in 5-year, 25-year, and 100-year rain return periods were processed resulting to the production of inundation flood maps of Lasang river floodplains. Two-dimensional (2D) flood maps were also prepared by our partner research team; however, validation of these 2D maps was conducted by our research team to verify the reliability of the gathered 2D flood depth and hazard maps.

Keywords: Flood Hazard Modeling and Mapping, Lasang River, Light Detection and Ranging (LiDAR), LiDAR Data Processing, LiDAR Data Validation

Abstract Id: 1259
As the Philippines is geographically located near Pacific Ocean, episodes of natural phenomenon are undeniably present and these has brought devastation in the country. As a response to these events, the Philippine government encourages the mainstreaming of Disaster Risk Reduction and Management and Climate Change Adaptation (DRRM-CCA) initiatives to national and local programs. Several of the initiatives were the installation of Automated Rain Gauges (ARG) and Automated Water Level Sensors (AWLS) in flood prone areas. These sensors provide key information to government agencies such as PAG-ASA and PROJECT NOAH, which are supposedly disseminated to the Local Government Units (LGUs) for them to be informed on an impending flooding in the area. However, it has been observed that these information and data are not directly accessible to local government units. As a preventive measure, the ADZU Phil LiDAR 1 has developed a system which aims to help the local authorities and communities along the flood-prone areas prepare for the adverse effects of floods by providing an early warning system which is capable of sending alert messages prior to flood events. The system retrieves data in the Water Level Monitoring Stations (WLMS) and Automated Rain Gauges (ARG) from the Advance Science and Technology Institute (ASTI). The ALeRTO device is programmed to monitor the ASTI website for critical water level and rain data, and interpret it into threshold categories which are: high, medium and low. As the device is programmed to determined water level threshold, it sends out alert messages via sms to registered users specifically to Local Government Units. Given this, the system will be able to expand the platform on disseminating information to two end-users, the LGUs and other government agencies (received via SMS) and at the same time to anyone who would access the website via the internet.

Keywords: real-time monitoring, water level, sensors, alert system

Abstract Id: 1260
GIS-BASED GENERATED FLOOD EXTENT MAP USING GROUND DATA POINTS: THE CASE OF DIGOS WATERSHED

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In November 2013, Digos watershed generated serious flood and the residents identify that this flooding was caused by heavy downpour which caused great damage to crops and properties. This flood event epitomized the need for a precise and dependable flood forecasting means for determining the possible extents of floods and also capable of meeting the needs for quick implementation in urgent situations. The purpose of this paper is to generate a flood extent map using ground data acquired from interviewed residents in the flooded area of Digos City to give account on the maximum flood level. For each reference point, the ground elevation was interpolated to the LiDAR DEM and GIS tool to generate flood extent map. The accuracy of the model have been assessed through error computation and analysis with those derived from widely used standard computer-generated depth (HEC-RAS) based. The result indicated was very good with the computed RSR value of 0.489 and RMSE value of 1.085 which means that the two data sets are comparable in terms of accuracy. The output of this study can be used as a reference to generate flood extent map of other rivers and creeks without LiDAR data and meeting the needs for a quicker execution of urgent situations by the flood management and mitigation agencies at different government levels, especially in situations where there is a lack of sufficient hydrologic/hydraulic knowledge and limited resources to implement the more complex models (e.g. HEC-RAS). With its simple implementation and ease of parameterization, flood extent map using ground data points is a potential alternative to the HEC-RAS model.

Keywords: Flood Extent Map, Flood Depth Points, Watershed, GIS

Abstract Id: 1261
GEOSPATIAL CHARACTERIZATION AND DECADAL CHANGES IN ALPINE MEADOWS OF WESTERN HIMALAYA: A CASE STUDY FROM KAILASH SACRED LANDSCAPE-INDIA

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Treeless vegetation between treeline (3000m) and snowline (5300m) represents rich habitats/communities and high floral and faunal diversity in the western Himalaya. In recent decades, with increased human population, harvesting of Medicinal and Aromatic Plant (MAPs), grazing and development activities have also increased various across alpine regions. Serious attempts have not been made to geospatially characterize the alpine habitats considering tough terrain and topography. Authors had systematically assessed the alpine habitats of western Himalaya during 2004 and same plots/sites were revisited in year 2016 in the Kailash Sacred Landscape-India with following objectives: i) geospatial characterization of alpine habitats/communities and (ii) to compare the decadal changes in species composition and grazing pressures.

About 20 alpine meadows were revisited (systematic random sample plots (10x1 m2) per site total 90 sites) and various habitats/communities viz., Tall Forbs, Mixed Herbaceous Formation, Matted Shrubs, Danthonia Grasslands, Kobresia Sedge meadows and Cushioned were studied for species composition and grazing pressure. Abundance of domestic livestock was estimated across meadows/valleys. Rule based classification approach was followed to geospatial characterization of various habitats.

Major four habitats of alpine region Mixed Herbaceous Formations, Matted Shrubs, Danthonia Grasslands and Kobresia Sedge meadows were separable with high number of ground truth points. Most of the flatter meadows (>250) were under heavy grazing pressure and dominated by unpalatable herbaceous species. At decadal interval the trend is showing dominance of certain species however, not much changed in species richness which varied from 12-15 (cold desert) to 48-54 species per site (moist). The density of unpalatable herbaceous species have increased (10-20%), whereas palatable grass species (15-25%) have decreased in gentle, accessible meadows over the decade. The population of sheep/goats is stable (50-55 thousands) but the mules population has increased drastically (3 times). Road construction in flatter meadows, collection of MAPs (Cordyceps sinensis) are major concern in the landscape.

Keywords: Alpine meadows, species richness, grazing, decadal changes, Kailash Sacred Landscape

Abstract Id: 1262
MONITORING SURFACE WATER BODIES USING MULTITEMPORAL LANDSAT IMAGERY

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Warangal district majorly depends on surface water sources for its irrigation and drinking needs. In this paper, the change in the surface water bodies of Warangal district is assessed using Normalized Difference Water Index (NDWI) and Modified Normalized Water Index (MNDWI). Multitemporal data of Landsat imagery has been used from 1990 to 2015 and area of surface water is calculated for each data set. The results are compared to detect the temporal change in water bodies. Although there are fluctuations in area of water surface with time, it has been observed overall decrease in water surface area. The spatio-temporal changes of the surface water bodies can be used for management policy and decision making processes.

Keywords: MNDWI, Multitemporal, NDWI, Spatio-temporal, Temporal change

Abstract Id: 1263
LIDAR-BASED FLOOD HAZARD AND EXPOSURE MAPPING OF A CRITICAL RIVER SYSTEM IN THE ZAMBOANGA PENINSULA, MINDANAO, PHILIPPINES

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One of the Disaster Mitigation programs of the Philippines is the Phil LiDAR 1 Program which aims to produce 3-D Flood Hazard Maps of the river systems in the country using LiDAR (Light Detection and Ranging) Technology. One of the partner implementing agencies is Ateneo de Zamboanga in Mindanao in southern Philippines wherein they were tasked to generate flood hazard maps of 18 river basins in Zamboanga Peninsula, including Tumaga-San Jose. The said riverbasin is considered one of the critical water systems in the region as the discharge of the watershed goes directly to the populated barangays of Zamboanga City. Given this, the ADZU Phil LiDAR 1 generated a study on the extent of flood exposure in the barangays within the flood plain of the river basin using the flood hazard maps generated and the database gathered using COMPASS (Community-based Mapping Platform for Attribution and Spatial Survey). Data on the classification of building and the type of materials of the feature were the focus of the survey in order to determine the number of exposed residential houses and its type. These data were then compared to the number of population per barangay based on the 2015 Census from Philippine Statistics Authority. Given these data, it is essential to note that most of the exposed residential houses in the flood plain are mostly made up of concrete materials. In the 100-year return period alone, a total of 27,799 houses were exposed; 13,597 are made up of concrete materials; 6,879 are semi-concrete and 7,323 are made up of light materials. Significantly, data as such are useful in identifying possible areas for immediate evacuation centers when flooding occurs in the area. Though socio-economic profiles of the residents were not considered, it is also observed that property damage would be significantly high during

Keywords: exposure, residential houses, flood hazard

Abstract Id: 1264
COMMUNITY-BASED MAPPING PLATFORM FOR ATTRIBUTION AND SPATIAL SURVEY (COMPASS)

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Central to every disaster preparation and mitigation initiative is information. Particularly, it is very essential that information on the built-up areas are organized in a spatial database so that it would be easier for the local government units to account infrastructure and property damage. For this purpose, a web-based offline application for the attribution of Features Extracted from a LiDAR-based Digital Surface Model was developed. The application practically intends to lessen the time of conducting feature attribution by combining automatic data consolidation, geo-tagging and offline navigation. The application is developed using a Palapa Web Server, and is then integrated into handy android smartphones. The collected data are automatically stored in database and can be downloaded in CSV (comma separated values) and KML (keyhole markup language) format. A CSV file is a table structured format which can be opened in Microsoft Excel. On the other hand, a KML file shows the collected data geographically and can be viewed through Google Earth. This process eliminates the tedious process of paper-pen survey, and thus lessens human-induced errors. Through this application, the team was able to gather the data on the types of buildings present in the flood plain. Aside from this, the buildings attributed were also categorized based on the materials used (concrete, semi-concrete and wooden), and classified into types (residential, commercial and etc) and number of storeys

Keywords: Mobile Application, Geo-tagging, Feature Attribution

Abstract Id: 1265
QUANTIFYING BIOMASS FROM POINT CLOUDS BY CONNECTING REPRESENTATIONS OF ECOSYSTEM STRUCTURE

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Quantifying terrestrial ecosystem structure in terms of biomass is a necessary part of monitoring carbon stocks and fluxes within the global carbon cycle and is, therefore, essential to understanding and mitigating anthropogenic climate change. Improvements to methods to quantify ecosystem-scale biomass can allow more cost-effective and accurate carbon accounting, advance knowledge on the interactions between the atmosphere and biosphere, and help to optimize natural resource management. Point cloud data such as from lidar and Structure from Motion (SfM) are effective for quantifying biomass over large areas. Inference models that estimate biomass from point clouds are well established in many environments, yet, are often scale-dependent, needing to be fitted and applied at the same scale and grid size at which they were developed. Furthermore, training such models typically requires large in situ datasets that are often prohibitively costly, time-consuming, or impractical to obtain. In this paper, we present a scale- and sensor-invariant framework for efficiently estimating biomass from point clouds. Central to this framework, we present and describe new algorithms that have been specifically developed for finding matches between in situ data and clusters in remotely sensed point clouds (such as from lidar and Structure from Motion). The algorithms are used for training and validating machine learning predictions of stored, above ground biomass in a semi-arid shrubland environment in Santa Rita Experimental Range in Southern Arizona of the United States. We present the results of the inference and cross-validation here. Our framework should allow for the inference of biomass more efficiently than more common subplot methods and more accurately than individual tree segmentation methods in densely vegetated environments.

Keywords: machine learning, lidar, point clouds, open source, biomass

Abstract Id: 1266
The use of Polarimetric Synthetic Aperture Radar (PolSAR) imagery has been studied increasingly and extensively since the launch of new generation SAR satellites. The polarimetry exploits different polarimetric configurations to measure the electromagnetic field backscattered by the ground surface in order to characterize the information related to the nature of the interaction between the radar wave and the backscattering. Therefore, the evolution of the Earth's surface can be analysis using such data. The scattering information can be addressed in a complex vector called scattering vector or the polarimetric covariance matrix and coherency matrix. The Wishart distribution is the simplest model for the Probability Density Function (PDF) of covariance/coherency matrix applying for homogeneous regions and images of coarse resolution with the assumption of fully developed speckle and no texture. However, for heterogeneous regions (non-Gaussian cases), the K, G0 and KummerU distributions are more appropriate to real data. This paper presents a change detection method for heterogeneous regions based on the maximum likelihood distance associated to the Spherically Invariant Random Vector (SIRV) model which is used to describe the real data. The relevancy of the method is illustrated on a pair of dual-pol ALOS-PALSAR images over Bat Xat district, Lao Cai province, Vietnam. This area has complex topography with high mountains, rivers, narrow valleys, etc. and the collected data involve changes due to flash floods and landslides.

Keywords: PolSAR data, Change detection, SIRV model

Abstract Id: 1267
HARNESSING NON-CONVENTIONAL ENERGY POTENTIAL USING SPACE BORNE SENSORS

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India has the fifth largest power generation capacity in the world and its current renewable energy contribution stands at 14.7% of the total installed capacity. The Government of India has revised its target of renewable energy capacity to 175 GW by end of 2022. This ambitious target includes Solar, wind, biomass small hydro power. In order to evaluate the potential energy resource, long-term measurements are utmost important, towards which spaceborne data can play a major role. At Space Applications Centre, databases of winds, solar and wave have been utilised from several Indian and foreign satellite datasets synergistically to compute potential energy resources. Global surface insolation has been generated at monthly interval using Kalpana-1 and INSAT-3D using clear-sky and three-layer cloudy-sky models. The recent products include Global Horizontal Irradiance, direct and diffuse normal irradiances, capacity utilization factor and annual energy production available for the entire country and at selected “Smart cities”. Monthly wind climatology in the Indian seas has been derived from QuikSCAT, OSCAT, ASCAT scatterometers. Monthly and Annual wind energy potential has been estimated by considering the bathymetric variations and distance away from the coast for all the coastal states within the EEZ of Indian coast. Relatively less exploited wave energy potential was also estimated along the Indian waters using merged altimetry products and state-of-art numerical models. These datasets are very essential to assess the potential renewable energy resources within India and its neighbouring coasts. All these datasets are available for the scientific community and other users on the Visualisation of Earth Observation Data and Archival System (VEDAS - www.vedas.sac.gov.in) website. Android based apps have also been developed as ‘solar calculator’ to know the solar potential for a given location and associated details required for solar installations and to compute wind energy potential in the Indian region.

Keywords: Renewable Energy, Wind Energy, Solar Energy, Wave energy, India

Abstract Id: 1269
THE ROLE OF CITIZEN SCIENCE PROJECT IN PREDICTING POTENTIAL HABITAT AND DISTRIBUTION OF EGYPTIAN VULTURE (NEOPHRON PERCNOPTERUS) IN UTTARAKHAND, INDIA

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Scientific data collection by well-designed experiments and methodology provide the bedrock for most scientific studies but with geographical, financial and time constraints. Citizen science is proving to be an effective tool in collecting plethora of data across large geographical areas. It helps in raising awareness of key environmental issues, such as climate change and loss of biodiversity, while at the same time promote development of scientific temper among the population as enshrined in fundamental duties of Indian constitution. In addition, they provide valuable scientific data by which to track environmental change. Species spatial database and mapping can be an excellent management tool for predicting patterns of biological diversity and for monitoring species spatial distribution, or even identifying geographical locations of conservation significance. In this study Worldclim bioclimatic variables, slope, aspect, elevation, land use/land cover data and 120 spatially well-dispersed species occurrence points from eBird, a global citizen science project that gathers bird observations around the world were used to predict the potential habitat of Egyptian vulture (Neophron percnopterus) an endangered species declared by IUCN using MaxEnt as species distribution model in Uttarakhand. Maxent model has got a statistically significant AUC value of 0.873. This approach can be an effective tool for species conservation efforts using citizen science as a potent tool.

Keywords: ebird, MaxEnt, Citizen Science, Egyptian Vulture, Endangered

Abstract Id: 1270
COMPARATIVE PERFORMANCE ASSESSMENT OF EIGHT UNI-VARIATE DATA FILLING TECHNIQUES IN MISSING PRECIPITATION RECORDS

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Long term point rainfall data is needed for climatic studies. Statistical studies done to quantify and predict climate change using meteorological data needs to be free from missing observations measured for a long period of time. In the past two decades, a number of imputation based techniques have been developed. Among them, expectation maximization (EM) algorithm which is a two-step iterative process is widely used owing to its ability to use the unobserved latent information to increase the log-likelihood evaluation of the model parameters, which in turn determine the missing value.

There is a significant decrease in the application of single imputation techniques owing to the drawback of considering the missing values as unknown and is replaced with a single estimate, whereas multiple imputation (MI)-based algorithms like Monte-Carlo Markov chain (MCMC) which is based on Bayesian statistics produces a set of possible values by developing more than two datasets, using which all missing values are estimated by taking the average of the pooled results.

Predictive mean matching (PMM) based MI is considered as an optimal technique for imputing quantitative variables that are not normally distributed and especially in situations when the missing data pattern was monotonic. In the last decade, it is to put more practical use. Still, its applicability to meteorological time series can be increased.

A comprehensive study aimed at comparing the above-discussed methods for the state of Kerala has not been carried out. Point rainfall data series is obtained from the Indian Meteorological Department (IMD) for 44 locations from 1901 to 2013 which spatially cover the entire state of Kerala. In the current study, randomly 5% of the data is chosen, hidden and predicted using the above-discussed techniques. For the completed series, root mean square error (RMSE) values are calculated and compared.

Keywords: Missing rainfall data, Expectation maximization method, Monte-Carlo Markov chain method, Predictive mean matching method

Abstract Id: 1272
According to Indian Population Census-2011, nearly 31% lives in urban areas and contributes 63% of its total Economy. Kakinada has been one among the three chosen towns in the Andhra Pradesh, India, for the 100 Smart City Development Project recently initiated by Government of India. The present work concentrates on Kakinada revenue division, East Godavari district, Andhra Pradesh, India. The study area is bounded within 82.0 Degrees - 82.47 Degrees East Longitude & 16.74 Degrees - 17.25 Degrees North Latitude. It comprises of 10 mandals (Intra-District administrative division) viz., Gollaprolu, Kajuluru, Kakinada rural & urban, Karapa, Kothapalle, Pedapudi, Pithapuram, Samalkota and Thallarevu spread in an area of 1357.15 sq.km significant for its marine diversity, transportation and crude oil resources. The district is popularly referred as ‘Rice bowl of Andhra Pradesh’, rich in its Biodiversity, Social & Economic significance and a healthier scope for future development. With this introduction, this study adopts a combination of Multi-Spectral data and Synthetic Apperture Radar (SAR) data for the Land use/ Land cover mapping using SNAP, ERDAS & ArcGIS software. Landsat-8 (Multi-spectral) and Sentinel-1 (SAR) data are used to execute the methodology defined. This combines the advantages of both visible and non-visible bands in the Electro Magnetic Spectrum. SAR data and Multi-Spectral data are classified as per Classification defined by National Remote Sensing Center (NRSC), Hyderabad, India, to assess the final results. The analysis of these results facilitate in better planning and management strategies.
The steady rate of soil erosion by precipitation causes land degradation as well as deposition of sedimentation in water impounding structures. Many large reservoirs are losing storage capacity due to steady sedimentation process actuated by soil erosion in the contributing catchments. The present study is to simulate the erosion process of Brahmani river catchment upto Rengali reservoir by using SWAT (Soil and Water Assessment Tool). Rengali reservoir constructed across Brahmani river, with a catchment area of 25,315.45 Sq.km. The average rainfall is 1460 mm and terrain slopes ranging between 0 and 34 %. The major soil types in the catchment area are red sandy soils, laterite, red loamy and coastal alluvium. SRTM DEM of 90m resolution, Land Use/Land Cover map derived from NRSC, Soil texture data from NBSSLUP, weather data from India Meteorological Department and National Centers for Environmental Prediction are used. SWAT model setup has been established to simulate the sediment yield (1983 to 2013) from the landscape, and sediment deposition and degradation in stream channel has been estimated using Modified Universal Soil Loss equation and Modified Bagnold’s equation respectively. The sediment load estimated by the model is 232.5 Million tonnes. The other forms erosion process, reservoir surplus flows, sediments in the bed loads, is not accounted in the modelling framework. Central Water Commission carried out a sedimentation assessment of Rengali reservoir using satellite data for the similar and a capacity loss of 194.26 million mm3 has been estimated, which is equivalent to 297.21 million tonnes of sediment deposition. The SWAT model based sediment load has reasonable correlation with satellite data based sedimentation assessment with a 21% deviation. The study demonstrated the utility of hydrological modelling to simulate sediment loading in storage reservoirs and can be used to for estimating useful life of reservoir.

Keywords: MUSLE,Sediment,SWAT Model,Rengali Reservoir

Abstract Id: 1275
SPATIAL ASSOCIATION BETWEEN CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND ITS RISK FACTORS IN AN URBAN AREA OF TRIVANDRUM, KERALA

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Introduction: Chronic Obstructive Pulmonary Disease (COPD) is the second leading cause of death in India. It is a spectrum of respiratory diseases that has high environmental influence. This study was done to map and determine association between COPD and its environmental risk factors using GIS, a novel approach in the setting.

Objective: To map the Chronic Obstructive Pulmonary Disease cases, its risk factors, and to determine the association between them using GIS in an urban area of Trivandrum, Kerala.

Methodology: Census type descriptive study was conducted in the main subcentre area of Medical College Urban Health Training Centre and 494 individuals were identified who satisfied the inclusion criteria in our descriptive study. COPD screener questionnaire was administered on them to identify the COPD cases. Geospatial co-ordinates of their residences, risk factors associated with COPD like tobacco smoking, firewood exposure (in person years) and distance from main road were mapped using portable Differential Global Positioning System.

Results: Spatial maps were prepared, which showed COPD case clustering in areas with higher firewood exposure, tobacco smoking and in households with closer proximity to road. Significant COPD hotspots were observed in an area with highest firewood exposure.

Conclusion: GIS technology is useful in identification of spatial clustering of COPD cases and its risk factors, making it an important input to design preventive strategies and health programs targeting COPD.

Keywords: Chronic obstructive pulmonary disease, DGPS

Abstract Id: 1276
SEISMIC VULNERABILITY ASSESSMENT OF BUILDINGS IN INDIA USING GIS

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Estimation of earthquake hazard, structural vulnerability and exposure of building stock are the main components in the seismic risk assessment of an area. India has experienced nine damaging earthquakes in past two decades, with significant risk to lives, properties and economic activities. The high seismic vulnerability of its housing stock was evident in the Bhuj earthquake in 2001. Methodologies that are capable of predicting accurate and reliable assessment of the seismic vulnerability of the existing building stock in future earthquakes are fundamental in the preparation of risk assessment and retrofittng strategies. This paper presents a review of the existing techniques and methodologies that have been developed/proposed for the assessment of seismic vulnerability of existing reinforced concrete (R.C) framed buildings. The key factors of the methodologies, including selection of seismic intensity measures, classification of building types, definition of building parameters, and selection of analysis methods, effect of soil-structure interaction on the building performance and definition of damage states will be discussed. The applicability of Geographic Information System (GIS), as a tool to assess the seismic vulnerability for speedy generation and updating of the hazard maps of the areas, with the development of inventory databases of the building stock will also be evaluated.

Keywords: vulnerability assessment, damages, seismic, reinforced concrete, GIS

Abstract Id: 1277
FOREST DISTURBANCE CHARACTERIZATION USING SENTINEL-1 SAR BACKSCATTER TIME-SERIES

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Tropical forests cover 8% of the globe and host more than 50% of global flora and fauna. It plays a vital role in carbon sequestration, thereby occupying a pertinent position in climate change mitigation and biodiversity conservation. Monitoring these forests is a prime objective in REDD+ and other international agenda. Also, continuous monitoring would enable us to check disturbance and chalk out policies to strategize conservation and mitigation measures. Remote sensing through its synoptic observation with continuous revisits has emerged as a potential tool in earth observation. Tropics being covered with cloud cover for the most part of the year, optical sensor observations are less feasible for continuous monitoring of vegetation in tropics. Radar sensors with its all-weather imaging and penetration capability have developed as an effective alternative in measuring and monitoring forests and crops. Synthetic Aperture Radar (SAR) time series backscatter has been utilized in assessing the forest cover change. In this study, sentinel-1 C-band multi-temporal SAR backscatter in VV polarization has been utilized to characterize forest disturbance dynamics in Indian forests. The time series analysis results show distinctive trend variation in SAR backscatter between disturbed and undisturbed forest patches. Undisturbed forest patch exhibited ±1db variation throughout the time series, whereas disturbed forest patch showed a distinctive decrease in backscatter by 3db. This distinctive variation shows the feasibility of using C-band SAR backscatter from freely available Sentinel-1 for forest disturbance characterization.

Keywords: Forest disturbance, Sentinel-1, SAR backscatter

Abstract Id: 1278
LINEAR MULTI-REGRESSION MODEL FOR ESTIMATING ACTUAL DAILY EVAPOTRANSPIRATION BASED ON S-SEBI METHOD OVER SONG CAU BASIN OF VIETNAM USING LANDSAT-7 IMAGES

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Calculating the actual evapotranspiration ETa is an important task in monitoring water balance in river basins, serving irrigation management in agriculture and in weather forecasting. In fact, it is difficult to measure ETa directly and in most applications ETa is calculated using empirical-theoretical models.

The article proposes a linear multi-regression model for calculating ETa based on the relationship between ETa extracted by the Simple Surface Energy Balance Index "S-SEBI" with the surface biological-physical parameters such as albedo, vegetation index NDVI, surface temperature Ts, and net surface solar radiation Rnd that were extracted from the Landsat-7 imagery dated November 23, 2001. The proposed model was evaluated based on ETa field observations on meteorological stations on November 4, 2000 with a Root Mean Square Error, RMSE of 1.294 mm/day and Mean Absolute Error, RME of 26.93% (or model accuracy is 73%). After eliminating the Mean Bias Error, MBE, the model achieves accuracy with RMSE = 0.727mm/day and MAE = 16% (model accuracy is 84%).

Keywords: kvinh

Abstract Id: 1282
FOREST DISTURBANCE ANALYSIS DURING 2014-2016 BY ANALYZING
PHENOLOGY OF DIFFERENT FOREST COVER TYPES IN MEXICO USING
TIME SERIES NDVI AND EVI DATA

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Vegetation phenology reflects seasonality patterns, and provides information for vegetation dynamics due to disturbances such as deforestation and forest degradation. It has been applied in studies of climate change, carbon cycle analysis, crop health assessments, drought monitoring, and wildfire risks.

The objective of this research is to compare, using time series vegetation index data, the phenology of conserved and degraded forest cover in Mexico during 2014-2016, to see if phenology can be used to study forest disturbance. The vegetation types analyzed in this study are: oak forest, pine forest, pine-oak forest, tropical dry forest, and Abies forest. We used MODIS product MOD13Q1 that has a normalized difference vegetation index layer (NDVI), an enhanced vegetation index layer (EVI) and a quality layer.

The NDVI, EVI, and quality layers were extracted from MOD13Q1 and reprojected and mosaiced for the entire Mexico using MRT tools. Polygons with conserved and degraded forest cover types were selected to extract time series NDVI/EVI data into an ASCII file, which was processed in Timesat software to reconstruct smoothed time series data using filters such as Savitsky-Golay, least-squared fitting and the asymmetric Gaussian Model. Before that, the quality layer was considered to remove the invalid pixels. The filtered NDVI time series were then analyzed to extract the phenological parameters for each forest cover type.

The obtained phenological patterns were: time for the start, mid and end of season, length of season, seasonal amplitude, base level, large and small seasonal integral. The phenological patterns were compared between NDVI and EVI for different land cover types in different conservation status. Results showed that forest disturbances could be detected using phenology analysis with NDVI and EVI values lower in degraded forests than in conserved ones. High spatial resolution satellite images of landsat-8 were used to validate the results derived from MODIS sensor.

Keywords: Phenological analysis, forest cover, time series, NDVI, EVI

Abstract Id: 1285
Risk Factors of Cardio Vascular Disease: Health GIS Perspective

Introduction: Cardio Vascular Disease (CVD) is the leading cause of morbidity and mortality in the world including India. Once thought to be a disease of old age, owing to the change in lifestyle and environmental modifications attributed to urbanization, the disease has now undergone a demographic transition. The study aims to depict spatial determinants of CVD like air and water pollution using GIS technology.

Objective: To find the determinants of cardiovascular disease in an urban population using conventional and Geographic Information System (GIS) techniques, in an urban area of Trivandrum, Kerala

Methodology: Census type descriptive study was conducted in a subcentre area (1.05 square kilometers) of Urban Health Training Centre of Govt. Medical College, Trivandrum Kerala, in 1649 individuals residing in 452 households. Socio-demographic details, risk factor exposures and self reported disease prevalence were determined. Simultaneously, location of houses, distance of the house from the main road (proxy for air pollution) and location of dug wells from which subjects drew drinking water were mapped using DGPS. pH of 50 well water samples were determined. Analysis was done using spss trial version and ArcGIS softwares.

Results: Prevalence of CVD was 5.8% in adults. Spot maps were generated, showing clustering of CVD and risk factors. Hotspot maps were created showing statistically significant spatial association between groundwater pH and CVD. Regression analysis revealed significant role for age, diabetes mellitus, hypertension and hypothyroidism in causing CVD.

Conclusion: Along with the usual methods, GIS technology is useful in identification of spatial clustering of CVD cases and its non-conventional risk factors like pollution and groundwater pH, making it an important input to design preventive strategies and health programs targeting cardiovascular diseases.

Keywords: CVD, GIS, pH

Abstract Id: 1286
ESTIMATION OF TROPICAL DRY FOREST DEGRADATION USING UAV IMAGERY AT LOCAL SCALE

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Forest degradation is a dynamic and continuous process that is complicated to evaluate spatially due to the limited spatial and temporal resolution of traditional remote sensing to map it accurately, especially in that forest where the phenology varies seasonally.

The objective is to assess the utilization of drones to mapping and quantifying forest degradation of tropical dry forest. First, we evaluated the capacity of drone imagery to estimate key forest attributes to describe the structure of forest, such as canopy height, canopy coverage, carbon content, and frequency of individuals. Subsequently, we integrated forest attributes to estimate states of forest degradation at local scale.

The methodology includes the acquisition of drone images for rainy and dry season, as well as measurements at field level for 22 plots. Based on imagery and their posterior processing by Structure from Motion photogrammetry, we obtain RGB orthomosaics and canopy height models (CHM) subtracting digital surface models from digital terrain models. The CHM allows the estimation of the height of tree canopy, and, combining with the orthomosaic, we developed an object based image analysis to delineate forest canopy. For the estimation of biomass and the frequency of the individuals, multiple linear regression models are developed, allowing relating the data at ground level of these key attributes with the height and coverage of canopy estimated by drone data. Finally, the estimation of forest degradation is done by a relative degradation index, which integrates the forest attributes obtained from drone images.

Our preliminary results, based in the field data, show a good behavior of the degradation index where the categories with greater degradation have less forest structure. The images of the drone so far have determined with good accuracy the data of average and maxima canopy height with an error of 0.4 and 3.1 m, respectively. Object-based method has obtained an overall accuracy of 95% for the canopy coverage. We expect that the calculation of drone-based forest attributes will continue to be estimated reliably, compared to those obtained from field survey.

Keywords: forest degradation, UAV, segmentation

Abstract Id: 1287
SIMULATION OF THE EFFECT IN FLOOD INUNDATION OF THE PROPOSED DREDGING PROJECT IN BAYAWAN RIVER, BAYAWAN CITY, NEGROS ORIENTAL, PHILIPPINES

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Bayawan River, is located in the southern portion of Negros Oriental in the Philippines. Hydraulic simulation of the river was generated using Digital Terrain Model (DTM) obtained from Phil LiDAR 1 Project of Department of Science and Technology. This DTM has an accuracy of 0.10 m horizontal and 0.20 m vertical. Flood inundation in Bayawan River was analyzed using HEC-RAS 4.1. The inputted data was the LiDAR DTM with integrated bathymetric data. A total of 17,686 bathymetric survey points were obtained on the field. The cross sections of the river were obtained from the computer simulation on an interval of 200 meters. To mitigate flooding in the river, dredging will be conducted. To account the proposed dredging design, the river cross-sections were edited. Simulations were conducted on the cross section of the current scenario and the cross section portraying the proposed dredging. For a rainfall event with a return period of 25 years, an inundation area of about 1.22 square kilometers was acquired for the current scenario. On the other hand, an inundation area of 0.92 square kilometers was acquired if the cross-sections of the proposed dredging is used. This shows that if the dredging project is implemented, the reduction in the inundation area is 0.30 sq. km for a 25-year return period flood.

Keywords: inundation mapping, LIDAR, HEC-RAS

Abstract Id: 1288
Digital India emphasis on the importance of the use of various available electronic devices and their functions, operations and applications. Today’s digital world is the result of various innovations, modernization and automation. The world has transformed from knowledge savvy to techno knowledge savvy. Digital media will have positive impact on the lives of several people in urban as well as in rural areas. The Digital India drive is a dream project of the Indian Government to remodel India into a knowledgeable economy and digitally empowered society, with good governance for citizens by bringing synchronization and co-ordination in public accountability, digitally connecting and delivering the government programs and services to mobilize the capability of information technology across government departments. This paper discusses about the improvement and use of digital media with the help of remote sensing for Agriculture Domain. It also emphasis on the concept of remote sensing of user’s location and providing suitable information to the user as per their requirement. In this the system will automatically fetch the users location as soon as the user logs in to the app and will provide the agricultural information related to the user’s area.

Keywords: Digital media, GIS, Agriculture, Mobility.

Abstract Id: 1289
ESTIMATING TOPOGRAPHY OF TIDAL MUDFLATS USING SEQUENTIAL SATELLITE IMAGES IN THE GULF OF KHAMBHAT

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Tidal mudflat is a complex system to comprehend due to its frequent inundation and drying during flooding and ebbing periods. Gulf of Khambhat is having large area of tidal mudflats, fringing the coast and forming Mudflat Islands, which are frequently inundated and dried by tides in the macro scale range. The present study is carried out to demonstrate the application of sequential satellite image under different tidal condition in deriving morphology of tidal mudflats by remote sensing and GIS techniques. Sequential LANDSAT 8 data of 2015 and predicted tidal elevation of different stations within Gulf of Khambhat has been used in the present study. The land-water boundaries of selected mudflats near to the tidal stations are delineated from temporal satellite images, which correspond to different tidal conditions, indicating different inundation levels. The inundation level or the land water boundary of the mudflat corresponds to the tidal elevation of the nearby tidal station, which is assumed to represent the surface elevation of the tidal mudflat. Land-water boundary is delineated from temporal satellite images under different tidal conditions, representing different surface elevation contour of the tidal mudflat. These contours are then spatially interpolated to obtain the surface morphology of the tidal mudflats. The study demonstrates the use of sequential satellite images under different tidal elevations in estimating the surface morphology of tidal mudflats. The information of the topography of the tidal mudflats shall be used in preparing bathymetry for regional modelling of the hydrodynamics.

Keywords: Tidal Mudflat, Tidal Inundation, DEM, Topography

Abstract Id: 1291
DEVELOPMENT OF NUMERICAL MODEL FOR RETRIEVING LAND SURFACE TEMPERATURE

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UHI), energy balance, heat wave, land cover changes, crop management, water management, fire monitoring, and other applications. A simple and effective numerical model was built to retrieve LST from the satellite images of Landsat series 5, 7 and 8. The emitted longwave portion of the thermal infrared region of 10.5-11µm (Band 6, Band 6 VCID 1, Band 10 respectively) used. This application converts raw digital numbers (DN) into a meaningful surface temperature value based on the algorithm embedded in graphical user interface (GUI). The application is sovereign towards the emissivity in which the user can use inbuilt emissivity methods such as reflectance and normalized difference vegetation index (NDVI) methods in addition, user can provide own emissivity image with similar spatial extent of the input image. This application provides user to download radiance, brightness temperature and surface temperature separately. User can process and produce the output to particular area of interest (AOI) using spatial extent defined by mentioning coordinates. Once the process gets completed, it stores output in *.Tiff format within the input folder with process name in the prefix. The accuracy of this model is yet to be analysed with more ground samples, however in previous studies, it was estimated as precise as ±1ºC. This model is useful to the research studies requires quick information about surface temperature. Each process takes less than two minutes to process a Landsat scene with a swath of 185km.

Keywords: Land Surface Temperature (LST), Thermal Infrared (TIR), Numerical Model, Urban Heat Island (UHI), Data Analysis

Abstract Id: 1292
VIIRS TO DEFINE EXTENT OF INDIA’S URBANIZATION

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India is rapidly urbanizing, but does the census based definition of 31.16% realistically capture the extent and scale of India’s urban story? Based on density of human activity over built-up area, this paper attempts to redefine the rate of national urbanisation as well as provide a more granular assessment of state and district level urban sprawl. Human activity is defined as a weighted combination of nightlights VIIRS (Visible Infrared Imaging Radiometer Suite) and micro population (World-Pop and Gridded Population: GHSL-Global Human Settlement Layer). The high volume and largely non-parametric distribution of satellite imagery allows for a robust application of machine learning techniques. The paper explores unsupervised clusters for exploring and defining urban sprawls. Using an ensemble of Random Forest, Gradient Boosting Machine (GBM) and Spline Regression, the paper also employs supervised algorithm in strengthening human activity attribute, by training population based attributes through VIIRS.

Unlike DMSP, VIIRS does not suffer with top coding and showcases reasonably well local spatial variance. VIIRS is also relatively free of seasonal biases as the release at a monthly frequency helps in accounting for localized spurts in light intensity caused due to event based external shocks like festivals or calamities.

Accurately capturing Urban and Rural regions is critical, particularly from an economic policy perspective. In case of India, a sizeable proportion of schemes and grants are disbursed based on an urban-rural bifurcation by center, states and local administrative bodies. Under the centrally sponsored scheme for urban development, AMRUT, the total outlay for five years from FY2015-16 to FY2019-20 is Rs. 50,000 crore. For rural development, under PGMSY the allocation was Rs19,000 crore and Rs 4,814 crore under DDUGY rural electrification scheme for 2017-18. Therefore, it is vital that the definition of urbanization is realistic so that the government fund is accurately allocated.

Keywords: Urbanization definition, VIIRS, GHSL, Unsupervised clustering

Abstract Id: 1293
A PRELIMINARY STUDY FOR REAL-TIME ESTIMATION OF PRECIPITABLE WATER VAPOR USING GNSS PRECISE POINT POSITIONING IN THAILAND

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The amount of precipitable water vapor (PWV) is an important variable in monitoring climate change, weather forecasting, and the greenhouse effect. The PWV is typically measured by meteorological instruments, such as radiosondes, microwave radiometers or meteorological satellites. On the other hand, the use of the Global Navigation Satellite System (GNSS) in meteorology known as GNSS-Meteorology is an alternative way to estimate the PWV values, which is less data processing load and cost-effective. Moreover, it has the advantages in high temporal and spatial resolution. In the last two decades, several studies have shown that the estimated PWV values derived from ground-based GNSS receivers are nearly proportional to the amount of PWV from the meteorological instruments. Thus it confirms that GNSS network can be used by meteorologist to remote sensing the atmosphere, meteorological applications or rainfall monitoring.

In this study, a preliminary study of real-time PWV using GNSS Precise Point Positioning (PPP) processing is conducted. The Federal Agency for Cartography and Geodesy (BKG) NTRIP Client (BNC) v.2.12.3 software platform, which use the Ionosphere-free combinations together with Extended Kalman Filter (EKF) techniques to estimate the receiver position, the receiver clock bias and the zenith tropospheric delay, is used to process the GNSS data. The CLK91 real-time orbit and clock products generated to the broadcast ephemeris based on the International GNSS Service (IGS) network by BKG through a NTRIP caster were adopted in the data processing step. The GNSS observations in three months period (April-June, 2017) from the 20 permanent stations in Thailand were used for this investigation. The real-time zenith tropospheric delays (ZTD) estimated from those stations were compared with those PPP post-processing from PANDA software. In order to accurately transform the zenith tropospheric delay (ZTD) into the PWV, the meteorological data and the local mean tropospheric temperature model (Tm) were evaluated for this study.

Keywords: Precipitable water vapor, GNSS Precise Point Positioning, BNC software

Abstract Id: 1294
ASSESSING THE DROUGHT SITUATION OF INDIA AS PER THE NEW DROUGHT MANUAL 2016

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GOI has brought out a New Manual for Drought Management in December 2016. In the manual different categories of indicators are recommended for assessing/declaring drought i.e Rainfall based (Rainfall Deviation/Dry spell/Standardized Precipitation Index), Remote sensing based (NDVI/NDWI Deviations, Vegetation Condition Index (VCI)), Hydrology based (Reservoir Storage Index (RSI), Stream-Flow Drought Index (SFDI), Groundwater Drought Index (GWDI)), Agriculture based (Area under sowing), Soil moisture based(Moisture Adequacy Index (MAI), Percent Available Soil Moisture (PASM)). Out of the above mentioned indices, rainfall is kept as mandatory indicator and will be used to check the drought trigger. Other four types of indicators (viz. Agriculture, remote sensing, hydrology, Soil moisture) are impact indicators. In order to assess the drought situation as per the new guidelines, analysis was carried out, at district and sub-district level, for 14 states of the country. IMD Rainfall data was used for finding the Districts with Drought Trigger 1 ‘Yes’ on the basis of Dry spell and Rainfall deviations. Remote Sensing and Soil moisture based indices were computed. The remote sensing derived Vegetation Condition Index (VCI) was generated from MODIS 250 m data. A spatial soil water balance model was used for daily soil moisture estimation and derivation of Moisture Adequacy Index (MAI). After checking the Drought Trigger, based on rainfall and dry spell, the impact indicators such as VCI and MAI were checked for three categories, Severe, Moderate and Normal. Based on the categories of Impact indicators, the districts were classified into various drought situations.

Keywords: Remote Sensing, Rainfall, NDVI, NDWI, VCI, MAI

Abstract Id: 1296
INTEGRATION OF GENETIC ALGORITHMS AND ARTIFICIAL NEURAL NETWORKS FOR VEGETATION COVER EXTRACTION AND CLASSIFICATION, USING SPECTRAL BINARY CODES

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The population of the world has been increasing exponentially, leading to an increase in the exploitation of resources. Due to this, vegetation, which is crucial for ecological balance and human sustenance, is being depleted at a rapid rate. Thus it has become essential to measure and to map the vegetation cover that is remaining, so that the resources can be deployed in a more sustainable manner.

In this paper, a new approach has been tested to map vegetation cover, which integrates Artificial Neural Networks (ANN) and Genetic Algorithms (GA). This method initially does a binary classification of the image into “vegetation” and “non-vegetation” areas using GA, after which the vegetation area is further classified into its sub-categories with ANN. This is different from traditional methods, in which GA is mostly used to optimize the weights of the ANN. Also, binary codes have been used to capture the variation of spectral intensities in different bands, making the analysis of the spectral data simpler. The performance of two networks, one trained with binary codes, and the other one trained with spectral values as inputs, have been compared to find that the ANN trained with binary codes performs better and thus has a higher precision and recall.

Keywords: Multispectral data, Vegetation feature extraction, Genetic algorithm, Artificial Neural Network, Binary code,

Abstract Id: 1297
TREND ASSESSMENT OF CROP VIGOUR IN APPLE ORCHARDS USING TIME SERIES HIGH RESOLUTION SATELLITE DATA

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Himachal is known as the apple state of India and covers nearly 49 per cent of the total area under fruit crop and 87 per cent of the total fruit production. Though area under apple orchards is growing, the present orchards are not able to meet the requirements of the countries. Many orchards have become uneconomic and require rejuvenation practices in order to boost their economic yield. Remote sensing has played a vital role in assessment of orchard inventories in India and around the globe. However, very few studies have been directed in the area which utilizes remote sensing as a tool or as a decision support system to keep a track of when and which orchards should be considered for rejuvenation. The present study was conducted in Shimla district of Himachal Pradesh, in an effort to identify such orchards. Apple area was identified using supervised classification of Resourcesat 2 LISS IV data (5 m spatial resolution). LISS III data (23 m resolution) from Resourcesat 1 and 2 were used to study the trend of their vigour over past 10 years (2004 - 2015). Regression analysis was performed on the NDVI dataset of 10 years data. Statistical test of the regression coefficient over apple growing region showed that as high as 27% of apple area showed a significantly declining trend of crop vigour in terms of NDVI. It is recommended that orchards having declining NDVI in addition to current low NDVI can be considered as potential orchards for rejuvenation while orchards where the recent (2015) NDVI is very low, needs to be looked for either corrective or rejuvenation practices. The possible reason of the trend are impact of global warming, shift in suitable growing degree days and unconventional pest-disease effect which need further investigation in future studies.

Keywords: Apple orchard, multiple regression technique, inter annual trend, remote sensing and GIS

Abstract Id: 1298
Accurate measurement of vegetation biomass of forests and monitoring the changes in vegetation biomass is important for forest conservation and assessment of carbon stock and carbon fluxes from the forest ecosystems. Synthetic Aperture Radar (SAR) data has shown great potential in retrieval of forest above-ground biomass (AGB) due to the capability of SAR to provide more dynamic range for vegetation growth variables as compared to optical data. Estimations of forest AGB of Gujarat state was carried out for multiple years using C-band Radar Imaging Satellite-1 (RISAT-1) and L-band Advanced Land Observing Satellite Phased Arrayed L-band Synthetic Aperture Radar (ALOS-PALSAR 1/2) data. In the present study, topographically corrected Medium Resolution ScanSAR (MRS) data of Indian RISAT-1 acquired during 2015-16 and global SAR mosaic products in HH/HV polarizations produced from Japanese ALOS-PALSAR 1/2 data for the years 2007-10 and 2015-16 were used to retrieve temporal forest AGB of Gujarat through semi-empirical model based on multi-linear regression coefficients of HH and HV polarization backscatter with field measured forest biomass. Gujarat has four major forest types namely, (1) tropical moist deciduous forest, (2) littoral and swamp forest, (3) tropical dry deciduous forest and (4) northern tropical thorn forest. Different model coefficients were derived for these forest types based on extensive ground measured forest parameters and the biomass maps of Gujarat were generated. High correlations were observed between HH and HH/HV backscatter with field measured biomass with the coefficient of determination $R^2$ varying from 0.7 to 0.85 at C- and L-band SAR, respectively corresponding to different forest vegetation types with biomass densities ranging from 20-120 t/ha. The study has also presented the advantages and limitations of C and L-band SAR data for estimation of forest AGB with varying biomass densities and has demonstrated how selection of suitable observation period of SAR data enhances retrieval of AGB of deciduous forests.

Keywords: RISAT-1, ALOS-PALSAR 1/2, topographic correction, Global SAR mosaic product

Abstract Id: 1301
RETRIEVING ICE VELOCITY OF HIMALAYAN GLACIERS USING INDIAN REMOTE SENSING DATA

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The mass transport of snow and ice is a key characteristic of glaciers. The mass accumulated in the accumulation region of the glacier is transported down to the glacier due to gravitational forces and thus ice velocity of glaciers is an important parameter in glacier studies. Temporal variation of Ice velocity is connected to the changes in mass balance of the glacier.

In remote sensing, D-InSAR and Image Correlation are the two techniques that are used to retrieve ice velocity. Feature tracking using optical images is based on the image correlation techniques that require cross correlation of pair of image acquired at different time. The images are pre-processed (to enhance the features on the glacier), co-registered and then image correlation is performed to derive displacement.

Feature tracking using SAR imagery is based on the cross correlation of SAR images and there are two methods- Intensity and Coherence Tracking. There are some advantages of using SAR imagery over Optical. One is, it can be used even for cloudy regions and second is that due to higher penetration of microwave in-depth features can also be tracked. In this study, a latest image correlation technique based on normalized cross-correlation of orientation images is used to retrieve ice velocity. LISS-3/LISS-4 NIR images (24 m resolution) from Indian satellite Resourcesat-2 and MRS data from RISAT-1 have been used to retrieve ice velocities for the three important glaciers of Indian Himalayas- Gangotri, Bara Shighri and Siachen Glacier. The velocity varies from 10-20 m/year at lower ablation region to 40-45 m/year in the upper ablation region for Gangotri glacier. The velocity in the upper ablation region is found to be 55-65 m/year for Bara Shighri Glacier and 130-160 m/year for Siachen Glacier. The spatial variation of velocity is observed along and across all the three glaciers.

Keywords: Himalayan Glaciers, Ice Velocity, Feature Tracking, Orientation Correlation

Abstract Id: 1304
DYNAMIC OF PASTURE YIELD AND PRODUCTION USING MODIS DATA IN MONGOLIA

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Pasture yield is one of the most important factors in determining pasture resources and capacity, assessing land degradation, and promoting appropriate pastoral land management policies. The objective of this study is to examine dynamic of pasture yield and production using MODIS data in Mongolia. We used frequently observing MODIS data and examined dynamic of pasture production in Bornuur soum of Tuv aimag. The result of pasture yield production increased 0.25 ton/ha between 2000 and 2016. We divided in 5 class the value of pasture yield, range with 0.4-0.8 ton/ha commonly occupied in our study area. This result showed that it was acceptable compared ground truth data.

Keywords: Pasture, MODIS, Mongolia

Abstract Id: 1306
Remote sensing images are useful for identifying crops. Freely available medium resolution Landsat-8 data is used in this study to identify sugarcane crop area from the study scene. Many authors have proved usefulness of Landsat-8 for crop identification and mapping. However, for fields having size less than one acre, Landsat-8 data of 30 m resolution may produce inaccurate results. In this investigation, decision trees have been constructed using only spectral reflectance response of bands, only principal components, combined use of spectral reflectance and texture images and combined use of spectral reflectance and Normalized Difference Vegetation Index (NDVI). Ten images acquired over a year, of the study area have been observed to prepare crop growth profile. NDVI, Leaf Area Index (LAI), Green-Red Vegetation Index (GRVI), Enhanced Vegetation Index (EVI), Soil Adjusted Vegetation Index (SAVI), VI-Green, Normalized Red (NR), Normalized Near Infra-Red (NNIR), Difference Vegetation Index (DVI) and Urban Index (UI) images have been prepared. It has been observed that NDVI, LAI, GRVI, EVI, SAVI and DVI show similar spectral response curve and confirm the prepared crop growth profile. Decision tree identifies area other than crop at level one and further crop area is classified into ripening/growing and harvest/senescence stage. It has been observed that low spectral reflectance of red band can support demarcation of sugarcane crop area effectively. Classified image is validated using ground truth data collected from 58 fields having sugarcane crop at senescence and 23 fields with crop at ripening stage. Results are compared with widely used Maximum Likelihood Classifier (MLC) method. Overall accuracy of MLC is higher but user’s and producer’s accuracy of decision tree increases by more than 5%. Accuracy assessment also shows that combined use of spectral reflectance and NDVI resulted in higher user’s and producer’s accuracy for identification of growth stage of sugarcane crop.
APPLICATION OF HYPERSPECTRAL DATA FOR LAND USE LAND COVER DELINEATION - CLASSIFICATION AND OPTIMUM BAND IDENTIFICATION

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Although land use land cover is a vast and generalized field for Hyperspectral data utilization, an initiative was made in investigating the effectiveness of AVIRIS - NG airborne hyperspectral data in distinguishing various closely resembling LULC classes. The spectral information available from broadband optical and space borne hyperspectral datasets is barely enough to delineate certain closely resembling classes like plantation and tree clad areas, riverine sand and urban structures, salt affected land and dry sand, grass lands and croplands, scrub land and fallow land etc. Discriminating these classes require an image with high spectral, spatial and radiometric resolutions. The high dimensionality/huge volume of the HS data cause redundancy in the information and bear a limitation in terms of high processing time and storage. Hence, identifying the optimum wavelength regions for various LULC classes attains significance in terms of reducing the processing time during the course of the current study for individual land cover features. The current study was taken up to identify the significance of airborne AVIRIS - NG hyperspectral data in LULC classification and to identify the significant bands contributing in delineation of spectrally similar classes. AVIRIS - NG data of 7.6m spatial resolution and 424 bands collected over Mangalore city was considered for the study. AVIRIS - NG data was pre-processed using FLAASH atmospheric correction module and MNF was applied to remove the noise and improve the SNR of the image. Training samples collected from the image and field spectra are used for classifying the pre-processed data using SAM, SID and Random Forest classifiers. Band max algorithm was used for identifying the optimum bands for various confusing classes. The AVIRIS - NG data was observed to have highest accuracy of 96.38% and excellent delineation between coastal sand and urban materials, fallow and scrub lands was noticed.

Keywords: AVIRIS - NG, Land Use Land Cover, Classification, Optimum Band identification

Abstract Id: 1310
Application of Geographic information system for water distribution networks through Quantum GIS plug-in with hydraulic simulation for infrastructure and development planning

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Globally the vital renewable natural resource at present and for the future scenario is considered to be water. Globally all country has been striving to address on many research aspects by which we can sustain this resources considering various aspects such as quality, optimization, maintenance etc. In order to ensure the availability of sufficient water, it becomes almost imperative in a modern society, to plan and design sustainable water distribution network (WDN) to the various section of the community in accordance with their requirements and demands. This study combines application of Geographic Information System (GIS) as a framework for managing and integrating data by Quantum GIS i.e (QGIS) with mainly three hydraulic plugins i.e. Ghydraulics, Open layer and Qgis2threejs. Ghydraulics allows to analysis WDN with Epanet, open layer with open street maps whereas Qgis2threejs plugin helps in exporting terrain data, mapping canvas image and vector data to the web browser and later analyzing through hydraulic simulation in EPANET. The main challenge faced is the decisions to ensure delivery of water to several locations with optimally sized, and compatible with existing infrastructure considering the demand and supply. The application of Geographical Information Systems (GIS) is to visualize, and simulate entire WDN from source to household and creating a technology with considerable potential for achieving remarkable gains in efficiency and productivity. Generally, the planning of the pipeline grid is carried out using Survey of India toposheets and preliminary ground survey which are demanding and time-consuming. In this research, use of remote sensing via spatial data, along with digital elevation model (DEM) is carried out for assessment of pipeline grids. DEM generated are used to understand the possible topographic profile which indicates the possible routes of gravity flow and outlines a procedure for pre-feasibility analysis and least pipe network could be laid thus optimizing the project considering above parameters.

Keywords:

Abstract Id: 1311
CROP MONITORING AND MAPPING WITH REMOTE SENSING TECHNOLOGY

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The objective of this research is to examine the current condition of crop monitoring in Mongolia. Crop monitoring and mapping using satellite data can provide independent and spatially complete information for planning purposes on the regional and national spatial scales. In this study, we focus on the Bornuur soum of the Tuv Province of Mongolia located approximately 100 km north of Ulaanbaatar in the forest steppe climatic zone. We also found that satellite data is fruitful information to control crop monitoring and production in Mongolia.

Keywords: Crop monitoring, remote sensing, Mongolia

Abstract Id: 1314
SPATIAL-TEMPORAL VARIATIONS IN SURFACE ELEVATION CHANGES OF ANTARCTIC ICE SHEET OBSERVED USING SARAL/ALTIIKA DATA

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Antarctica ice sheet plays a crucial role in understanding the global climate change and sea level rise. Improved estimation of the mass balance is now possible with the availability of data from state-of-art space-borne sensors ranging from passive microwave radiometer, Scaterrometer, Altimeters, Gravimeter and advanced data processing techniques such as GPS signal processing. Present study focuses on elevation changes occurring over Antarctica Ice Sheet, gain/loss using altimetry derived from SARAL/AltiiKa (35.75 GHz) data. Altimetry is one of the most powerful tools for observing the change in ice sheet surface elevation. SARAL/AltiiKa has radar altimeter with 40 Hz Geophysical Data Record (GDR) dataset (2013-2017) of Exact Repeat Mission (ERM) and Geodetic mission. Various range and slope corrections were applied for deriving the Antarctic ice sheet surface elevation. It was observed that error gets minimised by considering average elevation during larger period (like winter period) rather than 35-day cycle wise monitoring. The error further nullified while computing the change between two surface elevation layers. Impact of surface geomorphology on the retrieval was also investigated.
Intra- and Inter-annual variations were studied to assess the spatial and temporal pattern of change in surface elevations. Results indicated consistent loss of mass in the parts of West Antarctica. Whereas, over East Antarctica overall gain of mass has been observed.
Decrease in elevation change in Western parts of Antarctica can be attributed to increased presence of warm modified Circumpolar Deep Water (CDW) in Amundsen Sea.

Keywords: Antarctica, Ice Sheet, Elevation Change, SARAL/AltiiKa

Abstract Id: 1315
LAND COVER CHANGE DETECTION USING POLSAR IMAGES

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In this paper, a change detection scheme for Polarimetric Synthetic Aperture Radar (PolSAR) images using Normalize Difference Ratio (NDR) is proposed. The NDR changed map is compared with traditional Difference Map and Log ratio (LR) operators used to produce change map. A dual-pol L band ALOS1-PALSAR images are acquired on two different dates for our experiment. The amplitudes of polarimetric components (HH, HV) and the elements of the coherency matrix (T3) from both dates are used to generate the changed image. Supervised threshold segmentation is selected to extract a binary mask for change detection. The proposed technique is also compared with supervised post classification technique used for change detection. The result demonstrates that the proposed NDR operator produce much higher detection rate than the traditional difference and ratio operator.

Keywords: Polarimetric Synthetic Aperture Radar(PolSAR), Land use land cover change detection, Normalize difference ratio (NDR).

Abstract Id: 1317
ESTIMATION OF PARTICULATE AIR QUALITY BASED ON SATELLITE REMOTE SENSING: A CASE STUDY OVER HARYANA

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Ground-level fine particulate matter is a major component of urban air pollution with links to adverse health effects. A multiple linear regression equation was developed to estimate surface level PM2.5 concentrations based on MODIS derived aerosol optical depth (AOD) and meteorological parameters. One year continues measurements of PM2.5 were observed at three different stations in Haryana state i.e. Panchukula, Rohtak and Gurgoan and Daily level-2 AOD data over Haryana obtained from MODIS/Aqua for 2016. Analysis found that, the annual mean of fine particulate matter (PM2.5) concentration maximum (217µg/m3) is observed at Gurgoan than Rohtak(106µg/m3) and Panchukula(81µg/m3) due to relatively industrial emissions more in Gurgoan region. Seasonal variability of PM2.5 concentrations are observed in the range 60-217µg/m3, 38-157µg/m3 and 32-124µg/m3 for Gurgoan, Rohtak and Panchukula respectively. Spatial distribution of AOD shows distinct behavior in seasonally and associated with the variability in regional emissions and meteorology. Seasonal variability of AOD (550nm) varying in the range of 0.1-2.2 and maximum occurred in pre-monsoon season (AOD550nm ~1.5). A statistical linear multivariable regression method is used to establish the relation between MODIS AOD and PM2.5. However, the regional differences alter the correlation coefficients. Good agreements between the estimated and measured PM2.5 concentrations are found in all stations, with correlation coefficients (R2) values are 0.60, 0.78 and 0.83 for Gurgoan, Rohtak and Panchukula respectively. These ranges of R2 values show the prospect of using AOD to develop PM2.5 models, but it is crucial to take other parameters into account to increase estimations precisions. This approach greatly helpful to air quality policymakers since it provides cost-effective spatial information and also examined the transport pathways of pollutants.

Keywords: AOD,PM2.5,Remote Sensing,MODIS.

Abstract Id: 1318
OPEN DATA AND ITS BENEFITS TO SOCIETY: REMEMBERING THE BUCHENWALD CONCENTRATION CAMP

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More and more countries, states, and municipalities are making their raw LiDAR archives accessible to the general public. Many are doing so entirely for free with instant online access via download portals and a generous open license that allows data sharing and commercial use.

The traditional argument for restricting access to national geospatial data (paid for by taxes) and selling it back to tax payers to “fund future acquisitions” was exposed as flawed by a “freedom of information” request in England. It showed that the total amount of revenue generated for all LiDAR and derivatives sales by England's Environment Agency was a mere 0.03 percent of their operating budget. The reaction was swift. The Environment Agency has since made all DTM and DSM rasters down to 0.25 meter resolution as well as raw point clouds available online for open access with a very permissible license. This policy resulted in incredible re-use of data originally only acquired for flood mapping purposes and the Agency has been propelled into the role of a “champion for open data”.

In our talk we show how a similar open LiDAR policy in the German state of Thuringia has empowered us to focus on the former Buchenwald Nazi Concentration Camp in recent GIS capacity building and LiDAR training exercises. Given the rise of demagogues it is imperative to remind the citizenry of where demagoguery can lead. We create a hill-shaded Digital Terrain Model (DTM) from the bare-earth LiDAR points to finds the remnants of internment barracks and camp buildings that were demolished in 1950 but are still clearly visible ground disturbances under the canopy of the dense forest that has grown there since. Combining these open LiDAR derivatives with old maps allows us to create course materials that not only teach technical skills but are of important societal value.

Keywords: open data, LiDAR, citizen science, data re-use, capacity building

Abstract Id: 1322
UNSUPERVISED AND SUPERVISED CLASSIFICATION ANALYSIS OF MICROWAVE TERRASAR-X SAR DATASET AND ITS IMPLICATION ON STATISTICAL PARAMETERS

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The classification analysis has become one of the very important tasks, after the availability of microwave Synthetic Aperture Radar (SAR) datasets retrieved from satellites. But the received dataset have the presence of geometrical errors and speckle noise, which degrades the quality of the microwave SAR image. Hence, it is essential to remove such error and noise before classification. The multilook processing used for geometrical correction. The speckle noise can be removed by using speckle filter. In the present work standard speckle filter like Refined Lee filter is used. Its important property, it should remove noise and preserve the edges in the image.

The unsupervised classification techniques includes, H-alpha, Wishart H-alpha and Wishart H-A-alpha classifier. The supervised classification techniques include, Wishart and Support Vector Machine (SVM) classifier. The results of both classifiers are analyzed and the implication of statistical parameters are compared. It includes Mean, Median, Standard Deviation, Coefficient Variance, Equivalence Number of Looks (ENL) and errors calculations like omission and commission.

The overall process is applied on microwave X-band TerraSAR-X SAR dataset of Pangkalan Bun, Indonesia with dual polarization HH and HV. The four major classes studied is Water, Trees, Vegetation and Open Land. From the literature, it was found that the high frequency microwave X band SAR datasets is not capable for retrieval information from tree and vegetation variation. From the results, it was found that, in case of Wishart H alpha classifier, the low value of Mean, Median, Standard Deviation, Coefficient Variance and larger ENL value. Hence, in unsupervised classification, the Wishart H Alpha classifier found to be better performance for Trees, Vegetation class compare to the H Alpha and Wishart H A Alpha classifier. In case of supervised classification Wishart classifier has better accuracy compare to SVM classifier. The overall accuracy for Wishart classifier is 71.94 %.

Keywords: SAR, speckle filters, unsupervised classification, supervised classification, statistical parameters

Abstract Id: 1323
CROP DISCRIMINATION USING SPECTRAL, SPATIAL AND HEIGHT VARIATION USING MULTISPECTRAL SENSOR ONBOARD UNMANNED AERIAL VEHICLE(UAV)

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In Meghalaya due to small field size, undulating terrain and intercropping agriculture practices, separation of the crop types and estimation of acreage is very difficult. Also the persistent cloud cover in the region, during the crop growth period, limits the use of satellite imagery. With advances in Remote Sensing, new technology of Unmanned Aerial Vehicle (UAV) is gaining importance due to its high resolution imagery and availability of acquiring data in real time. Use of UAV has added new dimensions and possibilities of crop discrimination. This paper presents the observations made in crop discrimination using temporal data acquired over the sample field site in Jaintia Hills of Meghalaya using both RGB and Parrot Sequoia multispectral sensor onboard DJI Matrix 600 hexacopter UAV. The multispectral sensor have four bands Green 550 nm, Red 690 nm, Red edge 735 nm, and NIR 790 nm which were useful for discriminating crops such as maize, turmeric, plum, orange. In addition to this, Digital Surface Model(DSM) and Digital Terrain Model(DTM) generated by UAV data were used in separating the spectrally similar crops such as Bamboo, Orange on the basis of height.

Keywords: multispectral sensor, uav, crop discrimination

Abstract Id: 1324
AN INTEGRATED APPROACH OF HYDROCHEMISTRY AND STABLE ISOTOPES (Δ18O AND ΔD) TO INFER GROUNDWATER SALINIZATION IN A PART OF NCR, INDIA

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Groundwater resources in arid and semi-arid region areas are highly vulnerable to salinity problems especially in developing countries. Groundwater is an indispensable drinking water resource in most of these developing cities, where either no public water supply exists or inadequate infrastructure exist due to poor economic situation. Increasing salinity in aquifers is a major challenge to water resource managers. The present study has been done in a part of NCR, Delhi which includes districts of NCT Delhi, Gurgaon and Faridabad. Over-exploitation in past few decades led to declining water level has affected groundwater resources in this largest urban agglomerate of Asia. In the present study, a combined hydro-chemical and stable isotope (δ18O and δD) and GIS approach was used to investigate the potential sources of dissolved salts, to identify evaporation, understanding recharge processes and mixing dynamics in the study region. It was observed that groundwater salinization is governed by on multiple processes. The results suggest that in this poorly drained basin, climatic condition, groundwater-surface interaction, implementation of canal and various modern agricultural practices favors accumulation and mobilization of salts from unsaturated zone to deeper aquifer. In addition, declining water-level in past few decades and perturbation of the natural hydraulic equilibrium (intrinsic properties of groundwater flow system) favour the mobilisation of salts. The holistic approach of this study demonstrates the importance of various salinity mechanisms and provides new insights into the interference of natural and anthropogenic influences.

Keywords: Semi-arid, Salinity ingress, stable isotopes, Hydrochemistry, NCR Delhi

Abstract Id: 1325
APPLICATION OF 3D LASER SCANNING TO PRESERVE OF TRADITIONAL LOCAL TRAIN STATION, NAKHON RATCHASIMA, THAILAND

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Many traditional local train stations between Nakhon Ratchasima and Nong Khai province will be affected by Thailand-China high-speed rail project development. Some of those train stations are historic landmarks of national and international significance. The sites are associated with many important royal expeditions. Therefore, traditional local train stations are at risk to be removed or demolished. The study will discuss of how 3D laser scanning was used to record historic features rapidly and accurately despite the complicated conditions present at the site, also how the future impacts of natural processes and human activities can be managed using 3D laser scanning data as a baseline, how conservation and restoration work can be planned from the resulting models, and how 3D models created from 3D laser scanning data can be used to excite public interest in historic and cultural of Nakhon Ratchasima history.

Keywords: 3D Laser Scanning, 3D models, historic landmarks, Nakhon Ratchasima

Abstract Id: 1326
India possesses rich heritage preserved in the form of historic monuments, a variety of cultures and magnificent natural habitats spread across its length and breadth. There are 36 (28 cultural, 7 natural and 1 mixed) World Heritage Sites as recognized in India by the UNESCO World Heritage Committee. These sites attract a large number of tourists from across the globe contributing to country’s economy significantly. In addition to these recognized heritage sites (HS), several tentative HS also exist which have been proposed for consideration into the category of recognized sites. This paper studies the popularity of recognized as well as tentative HS in India using location based information derived from Social Media (Flickr) through GIS based Model InVEST. It also compares the sites in terms of major attractions viz. cultural viz. a viz. natural. The model gives spatially explicit values represented as visitation rates or photo user days (PUD). Results obtained shows a good number of tentative sites having high visitation rate, thus providing an evidence of their popularity and their further qualification into the list of recognized sites and high potential to develop tourism. Also, it was found that cultural HS has higher visitation preferences over the natural HS. Thus, the study provides a novel approach for rapid assessment of popularity of heritage sites when no such consolidated information is available otherwise.

Keywords: Heritage sites, Social media, Photo user day, InVEST, Popularity

Abstract Id: 1327
GROUNDWATER RESOURCE MANAGEMENT IN BHABHAR ZONE USING GEOMATICS TOOLS

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The escalating population in addition to unplanned developmental activities including urbanization, industrialization, and in appropriate land use practices has resulted in over exploitation of natural resources. In many areas it has resulted in lowering of groundwater table and pollution. In order to ensure ‘Health for All’, the Government of India has launched many program to provide potable drinking water to every settlement. In many rural areas of rural India water is not available for drinking what to say of sanitation and agriculture.

Groundwater occurrence is highly variable in space and time domain. It depends upon a variety of above surface, surface and subsurface characteristics of terrain. The required information such as lithology, geological structures, landforms, land use land cover, drainage networks, soil characteristics and slope of the terrain may be conveniently extracted from conjunctive use of remotely sensed data and ground truth. The extracted information can be integrated in a Geographical Information System (GIS) environment.

In the present study an attempt has been made to blend geomorphology, drainage density, lineament density, slope, geology, land use land cover, to delineate the groundwater source areas in Bhabhar zone for the management of groundwater. This has been achieved through multi criteria decision making. The relative influence of various themes has been worked out by Analytical Hierarchy Process (AHP). Finally from the view point of groundwater occurrence the rural area has been classified in to ‘very poor’, ‘poor’, ‘moderate’, and ‘good’.

Once the groundwater promising areas have been delineated the study was brought down to village level. This GIS based output result was validated by conducting field survey by randomly selecting wells in different villages. The results indicated that Geomatics tools are useful in groundwater resource management.

Keywords: ArcGIS, Thematic Maps, Groundwater, Multi-criteria decision making; Analytical Hierarchy Process.

Abstract Id: 1328
Space technology plays significant role for sustainable vegetation management practices. Classifications of vegetation provides a useful way of summarizing knowledge of vegetation patterns which are helpful for nature conservation and land-use planning. In this paper we have used space based as well as UAV based high resolution data to analyze the potential of Red edge band in vegetation classification. Red Edge covers the portion of the spectrum where reflectance drastically increases from the red towards the NIR regions and it is found sensitive to vegetation chlorophyll content (Schuster et al. 2012). Red Edge band is recently incorporated in some of the multispectral sensors. Rapid Eye is first high-resolution multispectral satellite system incorporating the red-edge band having range 690 - 730 nm. The parrot Sequoia multispectral sensor features four bands Red Green, Red Edge and NIR. Red Edge being centered at 735nm and having 10nm bandwidth. Classification was done with and without Red Edge band for both Satellite and UAV multispectral data using classifiers such as SVM, M XL, Neural Networks and also combination of various vegetation indices such as NDVI NDRE. Results of the study indicates that the vegetation classification based on multispectral satellite and drone based data generally benefit from integration of Red Edge band. Classification accuracy was found to be well within the acceptable error limit.

Keywords: Red Edge, Rapid Eye, UAV, Vegetation Classification, Multispectral Sensor

Abstract Id: 1331
It is well known fact that remote sensing has got many applications depending upon our knowledge, requirement and efficiency. In this present investigation, we tried to delineate suitable locations for growing kharif season potato which is not very common, using remote sensing, simulation modelling and GIS techniques. To identify these suitable locations, plateau area of the country from five different states viz., Andhra Pradesh, Karnataka, Maharashtra, Madhya Pradesh and Rajasthan was delineated based on elevation using data from 90 m Shuttle Radar Topography Mission which is available for free download. From the list of locations falling under 300-1300 m elevation, some major locations were selected and for them weather data sets were generated with the help of India Meteorological Department. Suitability of potato crop for these locations was tested based on length of growing season which was estimated based on average weather data for 10 years. By means of yield simulator available for potato, potential yields for these selected locations were estimated and the suitable locations were delineated into four different classes. The results indicated that there are many locations in plateau region of India which could be utilized for temporal expansion of potato cultivation by growing the crop during kharif season which is non-traditional season for potato. The yields ranged between 100 to 400 or even more quintals per hectare in different locations.

Keywords: suitable areas, GIS, RS, potato

Abstract Id: 1332
EVALUATION OF UAV DERIVED TERRAIN PARAMETER AT DIFFERENT FLYING HEIGHTS

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Updated and accurate Digital Elevation Model (DEM) of mountainous area is essential for many applications including natural hazards study (avalanche landslide and flood modelling), morphological change detection and terrain feature extraction. However, such data sets suffer from inaccuracy in adverse terrain conditions (deep valleys and temporary shadow regions) and overall the resolution is also insufficient, therefore, it is essential to explore other competing and complimentary platform such as unmanned aerial vehicle (UAV) to meet the crucial data gap experienced using satellite and aerial platforms. The main objective of this study was to utilise UAV data and evaluate the derived terrain parameter from data collected at different flying heights. Images were acquired at 80% forward lap and 50% sidelap specifications. Trimble UX5 UAV with the on-board RGB camera was flown over two study sites (Kesharwala and Koti (Nahan)), located in Dehradun district of Uttarakhand state. The data were acquired at different flying heights (750 meters, 515m and 200m). 72 numbers of high precision ground control points and check points were collected using DGPS and topographic variation with a total station for triangulation and validation purpose. Various topographic attributes viz: slope, terrain indices, aspect, terrain ruggedness were compared to evaluate the accuracy of DEM derived from different heights. For the analysis the area was divided into different regions based on terrain slope: flat, gentle, moderate and steep. From the analysis it is observed that average vertical accuracy achieved was 23.52cm, 13.87cm and 0.82cm for flying heights 750 meters, 515m and 200m respectively. While the overall rmse (vertical and planimetry) were 40.44 cm, 26.02 and 4.06 cm. The study highlighted that in order to achieve an vertical accuracy less than 5cm flying height less than 250m & for a quarter of meter accuracy 500m height and around 700m for less than 50 cm.

Keywords: UAV, flying height, Slope, height accuracy, ground measurements.

Abstract Id: 1333
MAPPING AND CHARACTERIZATION OF INLAND WETLANDS USING REMOTE SENSING AND GIS-A CASE STUDY OF UDAIPUR DISTRICT, RAJASTHAN, INDIA

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Wetlands play a significant role in maintaining environmental stability in a world, as it serves the important functions such as food storage, water quality maintenance and habitat for different species of wildlife, therefore sustainable management of wetland ecosystem is necessary. An inventory of wetlands in any given area is pre-requisite for maintaining the ecological balance through conservation and management. Geospatial tools when applied to wetland mapping help assess landscape changes, as well as monitor the pollution and siltation levels, weed infestation and aquaculture development. Besides wetland change assessment, water quality analysis and modelling, mapping of surface water bodies etc. are also area of application. A study has been carried out to delineate the wetlands of Udaipur district of Rajasthan, India, using LANDSAT-8 satellite data. The data for pre and post monsoon season; 27 Nov 2016 and 3 Mar 2017 respectively have been analyzed and wetlands have been qualitatively characterized based on the turbidity and aquatic vegetation status. The extent of water logging problem in the study area was inferred from the seasonal variation of waterspread during both the seasons. Different categories of wetland like ponds, lakes, water logged areas etc. have been identified. From the analysis, it has been observed that the use of different kinds of the digital indices like NDVI, NDTI etc. are helpful to identify wetlands feature like characteristics and extension. Thus, the study shows usefulness of remote sensing data for wetland mapping, seasonal monitoring and characterization.

Keywords: Wetlands, Mapping, Remote Sensing, GIS, Aquatic Vegetation

Abstract Id: 1336
SOIL EROSION MODELLING USING REMOTE SENSING AND GIS TECHNIQUE: A CASE STUDY OF BISALPUR CATCHMENT

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Soil erosion is a growing problem especially in areas of agricultural activity where soil erosion not only leads to decreased agricultural productivity but also reduces water availability. Remote sensing and GIS techniques have become valuable tool specially when assessing erosion at larger scales due to the amount of data needed and the greater area coverage. In the present study an attempt has been made to assess the annual soil loss in Bisalpur Catchment area using Universal Soil Loss Equation (USLE) in GIS framework. The present study demonstrates the prognostic modeling capabilities of geo-spatial technology based on soil erosion potential model to assess the effects of implementing land use changes within the area. The Revised Universal Soil Loss Equation (RUSLE) integrated with geo-spatial technology was used to produce predictive soil erosion map. The soil erosion rate was determined as a function of land topography, soil texture, land use/land cover, rainfall erosivity, and crop management and practice in the watershed. Rainfall erosivity (R), slope length-steepness (LS), soil erodibility (K), cover management (C), and conversation practice (P) were used to generate soil erosion map. The present information may help recognizing areas that are vulnerable to soil loss and the proposed method will be used for generalized planning and assessment purposes for supervision and preserve the soil erosion.

Keywords: Universal Soil Loss Equation(USLE);GIS; Remote Sensing

Abstract Id: 1337
ASSESSMENT OF OMI AEROSOL OPTICAL DEPTH OVER GANDHI COLLEGE INDIA

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This study presents the assessment of spaceborne Ozone Monitoring Instrument (OMI) retrieved Aerosol Optical Depth (AOD) with the ground-based Aerosol Robotic Network (AERONET) measurements over Gandhi College, India. The time period is from 2005-2015. This AERONET site is located in the village Mirdha (longitude: 84.128, latitude=25.871) which is prone to rural agriculture burning activities. The level-3 OMI/Aura Near UV Aerosol Optical Depth and Single Scattering Albedo (OMAERUV) product is compared with the Quality Assured Level 2.0 direct Sun AERONET measurements. The AERONET data is cloud cleared, post and pre-calibrated. The version 003 OMAERUV data at 388nm is directly assessed with respect to 380nm ground measurements. Deseasonal data is generated for both OMI and AERONET data in order to carry out trend analysis. Statistically significant increasing trends are found using both the satellite based and ground measured AOD over this region. The deviations of OMI data with the AERONET data are also noted along with their summary statistics.

Keywords: OMAERUV, AERONET, UV, Gandhi College

Abstract Id: 1339
3D MODEL CONSTRUCTION OF NUCLEAR POWER PLANT WITH UAV

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On, March, 2011, in Fukushima Daiichi nuclear power plant, some accidents such as core melting and hydrogen explosion occurred by the Great East Japan Earthquake. Pollution simulation was already carried out by particle model. But, 3D models of the nuclear power plant were not obtained at that time. In the future, 3D models are required for pollution simulation of nuclear power plant accidents in each place. In this study, 3D models of Sendai nuclear power plant in Kagoshima prefecture and Genkai nuclear power plant in Saga prefecture were constructed with UAV. Phantom 4 Professional was used in this study. In Civil Aeronautics Act, flight of UAV over nuclear power plants, access within 300 m from the site boundary and more than 150 m altitude flight are prohibited. Therefore, UAV route maps were created under the condition of 300 m away from the site boundary with 150 m altitude. Litchi for DJI Mavic / Phantom / Inspire was used as the automatic navigation software. Furthermore, all camera directions were trained to the nuclear reactor. RGB and IR images were taken as shooting conditions. Finally, using PhotoScan of image editing software, 3D models in RGB and IR were constructed from the aerial images.

Keywords: Automatic navigation, Civil Aeronautics Act, Infrared, Pollution simulation

Abstract Id: 1343
ESTIMATION AND COMPARISON OF TROPOSPHERIC DELAY IN IRNSS SIGNALS USING VARIOUS MATHEMATICAL MODELS

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Improvement in the field of navigation is always required and a subject of current research. The present work is a step forward in this area. The accuracy of geographical position depends on how the errors from different sources are identified and removed from the data. There are various errors sources which are accounted in a receiver to estimate more precise position. Tropospheric errors are one of those errors which affect the signal path and causes delay. In the present analysis, a comparative study has been carried out among Saastamoinen model, Neil's model and simple Black model. For the analysis, both types of signals S and L5 band are taken. To observe the effect on the Geo-synchronous and Geo-stationary satellite signal, IRNSS-1B and IRNSS-1C are taken. The analysis is carried out on one-day data to observe the delay pattern in day cycle. From the analysis it is observed that average one-day delay for Saastamoinen model, Neil's model, and simple Black model are 2.940m, 3.004m, 2.927m approximately for Geo-synchronous satellite and 5.683m, 5.811m, 5.667m approximately for Geo-synchronous satellite respectively. On taking the average over these models we got 2.957m for Geo-stationary satellite and 5.720m for Geo-synchronous satellite respectively. If we see the delay in day and night then the observed delay is more in the night as compared to the day. An analysis also carried out to estimate the delay with respect to elevation. It was observed that if the elevation is maximum then the delay is minimum and delay is maximum in case of higher elevation. An analysis is carried out in wet and hydrostatic delay to observe the each component, contributing to the total delay. The average wet and hydrostatic delay is 0.246m and 5.311m respectively for Geo-synchronous satellite, and 0.139m and 2.815m respectively for Geo-stationary satellite for one day.

Keywords: Tropospheric correction, IRNSS, Mathematical analysis, Position estimation

Abstract Id: 1344
WORKFLOW FOR QUALITY ASSESSMENT OF DIWATA-1 EARTH OBSERVATION MICROSAITLLE IMAGERY

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Microsatellites used for Earth observation, while being significantly cheaper than related large satellites such as Landsat 8 and WorldView-2, are also limited in their equipment capacity, manifested by the usage of miniaturized sensors that may not have the same quality characteristics as the ones equipped in their larger cousins. As such, it is imperative to have a robust satellite image quality assessment (IQA) system capable of noting possible issues that are present in microsatellite data. This paper discusses the concepts and accepted procedures in the IQA of data sent by Diwata-1, the Philippines’ first Earth observation microsatellite, as well as the preprocessing steps being undertaken before they are uploaded to the distribution channel. The presence of pixel dropout (PDO) is assessed by subjecting an image to a Laplacian filter. Analysis of individual presence and possible clustering of PDOs are used for initial characterization. Images deemed passed by the abovementioned test but possess transmission packet losses then undergo inpainting procedures to fill the “holes” with data that are referenced to the surrounding pixels. Signal-to-noise ratio is then computed via the homogeneous block method and fast cloud cover percentage determined by the Otsu method. Based on the abovementioned tests images are finally tagged using a qualitative scale made available on each image’s metadata file.

Keywords: image quality assessment, microsatellite, Earth observation

Abstract Id: 1346
REMOTE SENSING BASED MONITORING OF SNOW COVER DYNAMICS: A CASE STUDY OF SPITI VALLEY, HIMACHAL PRADeSH, INDIA

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The snow is most important land cover type in the Himalaya, which acts as an important source of fresh water for rivers. Snow is a form of precipitation, but it is treated somewhat differently because of the lag between when it falls and when it produces runoff, groundwater recharge, and is involved in other hydrologic processes. The researcher generally wants to know how much water is stored in a basin in the form of snow. They will also be concerned with the areal distribution of the snow, its condition and the presence of liquid water in it. Spiti Valley is a cold desert mountain valley located in the high Himalaya mountain chain in the North-Eastern part of Himachal Pradesh in India. Landsat TM (1990) and OLI/TIRS (2015) data have been used for assessment of snow cover dynamics. Several pre-process techniques have been used to correct satellite data like histogram equalization, haze reduction, layer stacking, and mosaic etc. Snow cover change detection technique revealed that snow cover has been consistently declining in the valley during the study period from 1990 to 2015. The result obtained from NDSI revealed that in 1990 about 468098.5 ha (61.68%) area was under snow cover of the Spiti valley while in 2015 the snow cover was found over the area of 369676.4 ha (48.71%). During the study period, about 98422.08 ha (21.02%) area of snow cover has converted into non snow cover area at an average rate of 3937 ha/year. Snow line is the lower topographic limit of permanent snow cover. The snow line is an irregular line located along with surface where the accumulation of snowfall equals to ablation (melting and evaporation). Average altitudes of the snow line taken for the study area have been used to derive a snow line, which rises.

Keywords: Remote Sensing, Landsat, Snow Cover and Snow Line

Abstract Id: 1348
DETERMINATION OF GROUNDWATER PROSPECT ZONES BASED ON HYDROGEOMORPHIC UNITS AND LAND USE LAND COVER USING REMOTE SENSING TECHNIQUES IN SAJNAM WATERSHED, LALITPUR (U.P)

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Water scarcity and recurrence of drought is a well-known phenomenon in hard rock terrain in Bundelkhand region of Uttar Pradesh. Sajnam watershed is a rainfed basin in Lalitpur District Uttar Pradesh where most of the rainfall occurs in the months from June to September and hence lead to periods of water scarcity resulting in water draft from wells. Groundwater prospect has been evaluated based on hydro-geomorphology, drainage, geology, lineaments, land use land cover, slope and relief. Georeferenced IRS P6 LISS III FCC (23.5 meter resolution) was used to identify various land use land cover categories and hydrogeomorphic units by using different image interpretation elements viz; tone, texture, colour, shadow, shape, association, etc. the maps were later updated after conducting field survey and validating the results obtained from satellite data. Drainage map was prepared using SOI toposheets on 1:50000 scale. The geological maps and lineament map were prepared district resource map. ASTER DEM was used to prepare the elevation and slope map. The GIS analysis of various thematic maps reveals that the groundwater potential is found to be moderate to poor in pediments, plateaus, and residual hills. Whereas the groundwater potential is good to moderate in valley fills, and pediments and buried pediments. Accordingly, on the basis of occurrence of ground water, various hydrogeomorphic units have been classified as high, medium and low prospect zones.

Keywords: IRS P6 LISS III, drainage map, hydrogeomorphology, geology, groundwater prospect.

Abstract Id: 1350
Flood is known to be a serious environmental hazard. It causes substantial damage to life and property. Proper monitoring and effective management technique using remotely sensed satellite data and GIS technique is an important way of flood hazard monitoring. In the present study an effort has been made to delineate the flood hazard zone of Murshidabad district of West Bengal. The district is drained by several perennial rivers and associated with huge monsoonal rainfall. The historical record shows occurrence of several flood in the district affecting several blocks of the district. Satellite image and SRTM data have been analyzed using remote sensing and GIS software to identify the flood hazard zone and the major and minor places that are located within high, moderate, low and safe zones of flood hazard. A proper mitigation and effective flood management planning can be adopted using remote sensing and GIS to check the flood problem of the district.

Keywords: Satellite Image, SRTM, Flood Hazard Zone, Murshidabad.

Abstract Id: 1351
Crop mapping and discrimination provide an important basis for many agricultural applications such as acreage, biomass, yield, crop rotation and soil productivity. Traditional multispectral broadband sensor data have known limitations of sensor saturation and absence of specific narrow bands to target and highlight specific biophysical and biochemical characteristics according to crop type. These factors lead to significant uncertainties in the discrimination of crop type. Recent advances in hyperspectral remote sensing technology provide the opportunity to measure the response of different crop types in terms of morphological and physiological characteristics. The specific narrow bands have a capability to perform crop discrimination over homogeneous and heterogeneous agricultural areas. The continuous band spectrum from imaging spectroscopy has opened up new avenues in the field of classification. In this study, crop discrimination has been carried out using principal component analysis and supervised classification techniques such as maximum likelihood classification (MLC) and spectral angle mapper (SAM) algorithms. AVIRIS-NG airborne hyperspectral data acquired over Maddur, Karnataka and equivalent multispectral LISS-IV data convolved through three broadband regions (Green: 0.52-0.59µm, red: 0.62-0.68 µm, near-infrared: 0.77-0.86 µm) using spectral response function of latter, were used over mixed and heterogeneous agricultural area of Maddur, Karnataka in Berambadi watershed located in Kabini river basin. Data dimensional reduction has been carried out using principal component analysis. In situ crop information was used to perform SAM and MLC-based classification. Classification accuracy was computed using confusion metrics. SAM classification showed classification accuracy of the order of 77.7 % and 42.8% with Kappa coefficient of 0.75 and 0.34 for AVIRIS-NG and LISS-IV equivalent, data, respectively. The MLC-based classification showed accuracy of 94.3% and 55.6% and Kappa coefficient of 0.93 and 0.46 for AVIRIS-NG and LISS-IV data. It can be concluded that imaging hyperspectral narrowband data has the potential to discriminate crops in a mixed and heterogeneous crop cluster with higher accuracy as compared to equivalent resolution multi-spectral broadband data.

Keywords: Sustainable management, Hyperspectral, crop type, Airborne, AVIRIS-NG

Abstract Id: 1352
A FRAMEWORK FOR IDENTIFYING POTENTIAL LOCATIONS FOR SOLAR POWER GENERATION: A CASE STUDY FROM MADHYA PRADESH

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Renewable energy has become essential in today’s growing global economies. It has become the integral part in answering the world’s major problem such as the mitigating climate change, promoting sustainable development and conserving the natural resources. Renewable energy is replenished naturally on human timescale, and utilization of Solar energy for production of electricity in tropical country like India is a remarkable progress in sustainable development practices. Spatial data analysis reveals that nearly 58% of the geographical areas potentially represent the solar hotspots in the country with more than 5 kWh/m²/day of annual average Global Insolation. India being the second most populated country in the world with fast growing economy, has high energy demand, for its industrial and various other purposes. An attempt is made to utilize the spatial data in identifying the potential sites where the solar energy can be trapped and converted to electrical energy for its optimum utilization.

This study focuses on the assessment and utilization of resource potential in the western part (Malwa Plateau) consisting Neemuch and Shajapur districts of Madhya Pradesh from satellite derived insolation data. The research contains optimum utilization of vast wasteland patches and to identify potential sites for installing solar power plants which includes generating Global solar radiation, global insolation (direct and diffuse), direct duration radiation maps using CARTODEM. A Multi Criteria Decision Analysis (MCDA) model was designed to rank and locate the potential sites by taking various socioeconomic factors such as near to town headquarters, built-up land and road connectivity based on their overall performance. The proposed method is demonstrated by a case study in this study. The methodology brings out more accurate, effective and systematic decision support tool for decision makers to conduct the evaluation process to select potential sites for solar power generation over whole country.

Keywords: Solar Power, Wasteland, Global Solar Insolation, Multi Criteria Decision Analysis (MCDA), Potential Site selection

Abstract Id: 1353
Every feature on the earth surface emits unique radiance which could easily be interpreted by spectral signature. However, it becomes challenging while interpreting through digital imagery as its individual pixel or its spectral resolution represents the reflected radiance as a sum composite of all the features. This results into mixing of features in a pixel leading to loss of individuality. Mixing noticeably decreases with high resolution spectral data. But it still persists and depends on how the feature is arranged on the ground. The unavailability and non-accessibility of high resolution imagery of target area lead to the process of spectral unmixing and sub-pixel classification. In digital image processing, spectral unmixing is a common phenomenon which decomposes reflectance spectra into a set of given end member spectra. In this paper, various standard methodologies such as Fuzzy, Distance and Least square to Orthogonalizations were applied and compared on the basis of quantitative analysis on water features to identify the best method. The experiments were carried on a set of Landsat-8 data to evaluate the performance of spectral unmixing. The Distance based unmixing proves to be the best method for unmixing water features as it covers the entire area.

Keywords: Radiance, Unmixing, Fuzzy, Least Square, Orthogonalization

Abstract Id: 1354
UNDERSTANDING THE MINERALOGY OF DEWAR GEOCHEMICAL ANOMALY ON THE LUNAR FAR SIDE

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Geochemical anomalies on Moon are marked by enhancement concentration of certain elements such as Iron, Titanium, Thorium etc. They are significant since they provide clues about the endogenic (volcanism) and exogenic processes (impact cratering) on the moon since its formation. The Moon can serve as the next most important source of minerals after Earth. Region north east of Dewar crater on the farside region of the moon is one such geochemical anomaly with relatively higher Th concentration. The area strangely exhibits a low albedo province amidst a brighter highland crust of the farside. In this work, we attempt to study the mineralogy of this anomalous zone using the Moon Mineralogy Mapper (M3) data. Integrated band depth parameter (Besse et al, 2011), spinel parameter (Pieters et al, 2014) were derived and the colour composite was prepared and the spectral signatures of various colours were examined. The spectra corresponding to the red colour in IBD colour composite suggest a presence of olivine, yellow colour indicates the presence of pyroxene. The spectra corresponding to some isolated green patches of the spinel parameter colour composite image indicate the presence of Mg spinel. The study indicates the Dewar anomaly area corresponding material derived from deep mantle source and might correspond with mg-suite of rocks.

Keywords: M3 data, Dewar, Spinel parameter, IBD parameter, Thorium anomaly

Abstract Id: 1356
High spectral resolution of hyperspectral sensors finds applications in various scientific domains like specific mineral identification and hence, capable of replacing the traditional techniques such as multispectral remote sensing and field-based approach for mineral exploration. Airborne Hyperspectral data is used. Minimum Noise Fraction (MNF) algorithm is used for the reduction of the dimensionality of data. PPI and n-Dimensional visualization are used for the extraction of the endmembers (pure pixels). The endmembers belong to clay minerals, carbonate minerals, iron-bearing minerals and other minerals (sulphates, silicates, oxides etc.) classes. Those endmember spectra are used for the different mapping algorithms i.e. SAM, MTMF. Different mapping algorithms illustrate the different results. SAM uses the spectral angle and MTMF maps single target with the help of matched filtering (MF) and suppresses the background while MT for detection of the erroneous positive pixels. MTMF method provides the better results than SAM. MTMF also discriminates the settlement from the mineral zones.

Keywords: Airborne hyperspectral remote sensing, Minimum Noise Fraction, Endmember Extraction, Spectral Angle Mapper, MTMF

Abstract Id: 1357
TEMPORAL ANALYSIS OF SUMMER-TIME URBAN HEAT ISLAND INTENSITY OVER FIVE METROPOLITAN CITIES IN INDIA

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The world is undergoing an unprecedented rate of urbanisation. About 70% of global energy is consumed in urban areas, which accounts for around 2% of the world’s land surface. Energy consumption in urban areas correlates positively with changes in urban micro-climate which contribute to raised air compared to rural areas with the temperature differences being between 1 and 3 °C. This phenomenon is called Urban Heat Island (UHI), which is traditionally examined by measuring air temperature using thermometers. With the advent of remote sensing technology, Land Surface Temperature (LST) (which explains most of the variation in air temperature) is used to map the impact of UHI over a large area. The present study examined the intensity of UHI over five selected Indian metropolitan cities (Ahmedabad, Chennai, Delhi, Kolkata, and Mumbai) for the period 1981-2016. These cities were chosen based on climate, demography, and rate of urbanisation. The cloud free Landsat level 1 data sets are processed using numerical models developed by our research group. The LST intensity and its spatial and temporal variations during the summer season are appraised in this study. The statistically significant hot spot and cold spot regions were identified using Getis-Ord Gi statistical approach. The mean difference between LST estimated for the span of 25 years is showing positive trend and quantified as 10 °C, 11 °C, 18 °C, 11 °C and 13 °C in the case of Ahmedabad, Chennai, Delhi, Kolkata, and Mumbai respectively. The relationship between LST and few surface characteristics is also studied. The result shows water bodies, soil moisture, and greeneries plays a vital role in reducing both surface and air temperature considerably in the adjoining areas. The results of this study would help policy makers and urban planners to monitor and mitigate UHI effectively.

Keywords: Urban Heat Island, Land Surface Temperature, Temporal Analysis, Urbanisation, cities

Abstract Id: 1358
The state of Jammu and Kashmir which is the northern most state of India is today a politically and geographically a volatile zone. Despite a great potential for development, it lags behind even the most backward regions in India. Even today the first thoughts that entangle the minds of millions of visitors who have enjoyed the splendor of Jammu and Kashmir are the words of Sir Walter Lawrence who wrote "The valley (Kashmir) is an emerald set in pearls; a land of lakes, clear streams, green turf, magnificent trees and mighty mountains; where the air is cool, and the water is sweet; where men are strong, and women vie with the soil in fruitfulness." Ironically this image has been fractured and/or overpowered by elusive images created by multiple modes of technological interventions. So it is in the fitness of the things to do research on this area which despite having a great potential is lagging behind by leaps and bounds.

The present research geo visualizes multiple possibilities for the development of Jammu and Kashmir. The study uses high resolution spatial data sets on one hand and various social media networks especially those one that have typical and non-commercial applications in the virtual world to map resource clusters using automated data processing, machine learning and natural language processing capabilities along with Geographic Information System. The relevance of this study lies in the fact that it looks into the various resource dimension and the sustainability of the development possibilities in the region. We also know that the economy of J and K which is under developed and can benefit from natural resource if used wisely and properly can revitalize and help in the development of Jammu and Kashmir; this study have researched this role also. In the region where data availability is even today a challenge the present study paves way of generating new learning towards spatial data collection in open source environment and seamless movement from varied sources unaware of their usefulness in geospatial visualization. Seven clusters have been identified where the state intervention can move towards sustainability of the northern most region of India.

Keywords: Resource cluster, Twitter, Natural Language processing, open source spatial data, Sustainable Development

Abstract Id: 1360
AN APPLICATION TO CAPTURE SPATIAL DATA BY CROWD SOURCING

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Over the past decade, crowdsourcing has emerged as a major problem-solving and data-gathering paradigm worldwide. The GPS which are currently available for data collection do not provide user defined attributes which lead to the development of many crowd sourcing mobile applications. These applications also have some limitations as they are developed only for certain specific themes which cannot be adapted for other themes. In order to overcome this problem, applications can be developed which are adaptable for all themes. We have developed a user friendly Android based mobile application for data collection from users where the attributes are customizable by the user themselves. And data can be uploaded directly to the Geo-Database through web service. This data can be viewed in a map through Map Server and can be downloaded directly.

Keywords: Mobile application, Crowdsourcing, data collection, Geo-Database, Map Server

Abstract Id: 1361
Livestock in India plays an imperative role however, due to the non-availability of proper feed and fodder its productivity has remained relatively low. Accurate fodder crop identification and area estimation in large agricultural area is very difficult by conventional technique so, remote sensing technique is only mean by which it can be possible in a fast and economically way. This study emphasizes the application of multi-temporal Landsat-8 imageries to identify and discriminate fodder crops from food crops and estimate the area devoted for fodder cultivation in parts of Haryana for Rabi Season. In the present study, classified map of different crops in study area produced by both maximum likelihood classification (MLC) and ISODATA clustering approach using normalized difference vegetation index (NDVI) derived from atmospheric corrected reflectance. Classified map produced by both approaches was validated with the help of ground truth data and it was found that maximum likelihood clustering approach gave more accurate results as compare to ISODATA approach. It was observed from NDVI based spectral-temporal that the time of sowing plays an important role in differentiating Fodder crop from other crops. Accuracy assessment was carried out between four classes i.e. Fodder crops, other crops, plantation and Forest. The overall accuracy of classification observed using MLC was 91.49%. Small size of field for fodder crop leads to inaccuracies in classification. The total area (Kurukshetra, Ambala and Yamunanagar) under fodder cultivation was estimated as 6.39 ’000 hectares for the Rabi Season.

Keywords: NDVI, Spectral-temporal,Landsat-8, Fodder crops, area assessment

Abstract Id: 1362
Comparison has been made between the cropping field sizes found in these countries. Compared the field size distribution prevalent in India, USA and Canada for agricultural studies.

1. Calculated field size of a sample site in USA. The maximum field size obtained in USA site is 180 ha and the average field size obtained is 9.6 ha.
2. Calculated field size of a sample site in Canada. The maximum field size obtained in Canada site is 279 ha and the average field size obtained is 32 ha.
3. Calculated field size of a sample site in central India near Nagpur. The maximum field size obtained is 13.2 ha and the average field size obtained is 0.4 ha.
4. Calculated field size of a sample site in Indo-Gangetic belt near Kanpur. The maximum field size obtained is 7.3 ha and the average field size obtained is 0.4 ha.

RISAT MRS data multi-temporal Synthetic Aperture Radar data have been used for evaluation of rice crop of Bangladesh country. Four Medium Resolution ScanSAR dual-polarization (HH/HV) mode RISAT-1 data were acquired as per the growth stage over Bangladesh region in kharif season of year 2015 and without any ground data. The total rice area estimated during the kharif season 2015 is 6.9 Million hectare using RISAT data. The data is taken upto early September. The newer areas are added during subsequent months which has not been reported here. This give the early trend of rice area transplanted till early September which continues further. Mutidate IRS AWiFS data were taken for Nov. 2014 to Mar. 2015 for the rabi season of 2015 to study the wheat area estimate of Pakistan without the use of ground truth information from that country. The total wheat area was classified to 9.1 million ha for 2015.

Keywords: IRS, RISAT, field size, crop area estimation, AWiFS

Abstract Id: 1363
DETECTION OF PEST INFESTATION AREA IN PADDY FIELD BY VISIBLE BANDS VEGETATION INDICES

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Due to the fact that almost every part of the paddy plant can be consumed by insects at every stages of its growth, paddy field always is being a target for various pests. This might reduce the quality and quantity of the yield. Manual observation and sampling might take more time and would affect the accuracy of detection. The idea of using remote sensing in the means of UAV-RGB images to determine pest infestation, so that the exact site in the area could be detects. This study investigates the ability of different vegetation indices in detection of pest infestation area from UAV-RGB images. Eight vegetation indices used to detect the injuries cause by Brown Plant Hopper (BPH) in the paddy field, where four of them is common indices and another four were developed by enhancement and manipulation of the common indices. The indices used are Vegetation Index Green (Vlg), Vegetation Index Green(VARIg), Excess Green (ExG), Vegetation Visible Index (VVI), T1, T2, T3, and T4. All the indices used based on greenness where green area would yield higher index value than others. Thus, areas that have been injured by BPH will have much less index value than the areas were not infested due to the hopper burn. The statistical distribution of the indices then were compare to determine the stability and capability of indices in detection of pest infestation area of paddy field in Malaysia. When comparing four indices that have the lowest mean different and standard deviation values, T2 and T4 showed the most stable values compare to the others. A comparison between T2 and T4 index showed that although both indices, shows stability, T4 is more reliable.

Keywords: Paddy, Pest, UAV-RGB, Vegetation Indices

Abstract Id: 1364
EVOLVING FUZZY INFERENCE-BASED DECISION SUPPORT METHODOLOGY FOR RISK MAPPING OF WASTEWATER-FED AQUACULTURE SYSTEM

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Wetlands also serve as wastewater-fed aquaculture system for augmentation and recycling of municipal wastewater. These ecosystems are not only the place for safe disposal of huge quantity of urban sewage, but also provider of food and employment. Anthropogenic interference with commercial interest and process of urbanization has made this system dynamic and vulnerable to exploitation. Wetlands are often misunderstood as wastelands, and as a result easy victims of the development process. However, water policies do exists in India that supports and accepts the wastewater reuse. For efficient utilization and conservation of these wetland ecosystems, proper assessment and mapping is essential. In this regard, there exists a huge gap. Selection of mapping and modeling techniques for wastewater-fed aquaculture system requires the understanding of the complex components related to social, economic, technical, and environmental processes; possible trade-off variables; and its related social and economic costs. All these related datasets are sometimes incomplete and vague, which are difficult to be captured by traditional threshold-based models. Such uncertainties can be addressed by fuzzy logic, whereby fuzzy set theory provides a unifying framework for vague and fuzzy information processing. This paper presents a conceptual framework of Fuzzy Inference System (FIS) for wetland risk mapping and assessment. The framework integrates multiple risk factors and quantification of uncertainties within a system to generate consistent outcome. Remote sensing and GIS plays an integral part in generating the base layers for the system. FIS-based wetland risk assessment includes: definition of membership functions, determination of linguistic variable, construction of fuzzy rules, determination of model properties, and defuzzyfication. The fuzzy inference-based decision support system for wetland risk mapping presented here can be a useful tool for decision makers involved in the planning and management of the ecosystem.

Keywords: Wetlands, wastewater system, risk mapping, Fuzzy Inference System

Abstract Id: 1365
SHIP DETECTION AND ITS DIMENSION ESTIMATION - AN ANALYSIS
BASED ON COMPACT POLARIMETRIC RISAT-1 DATA

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Detection of ship and estimation of its characteristics has its significance in tracking these sea vessels for surveillance. It also has its importance as an ancillary information for marine applications like oil spill detection and its source tracking. This paper aims to explore the strength of hybrid polarimetric information present in RISAT-1 CTLR data through PolSAR pro ver 5.1. RISAT-1 was one of its kind space born SAR which provides CTLR Level-1 data.

The processing steps involves generation of covariance matrix and decomposition followed by classification. For decomposition entropy and alpha are obtained for ship detection. H-Alpha Wishart classification is empirically found significant in further enhancing the visibility of ship in ocean. This is required for better accuracy of calculating length and breadth characteristics of ships programmatically.

Keywords: SAR Polarimetry, H-Alpha Wishart classification, Compact polarimetry, RISAT-1

Abstract Id: 1366
SOIL TEXTURE IDENTIFICATION USING EMPIRICAL MODE DECOMPOSITION

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Hyperspectral remote sensing is a potential tool to estimate soil properties that are needed for many civilian and defence applications. In terrain research, movement of surface vehicles in off-the-road situations requires the knowledge of the ground response. Soil texture with higher moisture content adversely affects the off-road trafficability. Further remote sensing is the one of the most potential technology to gather information for inaccessible areas. The hyperspectral remote sensing data of soil needs to be processed to extract information to aid in vehicle movement evaluation system. One of the soil property pertains to its texture which refers to particle size present in the soil. It is described by the proportions of three constituents, namely sand, silt, and clay. Soils of different regions have different textures signifying the proportion of sand silt and clay which affects soil properties such as soil structure, water holding capacity, and the ability for off-road vehicular movement, etc.

In this paper, a signal decomposition approach is used for feature extraction. Soil textures samples are collected from various Indian terrain of western sector. Hyperspectral data of the soil samples covering different terrains is acquired using hand-held spectroradiometer operating in 350nm to the 2500nm region of electromagnetic spectrum covering visible to the shortwave infrared region under laboratory conditions. An empirical mode decomposition is carried out to generate the intrinsic mode functions (IMFs). Spectral statistics of IMFs are computed and used as features for soil texture identification. The proposed method shows encouraging result which enables to differentiate between different soil types with supervised classification and can lead towards the development of a remote sensing based trafficability assessment system.

Keywords: Hyperspectral, remote sensing, empirical mode decomposition, soil texture, trafficability

Abstract Id: 1367
Glaciers are widely accepted as the indicators of climate change. Mountain glacier parameters such as glacier area, volume and thickness as well as glacier velocity are indicators of the glacier health. One way to measure these parameters is ground based surveys. But traversing the rugged terrain of the Himalayas is a huge challenge and limits the spatial coverage of the acquired data. Remote sensing techniques can be utilized to measure these parameters which indicate the glacier’s response to the changing climate. However, optical remote sensing data is limited by weather conditions, especially in the tropical regions. Radar remote sensing data provides an alternative technique which is not affected by cloud cover. TanDEM-X/TerraSAR-X satellite pair provides the first space-borne Synthetic Aperture Radar (SAR) interferometer capable of acquiring Interferometric SAR (InSAR) data with 11 days interval at a very high resolution. Much interest is generated in utility of TerraSAR-X data for glacier movement and glacier change monitoring. In this research work, multiple acquisitions of TerraSAR-X over Chorabari, a Central Himalayan glacier, are acquired in same season from 2011 through 2016. Further, repeat-pass TerraSAR-X/TanDEM-X acquisitions at 11 days gap are acquired and the glacier velocity is estimated to be 0.6 cm/day. The acquired annual data provided an average glacier elevation change of 0.25 m from 2011-2016 which was used to estimate the glacier mass balance. This result was cross-validated with field based measurements reported in recent literature. X-band SAR data shows remarkable capability to provide accurate glacier velocity and glacier mass balance estimates at high temporal and spatial resolution.

Keywords: Himalayas, TerraSAR-X/TanDEM-X, glacier velocity, glacier mass balance

Abstract Id: 1368
This study broadly comprise of two sections. One is analysing the long term gridded CRU TS data to find the trend and magnitude of the climatic parameters like Rainfall and temperature for the time period 1901-2015 of Manipur state. The long term rainfall and temperature of spatial and temporal trends on annual and seasonal scales are examined in this study. After testing the homogeneity for entire data set the monotonic two tailed Mann-Kendall test analysis is applied for the time series data to detect the trend in Rainfall and Temperature. Theil and Sen’s slope estimator test is used for finding the magnitude of change over a time period. It has been found that there is a significant decrease in monsoon rainfall of the south-western region of Manipur (Tamenglong, Churachandpur districts) state and there is an overall increase in monthly mean temperature at the rate of 0.004º C per year in the Manipur State. And, also there is south-western part of the Manipur state has maximum spatial variation of the rainfall.

The second section of this study is done on MODIS satellite products of normalized difference vegetation index, land surface temperature and Rainfall of TRMM products for the time period 2001-2016. The studies of vegetation influenced by climatic factors contribute to examine the relationships between regional ecosystems and climate changes. This study analyzed the spatial-temporal distribution of vegetation cover, land surface temperature and rainfall, and also discussed the relationships among three factors in Manipur State. The mean seasonal land surface temperature varied between 18.1 ºC and 32ºC. In the valley region, the correlation coefficient between vegetation index and land surface temperature and rainfall is small or negligible. In the hilly region, the correlation coefficient between vegetation index and land surface temperature is small in July and high in February. The correlation coefficient between vegetation index and rainfall was the biggest in August. In hilly region, vegetation was influenced greater by the rainfall than land surface temperature from May to September.

Keywords: Mann-Kendall Trend Analysis, Correlation, Climate Change, Vegetation dynamics, Manipur, NDVI, LST, Rainfall, CRU TS data.

Abstract Id: 1369
COMPACT POLARIMETRIC RISAT-1 SAR DATA RESPONSE TO PLANT BIOPHYSICAL PARAMETERS OF WHEAT CROP

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Compact/hybrid polarimetry architecture consists of transmitting circular polarisation, and receiving two orthogonal linear polarisations and also their relative phase, which was used to calculate the four Stokes parameters. Different polarimetric parameters and decompositions were derived from these hybrid data. Crop information on plant age and plant biomass were studied with derived parameters from hybrid data. RISAT-1 SAR data operates in the unique hybrid polarimetric mode which has polarimetric information in form of the Stokes parameters, was used for this study. SAR data were acquired on two different dates at different stages of crop. Right circular transmitted and horizontally (RH) and vertically (RV) received backscatter values show good response with the plant information as the plant age and biomass increases. Raney (m-delta) decomposition volume component shows good response with the increase in age and biomass of the plant. Radar Vegetation Index (RVI) value also shows significant increase in values as the age and biomass of crop increases. The polarimetric parameters like alpha angle and entropy are found to be significantly correlated to the above plant biophysical parameters.

Keywords: hybrid/compact polarimetry, wheat, decompositions, biophysical parameters, RVI

Abstract Id: 1370
GIS-BASED AND MULTI-CRITERIA ANALYSIS TO EVALUATE SUITABLE LAND FOR CROPS - A CASE STUDY IN BAO LOC DISTRICT, LAM DONG PROVINCE, VIETNAM

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Abstract: By integrated GIS techniques and multi-criteria analysis (MCA), land suitability for fruit crops had to be identified for agriculture planning in a commune of Bao Loc district, Lam Dong province, Vietnam. The primary data was obtained through landuse maps, interviewing experts, and statistical sources. Based on these data, the digital elevation model was derived and used to extract other pertinent data. Other data was used for database construction. After that, MCA was performed as the actual decision-making process to find the most suitable land for citrus and mangosteen, taking into consideration the factors necessary to make it operational. Each of these factors had to be weighted using both the Analytic Hierarchy Process (AHP) and the Rank Order System (ROS). Both weighted systems provided same results as to the most suitable land area for fruit planting. The result shown that are 1054.5 ha for citrus and 1675.4 ha for mangosteen. The integration of GIS-based and MCA would be useful methodology to select landuse types and crops for decision making process.

Keywords: MCA, AHP, ROS, Bao Loc district

Abstract Id: 1371
ANALYSIS OF SOIL PHYSICOCHEMICAL PROPERTIES OF AGRICULTURAL SOILS FROM HYPERSPECTRAL REMOTE SENSING DATA

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Soil physicochemical properties analysis is challenging task by traditional ways due to time, irregularity of soil compositions with spatially and temporally. Spectral model development of soil physicochemical properties is emerging issue in soil science and remote sensing. In this condition, hyperspectral remote sensing (HRS) is an essential tool for digital soil mapping. Mapping of soil physicochemical characteristics is useful for crop growth and food production which will be valuable to farmers for crop management. In the present research, the effort has been made on analysing soil physicochemical properties from several agricultural areas of Phulambri Tehsil of Aurangabad district of Maharashtra, India. Soil samples were scanned by non-imaging Analytical Spectral Device (ASD) Field Spec 4 Spectroradiometer device under controlled laboratory condition. The partial least square regression (PLSR) model were implemented for the prediction of soil physicochemical properties such as soil organic matter (SOM), nitrogen, pH values, sand, silt and clay. The regression analysis yielded levels of correlation for soil variables with better R2 values 0.98 for SOM, 0.69 for nitrogen, 0.82 for pH values, 0.98, 0.99, and 0.95 for sand, silt and clay respectively. The root mean square error was ranging from 0.003 to 0.016 produced the best results from this study. In the conclusion, the investigated study is reliable for prediction of soil physicochemical properties from agricultural areas.

Keywords: Hyperspectral remote sensing, partial least square regression, soil physicochemical properties, reflectance spectroscopy, agriculture

Abstract Id: 1373
WEB GIS INFORMATION SYSTEM FOR MEDICINAL PLANT RESOURCE MANAGEMENT, CONSERVATION AND PLANNING- A GEO-VISUALIZATION FOR RAUVOLFIA SERPERNTINA

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Medicinal and aromatic plants play an important role in healthcare. The inventory, location of plant species, utilities, frequency of occurrence and its systematic geographical based information data using Web GIS information system can plays an important role in its management and conservation. Uttarakhand State is very rich in Medicinal and Aromatic plants resources. A comprehensive geospatial database and web based geovisualization of these economically important species can be helpful in various management and planning activities. The present paper deals with web based information system for Rauvolfia serpentina important medicinal plants. It is one of the finest remedy that is widely used for high blood pressure and is also as sedative and tranquilizing agent. The Geo-spatial study conducted for the species present extend/ location and suitable site for cultivation. The generated multilayered database like, LULC, location of plant species, soil layers, distribution, suitable site for cultivation, utilities and other collateral information was integrated using Arc GIS software and publish on web platform. This information was generated using administrative boundaries like district, block and village as well as forest boundaries for user interface. This web based information system will quite helpful in knowing present distribution, extend and suitable zone for cultivation of species in the selected zone. This allows the users to share the collected data through using web GIS platform for resource management, conservation and planning of medicinal and aromatic plants sector in the State.

Keywords: Web GIS, Rauvolfia serpentina, web GIS platform, thematic maps, Geo-spatial

Abstract Id: 1374
URBAN CHANGE DETECTION AND SITE SUITABILITY ANALYSIS IN THIRUVERUMBUR TALUK, TIRUCHIRAPPALLI DISTRICT - A GEOSPATIAL APPROACH

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The sudden growth of a city is an indicator of rapid urbanisation and industrialisation, which causes huge pollution and decreases the quality of environmental health. The study on urban landscape changes at different time period would provide the information about the present state of expansion and the nature of the changes that have occurred. Using change detection analysis to compare the satellite data from different times to assess the change of nature, understand the ways in which humans alter the land and water, and characterise climatic and seasonal changes to the landscape. So, current study attempts to identify the changes and suitable site for future urban development in Thiruverumbur Taluk, Tiruchirappalli District, Tamil Nadu using integrated GIS and Multi-Influence Factors (MIF). The agricultural land, urban sprawl, waterbodies, wasteland/barren land and road networks, terrain, geomorphology, and geology are taken as the key features to map the changes in Thiruverumbur Taluk. The satellite images were obtained in the three different periods such as Landsat 5 (2001), Landsat 7 (2011), and Landsat 8 (2017), which were used in the present study along with the topo-maps. Mapping of urban changes have been done in the view of developing urban land with four different classes such as more suitable, suitable, less suitable and not suitable for urban development. Identification of suitable sites for urban development is also important for planners, policy makers, and rulers to do sustainable development.

Keywords: Urban, Urban Landscape, Urbanisation, GIS, Urban sprawl

Abstract Id: 1378
QUANTIFICATION OF SEASONAL CHARACTERISTICS OF LAND SURFACE TEMPERATURE OVER DELHI USING LANDSAT 8 SATELLITE IMAGERY

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The dense-built up areas exhibit higher land surface temperature (LST) compared to the surrounding landscape, resulting in urban warming. Because of this, urban areas act as islands of elevated temperatures surrounded by relatively cool suburbs. This phenomenon is defined as Urban Heat Island (UHI) effect. Present study investigates the current trends of spatial variation in surface temperature over Delhi during summer and winter seasons, and assesses the effect of urbanization on the local climate. Delhi is a metropolitan city with reserved forests, protected forests and wildlife sanctuary. However, the concrete areas of Delhi have experienced unprecedented horizontal and vertical growth, leading to major modifications of land use/cover. Mono-window algorithm was applied in the study for Land Surface Temperature (LST) retrieval using Landsat 8 satellite data. The mean LST value for Delhi in January and June 2017 was estimated to be 19.05 °C and 27.35 °C, respectively. In summer, LST ranged from 32.1 °C to 22.8 °C and in winter from 23.5 °C to 14.6 °C, which are much influenced by the existing Land Use/Covers. During summer, the lowest temperature was recorded from surface waterbodies and highest temperature was recorded from barren agricultural land, and dense urban areas. However, a weaker UHI phenomenon was observed during winter. Furthermore, the Central Delhi Region and the commercial/industrial areas displayed heat island conditions in both seasons, with a mean temperature difference of 2.3 °C, compared to the suburbs. The small increase in surface temperature at city level is mainly accredited to the combined impact of human activities, changes in LULC pattern and vegetation density. The results of the study suggest that that in the urban area of Delhi, observed temperature are comparatively higher than the temperature of rural areas.

Keywords: Delhi, Urban Heat Island, Land Surface Temperature, Land Use/Cover

Abstract Id: 1381
LAND COVER CHANGE DETECTION USING GIS AND REMOTE SENSING TECHNIQUES: FOR BETTER AGRICULTURE MANAGEMENT IN TIRUPATI REVENUE DIVISION CHITTOOR DISTRICT, ANDHRA PRADESH

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Change detection is the measure of the distinct data framework and thematic change information that can guide to more tangible insights into underlying process involving land cover and land use changes than the information obtained from continuous change. Digital change detection is the process that helps in determining the changes associated with landuse and land cover properties with reference to geo-registered multi temporal remote sensing data. It helps in identifying change between two (or more) dates that is un-characterised of normal variation. Change detection is useful in many applications such as landuse changes, habitat fragmentation, rate of deforestation, coastal change, urban sprawl, and other cumulative changes through spatial and temporal analysis techniques such as GIS and Remote Sensing along with digital image processing techniques.

GIS is the systematic introduction of numerous different disciplinary spatial and statistical data, that can be used in inventorying the environment, observation of change and constituent processes and prediction based on current practices and management plans. Remote Sensing helps in acquiring multi spectral spatial and temporal data through space borne remote sensors. Image processing technique helps in analyzing the dynamic changes associated with the earth resources such as land and water using remote sensing data. Thus, spatial and temporal analysis technologies are very useful in generating scientifically based statistical spatial data for understanding the land ecosystem dynamics. Successful utilization of remotely sensed data for land cover and landuse change detection requires careful selection of appropriate data set. It has functionality for raster analysis, vector analysis, site analysis, image processing, modeling and graphics visualisation. This help in adopting holistic approaches to regional planning which ensures sustainable development of the region.

Keywords: Land use/Land cover Dynamics, Change detection, GIS, Remote Sensing,

Abstract Id: 1382
COMPARATIVE STUDY AND ANALYSIS OF DIMENSIONALITY REDUCTION TECHNIQUES FOR HYPERSPECTRAL DATA

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The enhanced capabilities of the remote sensing devices lead to capture more precise and accurate spatial and spectral information about surface materials. Increased spectral resolution results in more number of spectral bands and raises the challenge of data dimensionality. This high volume data holds plenty of redundant information. This redundancy affects both the time as well as space complexity while analysis. To process and analyze the hyperspectral data with less computational cost with no information loss, data dimensionality needs to be reduced. The literature shows that the traditional image processing techniques with some modifications are applied for hyperspectral dimensionality reduction, but none of the methods give specific solution. This paper evaluates the performances and limitations of the state-of-the-art dimensionality reduction techniques. The algorithms studied and evaluated are Principal Components Analysis (PCA), Minimum Noise Fraction (MNF), Independent Component Analysis (ICA), Fisher Linear Discriminant Analysis (FLD), Factor Analysis (FA) and Linear Discriminant Analysis (LDA). The experiments are performed on the SCIEN hyperspectral data having 148 spectral bands.

Keywords: Hyperspectral Image, Dimensionality Reduction, Principal Component Analysis, Minimum Noise Fraction, Independent Component Analysis

Abstract Id: 1384
Extreme heat waves, disastrous storms, rising of sea levels, heavy precipitation, prevalent droughts and river flooding are all influenced by the widespread change in weather patterns. Extreme weather conditions are being experienced across the globe because of human-induced climate change. This could result in food insecurity, health risks, migration and other effects in the near future. The Philippines is located along the typhoon belt in the Pacific and is visited by an average of 20 typhoons every year. Typhoon Washi struck the cities of Cagayan de Oro and Iligan last December 16, 2011 leaving 1,206 dead victims in Region X as recorded by National Disaster Risk Reduction and Management Council. This tragedy should serve as a wake up call to the local stakeholders and the Government to plan and prepare disaster mitigation and preparedness program. Thus, this paper aims to compare and assess the resulting runoff volumes and hydrographs of the Iligan river basin through simulating five basin models, each representing different land cover scenarios. The basin models are prepared and processed in ArcMap using the HEC-GeoHMS (Hydrologic Engineering Center's Geospatial Hydrologic Modeling System) extension, in which these five basins have the same physical characteristics except for its land cover. Land cover data to be used are from the years 1973, 1989, 1998, 2008 and 2015. HEC-GeoHMS generates the hydrologic modeling data necessary for HEC-HMS (Hydrologic Engineering Center's Hydrologic Modeling System). The models will be simulated in HEC-HMS using the 5, 10, 25, 50 and 100yr rainfall-return periods (RRPs), giving 5 sets of outflow result simulated in a 24hr rainfall scenario per basin model. It is important to note that in this study, the land cover is considered as a variable factor behind the behaviour results of the hydrographs, as it changes in time. Outflow from HEC-HMS will be used in RAS (River Analysis System) to visualize the flood inundation extent of the simulations. The study in general will show how land cover/use changes over time and how it affects the runoff behavior inside the river basin.

Keywords: disaster, runoff, hydrographs, flooding, mitigation

Abstract Id: 1385
Extreme heat waves, disastrous storms, rising of sea levels, heavy precipitation, prevalent droughts and river flooding are all influenced by the widespread change in weather patterns. Extreme weather conditions are being experienced across the globe because of human-induced climate change. This could result in food insecurity, health risks, migration and other effects in the near future. The Philippines is located along the typhoon belt in the Pacific and is visited by an average of 20 typhoons every year. Typhoon Washi struck the cities of Cagayan de Oro and Iligan last December 16, 2011 leaving 1,206 dead victims in Region X as recorded by National Disaster Risk Reduction and Management Council. This tragedy should serve as a wake up call to the local stakeholders and the Government to plan and prepare disaster mitigation and preparedness program. Thus, this paper aims to compare and assess the resulting runoff volumes and hydrographs of the Iligan river basin through simulating five basin models, each representing different land cover scenarios. The basin models are prepared and processed in ArcMap using the HEC-GeoHMS (Hydrologic Engineering Center's Geospatial Hydrologic Modeling System) extension, in which these five basins have the same physical characteristics except for its land cover. Land cover data to be used are from the years 1973, 1989, 1998, 2008 and 2015. HEC-GeoHMS generates the hydrologic modeling data necessary for HEC-HMS (Hydrologic Engineering Center's Hydrologic Modeling System). The models will be simulated in HEC-HMS using the 5, 10, 25, 50 and 100yr rainfall-return periods (RRPs), giving 5 sets of outflow result simulated in a 24hr rainfall scenario per basin model. It is important to note that in this study, the land cover is considered as a variable factor behind the behaviour results of the hydrographs, as it changes in time. Outflow from HEC-HMS will be used in RAS (River Analysis System) to visualize the flood inundation extent of the simulations. The study in general will show how land cover/use changes over time and how it affects the runoff behavior inside the river basin.

Keywords: Hyperspectral Endmember extraction, Pixel Purity Index, Convex Cone Analysis, N-FINDR, AVIRIS-NG

Abstract Id: 1386
APPLICATION OF GEOINFORMATICS FOR DOMESTIC WASTE MANAGEMENT - A STEP TOWARDS RURAL SANITATION

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Regulations and public opposition can make siting municipal solid waste landfills difficult. In this paper, a spatial analytical hierarchy model (SAHM) is developed to identify and rank potential landfill areas for preliminary site assessment. This model takes into account area attributes, and site assessment criteria provided by experts and/or users. This model uses an analytical environment provided by Geographic Information System (GIS) and a decision-making method provided by the analytical hierarchy process (AHP). For the spatial data requirements of GIS, a number of thematic map layers (land use, topographic contours, roads, soil type, geology etc.,) are prepared in digital format.

Spatial Analytical Hierarchy Model (SAHM) is a decision making technique which can be used to analyze and support decisions in which multiple and even competing objectives are involved and multiple alternatives are available. In order to do this; a complex problem is divided into a number of simpler problems in the form of a decision hierarchy. This model is often used to compare the relative suitability of a small number of alternatives concerning an overall goal.

The objectives of the paper are to (1) review available landfill site selection procedures; (2) present SAHM, a method which can be used to identify and rank potential landfill areas using GIS and AHP; (3) illustrate the method by presenting a site selection study in the rural area in Roorkee-Haridwar region ; (4) analyse the effect of varying the relative importance accorded decision factors, and the location restrictions on the distribution and availability of potential landfill areas.

Keywords: Landfills, Geographic information System, Analytic hierarchy Process, spatial data

Abstract Id: 1387
COMPARATIVE EVALUATION OF PLEIADES, CARTOSAT-2 AND KOMPSAT-3 STEREO DATA PRODUCTS FOR DSM AND 3D MODEL GENERATION

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Growing urbanization in horizontal as well as vertical direction demands modeling and monitoring of urban areas in 2D as well as 3D domain. Although, LiDAR and Airborne image data are considered as one of the best data for extraction of 3D models of urban areas, but they have limited availability. On the other hand, increasing availability of sub-meter resolution satellite stereo data sets have opened up new dimensions and potentials in this field. Since, satellite images has wider coverage and has less restrictions for use, they are explored world-wide for extraction of 3D parameters. Hence, in this study, a comparative evaluation of Cartosat-2, Kompsat-3 and Pleiades stereo datasets was carried out for Digital Surface Model (DSM), normalized DSM (nDSM), Ortho and 3D model generation in an urban area. For evaluation DSM was generated both using RPC model and by integrating the Ground Control Points (GCPs) obtained from DGPS survey. It was found that the accuracy of DSM generated using GCPs have improved significantly for Cartosat-2 and Kompsat-3. The accuracy of DSM generated using RPC model of Pleiades was found to be 0.20 m in X, 0.18 m in Y and 1.33 m in Z direction. The RMS error of the nDSM was found to be 0.31m for Pleiades data and 4.1 m for Kompsat-3 data.

Keywords: High Resolution Stereo, 3D Model, Building Heights, DSM

Abstract Id: 1388
MAPPING AND DOCUMENTATION OF NEWLY EMERGED LANDS IN THE COASTAL AREA OF THE ODISHA STATE, INDIA USING HIGH RESOLUTION REMOTE SENSING DATA AND GIS

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Geospatial technology plays a major role in identifying, mapping, characterizing, documenting and displaying newly emerged and submerged lands along the coastal areas for inventorying new land mass for land record updation and many important coastal activities. Their documentation is needed in context of scarcity of land parcels for extension of existing industrial activity, identification of land for Coastal Economic Zone (CEZ), port extension activity, sites for coastal forest regeneration, shoreline changes, identification of unauthorized settlements, anomalous/disputed ownership pattern, nearness to the Coastal Regulation Zones (CRZ), etc. Presently High resolution satellite image coupled with GIS and GPS provides ample scope to demarcate the emerging lands along the coastal regions. The cadastral datasets available from the Government Revenue Department belong to surveyed data of different years. Comparison of high resolution satellite image (World View-II data, period 2014-15 having sub-meter spatial resolution) with the digital cadastral datasets of past years helps in identifying the newly emerged land and the exact status of land cover/land use along the coast. The Odisha coast being a depositional coast formed due to alluvial materials deposited by the intricate river networks in the deltaic region, is seen endowed with lands which are seen submerged in some places forming swales and as well as emerged in developing mudflats, sand cast areas and beach formation. These need to be identified, documented and intimated to the Revenue Department and General Administration Department of the local government so that needful planning on the newly created lands can be taken up. The objectives of the mapping is to identify the newly emerged lands in the coastal area of two local administrative units (Jagatsinghpur and Kendraparha districts) of the State using high resolution satellite image and digital georeferenced cadastral database and mapping of the current land cover/land use status along the coast using high resolution satellite image. High resolution satellite image (World View-II, PAN and MX) are georeferenced with available data sets at Odisha Space Applications Centre. All the historical cadastral dataset i.e 1923-24 to 2014-15 are also georeferenced and spatially adjusted with respect to the high resolution satellite image. Cadastral dataset is superimposed on high resolution satellite image and newly emerged lands have been captured.

Keywords: Remote Sensing, GIS, Coast, Cadastral map, Georeference

Abstract Id: 1390
India has witnessed several extreme heat wave events during the summer season. The frequency and the severity of heat wave events have caused the death of over 9000 people in the past 35 years. These statistics demand a proper study of heat wave events and its root causes. Previous studies on heat waves show a significant correlation between air temperature over land and sea surface temperature (SST). This study examines the heat wave events and its predictability based on SST reading during previous heat wave periods, thus attempts to establish a relationship between the temperature changes happened over land and the changes in the sea surface. The approach to this study is purely observational in nature.

The heat wave period from 1983 to 2017 over the coastal parts of India were identified based on the measures set by India Meteorological Department (IMD). Most of the heat wave events over coastal areas were falling between April and June months. Analysis of sea surface temperature retrieved using satellite data over the study area from 2002 to 2017 at the time of heat wave events shows an increase in the minimum and maximum SST during identified heat wave periods. It is found that the maximum sea surface temperature gets intensified near the coastal areas that are identified as heat wave affected zones by IMD. Hence the study shows the significant influence of SST on heat waves over the land and the marginal predictability of heat waves based on these patterns. This study calls for further investigation of the physical parameters which affect heat wave, and this can even lead to the possibility of a potential tool for long lead predictability of heat waves.

Keywords: Heat wave, Sea surface temperature, Air temperature

Abstract Id: 1391
CONVOLUTIONAL NEURAL NETWORK APPLIED ON REMOTE SENSING IMAGE USABILITY ASSESSMENT

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The continuous development of space technology brings us to the remote sensing information age. In view of the requirement of mass data, this age makes it possible to apply deep learning on remote sensing image processing. However, the large amount of remote sensing images also makes it puzzled to select the useful images. So we propose a remote sensing image usability assessment method improved from the convolutional neural network (CNN) structure of Kangle. According to the definition of image usability, we increase the size of input patch and change the kernel size. For a test image, instead of averaging the score of all patches, we give a bigger weight to the patches with more details. And then apply the method on the usability-based remote sensing image database. The experiment results show that CNN based on characteristics of remote sensing images effectively improves the performance.

Keywords: convolutional neural network, remote sensing image, image quality assessment, usability assessment

Abstract Id: 1393
BUILDING FOOTPRINT EXTRACTION FROM HIGH RESOLUTION REMOTE SENSING DATA- A CASE STUDY ON AYYAPPANKOVIL, ELAPPARA AND UPPUTHARA VILLAGES, (IDUKKI DISTRICT, KERALA)

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Delineating different types of physical and cultural features present in the earth is the important part of remote sensing and image analysis. The study carried out is to extract building footprints along flood prone zones for the villages Ayyappankovil, Elappara and Upputhara. First the image is split and merged together using segmentation process, and then various raster processes were applied such as probability and size filter. Then the extracted output was converted into vector file and cleanup process such as smooth and island filter were applied to get desired output. Finally settlements from respective villages are digitized to know the accuracy of extraction.

Keywords: Quickbird imagery, Flood inundation, Segmentation, Building Footprint

Abstract Id: 1394
Continuous facility maintenance is important to prevent accidents. However, the maintenance is dependent on visual inspection, which is costly, time consuming and has a risk of casualties. Therefore, it demands a systematic system for inspecting facilities efficiently. In this paper, we propose an image based inspection method, which measures location of points of interest using a smartphone image for effective facility maintenance. We performed georeferencing of smartphone images using pre-processed unmanned aerial vehicles (UAVs) reference images without ground control points (GCPs). We then rectified the images using position of smartphone images derived from georeferencing onto target plane of the facility. Experimental results show that the proposed approach has accuracies of 5 cm, 0.28° in the position of smartphone images and 10 cm in the location of points measured from images. We expect that this method can enhance utilization of image based facility maintenance.

Keywords: geometric correction, smartphone images, UAVs, reference images, image based maintenance

Abstract Id: 1396
FOREST ABOVE GROUND BIOMASS MODELLING USING SIMULATED SAR BACKSCATTER IMAGE OF ALOS PALSAR-2 IN UTTARAKHAND

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Synthetic Aperture Radar (SAR) has shown a great potential for forest biomass estimation because of its sensitivity to plant canopy coupled with penetration ability, varying spatial resolutions and incidence angle. The study investigates the potential of SAR simulated backscatter values derived from ALOS PALSAR-2 data sets for the estimation of forest above ground biomass in tropical and sub-tropical forests of Uttarakhand. The tropical and sub-tropical forests of Uttarakhand is found to be of rugged terrain with are apparent in the SAR data in the form of layover and foreshortening. This physical phenomenon is responsible for large scale uncertainty in the biomass estimation. Thus, the multiple data sets (8 scenes) having different incidence angles and polarisations were used for the generation of simulated backscatter coefficients. All the data sets were processed and the valid pixels were extracted from all the scenes. All the valid pixels were stacked to get a simulated SAR backscatter. The plot level data (girth at breast height, height) were collected from 180 field plots and converted to biomass using Biomass equations developed by Forest Survey of India. A total of 120 plots were used for the training the model and the rest 60 were used for the validation of the model. The biomass models were developed between different indices of simulated SAR backscatter and plot level biomass using stepwise multiple regression. The best fir model having highest coefficient of determination was used for the upscaling of biomass from local to regional level. Finally, the relationship between modelled biomass and observed biomass was analysed. The coefficient of determination ($R^2 = 0.82$) and Root Mean Square Error (RMSE = 54.21 t/ha) were observed.

Keywords: ALOS PALSAR-2, Simulated Backscatter, Above Ground Biomass, Biomass Modelling, Stepwise Multiple Regression,

Abstract Id: 1397
APPLICATION OF TOUZI PHASE FOR PERMANENT SCATTERERS IDENTIFICATION

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Permanent Scatterers (PS) points identification is the key step in Persistent Scatterer Interferomeric SAR (PSInSAR) technique and for reliable selection of PS points, large number of images are required. This is the main disadvantage of PSInSAR technique. In order to reduce the number of images, Samsonov and Tiampo in 2011 used polarization phase difference (PPD) to identify PS pixels. In this work, same method was adopted but instead of PPD, normalized value of Touzi phase averaged over three RADARSAT-2 images was used because of its advantages over PPD. The latter provides the phase offset between the HH and VV polarizations, whereas dominant scattering type phase (Touzi phase) $\Phi_s1$ measures the phase offset between the trihedral and dihedral scattering.

In order to justify the application of scattering type phase (Touji phase) over PPD for PS identification, first we analysed UAVSAR L-band sample data of San Francisco region and compared PPD and Touzi phases for different classes. Touzi phase showed the phase value near to zero for water class and near to 90 degrees for urban class which is justifiable as the water class undergoes odd bounce and even-bounce is found in urban areas. After demonstrating the usefulness of dominant scattering type phase over PPD, we used three RADARSAT-2 FQ9 images of 6th April 2008, 30th April 2008 and 17th June 2008 covering Hamirpur city and surroundings in India for identifying PS pixels by utilizing the summation of normalized value of the dominant scattering type phase. The results obtained using Touzi phase were compared with other PS identification methods (amplitude dispersion index, independent component analysis and polarization phase difference) and the density of reliable PS points were found to be higher in case of Touzi phase.

Keywords: PSInSAR, Touzi phase, SAR, PPD

Abstract Id: 1398
PROXIMITY OF HEALTHCARE FACILITIES RELATIVE TO PREVALENT DISEASES ALONG MULETA WATERSHED, PHILIPPINES USING GIS

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The economy-environment tradeoff has been very evident in Mindanao, Philippines, whose natural wealth has been exploited over many decades for the benefit of a relative few, and at great cost to future generations. As the food basket of the country, it is more prominent in agriculture and agriculture-based industries. Thus, the emergence of urbanization and globalization in the country makes it susceptible to environmental degradation and in turn affect human well-being. Health as a fundamental human right and a major concern of everyone, it is important that everybody can and have access to right healthcare services with adequate facilities. However, remote areas are still facing this problem, especially in Mindanao areas. This paper evaluates prevalent diseases among residents relative to health care facilities within the vicinity of the watershed. Semi-structured interviews were conducted with randomly selected 297 households to assess prevalent diseases among household heads. Based on the major means of transportation to each healthcare facilities, GIS was used to determine the proximity of the community with prevalent diseases to healthcare facilities. Findings revealed that 13% of the population had experienced fever, and 12% had chronic non-communicable diseases like hypertension, diabetes and etc. In addition, only 2 hospitals were available within the vicinity of the watershed, located in Don Carlos, Bukidnon, along with the midstream, regardless of the municipality. The distance of these 2 hospitals to the communities especially in the upstream areas is very far. Therefore, providing healthcare services to the community along Muleta watershed is very inadequate and insufficient. Prevalent diseases are widespread along the watershed, and available health care facilities are only at the midstream. It is further recommended that more healthcare facilities should be built along the watershed for the ease of access of communities from upstream and downstream areas.

Keywords: Watershed, Healthcare facilities, GIS

Abstract Id: 1399
URBAN ENVIRONMENT MAPPING OF DELHI

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The unplanned urbanization is becoming an environmental-social-economical threat to accommodate the huge number of population which is literally boosting the present situation of climate change due to global warming. Extracting, measuring and treating the urban area which compiles of dense built-up and complex road network, is very essential to decrease the negative impact on environment. If most of the impervious surfaces can be replaced with permeable or semi-permeable materials or solar panel then the habitation will be saved from natural disastrous events like heat wave and flash flood.

Urbanization can be categorized mainly into two; 1) Static (urban open space + built space) and 2) Dynamic (transportation). The static urbanization largely consists of impermeable or impervious materials. Impervious surfaces are alluded as the anthropogenic elements through that water can't infiltrate into the soil, such as streets, driveways, parking areas, houses, structures etc. An urban area is a densely populated human settlement, facilitated with multiple infrastructures including built and un-built. These areas or settlements are categorized as towns, suburbs, cities by urban morphology. Through balancing the ratio between the un-built (urban space) and built (building & roads), urban disastrous events due to climate change can be minimized.

This research mainly focused on the extraction of impervious areas using regression modelling approach which is used to generate an impervious surface map using Landsat-8 TM dataset of Delhi and for further detailed mapping SVM classification using Sentinel-2 dataset.

Keywords: Normalized Classification, Regression Modelling, SVM Classification, Impervious surface mapping

Abstract Id: 1400
India has witnessed several extreme heat wave events during the summer season. The frequency and the severity of heat wave events have caused the death of over 900 people in the past 35 years. These statistics demand a proper study of heat wave events and its root causes. Previous studies on heat waves show a significant correlation between air temperature over land and sea surface temperature (SST). This study examines the heat wave events and its predictability based on SST reading during previous heat wave period, thus attempts to establish a relationship between the temperature changes happened over land and the changes in the sea surface. The approach to this study is purely observational in nature.

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Keywords: Heat wave, Sea surface temperature, Air temperature

Abstract Id: 1401
India has witnessed several extreme heat wave events during the summer season. The frequency and the severity of heat wave events have caused the death of over 9000 people in the past 35 years. These statistics demand a proper study of heat wave events and its root causes. Previous studies on heat waves show a significant correlation between air temperature over land and sea surface temperature (SST). This study examines the heat wave events and its predictability based on SST reading during previous heat wave period, thus attempts to establish a relationship between the temperature changes happened over land and the changes in the sea surface. The approach to this study is purely observational in nature. The heat wave period from 1983 to 2017 over the coastal parts of India were identified based on the measures set by India Meteorological Department (IMD). Most of the heat wave events over coastal areas were falling between April and June months. Analysis of sea surface temperature retrieved using satellite data over the study area from 2002 to 2017 at the time of heat wave events shows an increase in the minimum and maximum SST during identified heat wave periods. It is found that the maximum sea surface temperature gets intensified near the coastal areas that are identified as heat wave affected zones by IMD. Hence the study shows the significant influence of SST on heat waves over the land and the marginal predictability of heat waves based on these patterns. This study calls for further investigation of the physical parameters which affect heat wave, and this can even lead to the possibility of a potential tool for long lead predictability of heat waves.

Keywords: Aerosol, IGP, Fuzzy clustering, Membership value, AERONET

Abstract Id: 1402
IMPACT OF CLIMATE CHANGE ON GROUNDWATER RESOURCES WITH SPECIAL EMPHASIS TO TAMIL NADU - A REVIEW

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Climate change studies are one of the most emergency fields in the entire sector to understand the safe living on the Earth in future. Water is crucial for survive, but its availability at a sustainable quality and quantity is threatened by many factors, of which climate plays a foremost role. Groundwater is one of the most utilized resources in India for drinking and irrigation purposes. The Intergovernmental Panel on Climate Change (IPCC) estimates that the global mean surface temperature has increased 0.6 ± 0.2°C since 1861, and predicts an increase of 2 to 4°C over the next 100 years. The present study, carry out reviews on impact of climate change on groundwater resources with special emphasis to Tamil Nadu State. The normal annual rainfall falling over the state is 958.4 mm is received at the State. The maximum temperature over Tamil Nadu is projected to increase by 1.1°C, 2.0°C and 3.4°C in the years 2040, 2070 and 2100 respectively with reference to the baseline 1970-2000. Annual rainfall projected for 2040 indicates a general increase in rainfall by about 7cm for the period 2040 to 2070 with reference to the base mean 1970 to 2000 while it increases by 9cm for the period 2070 to 2100. The State depends (75%) on neighbouring States for considerable quantum of flows annually and up to 80% of the groundwater is being used out of total available. This has led to the decline in groundwater table. Due to erratic rainfall and inflation of agricultural inputs many agricultural lands were kept fallow or converted for other uses and agricultural labourers migrated to urban areas for searching jobs to sustain their life. In this context, it is necessary to estimate the climate change impact on groundwater resources in Tamil Nadu State for better sustainable environmental development.

Keywords: Climate change, Remote sensing, GIS, Groundwater, Tamil Nadu

Abstract Id: 1405
DEVELOPMENT OF HIGH ALTITUDE WETLAND INFORMATION SYSTEM IN KULLU DISTRICT OF HIMACHAL PRADESH USING GEOSPATIAL TECHNIQUES

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High Altitude Wetlands (HAWs) are very special wetlands and play significant role in the hydrological cycle and water resources of state of Himachal Pradesh besides harbouring unique biodiversity. Realizing their importance, Chandertal lake in Kullu district has been declared as Ramsar site. Efforts towards bringing more such lakes under notified/protected/Ramsar site are being initiated. Inventory of wetlands at 50,000 scale has been considered as the minimum requirement for such planning, as numerous small size wetlands abound in Himachal Pradesh which have significant value to local environment. Mapping of High Altitude Wetlands and creating a geospatial data base in state of Himachal Pradesh was taken up at 1:50,000 scale using satellite remote sensing data. This study is part of National Wetland Inventory and Assessment (NWIA) project. IRS P6 LISS III digital data having four spectral bands: Green, Red, Near Infra Red, and Short Wave Infra Red with spatial resolution of 24 m was used for mapping of wetlands. Two-date data: one acquired during pre-monsoon and another during post-monsoon period was used to decipher the status of wetlands during wet and dry period. The Digital Elevation Model (DEM) derived from Shuttle Radar Topography Mission (SRTM) data was used to generate elevation contours and classify the lakes as per altitude range. A classification system based on IUCN/RAMSAR definition and amenable from remotely sensed data was used to categorise the wetlands. A Total of 19 types of wetlands were delineated using a hierarchical system. High Altitude Wetlands is one of the class mapped, which is first such attempt in India. A total of 78 HAWs were delineated constituting 0.98 Sq. Km area. Maximum number of lakes (71) is of very small size (< 0.0225 Sq. Km). Altitudinal distribution of these wetlands showed that highest concentration is in the range of 4000 to 5000 m.

Keywords: High altitude wetlands, Digital Elevation Model, Indian Remote Sensing LISS 3

Abstract Id: 1406
RESOURCE MAPPING OF HIGH VALUE CROPS IN CAVITE AND DEVELOPMENT OF THE ALGORITHM FOR DETECTING COCONUT, SUGARCANE AND RICE USING LIDAR DATA

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This paper presents the development of the algorithm for detecting coconut, sugarcane, and rice which is included as one of the highest value crops in the world. The demand for the production of crops is also rising given that food is one of the basic human necessities. The Philippines has a vast number of agricultural resources. However, monitoring is one of the problems in agricultural industry. Due to the fast paced economy and rapid land use and land cover changes; it is mostly important to produce detailed resources maps. This study investigated the prospective of LiDAR data that provides explicit information in delineating land use and land cover. Nevertheless, considering the labor and cost of providing the whole area with LiDAR data might be very challenging; hence, this study developed methodologies to generate maps using LiDAR data and satellite imagery. The optimization of the classification has been applied in image analysis with both qualitative and quantitative measures using Support Vector Machine. The utilization of the features has been described in this study. Furthermore, the study presented the performance of pixel-based and object-based classification. The experiments were conducted in six different areas in the province of Cavite. Results show that pixel based algorithm provide higher result than object based given that the classes are in spatially large location. Nevertheless, object-based classification provided detailed information with implicit information of the classes in the area.

Keywords: Remote Sensing, LiDAR, Satellite Imagery, Object-Based Image Analysis, Pixel-Based Classification

Abstract Id: 1408
Agriculture is a major component of Indian economy. Though it contributes only 14.6% of GDP, it provides employment opportunity to 54.6% of the working population. Hence, agriculture has been a major thrust for every aspect of Indian developmental planning, including Indian remote sensing programme. Starting from the initial coconut root wilt experiment to current operational applications in agriculture, remote sensing programme of India has been majorly agriculture driven. Many established applications in agriculture include crop production forecasting, agricultural drought assessment, cropping system analysis, crop suitability analysis, precision farming, irrigation management, crop insurance, horticultural inventory & development, climate change impact assessment, etc. National level programmes, such as FASAL (Pre-harvest crop production forecasting for 8 major crops at National/State/District level), NADAMS (District/sub-district level operational drought assessment for the drought prone states of the country), CHAMAN (Assessment of 7 horticultural crops in 185 districts and planning for horticultural development) and KISAN (Use of satellite data for crop insurance) have been operationalized with the support of Indian remote sensing data. The acceptance of remote sensing based agricultural assessment by the user departments has been showcased through the flagship programmes of Ministry of Agriculture, which advocate use of remote sensing data and geospatial tools for their successful implementation. Based on the success of the above-mentioned programmes, the Ministry of Agriculture is proposing a new integrated programme, called National Programme on Space Technology for Agriculture (NPSTA). This paper will deal with the details of the above programmes and thus present a success story of remote sensing utilisation for agriculture in India.

Keywords: Remote Sensing, Agriculture, India, FASAL, CHAMAN, NPSTA

Abstract Id: 1409
DATA PROCESSING AND MANAGEMENT OF DIWATA-1 IMAGERY USING FREE AND OPENSOURCE SOFTWARE STACK


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Diwata-1, the first Philippine microsatellite, has been operating for the past 15 months, providing imagery for earth observation. Concurrent with this development, the ground control and receiving station capacity is also being developed. This includes the capability to automate data processing of acquired images for faster turnaround times after image acquisition and reception. In this paper, we discuss the efforts of the PHL-Microsat program to process and manage these images using a FOSS (Free and Open Source Software) stack.

Upon reception, quality assessments and radiometric calibration of the images are performed using custom scripts based on GDAL, Rasterio, and OpenCV. These scripts include (but not limited to) computations for Pixel Dropout, Signal to Noise Ratio (SNR), and cloud cover assessments. Pointing constraints on the small spacecraft, necessitated improvements on the geolocation procedures which include the development of an automated georeferencing platform using a PostgreSQL/PostGIS-based key point database derived using SIFT descriptors from OpenCV. While this is currently in progress, manual operations proceed using QGIS and GDAL Georeferencer plugin. Overarching these are operations and management tasks, for which we developed an in-house browser based platform utilizing FOSS web technologies such as Django, Leaflet, among others. The system capability includes an orbit tracker, image management dashboards, and data distribution end point.

Customizing for fit of use, performance, and overall improvements; these developments have already undergone several iterations and FOSS changes. With the lessons learned, systems and platforms developed; increases our operational capacity in preparation for Diwata-2 and other upcoming Philippine satellites.

Keywords: FOSS, Diwata-1, data processing, data management

Abstract Id: 1410
MINERAL IDENTIFICATION BY BAND RATIOS AND FEATURE ORIENTED PRINCIPAL COMPONENT SELECTION TECHNIQUES IN THE BHUKIA REGION, RAJASTHAN

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The applications of Remote sensing are dynamic and ever growing. In the field of mineralogy in particular, the application of remote sensing reached a new dimension with the advent of hyperspectral remote sensing which includes both imaging and spectroscopy in a single system.

The basic concept behind this mineral identification through remote sensing lies in the minerals’ uniqueness in the reflectance and absorption pattern across different wavelengths.

In this study Band Rationing and Feature Oriented Principal Component Selection (FPCS) have been applied to VNIR-SWIR bands of ASTER data set to identify the minerals in the study area.

By studying the spectral signatures of the minerals in the spectral range of the datasets and by referring to certain previous works, appropriate Band Ratios have been operated and the minerals have been identified and matched through the USGS spectral mineral library. With this basic approach, the FPCS technique has also been applied where Principal Component Analysis (PCA) has been functioned on a set of four bands selected by considering the spectral signatures of the minerals and then analyzing the eigenvectors.

Mineral spectra have also been generated from the field samples for the validation purpose and the spectra thus obtained have been matched with the USGS spectral mineral library.

Finally, calcium rich minerals such as Dolomite, Diopside, Calcite, and Talc, clay minerals such as Kaolinite, Illite, Montmorillonite and Nontronite and a few iron rich minerals such as Pyrrhotite, Jarosite and Hematite have been documented. The minerals obtained were in support of the GSI geological map of the area.

Keywords: Band ratio, FPCS, Mineral identification, USGS Spectral library, Spectroscopy

Abstract Id: 1411
LAND COVER/USE SCENARIO BUILDING AND ITS IMPACT ON RUN-OFF AND FLOODING INSIDE THE ILIGAN RIVER BASIN

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Keywords: flooding, runoff, land cover, land use

Abstract Id: 1412
EXTRACTION AND ASSESSMENT OF URBAN TREE COVER IN MALAYSIA USING MULTI-RESOLUTION REMOTE SENSING DATA

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Trees have a profound effect on urban liveability by improving people’s physical and mental health, removing pollution, lowering temperature and enhancing urban biodiversity. Mapping and quantifying tree cover in cities is vital for environmental protection and sustainable urban planning. The aim of this study was to extract tree cover information of three major cities in Malaysia. Medium to very high resolution remote sensing data were used to effectively delineate tree cover in Kuala Lumpur (capital city), Johor Bahru and Pasir Gudang (located within the fast growing economic region in south of Peninsular Malaysia). Various image processing techniques such as per pixel (maximum likelihood), sub-pixel (monte carlo unmixing technique embedded in Claslite software) and object oriented classifications were applied to Landsat, SPOT and Geoeye satellite data dated 2016. Results show that both sub-pixel and object oriented classification yielded tree coverage of 17% in Kuala Lumpur. Meanwhile, Johor Bahru and Pasir Gudang had high tree coverage of 36% and 48% respectively. These results are close to the values (33 % and 41%) obtained from i-Tree software that is commonly used to estimate urban tree cover in north America and Europe. Tree coverage in these cities also includes commercial trees such as oil palm and rubber and mangroves. In Kuala Lumpur tree coverage is still below the target set by other cities like London (30%), and Melbourne (40%). Based on these studies, it is recommended that Kuala Lumpur city hall set a target of 30% tree canopy cover an amount that can keep the temperatures low, keep the air clean and provide extremely effective onsite storm water management and plan strategically to increase tree cover (including roof top planting, increasing number of pocket parks and connecting green spaces).

Keywords: Tree cover, urban, Malaysia, remote sensing, i-Tree, sustainability

Abstract Id: 1414
OPTIMIZATION OF A SEMI-ANALYTICAL ALGORITHM FOR WATER QUALITY MONITORING IN GANGA RIVER USING AVIRIS-NG DATASET

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Airborne Visible Infrared Imaging Spectrometer (AVIRIS) class spectrometer and field hyperspectral sensors are benchmark instruments for water quality monitoring. In this study, we have parameterized a semi-analytical algorithm to derive water quality constituent concentrations from AVIRIS-NG acquired scene over Ganga river, Patna. The total remote sensing reflectance (Rrs) was divided into two parts, i.e. contribution due to optically deep water, and contribution of finite water column. For optically deep waters, sub-surface remote sensing reflectance (rrs) was simulated as a function of absorption, backscattering, and attenuation properties of the water column. The four constituents assumed to contribute to the Rrs in the water column are pure water, phytoplankton, suspended sediment, and colored dissolved organic matter (CDOM). For shallow waters, three different type of bottom types were also included in the simulations of Rrs. Master dataset was prepared using forward simulations of Rrs for varying water optical properties and different depth. This Rrs needs to be inverted to retrieve the water constituent concentrations. Here we have tuned our algorithms to retrieve concentrations of chlorophyll-a (chl-a) and suspended sediments after taking into consideration the bottom effects. By applying this algorithm to AVIRIS-NG dataset acquired over the study area, it can be clearly inferring that how a high turbid Gandak river after mixing in the main stream of Ganga river, changing the water quality drastically. After few distance the turbidity uniformly mix with the main stream. With the help of hyperspectral dataset, we were able to distinguish the cause of the turbidity, whether it is due to the sediments or due to higher chlorophyll concentration. Our algorithm produced chl-a concentration was found to be vary over a range of 10-20 mg/m3. The model also produced estimates of suspended sediments concentration over a range of 0-25 g/m3.

Keywords: Remote Sensing reflectance, spectro-radiometer, semi-analytical algorithms, AVIRIS

Abstract Id: 1415
In India, large number of major crops area grown during kharif (rainy) season, which include rice, cotton, millets, pulses, groundnut etc. Getting cloud free data for their assessment is very difficult. Microwave SAR data provides an alternative. However, Multi-date SAR data analysis for classification of crops like Rice (transplanted) and Jute has been well established and operationalized. For other crops the research is still on using microwave data. The present study was carried out to explore the use multi-date single and dual polarization SAR data for assessment of rice and cotton crops. In this context, this study was conducted for Sirsa district of Haryana state, where cotton and rice are two major kharif season crops. RISAT 1 SAR data with both HH and HV polarization was used for the study. The data acquisition dates were 23 June 2015, 18 July 2015, 12 August 2015 and 6 September 2015. The crop classification was done using ISODATA and Hierarchical Classification using multi-date RISAT HH and HV data with the ground truth collected during July. Both HH and HV signature profiles were also analysed. In case of rice, HH and HV data over four dates, showed similar pattern, though HV values were low. However, HH and HV profile patterns were significantly different in case of cotton. The classification accuracy (with 4 classes: rice, cotton, guar and other) was 84%, with kappa coefficient being 0.7665. However, when compared with DES estimates, the rice estimate was very close (-1.6% deviation), but the cotton area estimate was 22% lower than the DES estimate. Thus, though this study shows good accuracy of non-rice crop classification using dual polarization SAR data, there is need for further work for improving the area estimation.

Keywords: Classification, SAR data, Polarization

Abstract Id: 1416
In the last few decades, digital watermarking is being used for copyright protection, data authentication and data source tracing of digital multimedia data. Also there is significant research on copyright protection of geospatial vector data in recent years. Image watermarking evaluation methods cannot be directly applied to watermarked geospatial data as geospatial data is different from digital images. As geospatial vector data have different and stricter data quality requirements compared to digital images, it is vital to do analysis in terms of closure and topology of watermarked vector data along with imperceptibility, error analysis and robustness evaluation. At present, watermarking algorithms are mainly focusing on robustness evaluation and error analysis. One of the important aspects related to vector data quality i.e. topological relationship integrity is neglected.

In this paper, an attempt has been made to incorporate invisible watermark in geospatial vector data by applying multilevel wavelet based watermarking algorithm using Haar, Daubechies, Symlet, Coiflet and biorthogonal wavelets. The resultant watermarked data have been evaluated in terms of polygon closure and topological relationship integrity and compared with existing watermarking schemes. Experiments show that although polygon closure is retained for large value of embedding strength, topology starts collapsing even at smaller value of embedding strength of the watermark. Also, visual degradation caused is a function of embedding strength. It has been observed that Haar wavelet outperforms over other wavelets at all decomposition levels for given input dataset. Also, it has been observed that wavelet based scheme is able to retain closeness of polygons and topology preserverance compared to existing DCT and DFT based vector data watermarking schemes. The study helps to choose suitable watermark embedding strength, level of decomposition and suitable wavelet to retain the integrity of topological relationship.

Keywords: Geospatial Data, Protection, Watermarking, Vector Watermark, Robustness

Abstract Id: 1417
STUDY ON URBAN RIVER USING IMAGE PROCESSING TECHNIQUE'S

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River discoloration into polluted drain is a common perspective in present scenario, as urban population is getting expanded and due to improper maintenance of sewages, the domestic sewage and industrial waste is getting dumped into natural rivers. It leads to fading of urban natural rivers.

Regeneration techniques of Remote sensing and GIS are widely used in studying change detection techniques of river encroachment at catchment points and also used in identification of industrial drain tributes, Land use analysis at river bank. Hyderabad is a fastest growing metropolitan city originated from the bank of Musi river in 1591 by Mohammed Quli Qutubshah, at present river divides the Historic old city and new city. Musi river origins at Anantha giri hills at below mentioned coordinates i.e latitude 17.31, longitude 77.86. River flows for an area of 30 km in Hyderabad. This study involves analyzing the change detection of musi river over a period of decade and also interpreting the degradation of river using open source satellite images. The general objective of study is to geographically identify and analyse the extension, encroachment and additional parameters of musi river like its sub drains & land use at river bank. This study demonstrates the use of open source satellite data in determining the drain patterns and tributary of river. The objective of work includes using the existing modules in Erdas imagine i.e Change detection, PCA techniques for analyzing change detection of musi river.

Keywords: Change Detection, Erdas Imagine, Encroachment, Drains

Abstract Id: 1418
EFFECT OF URBANIZATION ON LAND SURFACE TEMPERATURE AND NDVI: A CASE STUDY OF DEHRADUN, INDIA

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One of the significant environmental consequences of urbanization is reduction in vegetation cover and formation of urban heat island effect. The present research utilized Landsat data from 1998 to 2017 to study the spatio-temporal pattern of NDVI and land surface temperature (LST) in Dehradun - the capital of the newly formed state of Uttarakhand, which experienced rapid urbanization since 2000. LST has been calculated from thermal data of Landsat TM/TIRS using emissivity derived from NDVI images. The spatio-temporal pattern of LST indicates that urban/built-up area has increased over two decades and has higher temperature than the surrounding vegetated areas. LST statistics show that there has been a rise of 3.5 degrees in the minimum and 4.9 degrees in the maximum temperature in the 19 years. Urbanization leads to increase in the built-up areas which in turn get heated up as compared to the surrounding areas leading to urban heat island effect. In addition, correlation has been attempted between NDVI and LST. The results show an obvious negative correlation between the two i.e. the NDVI values are low or even negative where LST is high and vice-versa.

Keywords: Urbanization, NDVI, Land surface temperature (LST), Vegetation, Remote Sensing

Abstract Id: 1419
DEVELOPMENT OF AN OPEN SOURCE TOOL FOR UAV PHOTOGRAMMETRIC DATA PROCESSING

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Unmanned aerial vehicles (UAVs) or Drones are light weighted platforms with numerous advantages and can acquire very high-resolution data rapidly with less expenditure. However, the processing of very high-resolution data acquired through the sensors mounted on the UAV platform is a major challenge and the commercial UAV data processing software are expensive. These software packages require high configuration hardware and follow the general workflow of conventional photogrammetric approach for image alignment, point cloud generation, mesh generation, DSM and Ortho-mosaic generation. The integration of computer vision algorithms with digital photogrammetric techniques has made it possible to process the high-resolution datasets quickly. A wide variety of open source software utilities are available that can perform these tasks individually; however, an integrated solution is always desirable. An attempt is made to develop an open source tool for photogrammetric processing of UAV data using open source libraries in python. The software provides an complete workflow for photogrammetric processing of UAV data ranging from camera calibration, point cloud generation, direct georeferencing of generated point cloud and digital elevation model (DEM) generation. The developed software is compatible with both 32-bit and 64-bit operating systems and low configuration hardware.

Keywords: Drones, unmanned aerial vehicle, high resolution, open source software, direct georeferencing.

Abstract Id: 1420
ANALYSIS OF SNPP-VIIRS-DNB DERIVED NIGHTLIGHTS OVER INDIA

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Nightlight observations from satellites are being used by researchers for nearly three decades to monitor the societal development. Nightlight images available from Day/Night Band (DNB) of Visible Infrared Imaging Radiometer Suite (VIIRS) aboard the Suomi-National Polar-orbiting Partnership (SNPP) satellite have many advantages over the previously available images from Operational Linescan System (OLS) of the Defense Meteorological Satellite Program (DMSP). This study aims at analyzing the SNPP-VIIRS-DNB images over India as proxy to monitor the development. Monthly average radiance composite images from SNPP-VIIRS-DNB made available by the Earth Observation Group of NOAA are used to prepare annual (April to March) average radiance composite images for 2012-13 and 2016-17. While preparing the annual composites, outliers due to ephemeral events (if any) have been removed and number of cloud free observations in each month has been used as the weighting factor. To suppress the background values, we attempted three approaches: (i) thresholding based on observed radiances of inland water bodies, snow, desert and ocean; (ii) subtracting minimum value through a moving window; and (iii) Getis statistic. However, these approaches did not yield good results. Finally, “sum of lights” (SOL) were calculated from annual average radiance images of 2012-13 and 2016-17 and plotted for the States and Union Territories (UT) of India. Most of the States/UT and India as a whole showed positive trend as expected; whereas, in some of the northern and north-eastern States negative trend was observed. The plausible reasons for this negative trend could be: (i) over-correction for forest fires and crop residue burning during pre-processing (in Delhi, Haryana, Himachal Pradesh, Punjab and Uttarakhand); (ii) albedo effect of snow cover (in Arunachal Pradesh and Sikkim); and (iii) bad pixels/ artifacts in 2012-13 image generated during pre-processing (in Mizoram). Hence, local land cover/ practices need to be considered while interpreting VIIRS images.

Keywords: VIIRS, DMSP-OLS, nightlights, societal development

Abstract Id: 1421
GIS-BASED SITE SUITABILITY ASSESSMENT FOR EVACUATION SHELTERS DURING FLOOD EVENTS USING ANALYTIC HIERARCHY PROCESS IN TALOMO WATERSHED, DAVAO CITY, SOUTHERN PHILIPPINES

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An evacuation shelter, in some instances failed to serve its purpose since it happened to be situated in another hazard prone area. This study assessed the Talomo floodplains to identify evacuation shelter suitability using Analytic Hierarchy Process (AHP) and Geographical Information System (GIS) over 5-25-100 year return periods. The criteria considered in evacuation shelter selection were as follows: flood hazard, landslide hazard, elevation, proximity to road networks, and proximity to health-care facilities. AHP was used to generate the weights of each suitability criterion and the results showed that the elevation has a weight of 50.18%; landslide hazard has 15.77%; proximity to health-care facilities, 14.09%; flood hazard with 12.35%; and proximity to road networks, 7.62%. The generated maps for the 5-25-100 year-return periods showed that almost half of the floodplain is within moderately suitable areas while the remaining areas were either suitable or highly suitable. The assessment of the existing evacuation shelters showed that the shelters designated to Mintal and Sto. Niño were in highly suitable areas. Bago Gallera and Talomo shelters were in suitable and moderately suitable places, respectively. St. Francis Xavier College Seminary of Davao was designated as suitable evacuation shelter. For areas with no designated evacuation shelter, new evacuation shelters were identified and recommended. The result of this study could contribute to the local disaster response management. An improvement of this study would include addition of criteria such as proximity to fault lines and sea level rise, addition of expert’s opinion for weight generation, and the use of current updated database to improve the study.

Keywords: evacuation shelter, GIS, suitability assessment, Talomo watershed

Abstract Id: 1422
USEFULNESS OF HIGH RESOLUTION IMAGERY IN HYDROPOWER DEVELOPMENT

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Development of hydropower projects need to study environmental impact assessment (EIA), social impact assessment (SIA), roads, infrastructures, geology and land form, glacial lakes for construction of dam, powerhouse and transmission line.

Detail design is carried out on the basis of detail topographical mapping by field surveys or/ LiDAR survey and other field investigations.

High resolution satellite imagery and stereo aerial imagery are used in detail investigation of study environmental impact assessment (EIA) on fauna and flora, social impact assessment (SIA) due to land acquisition and resettlement, roads, infrastructures, geology and land form, glacial lakes and other objects for construction of dam and powerhouse as well as affect due to filling of reservoir of various depths. They are also used to to assess the existing roads, infrastructures and to fix transmission line route and its impact on environment and socioeconomic situations of the the area. The imagery is generally used along with topographical data and Google image.

The high resolution imagery is scaled, oriented and orthophoto generated on the basis of control points extended of national control points by DGPS, establishment of control points by precise traverse and leveling, details depicted by field or LiDAR survey method and DEM generated from existing larger scale topographical maps. The planimetric features of orthophoto so generated are verified with field survey data.

This article briefly describes how the 0.5m or higher resolution imagery is being used in hydropower development activities in hilly or mountainous terrain. It is also briefly describe the limitations of such satellite imagery.

Keywords: Hydropower Development, EIA, SIA, transmission line

Abstract Id: 1423
Spatial statistics on Area and production of high value crop like Menthol Mint is much needed for various stakeholders since India is the largest producer of Mentha oil (73% of world production) and the crop is an export earner for the country. The present study has two fold objectives namely - mapping menthol crops and assessing its above ground fresh biomass which is the economical part of the crop. Barabanki district of Uttar Pradesh state, a prominent mint growing district is the study area. Object oriented classification approach was applied to overcome the limitations of pixels based approach. Multi-resolution segmentation was performed on Single scene of Sentinel 2 data for the period corresponding to the maximum vegetative stages with suitable scale, shape and compactness factors. Segmentations were assigned classes based on the threshold value of Normalised difference vegetation Indices (NDVI) and Grey Level Concurrence Matrix (GLCM) homogeneity derived from Ground truth data for the study region. The object based accuracy assessment was made for the classes. Sentinel-2 multispectral data were utilized in terms of Narrowband Vegetation Indices (NVI) and angle or area based vegetation index (AVI) to estimate the fresh Biomass of the crop as these do not have saturation problem like broadband Indices. To overcome the multicollinearity among the Vegetation indices the multivariate analysis were performed for Biomass prediction using stepwise multiple linear regression (SMLR), Partial Least Square regression (PLSR) and Principal component regression (PCR). Further, twenty one NVI and six AVI were computed using visible, Red-edge and Near Infra Red bands of Sentinel-2 data. Univariate and MultiVariate prediction of Biomass were made. Sixty percent of field measured biomass data was used for developing the model and rest is used for validating the model. Result of univariate model validation reveals the highest coefficient of determination (R²=0.65) for

Keywords: Menthol mint; Object oriented; Narrow Band vegetation indices, Partial least Square regression (PLSR); Red Edge

Abstract Id: 1424
The high growth rate of urban population has led to an increase in the demand for better urban planning and monitoring which mainly includes road network development. Manual monitoring of road development is time consuming and inefficient. In this paper, we propose a method for automatic extraction of roads in vision spectrum (RGB) images acquired by remote sensing from a UAV, also known as Low Altitude Remote Sensing (LARS) or Near Earth Remote Sensing. Extreme Learning Machine (ELM), a neural network based classifier is used for spectral classification. ELM is a single-hidden layer feed forward neural (SLFN) network with a fast learning algorithm, whose learning speed is faster than traditional feed forward network learning algorithms like Back-Propagation (BP) algorithm while obtaining better generalization performance. Spectral classification is further improved by applying spatial techniques. The spatial techniques include a combination of Shape Index(SI), Density Index(DI) and mathematical morphological close operations. Seven images of diverse road stretches are analyzed to verify the robustness of the proposed method. The classification results are analysed using confusion matrix. The performance parameters derived from confusion matrix are analyzed for a range of hidden neurons of the ELM model and an optimum number of hidden neurons are chosen. Successful road extraction demonstrates the potential of using UAV imagery for monitoring road development.

Keywords: UAV, Extreme Learning Machine, Road extraction, Spatial segmentation

Abstract Id: 1425
DEVELOPMENT OF PANCHAYAT RESOURCES INFORMATION SYSTEM USING GEO-INFORMATICS

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The process and practice of planning are getting decentralized to lower area units to make them area specific and responsive to the needs of local people. It is extremely important to empower panchyats, the grass root Institutions in India in terms of resource database creation and use of the same for better future.

Spatial information of the available resources is a pre-requisite for developing grass root level developmental plans, attaining the goals and for the time bound completion of the developmental-plans. To harness benefits of Space Technology and Geo-informatics for developmental planning, a project was carried out to develop panchayat resources information system in Chamryana, Malyana and Pujarli panchayats of Himachal Pradesh. Panchayat resources information system is designed for the identification and mapping of the local resources spatially and understanding the problems and potentialities of each resource. It provides the basic details in GIS format for the planning and the development activities of panchayats. The Indian Remote Sensing Satellite Cartosat - I images are the basic remote sensing data which has been used for mapping the panchayats. The spatial resolution is 2.5m and thus mapping scale amenable for 1:10,000 scale mapping. The ancillary/collateral Data used was collected from panchayat asset registers and district census handbook. The location of various natural and manmade resources was collected with the help of maps and Global Positioning System. In addition, the non spatial information pertaining to the land resource and water resource are also collected in the separate performa designed for the project. The mapping & creation of Geo-database was done using Arc GIS software. This will be a supportive system for e-governance at micro level. The output is in digital format serves as a base for planning the development activities of the departments like Planning, Agriculture, Soil Survey, Soil Conservation, Rural Development.

Keywords: Panchayat, Geo-database, Desktop applications, Web based applications

Abstract Id: 1426
MENTHA CROP ASSESSMENT USING MULTIDATE REMOTE SENSING DATA: A CASE STUDY FOR BARANANKI, UTTAR PRADESH

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Mentha (Mentha arvensis) or Mint is a cash crop grown for producing Mint oil, which is used pharmaceuticals, dentifrices, cosmetics, mouth-washes and flavouring of beverages. India is the highest producer and exporter of mint oil. Uttar Pradesh state contributes around 80 per cent of the total Mentha production in the country. In UP, Barabanki and its surrounding districts produce around 60% of total mentha oil produced in India. The analysis of Mentha area for last 5 years showed that the area during is reducing, may be because of reduction in price, and reduction in demand due to synthetic mint oil availability in market. Because of its high commercial value and export potential, the accurate assessment of its area, condition and production is essential.

Hence, at the request of Ministry of Agriculture, Mentha area analysis was performed for Barabanki district, Uttar Pradesh, under the CHAMAN project, for the year 2015-16. Mentha is generally grown from March to June in this area. Groundtruth (>50 sites) was collected during May, 2017. The major crops, other than Mentha were Orchards and Vegetable. Multidate Resourcesat-2, LISS-III data during March to May 2016 was used for crop area assessment, crop condition monitoring and crop phenology study. A combination of supervised and unsupervised classification of multi-date NDVI data was used for area estimation. The classification accuracy was 83.6 %. The Mentha area in the Barabanki district was found to be 67.6 Thous Ha. Crop area was separated into different health classes, based on NDVI values. The multi-date data also helped to identify the maximum vegetative stage, which can be useful information for harvesting. The analysis showed that the crop area has reduced, though it was slightly higher than the previous year.

Keywords: Resourcesat 2 LISS III, Mentha, Classification, Accuracy Assessment

Abstract Id: 1428
APPLICATION OF REMOTE SENSING AND GIS FOR PREDICTING OF LAND-USE CHANGE WITH THE LCM MODEL FOR TERRITORIAL PLANNING OF HAI PHONG PROVINCE (VIETNAM)

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The ability for mapping and monitoring Land-Use Change is very useful in development of planning options. They can be used to identify the solution space for future development. Currently, Multi-temporal satellite data can provide the potential for mapping and monitoring Land-Use Change, a model LCM (Land Change Modeler) allows generation of the land-use scenarios for territorial planning. Integration of spatial models within GIS can help to evaluate different planning scenarios.

This research studies Land-Use Change and predicts Land-Use Change for territorial planning. The study was carried out in Hai Phong province (1.519 km²). We generated land-use maps of the past changes and have used them to calibrate a spatial predictive model LCM, and have generated maps of expected future change (scenarios) projection for 2025 and 2030 under various variables.

Using LANDSAT satellite images in 2002, 2011 and 2016, the land-use data for the three corresponding years was first generated and the diachronic land-use analysis from 2002 to 2016 was next carried out. Besides, the land-use in the future was generated regarding to evolution trend of land-use in the past based on the LCM. Then, the multi-temporal analysis of land-use change was carried out using the Logistic Regression and the Markov transition probabilities. Two pairs of maps (2002, 2011) and (2011, 2016) were used to generate the predictive maps. The first phase helped us to identify potential relationships between land-use changes and potential variables, and then to validate the predictive model LCM by comparing results to reference maps in 2016 which issued from remote sensing processing; the second phase permitted the establishing of land-use scenarios projection for 2025 and 2030 by using land-use maps 2011 and 2016. Finally, land-use scenarios were modeled by LCM, which have used as important materials for territorial planning of Hai Phong province to 2025 and 2030.

Keywords: Land-Use, Remote Sensing, GIS, LCM, Territorial Planning

Abstract Id: 1429
EVALUATING THE IMPACT OF LAND COVER CHANGE ON RUNOFF USING GIS AND HEC-HMS’ GREEN AND AMPT INFILTRATION EQUATION: THE CASE OF TALOMO WATERSHED, DAVAO CITY, SOUTHERN PHILIPPINES

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A physically based hydrologic model and Geographic Information System (GIS) approach was used to evaluate the impact of land cover change on surface runoff using 2004 and 2010 datasets at Talomo watershed. This watershed is 21.578 square kilometers in area and constitutes 26 barangays or villages. Agricultural development has been the focus of this basin increasing croplands by converting open areas and residential dwellings into tree plantations such as coconuts. Due to these changes in land cover, hydrological process specifically the increased interception of rainfall has affected the generation of surface runoff after precipitation. Runoff estimates were calculated through an application of Hydrologic Engineering Center’s Hydrologic Modelling System (HEC-HMS) along with Green and Ampt infiltration equation and Soil Conservation System (SCS) unit hydrograph for the interception loss. Physical characteristics for each set of land cover such as soil parameters were estimated based on Rawls and Brakensiek values for different classes whereas land cover based curve numbers were generated from hydrologic soil groups. Peak rainfall events from the rain gage in Baguio district were selected for simulation representing the categories intense, heavy, and moderate. The simulated runoff was then compared by category and between the years 2004 and 2010 through the use of paired t test. The statistical analysis showed that there is significant difference between these two pairs of data across all categories indicating a decrease in overall runoff output in 2010. Further studies may be done using the latest land survey data, the 2010 land cover for a timelier evaluation on the impact of land cover change on surface runoff. Other runoff models or runoff modelling software may also be used.

Keywords: GIS, Green and Ampt, HEC-HMS, Runoff, Talomo Watershed

Abstract Id: 1430
DETECTION AND MONITORING OF TRACE-GAS EMISSION EVENTS OVER INDIAN REGION USING EOS: METHODOLOGY AND A CASE STUDY

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The ability to measure air pollution and other chemically reactive trace gases in the lower atmosphere from satellites has a heritage dating back nearly three decades when the first measurements of carbon monoxide (CO) were made from the space shuttle Challenger in November 1981. Continuous measurements of atmospheric trace gases are available that can be utilized to monitor long term changes of concentrations.

Off late, satellite remote sensing has helped to mitigate this aspect to a great extent. Satellite observations provide a handle for the overall monitoring of atmospheric trace gases on a global scale. Especially, the delineation of tropospheric concentrations through the development of innovative algorithms has proven to be an effective tool to monitor NO2 emissions. OMI platform provides continuous columnar SO2 and tropospheric NO2 observations from 2003 till date and has proven to be an effective database of observations over a long term period. AIRS platform on-board AQUA/TERRA satellites provides long-term CO concentrations for different pressure levels.

In the present work, the long-term satellite data available from various platforms are used to first construct a species specific background of observations. The estimated background concentrations are arrived at based on statistical analysis wherein long-term data has been filtered to bring out realistic variabilities. As the life-time of each trace gas species is different, the background concentrations are significant at different time-scales. Further, the background concentrations are compared with present satellite observations to arrive at a realistic map of high emission events over the country. The study is validated with the high-emission event of trace gases during a forest fire event at Uttarakhand and the results are discussed in the manuscript. This work is attempt towards obtaining operational inputs of trace gas emissions over the country.

Keywords: SATELLITE, EMISSION EVENTS

Abstract Id: 1432
MONITORING CHANGE IN VEGETATION COVER USING MULTI-TEMORAL INFORMATION OF BHITARKANIKA MARINE NATIONAL PARK REGION, ODISHA, INDIA

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Worldwide the coastal zone occupy about 8% of earth’s terrestrial surface but contribute 37% and 44% of world’s population (as of 1994) within 100k.m and 150k.m of a coast line respectively(Cohen et.al, 1997). Thus, coastal zone ecosystem(Estuaries, Wtlands, Coral reefs etc), which are rich in natural resources are in extreme pressure. There has been a tremendous pressure on the resources and habitats of Odisha coast in the last few decades. Rapid industrialization in Paradeep and Dhamra port, increase of aquaculture activities, denudation of coastal sands, rapid degradation of coastal vegetation, salinity ingress in the agricultural land, natural and artificial disturbance on the habitats of sea turtles etc. Mangroves, which act as a barrier for the coast from any natural disasters is now degrading in a rapid rate which threatens the ecosystem and coastal environment.

In the study it is found that there is a decrease in the vegetation cover continuously from 1972 to 2017. Some most vegetative cover region such as Bhitarkanika R.F, Hatamundian RF, In Kalibhanj Dian RF, Satbhaya RF within the Marine National Park has been degraded, i.e-The dense vegetation cover was 35.23%(1973) which decreased to 22.43%(2017) which is threatening the Environmentally sensitive region. It can be suggested that The coastal resources and their apparent changes and threats suggest that the existing conservation measures and protection plans are inadequate to reclaims the Coastal natural resources. The community participation is essential for the protection of the brittle coastal environment. But more rigid laws must be effectively enforced. In developing countries like India, public participation, education programme, awareness initiatives are the foundation of success of any Coastal Management Programme(Hale, 1991). Thus, in order to achieve a sustainable development in the delicate coastal ecosystem, involvement of local community at all levels is essential to protect the Eco- Environmentally sensitive Bhitarkanika Marine National Park region.

Keywords: Remote Sensing and GIS, Coastal vegetation, NDVI Index.

Abstract Id: 1434
ORTHORECTIFICATION AND DIGITAL ELEVATION MODEL (DEM) GENERATION USING CARTOSAT -1 SATELLITE STEREO PAIR FOR BABA BALAK NATH, HIMACHAL PRADESH

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A digital elevation model (DEM) is a simple representation of a surface in 3 dimensional way with height as the third dimension along with x and y in rectangular axes. DEM has wide applications in various areas like disaster management, hydrology and water management, geomorphology and in urban development. Valuable information about a terrain can be inferred by exploiting a DEM in proper way. Study of DEM becomes very useful for studying mountainous terrain which is otherwise hard to access due to inaccessibility. Cartosat-1 or IRS P5 (Indian Remote Sensing Satellite) is a state-of-the-art remote sensing satellite built by ISRO which is mainly intended for cartographic applications. The satellite carries two panchromatic cameras which are capable of acquiring stereoscopic data along the orbital track. The high resolution stereo data have great potential to produce high-quality DEM. This paper discusses the generation of DEM from Cartosat -1 data for Baba Balak Nath (Himachal Pradesh, India) using ERDAS Leica Photogrammetry Suite (LPS). Cartosat stereo pair based Digital Elevation Model (DEM) was generated using the Rational Polynomial Coefficients (RPC) supplied along with the data products. Steps used for generation of DEM are cartosat-1 input with RPCs, interior and exterior orientation, tie point generation, block adjustment and DEM generation. This data will be useful for spatial planning of towns being undertaken by Department of Town and Country Planning, Himachal Pradesh.

Keywords: Digital Elevation Model, Cartosat-1, Baba Balak Nath, Photogrammetry, LPS

Abstract Id: 1435
From past few years, recent developments in Unmanned Aerial Systems with integration of advance technology has brought a new dimension in large scale as well as small scale mapping industry. Recently large areas are being mapped using aerial photography with the application of UAVs. Using these state of the art techniques a new age of surveying is being evolved with versatility and better approach in 5D (3D + time and cost dimensions).

Generating High Resolution Digital surface Model or DSM often demands highly accurate data. Images captured through unmanned aircraft are processed through methodologies ranging from classical photogrammetry to modern photogrammetric computer vision. This research shows all the different parameters important for a high resolution DSM generation using UAS as the source of image acquisition. In DSM generation process, point cloud generation is very crucial for a better result, for which algorithms such as SIFT, SURF are used. MatLAB are also used for running SFM or Structure from Motion algorithm to derive Point Cloud.

This research also explains about all the reduction phase’s requirement such as camera calibration, orientation parameters and effects of GCP in a surface model. Contours are also created using the same approach in an extensive manner. Using various algorithm linked to commercial as well as open-source platforms were studied and analysed to get the results. These methodologies are compared to assess the efficiency and productivity. The results are compared for accuracy assessments. Relative as well as absolute accuracy were computed for the set of images used for processing.

Keywords: UAV photogrammetry, Digital Surface Model, 3D reconstruction, SFM, Point cloud

Abstract Id: 1436
INVESTIGATING THE RELATIONSHIP OF URBAN FORM AND FUNCTION WITH SURFACE TEMPERATURE PATTERNS: A CASE STUDY OF CHANDIGARH

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Urban climate refers to climatic conditions in an urban area that differ from neighbouring rural areas, and are attributable to urban development. Temperatures are higher in cities than the surrounding rural areas—which is popularly manifested as Urban Heat Island (UHI). Urban climate is an effective issue on the local and global climates which is influenced by several factors such urban morphology and density, the properties of urban surfaces and vegetation cover. The urban built form due to its dense development, high rise character and increase in impervious, absorptive surfaces is responsible for the trapping of heat and reduction in evaporative cooling due to decrease in vegetated, soft, pervious surfaces in urban areas. The Local Climate Zonation presented by Stewart and Oke, 2012 defines various urban built form classes based on urban form and function and are derived from logical division of the landscape into a hierarchy of sub-classes, differentiated based on urban surface cover, geometry, fabric and metabolism. This scheme divides urban built form in 10 urban built up classes from High rise compact development to Heavy industries and 7 land cover classes based on urban form and function. In this study local climate zonation of Chandigarh city, India was prepared for year 2008 and 2013 following the methodology developed by World Urban Database and Access Portal Tool (WUDAPT) and it was compared with Land Surface Temperature maps (Derived using Landsat Thermal band) of the same dates. It was found that Land use that uses more energy such as industrial areas shows higher land surface temperature. Heavy industries are showing the maximum Land Surface Temperature in both the years 2008 and 2015 followed by high rise compact urban development whereas water has lowest temperature in both the years.

Keywords: Urban Built form, LST, WUDAPT, Local climate zonation

Abstract Id: 1437
IMPACTS OF CLIMATE CHANGE ON AGRICULTURAL SECTOR USING REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM

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In the present study, an attempt was made to find the impact of climate on agriculture in relation to climatic parameters for Mysore taluk. To analyze the impact of climate on agriculture, weather parameters like Rainfall data, temperature data were used. NDVI analysis, MODIS TERRA data was used. Whereas, NCEP reanalysis, Relative Humidity, Soil Moisture, Solar radiation, water runoff were used. The findings of the study shows that the impact of climate change on agriculture from 1986 to 2016, the annual and monsoon rainfall trend and anomaly decreases, In case of minimum temperature, it shows decrease in trend, whereas, in case of maximum temperature, it shows increase in trend for annual and monsoon seasons respectively.

The NDVI analysis for 2000-2016 indicated that there is increase in NDVI (positive trend) in case of monthly, annual, winter, monsoon and post monsoon season and decrease in NDVI (negative trend) during summer. In case of NCEP reanalysis, the Monthly average of RH, soil moisture and water runoff is positive trend. Whereas, annual average of Relative Humidity (RH), soil moisture and water runoff is negative trend. The solar radiation (Upward/Downward) for monthly is negative trend and annual is positive trend. The crops area such as cereals, millet's, pulses, oil seeds, cotton and sericulture shows decreasing trend. Whereas, crop area for fruits, vegetables and sugarcane shows increasing trend. C-MMACS, GCM Model, the future prediction of rainfall and temperature shows increase in rainfall and decrease in temperature (negative trend) for the year 2020 and 2030 respectively for Mysore taluk.

Keywords: climate change. Rainfall, temperature, NCEP reanalysis and MODIS data

Abstract Id: 1439
GIS MODELLING TECHNIQUE FOR GROUNDWATER POTENTIAL MAPPING AT THE UPPER LANGAT BASIN, MALAYSIA

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Conventional groundwater exploration method of field based hydrogeological survey is time consuming, required high budget and do not always account for the diverse factors that control the occurrence of groundwater. The main objective of this study is to delineate groundwater potential zones at the Upper Langat Basin, Malaysia, using integrated approach geographical information systems (GIS) modelling technique and remote sensing. The study area is the Upper Langat Basin which is located in the south eastern part of Selangor State, Malaysia. In this study, groundwater controlling factors that affect groundwater occurrences are derived from remotely sensed imagery, available maps, and associated databases. Those factors are: lithology, slope, lineament, land use, soil, rainfall, drainage density, elevation, and geomorphology. Then the groundwater factors were integrated in GIS environment to produce groundwater potential map. The predicted groundwater potential map was classified into four distinct zones based on the classification scheme designed by Department of Minerals and Geoscience Malaysia (JMG). The final groundwater potential map of the study area showed that about 85.11 km² (14.78%) of the study area falls under low potential zone, with 327.13 km² (67.68%) on moderate potential zone, 78.37 km² (16.90%) with high potential zone, and only 2.16 km² (0.62%) falls under very high potential zone. In addition statistical analysis indicated that the hard rock aquifer dominant of the study area is better controlled by fracture system rather than well depth. Proximity analysis of the groundwater borehole wells indicated that higher yields are located near to the lineament. Results obtained from this study can be use for future planning of groundwater exploration, planning and development by related agencies in Malaysia. The modelling technique may also be used in other areas of similar hydrological characteristics and climate conditions.

Keywords: Langat, lineament, groundwater, GIS, Malaysia

Abstract Id: 1441
MAPPING SPATIAL PATTERN OF SATURATED AREAS IN TALOMO WATERSHED BY TOPOGRAPHIC WETNESS INDEX

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Geographic Information System (GIS) and Remote Sensing (RS) can assist not only in observing the apparent layer of the earth and its geomorphology but also in understating natural occurrences like variability in soils, hydrological processes, and stream water quality which are helpful in precision agriculture and agriculture itself. In this sense, this work aimed to map spatial pattern of saturated areas by getting its digital terrain attributes such as slope gradient, flow direction, and flow accumulation using the 10 meter spatial resolution Synthetic Aperture Radar-Digital Elevation Model (SAR-DEM). Subsequently, to calculate the Topographic Wetness Index (TWI) of the target area using the upstream contributing area in km² and the slope raster of the watershed. This study was developed in Talomo watershed where vegetation and urbanization come across, located in Davao City the southeast region of the Philippines. The processes in this study were administered using the ArcMap 10.2.2 software with Hydrologic Engineering Center-Geographic Hydrologic Modeling System (HEC-GeoHMS) extension. The result which is the calculated TWI for Talomo watershed, have characterized the spatial distribution of wetness condition in its catchments. These characterizations can then be used to map wetlands inside the watershed which can be used for agricultural planning and all agricultural practices that involve moisture.

Keywords: Synthetic Aperture Radar, Topographic Wetness Index, Wetness Condition, Spatial Pattern, Slope

Abstract Id: 1442
Pine Island Glacier and Thwaites glacier is one of the most important glacier of Western Antarctica region. They are the fast flowing outlet glacier drains in the western ice sheet. The Pine Island and Thwaites glaciers are two of Antarctica's five largest ice streams, which do not flow into the large ice shelf. They are the part of the Amundsen Sea Embayment. The basin of Pine Island glacier comprises 10% of the West Antarctica Ice Sheet, which is responsible for the 25% of Antarctica ice loss. Thwaites glacier feeding Pine Island Bay which is a part of Amundsen Sea. Pine Island glacier has been undergoing several changes including grounding line retreat, thinning and acceleration. Pine island glacier accelerates the most since 1973, which makes its one of the vital to study. Pine island glacier is 30 km wide at the grounding line and feed by nine tributaries glaciers. 

The proposed study is to calculate the surface velocity of Pine Island and Thwaites glacier using MODIS data between 2000 and 2017. The velocity derived from MODIS between 2000 and 2017, data might have error estimation of 250 meters as one pixel of MODIS data is 250 meters on a ground, and hence the difference between two pairs of images are of one, two and three consecutive years to minimize the error. MODIS derived velocities were compare with LANDSAT derived velocity where we observe a much lower range of velocity. The velocity derived using feature tracking method based on normalized cross correlation method. The normalized correlation technique is used to evaluate the change in the speed of glaciers. This is a highly effective method for the image matching techniques. The image matching is a group of the techniques is of finding corresponding features or image patches in one or more images.

Keywords: India

Abstract Id: 1443
LOW COST AND PORTABLE SENSOR BASED DEVICES FOR SMART AGRICULTURE APPLICATION IN BANGLADESH

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Agriculture is mainstay in many countries. This agriculture is pressurized not only by overdose of insectize, pest, and medicine but by lack of need-based real time information. The precision farming and smart agriculture comes to solve those short coming. The main purpose of smart agriculture and precision farming is to provide right amount of inputs to the right place at the appropriate time that is not easy to adopt to farming communities. The research field was chosen by 15 poor farmers in Pajulia of Gazipur district in Bangladesh. The current information is very critical for agricultural development to adopt any technologies to the farmers. Real time information and decision-making process is key for increase the productivity and reduce the input cost. To overcome this problem the low cost modularized & portable sensor based devices and decision support system developed for targeting poor and pro-poor farmers in Bangladesh and alike countries. The sensor provides the real-time data to the central server and decision support system provide solution to farmers for their crop management in local language. To ensure the field sensors are also sending the coordinate to the server for getting appropriate location based information. The following five sensors accommodated in a single portable low cost device; Soil Irradiation; Soil Moisture; Air Temperature; Air Moisture and Leaf Wetness. It is found the GPS with the sensor is very necessary to get the appropriate field data and it is determined the device is sending correct coordinates. The comparison made with the developed low cost portable sensor within USD 100 and other sensors. It is found data received by the sensor is accurate. The farmers can afford the device. It is also possible to accommodate more sensor into this device with very minimum cost.

Keywords: ICT and Agriculture

Abstract Id: 1445
Total Suspended Matter (TSM) is one of the parameters to know the water quality in inland water systems. Remotely sensed data is widely used to assess water quality with different satellites data sets.

We tried to develop an algorithm based on near-infrared (NIR) band to estimate TSM in the Ganga river basin, specifically near Allahabad and Patna. The algorithm developed based on NIR band reflectance of IRS-Resourcesat-2 LISS 3 (Linear Imaging Self Scanning Sensor) data, after doing atmospheric corrections with software ENVI (Environment for Visualizing Images) 5.3 version, it is having FLAASH module (Fast Line-of-sight Atmospheric Analysis of Spectral Hypercubes), resulting in an atmospherically corrected inland waterbody remote sensing reflectance.

TSM increases the backscattering of light and its concentration depends on such as silt or clay, inorganic materials, organic matter such as algae, plankton and biodegradable material. This paper reports the pre and post monsoon variability in TSM over selected regions of Ganga River basin (Allahabad and Patna). Satellite Data (IRS-R2 LISS 3) was analysed from 2012 to 2016 for March/April (Pre monsoon) and October/November (post monsoon). It was observed that TSM concentration in pre and post monsoon seasons 50 - 370 mg/L and 90 - 350 mg/L at Allahabad, 70 - 360 and 90 - 370 mg/L at Patna respectively. TSM values near Patna were found relatively higher as compared to Allahabad site. Tributaries joining the main river Ganga have important role in changing the TSM values (such as Yamuna at Allahabad and Gandak and Ghaghar at Patna).

Keywords: IRS-Resourcesat-2 LISS 3, ENVI FLAASH, Ganga River and Tributaries.

Abstract Id: 1447
APPLICATION OF THERMAL IMAGING OF WHEAT CROP TO ESTIMATE THE CANOPY COVERAGE UNDER DIFFERENT MOISTURE STRESS CONDITION

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Thermal imaging cameras determine the temperature of the object by non-contact measurements and give temperature reading for each pixel of the image. This proximal remote sensing technique work with the same principle of spot pyrometers. Thus the thermal image directly gives the temperature of the crop canopy and provides a better distinctibility between the two classes i.e., leaf and soil using image classification techniques. In this study thermal imaging was used to determine the canopy coverage using image classification analysis. As a further application of this technology, an attempt was made to estimate the canopy coverage of the wheat crop grown under different moisture stress conditions. Thermal Images were analyzed with five different supervised image classification techniques namely Maximum likelihood, Mahalanobis, Minimum distance to mean, Parallelepiped and Support Vector Machine methods using ENVI - image analysis software. Results showed that the best estimation of canopy coverage was possible using Support Vector Machine method, due to its higher overall classification accuracy and Kappa coefficient. This is further supported by the statistical analysis based on the comparison with instrument (plant canopy analyser) observed LAI and digital image derived canopy coverage. In general Support Vector Machine method estimated the wheat crop canopy coverage from the thermal image meaningfully with high R2 value of 0.915 and with low values of RMSE and MBE. Thus the present study clearly showed that thermal image analysis could be applied as a non-destructive, rapid, proximal remote sensing technique to characterize the crop canopy temperature and estimate the canopy coverage of the wheat crop grown under moisture stress conditions.

Keywords: canopy coverage

Abstract Id: 1448
POTENTIAL APPLICATION OF NASA-ISRO SYNTHETIC APERTURE RADAR (NISAR) FOR SPATIO-TEMPORAL TRACKING OF ICEBERG CALVING EVENTS IN ANTARCTICA

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Antarctic researchers are faced with an unparalleled challenge in estimating mass loss of the Antarctic ice sheet caused by iceberg calving. Antarctica is surrounded by a variety of large, medium and small sized ice shelves, glacier tongues and coastal areas without offshore floating ice masses. It is possible to monitor surface structures on the continental ice and the ice shelves as well as calved icebergs using NISAR satellite images. The NISAR can be used as an all-weather and all-season system to classify the coastline of Antarctica to map patterns of surface structures close to the calving front. Additionally, classifying patterns (parallel to coastline or perpendicular to coastline) and density (e.g. dense, less dense) of surface structures distributed over the ice shelves and ice tongues can be a challenging research where NISAR can be of a great advantage. Based on the surface structures relative to the calving front within a 30 km-wide seaward strip, the ice shelf fronts can be separated into three classes, (i) parallel, (ii) orthogonal, and (iii) a combination of parallel and orthogonal. The resulting map of the classified calving fronts around Antarctica and their description would provide a detailed representation of crevasse formation and the observed dominant iceberg shapes. In brief, NISAR would be of potential use to map surface structures visible on ice shelves (e.g., crevasses, pressure ridges, ogives) and to provide advisories to field teams.

Keywords: NISAR, iceberg calving

Abstract Id: 1450
LAND COVER AND WATER TYPE CLASSIFICATION USING IMAGES CAPTURED BY THE PHILIPPINES’ FIRST EARTH-OBSERVING MICROSATELLITE DIWATA-1

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Diwata-1 is the Philippines’ first earth-observing microsatellite which captures multispectral and high-resolution images intended for a wide spectrum of applications including agriculture, forestry, urban, and coastal studies. In this study, land cover and water type classification was performed using Diwata-1 images captured across the country. Supervised classification using maximum likelihood method was utilized to categorize different land cover and water types. The accuracy of the generated land and water classification maps were evaluated using error matrices based on ground truthing and high-resolution images from Google Earth. Based on the results, shallow water pixels were successfully delineated from the deep waters. Vegetated areas were differentiated from non-vegetated ones; however, several bare and built-up pixels were misclassified mainly due to resemblances in spectral information. Nonetheless, overall results indicated good accuracy for the classified images. These preliminary results may pave the way for a more detailed classification such as identification of different vegetation types. Furthermore, land cover and water type classification maps can aid decision makers in assessment, planning and management of the Philippines’ environmental resources.

Keywords: classification, microsatellite, optical

Abstract Id: 1452
EVALUATION OF ERROR IN SATELLITE-DERIVED PRECIPITATION ESTIMATES OVER THE HIMALAYAN REGION: A CASE STUDY FOR AN EXTREME EVENT IN 2013

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Conventional tools such as rain-gauge stations and meteorological radars were used to monitor extreme rainfall events in many parts of India. But applications of these measurements to perform hydrological analysis were limited over Indian Himalayas regions because of inaccessibility of areas and lack of homogenous networks of rain-gauge stations. Satellite-based Precipitation Estimates are the alternative options for assessing any hydro-meteorological hazards over Himalayas. In this study, we evaluated three satellite based rainfall products (i.e., TMPA-3B42, Global Satellite Mapping of Precipitation (GSMaP), and NOAA CPC Morphing Technique (CMORPH)) against the rain gauge-based India Meteorological Department (IMD) gridded dataset. The errors in precipitation were assessed especially for an extreme rainfall episode that was witnessed during June 2013 in the Western Himalayas. This event was widely known as Kerdarnath disaster, which has caused widespread flash floods, landslides, and debris flow.

The findings from this comprehensive study suggested that the magnitude of precipitation as well as peak rainfall intensity were underestimated in TMPA-3B42 and CMORPH. However, GSMaP showed dual trends with under-and over-estimations against gauge-based IMD data. Based on the statistical approach on the determination of error statistic metrics, namely, MAE (mean absolute error), NRMSE (normalized root mean square error), PBIAS (percent bias), and NSE (Nash-Sutcliffe efficiency) of respective satellite products, it was confirmed that TMPA-3B42 estimates were more relevant and accurate compared to other two satellite products for this extreme rainfall event. The TMPA-3B42-based precipitation was negatively biased by 18%, while GSMaP was positively biased by 14%. The NSE for TMPA-3B42 were lower (-0.93) compared to other products. Thereby, this study concludes that TMPA-3B42 precipitation can be useful for any hydrological study for extreme rainfall episode in the region, where rain-gauges are sparse or rain-gauge networks are unevenly distributed.

Abstract

Keywords: TMPA-3B42, Extreme rainfall event, Kerdarnath disaster, percent bias, Nash-Sutcliffe efficiency

Abstract Id: 1453
ASSESSMENT OF SURFACE RUNOFF FOR BEDATI CATCHMENT OF WESTERN GHATS USING REMOTE SENSING AND GIS TECHNIQUE

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Assessment of surface runoff for Bedati catchment of Western Ghats using Remote Sensing and GIS technique. The Arc hydro tools are used to create watershed by using Carto-DEM of 30m resolution. The analysis includes fill sink, flow direction, flow accumulation, stream definition, stream segmentation, catchment grid delineation, catchment polygon processing, drainage line processing and drainage point process has been used to create the watershed. The different methodologies have been followed in the study includes DEM analysis, Rainfall analysis, Runoff analysis, Linking of watersheds and Rain water conservation measures. Rainfall analysis for the Bedati catchment area of 721 sq.km receives the annual average rainfall of 831mm for 1960-2014 (54 years). The South West monsoon contributes 66%, the Pre Monsoon contributes about 16% and whereas, North East monsoon contributes 18% for 1960 to 2014. Runoff has been calculated by NRCS-CN method using inputs like LU/LC, soil type, slope and rainfall data. The probability of event of yearly or seasonal runoff from 1971 to 2014 (43 years) has been generated. The probability graph shows that an 2% probability gives a runoff of 17 TMC of water, 30% probability gives an runoff of 11 TMC of water, 60% probability gives a runoff of 9 TMC of water, 90% probability gives a runoff of 6 TMC of water and 96% probability gives a runoff of 4 TMC of water generated in Bedati catchment. The 50% probability yields 10 TMC of runoff water will be generated in study area. The 20% of 10 TMC (2TMC) water proposed to divert from Bedati catchment to Benni Halla, where Benni halla watershed falls in water deficit. The linking process can be achieved by lifting water from Bedati Reduced level (RL) 450m to Benni halla RL 560m, which is having a distance of about 14 km and the lifting height is about 110m.

Keywords: NRCS - CN, Rainfall, Runoff, Conservation of Soil and Water

Abstract Id: 1454
GEOSPATIAL APPLICATIONS IN THE ANTARCTIC CRYOSPHERE

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The cryosphere, which comprise of snow, river and lake ice, sea ice, glaciers, ice shelves and ice sheets, and frozen ground, plays a major role in the Earth’s climate system. It has a fundamental control on the physical, biological and social environment over a large part of the Earth’s surface through its impact on the surface energy budget, water cycle, primary productivity, surface gas exchange and sea level. Since all of its components are sensitive to temperature change over a wide range of time scales, the cryosphere is a natural integrator of climate variability and provides visible signatures of climate change. Employing a wide range of remote sensing applications, our research is focused on synthesis of digital elevation models (DEMs) for the cryospheric regime, normalized difference spectral index ratios for surface characterization, southern ocean hydrodynamics highlighting the role of melt water on thermohaline structure in the Indian ocean sector, and two-way feedback of Antarctic sea-ice trends on climate. Extended research deals with mapping of shallow Antarctic lake bathymetry, extracting and mapping blue-ice areas, monitoring of calving ice-berg events in Antarctic, customization of spectral indices for Antarctic land-cover mapping applications, applications of DEM to cryospheric land cover classification, mapping of Antarctic vegetation geospatially using high spatial resolution multispectral data, and mapping of supra-glacial debris in the Antarctic environment. This work highlights India’s contributions to the cryospheric environment using space sensors and ground truth data.

Keywords: Geospatial applications, cryosphere

Abstract Id: 1455
DEVELOPMENT OF CROP SPECTRA FOR VARIATIONS IN NITROGEN AND WATER APPLIED IN UNREGULATED FARMER’S FIELD PLOTS BASED ON SPECTRAL SIMILARITY WITH SPECTRA COLLECTED FROM REGULATED TEST FIELD PLOTS

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To develop crop spectra for variation in application of nitrogen (as fertilizer) and water at farmer’s field plots is very difficult as there are large variations in nitrogen and water applied also time of applications were different. During field visit it was found that various crops growth was not uniform in the study area even though local conditions (seed quality, soil and weather) were same this is possible due to variation in application of nitrogen and water. Development of crop spectra for nitrogen and water variations for unregulated farmer’s field plots based on spectral similarity analysis with regulated test field plots (where required amount of nitrogen and water applied at appropriate time) provides a fresh opportunity to develop and evaluate the crop spectra for nitrogen and water variations for real time applications. Spectral Information Divergence (SID) based spectral similarity analysis was carried out among spectra collected from unregulated farmer’s field plots and regulated test field plots for chickpea, sorghum and wheat crops. An average SID values equivalent to coefficient of correlation computed for four groups of nitrogen and water variations for chickpea, sorghum and wheat were 0.998, 0.996 and 0.994 respectively.

Keywords: regulated field plots, spectral similarity and spectral information divergence

Abstract Id: 1456
A COMPARISON OF TWO LAND COVER SCENARIOS AND ITS EFFECT ON THE RUN-OFF PROCESSES INSIDE THE MANDULOG RIVER BASIN

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This study seek to determine what happens to runoff volume, peak flow and the lag time between peak rainfall and peak river discharge or peak flow when no proper land use management is done and what happens to it in time. This is represented by the Projected Land Cover. Another is what happens to the runoff processes when sound land use management is adopted. The first land cover scenario was created using a Trend Analysis function from MS Excel derived from the 1973, 1989, 1998, 2008 and 2010 land cover images. The second scenario is the Desired Land Use wherein it makes use of slope as the basis in assigning the different land uses. The SCS CN (Soil Conservation Service - Curve Number) values were determined for the two land cover scenarios. Limitedly available LiDAR DEM (Light Detection and Radar - Digital Elevation Model) strips was integrated into the IFSAR DEM (Interferometric Synthetic Aperture- Digital Elevation Model) to generate a detailed basin model and slope in GIS. The HEC-HMS (Hydrologic Engineering Center- Hydrologic Modeling System) was used for simulating runoff models. The Projected Land Cover has a higher total runoff volume, peak flow and shorter Lag time as compared to the Desired Land Use in the four (4) Rainfall Return Period scenarios. The latter has twice as much forest vegetation than the projected land cover scenario, it has better forest cover quality and plus the presence of agroforestry land use. Such condition helps improve soil infiltration and thus reduces runoff volume and peak time. The study shows when land cover conditions are left by itself in time without any intervention, runoff which is the input for flooding is more likely to be magnified. The study also shows that runoff can be reduced if the Desired Land Use will be adopted.

Keywords: runoff, peak flow, peak rainfall, lag time, land cover

Abstract Id: 1457
Rapidly growing urbanization is one of the major issues of developing countries. It may sometimes lead to an unhealthy and unplanned urban growth. The metropolitan cities of India are growing rapidly in all aspects. Similarly, the capital of West Bengal, Kolkata is listed among the fastest growing metropolitan city. The identification of urban change and its periodic monitoring using satellite data and GIS technique is a very scientific method. In the current study an attempt has been made to analyse major urban growth and its effect on environment that has taken place in Kolkata and its surrounding periphery from 1987 to 2017 using geo-spatial technique. Landsat TM, Landsat 8 and Sentinel-2 along with Census data has been analysed in ArcGIS 10.0 and Erdas Imagine software. The result shows that a high rate of changes in terms of its vegetation cover, built-up area and accessible roads. These changes are creating serious environmental issues in the urban environment. The result obtained suggests a need of implication of effective land use planning and monitoring of the environmental issues for their sustainable use.

Keywords: Satellite image, urban sprawl, Change Analysis, ArcGIS, Erdas, Kolkata

Abstract Id: 1458
Atmospheric aerosol plays an important role in global and regional climate. Aerosols affect our weather and climate because they change the amount of sunlight reaching earth’s surface. Aerosol Optical Depth (AOD) is a measurement of transparency (or lack of it) of the atmosphere due to aerosol. Larger the AOD at given wavelength, less the light of that wavelength reaches earth’s surface. Spectral variation of AOD is important for estimating the concentration, size distribution and other aerosol properties in the atmosphere. AOD is measured at five optical channels by Microtops II sun photometer at Physical Research Laboratory, Ahmedabad from 30 January to 21 March 2017. The angstrom exponent ‘α’ is calculated from AOD measurements. The variation of AOD and α is analyzed on daily basis. Records with ‘α’ less than 0.5 are removed from further processing as this could be due to cloud in field of view of sun-photometer. For remaining data, It is observed that the minimum and maximum of daily average values of α are 0.535 and 1.314 in 17 March 2017 and 15 Feb.2017. Likewise, the value of AOD at 500 nm is 0.183 on 9 Feb. 2017 and 0.902 on 13 Feb. 2017. The value of α shows that the different types of aerosols are present over Ahmedabad in beginning of the measurement period and in the ending of measurement period.

Keywords: AOD, Aerosol, Photometer, Remote Sensing, Microtopes

Abstract Id: 1459
MAPPING SPATIAL PATTERN OF SATURATED AREAS IN TALOMO WATERSHED BY TOPOGRAPHIC WETNESS INDEX

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Geographic Information System (GIS) and Remote Sensing (RS) can assist not only in observing the apparent layer of the earth and its geomorphology but also in understating natural occurrences like variability in soils, hydrological processes, and stream water quality which are helpful in precision agriculture and agriculture itself. In this sense, this work aimed to map spatial pattern of saturated areas by getting its digital terrain attributes such as slope gradient, flow direction, and flow accumulation using the 10-meter spatial resolution Synthetic Aperture Radar-Digital Elevation Model (SAR-DEM). Subsequently, to calculate the Topographic Wetness Index (TWI) of the target area using the upstream contributing area in km² and the slope raster of the watershed. This study was developed in Talomo watershed where vegetation and urbanization come across, located in Davao City the southeast region of the Philippines. The processes in this study were administered using the ArcMap 10.2.2 software with Hydrologic Engineering Center-Geographic Hydrologic Modeling System (HEC-GeoHMS) extension. The result which is the calculated TWI for Talomo watershed, have characterized the spatial distribution of wetness condition in its catchments. These characterizations can then be used to map wetlands inside the watershed which can be used for agricultural planning and all agricultural practices that involve moisture.

Keywords: Synthetic Aperture Radar, Topographic Wetness Index, Wetness Condition, Spatial Pattern, Slope

Abstract Id: 1460
MAPPING OF SOIL ORGANIC CARBON UNDER DIFFERENT AGRO-ECOSYSTEMS USING AVIRIS-NG AIRBORNE IMAGING SPECTROMETER


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Present study was carried out to explore use of AVIRIS-NG (Airborne Visible Infra Red Imaging Spectrometer - Next Generation) for mapping soil organic carbon on a regional scale. Synchronized soil sampling and spectral data collection was done at 7 sites in India during field campaign of AVIRIS NG through collaborative experiment of ISRO and NASA during December 2015 to February 2016. Soil samples collected were processed for collection of reflectance spectra in laboratory condition using spectroradiometer (Fieldspec3, ASD, USA) along with contact probe followed by estimation Total Organic Carbon (TOC) using TOC analyzer through dry combustion method. AVIRIS NG L2 surface reflectance image was used to retrieve soil spectra using geolocations of soil sampling points. Soil mask has been created applying the Spectral Information Divergence (SID) classifier. Predictive models were developed using Partial Least-Squares Regression (PLSR) and Step-wise Multiple Linear regression (SMLR) between extracted soil oragic carbon and AVIRIS-NG L2 surface reflectances in the sensitive band regions. A Jack-Knifing method was adopted to develop predictive models from 2/3rd data pairs followed by validation from 1/3rd data pairs. The result revealed that the estimation accuracy of PLSR (R2 = 0.89, RMSE = 0.22) was little better than SMLR (R2 = 0.83, RMSE = 0.24). Location specific model developed were used further for generating soil organic carbon map using AVIRIS-NG L2 reflectance image.

Keywords: AVIRIS-NG, Spectral Information Divergence, Partial Least-Squares Regression, Multiple Linear regression, Soil Organic Carbon

Abstract Id: 1461
WEB-BASED APPROACH FOR RAINFALL DATA DISTRIBUTION AND VISUALIZATION USING OPEN SOURCE TECHNOLOGIES

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The weather data, moreover rainfall data has got its importance in country like Nepal. Nepal is an agriculture dependent country and every year there is huge amount of devastating flood destroying lots of human lives and economy. It’s because we do not have proper weather forecasting and analysis science and technology so we could predict reasonably what will happen in future and methods for prevention could be adopted. By updating and storing the rainfall data one can discover trend of rainfall in particular place. Consequently, amount of rainfall and suitable cultivation can be predicted ensuing better production. This research focus on the visualization of rainfall data website. open source technology is used to make a prototype system for displaying rainfall data in website. Apache server for http contents, Geo server for serving spatial data, postgresql with postgis extension for attributes and spatial data storage, Openlayers JavaScript library for visualizing spatial data on client side and php for server side scripting and database queries were implemented. Anyone having internet access can easily access this rainfall data. One can easily observe the data history regarding rainfall of available stations. The admin panel has the privilege of updating the daily rainfall data of every rain gauge station through our system interface. The updated data is recorded to rainfall database and displayed then in web in data history. The current rainfall status is visualized in the map. The future research could be extension of other parameter of weather display in website

Keywords: Open Source, Open source Standards, Geo server, Open Layers, JavaScript

Abstract Id: 1462
TOPOGRAPHIC MAPPING USING GIS AND LIDAR DATA FOR IRRIGATION PURPOSES

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Designing an Irrigation system requires the need for careful topographic mapping. Light Detection and Ranging (LiDAR) data provide a means for obtaining high-resolution topographic terrain maps. This study aimed at deriving a topographic map of a watershed in Davao city where a large scale irrigation system is situated. The 1-meter resolution LiDAR data from Phi-LiDAR Project will be utilized for the creation of the topographic maps using the ArcGIS software. Knowing in great detail the topography of the area has signified that water does not flow uphill or even on the same level. In contrast, water flows rapidly down a steep slope to produce erosion or soil washing. This study does not only provide a higher resolution topographic maps which update the existing available maps but also can be used in planning for the construction of new irrigation system facilities.

Keywords: GIS, LiDAR, Map, Irrigation System, Philippines

Abstract Id: 1463
RESPONSE OF SATELLITE-DERIVED AGRICULTURAL DROUGHT INDEX ON THE DIFFERENT METEOROLOGICAL PARAMETERS

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Drought is one of the extreme events concerning the agricultural sector in the Philippines. It is generally characterized by the relatively low rainfall amount over a period of time that affects not only the agricultural sector but also the economic sector. In this study, different meteorological parameters, such as evapotranspiration, potential evapotranspiration, land surface temperature, and rainfall, were linked to the satellite-derived agricultural drought index in the Philippines. Agricultural drought were assessed using the Standardized Vegetation-Temperature Ratio, an index based on satellite derived land surface temperature and vegetation. Logistic regression was applied to identify the individual influence of the different meteorological parameters in the occurrence of agricultural drought.

Results show positive correlations between evapotranspiration and rainfall to the agricultural drought, while negative correlations were found on land surface temperature and potential evapotranspiration. The effect of rainfall on the agricultural drought increases with time, until 3-months, which signifies lag effect of rainfall on development of agricultural drought. Over-all, evapotranspiration was found to have the greatest influence on the current status of agricultural drought. As the lag increases, the effect of rainfall on the occurrence of drought was increasing. Also, higher correspondence was found during the dry season than during wet season. The effect of rainfall deficiency on the occurrence of agricultural drought increases with time during the dry season. In general, higher agreement between meteorological parameters and agricultural drought was found during the dry season in the Philippines, and previous rainfall deficiency, as well as high evaporation, highly contributes to the development of agricultural drought. Results of this study may be used as a guide for concerned sector in planning and mitigating the effects of drought.

Keywords: agricultural drought, meteorological drought

Abstract Id: 1464
A Multi-wavelength laser radar has been designed and developed in-house and made operational at the location Cheeryal Village (17.51° N, 78.62° E), which is at a distance of about 20 Km in the suburbs of Hyderabad, India. The Nd:YAG laser (M/S Bright Solutions, Italy) based multi-wavelength lidar operates at 532 nm and 1064 nm with a pulse energy of 50uJ at both the wavelengths. The two wavelengths are generated coaxially with a pulse width of 10ns and the laser operates up to a PRF of 4 KHz. The receiver system consists of a 360 mm Newtonian optical telescope, 10 nm of interference filters and the Licel Gmbh, Germany make 250 MHz Photon Counting recorder. Noise and signal to noise ratios are investigated during optimization of this system. In this paper we present the different sources of noise and their probability density functions and noise estimations. Lidar signal pre and post processing methods for improving the signal to noise ratio are investigated.

Keywords: lidar, lidar signal processing, noise, signal to noise ratio, averaging

Abstract Id: 1465
TWO-DIMENSIONAL HYDRODYNAMIC MODELLING OF THE SOUTHWEST MONSOON TO DETERMINE THE INFLUENCE OF TWENTY YEAR DIFFERENCE IN LAND USE ON FLOOD INUNDATION AT VALENZUELA-OBANDO-BULACAN

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Flooding due to rapid urbanization has been worsening over the years especially due to torrential rains caused by the Southwest Monsoon. The intensity of urban flooding in Metro Manila is greatly concentrated in Valenzuela-Obando-Meycauayan Area. Various flood mitigation measures used in the country currently such as flood walls, dikes and pumps are mainly structural in nature. Structural means of flood control can be effective in mitigating floods with proper design. However, the implementation of such projects would require massive amounts of capital. Instead of diverting the flood waters away from the people, an approach where keeping the people away from the flood waters can also be approached. This can be primarily done by taking in consideration the behavior of flood inundation in the development of the Comprehensive Land Use Plan in human settlements. The study aims to determine the influence of twenty-year difference in land use on flood inundation for years 2000 and 2020 in the VOM area. The study also aims to simulate two-dimensional hydrodynamic models for years 2000 and 2020 using FLO-2D software. Year 2000 land use and Year 2020 land use will be used to denote land use change. The study also aims to generate a flood hazard map and flow depth map for years 2000 and 2020. And finally, the study also aims to identify the locations of depression storages in the project area. By relating the change in flood inundation in respect to land cover change and considering this parameter in the development of future land use plans, people and important infrastructures can be transferred away from flood vulnerable areas.

Keywords: Urban Hydrology, GIS, Hydrodynamic Modelling, Land Use Change, Southwest Monsoon

Abstract Id: 1466
VALIDATION OF INSAT-3D AND INSAT-3DR SATELLITE DERIVED PRODUCTS FOR HEAVY AND VERY HEAVY RAINFALL EVENTS OVER GUJARAT STATE OF WESTERN PENINSULAR INDIA

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Rainfall during Southwest monsoon season over Indian continent is extremely important since it received more than 90% of annual rainfall during monsoon season. It is important for agriculture and in turn Indian economy as a whole. Whenever heavy rainfall occurs, it proves disastrous. Prediction of heavy and very heavy rainfall is prime time necessity for developing country like India. In the present study, INSAT-3D and INSAT-3DR satellite derived rainfall products are validated by comparing ground based heavy and extreme heavy rainfall data collected by meteorological observatories of India Meteorological Department (IMD) for Gujarat region of western peninsular India. The validation exercise was carried out for last 5 years for IMD stations and other ground measurements for Gujarat state of western peninsular India. The relationship between satellite derived products and ground based data were studied using statistical methods like correlation and regression analysis and visual inspection of basic data. On the basis of analysis of heavy and very heavy rainfall indices for both satellite INSAT-3D and INSAT-3DR datasets, they are found to be in good agreement with measured rain observations. On the validation of INSAT-3D and INSAT-3DR satellite products, applying proper approximations, the product can be used for predictions where no ground based rainguages are available. It can also be concluded that rainfall products for both the satellites, INSAT-3D and INSAT-3DR provide good rainfall estimation for heavy and very heavy rainfall events over a large spatial scale with reasonable spatial resolution and they can be used operationally for rainfall estimation.

Keywords: INSAT-3D, INSAT-3DR, Extreme heavy rainfall, South west monsoon, rain gauge, Gujarat region.

Abstract Id: 1467
REMOTE SENSING AND PGIS BASED APPROACH FOR THE LAND USE LAND COVER OF BEGNAS LAKE WATERSHED AREA

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Land use/ Land cover is significant map which address the human activities and the environment that helps to understand deviations to save maintainable environment. Remote sensing and geographic information systems (GIS) are important for the monitoring, modelling and mapping of land use and land cover changes across a range of spatial and temporal scales, in extent. Remote Sensing imagery of several times were acquired from the United States Geological Survey order to assess the (USGS) Earth Explorer and quantified the land use /land cover change in region of study. Supervised classification methodology with minimum likelihood technique was implemented in the Erdas Imagine. The study revealed that land use transformations posed a serious threat to the wet lands. The stakeholder sketched the map using the Participatory Geographic Information System (PGIS), which was used to verify with the result. The study identified that the major issue are soil erosion and agriculture practices that has been increased in the recent years with the increase in the population hence, proper prevention measures should be implemented for the protection of Begnas and Rupa Waterbodies.

Keywords: Participatory GIS, Erosion, Remote sensing, Land use land cover

Abstract Id: 1471
AUTOMATIC GEOREFERENCING FRAMEWORK FOR TIMESERIES FORMOSAT-2 SATELLITE IMAGERY USING OPEN SOURCE SOFTWARE

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Georeferencing is a way to assign mapping coordinate system and to produce a geo-rectified image for satellite image. It is an important preprocessing for multi-temporal images analysis as well as multi-source data fusion. Due to the development of geospatial big data analysis, the growing satellite image archive requires automatic and precise georeferencing framework to handle time-series satellite images. The aim of this study is to develop an automatic georeferencing framework using geospatial open data and open source software for Formosat-2 satellite image archive. The geospatial open data for correction of terrain relief are 30m Shuttle Radar Topography Mission (SRTM) elevation data and EGM96 Geoid data. The georeferencing framework utilizes an orthoimage as a reference image. In order to perform automatic georeferencing, a predefined orthoimage is selected as a reference image to find corresponding points between orthoimage and raw satellite image. The geospatial open source software in used includes VLFeat (http://www.vlfeat.org/) and Orfeo Toolbox (https://www.orfeo-toolbox.org/). This study uses VLFeat Library to construct an image pyramid-matching scheme in automatic coarse-registration between reference-orthoimage and raw image. Then, several tools from Orfeo Toolbox are composed to build up an iterative refinement scheme in automatic fine-registration. The sensor model of Formosat-2 is used is rational function model (RFM) using sensor-oriented rational polynomial coefficients (RPCs). Therefore, this study applies orthorectification rather than 2D registration in this georeferencing framework. The experiment utilized a set Formosat-2 1A satellite images with different cloud coverages (e.g. 0% to 40%) in the proposed scheme. The proposed georeferencing framework automatically rectified satellite images and improved the geolocation accuracy from hundred meters level to 5 meters accuracy.

Keywords: Georeferencing, Formosat-2, Satellite Image, Orfeo Toolbox, VLFeat

Abstract Id: 1472
The leaf area index (LAI) is a key vegetation parameter, which is widely used in crop monitoring, yield predictions and ecosystem productivity models at different scales. Present study aimed to retrieve LAI from AVIRIS NG L2 surface reflectance data of different crops. Synchronized spectral observation and LAI measurement were done using field portable spectroradiometer (Fieldspec3, ASD, USA) and plant canopy analyzer (LICOR, USA) during airborne AVIRIS-NG field campaign through collaborative experiment of ISRO and NASA during December 2016. L1 product of AVIRIS-NG was atmospherically corrected through Fast Line-of-sight Atmospheric Analysis of Hypercubes (FLAASH) using MODTRAN4 algorithm and surface reflectance was retrieved and filtered using Savitzky-Golay filter and validated with ground spectroradiometric measurements and also evaluated with JPL L2 reflectance product. Classification of different cropping area was done using spectral angle mapper classification technique. Radiative transfer model PROSAIL was used for retrieval of LAI through its inversion. LAI product was evaluated with regression based 10-term LAI prediction model. Evaluation of retrieval was done on the basis of coefficient of determination (R2), root mean squared error (RMSE), normalized root mean squared error (nRMSE) and ratio of prediction to deviation (RPD).

Keywords: AVIRIS NG, LAI, PROSAIL, Spectral reflectance
Remote sensing using Synthetic Aperture Radar (SAR) is one of the most commonly used methods for detecting and characterising oil spills in seas and oceans. However, distinguishing true oil spills from false look-alikes like biogenic oil is a major challenge. The aim of this study is to use polarimetric decompositions like H/A/alpha decomposition and other contextual features to probabilistically separate oil spill areas from look-alikes using markov random field (MRF) classification method. The classification algorithm is applied to a qual-polarised dataset Uninhabited Ariel Vehicle Synthetic Aperture Radar (UAVSAR) of an experimental oil spill in Norway. The dataset contains a strip of plant oil and four strips of different types of oil emulsions with varying concentration of oil. This dataset is multilooked and speckle filtered. Polarimetric features are extracted using H/A/alpha decomposition and contextual features are extracted using grey level co-occurrence matrix GLCM method. An MRF classifier is trained and its parameters are tuned using a small subset of an image. The classification results are compared before and after applying incidence angle effect correction. Using the MRF classifier on features results is a reasonable classification of different type of oil spills. The confusion between classes increases as the level of dilution in the oil-water emulsion increases. The classification accuracy improves significantly after the effect of incidence angle is corrected. Soft-classification probabilistic surface plots of oil spill area help in better characterization of oil spills. The procedure works well on classifying oil spills from water. It also helps to better characterisation of different type of oil spills. Incidence able effect also contributes to the misclassifications in the area. This can be rectified applying incidence angle correction.

Keywords: Oil-spills, SAR Polarimetry, Markov Random Field

Abstract Id: 1474
A FRAMEWORK OF WEB PROCESSING SERVICES (WPS) FOR SPATIAL DATA PROCESSING

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The online geoportal and web services based systems are becoming popular among users of geo-spatial technology for solving various real world spatial problems. It is also seen that services utilizing satellite data play instrumental roles in daily lives as well as in the fields of environment and science. Sometimes it is also observed that for performing the simplest of tasks one has to search for the datasets then for the required softwares and further learn the softwares in order to perform those tasks. The motivation of this study is to create an all in one web portal to provide all these in the form of web services in such a way that the accessibility of the geo-web services to the general public as well as to the researchers can be easier and the focus is only on the tasks to be performed. This involves creating a web service implementing the Open Geospatial Consortium (OGC) - web processing service (WPS) 1.0.0 and 2.0 standards which provides services as well as the data source to the user such that all the processing is performed at the server end with user input being name of the data layers on which the current service has to be utilized. The services will be available in the form of API so that anyone can integrate them into their respective web usages. The framework was designed and built using only the open source frameworks and softwares and the services were designed in such a way that user has complete control over the functioning of the web services. The services can also be called from other WPS clients such as QGIS using WPS pugin. The frameworks used in the project include Geoserver, ZOO project, OpenLayers and the entire programming of services will be on C and Python

Keywords: Service Orientated Architecture, geospatial data processing, OGC-WPS, ZOO Project, Geoserver

Abstract Id: 1475
GENERATION OF INTEGRATED FIRE BURNT AREA INDEX USING MULTIPLE BURNT INDICES IN GEOSPATIAL ENVIRONMENT

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Forest fires are acknowledged as one of the major drivers that influence global ecosystem patterns and processes. Remotely sensed data of fire footprint in the visible, near infrared, middle infrared and thermal infrared regions of the electromagnetic spectrum can be potentially used to infer information on the a) location (active fires during satellite overpass), b) extent (area burnt) and c) intensity (radiated fire power). Of the three, burnt area is considered as the primary ‘fire disturbance essential climatic variable’ (ECV). Burnt area products derived from satellite data provide important information that can be utilized in the studies for the fire science and its applications.

Indian forests experience forest fires during dry season every year, with a peak in March-April months. A novel approach for mapping forest burnt area using integrated approach via available burnt indices has been presented in this paper. Four regional forest fire hotspots in India, which have variable yet significant spatio-temporal fire patterns, have been taken into consideration for the study viz., Western Ghats, Eastern Ghats, Central Plains and Western Himalayas. The various indices considered include Normalized Difference Vegetation Index (NDVI), Normalized Burn Ratio (NBR), Burnt Area Index Modified (BAIM) and Middle Infrared Burnt Index (MIRBI) using Landsat-8 satellite dataset. The synthesizing of this new index using multivariate statistical techniques is a feasible option to use the strength of each index and generate one index to get burnt area. Principal Component Analysis (PCA) has been used for the generation of this integrated burnt index. The derived burnt area from new integrated burnt index was verified for omission/commission errors and accuracy.

Keywords: Burnt Index, PCA, Remote Sensing, Forest fires

Abstract Id: 1476
THE ESSENCE OF TRADITIONAL TEACHING METHODOLOGY OVER WEB BASED LEARNING (EX. FLIPPED CLASSROOM TEACHING METHOD)

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The traditional teaching method involves a teacher centered approach where a teacher explains the concepts and gives home work to revise. In today's web based world, the methodology is becoming cliched against the flipped classroom approach based on video lectures, podcasts, and personalized home-based e learning with discussion and practical applications in the classroom. Both methods need a teacher but there is a significant difference between the outcomes of learning for students. In India where there are 100 students in a classroom, an authoritative approach helps in reaching the mass. It supports the learning of the students where the learners are on same platform and taught from basics and all equally. One cannot ignore the benefits of flipped classroom which has an essence of covering more content and in more versatile way. However, in this exercise the few learners can be benefited and few can lose on their learning due to no preparation of content at home. In India, the learner does not get a choice based grading education system always. He needs constant guidance, assistance and sometimes forceful dissemination of knowledge. According to Blooms technology first 2 levels are remember and understand. Though they are being taken as the lowest levels of the triangle, they are the main base of learner’s foundation system. Hence using application based learning from flip classroom and an authoritative approach for firming the fundamentals with mass would make learning extremely interesting and fruitful. For this paper the class of 50 was divided equally for traditional method and flipped classroom method. Both the learning were compared. This paper tries to emphasize on the traditional ways along with modern techniques which leads to progressive teaching learning process.

Keywords: traditional, flipped classroom, Blooms taxonomy

Abstract Id: 1477
Imaging spectrometer has vast potential for estimation of different biophysical and biochemical parameters of field crops and thereby plant growth conditions in a spatio-temporal scale for precision farming. Present study was carried out to find most suitable hyperspectral bands, and indices for quantitative estimation leaf N content of wheat crop in a spatial scale. Wheat crop was grown in research farm with eight varying levels of nitrogen and three irrigation levels in three replications. Hyperspectral image was captured using nano-hyperspec camera (Headwall photonics, USA) in VNIR range (396-1003nm). Spectral reflectance measurement using spectroradiometer (Fieldspec3, ASD, USA) in spectral range of 350 to 2500nm were recorded and plant samples were collected for laboratory analysis for nitrogen synchronized with image acquisition time. Image acquired was preprocessed to covert to surface reflectance image. Multivariate models like partial least square regression (PLSR) and multiple linear regression (MLR) were used for estimation plant leaf nitrogen. Significant bands (408, 425, 560, 564, 712 and 737nm) found from PLSR analysis were used for developing MLR model. PLSR model found to have better predictability (R^2 = 0.74 and RMSE 0.13) compared to MLR (R^2 = 0.68 and RMSE 0.14). Evaluation of different hyperspectral vegetation indices were done and few of them were identified based on correlation analysis. Different mathematical transformations (difference, addition, ratio) of these indices were done to find best one for N estimation. Best indices found were Normalized Difference Red Edge Index (NDREI), Ratio Half Index (RHI) and Vogelman Index-a (VI-a) and Additive operations of two indices, Vog a+ NDREI yield better result having highest R^2 =0.58. Plant nitrogen map of wheat field generated from both MLR and best suitable index were evaluated and further used for recommendation nitrogen requirement.
Global warming is inducing the treeline ecotones to migrate to higher elevations in the Himalaya. Satellite remote sensing of alpine treeline ecotone in Eastern Himalaya reveals an upward shift in c. four decades. The past alpine treeline ecotone has phenological changes and greening trends. In this study, satellite-derived NDVI data from Landsat-2 (MSS), Resourcesat-2 (LISS-III) and NOAA-AVHRR is used to investigate the long-term dynamics at the treeline ecotone. It is observed that the treeline has shifted c. 452 ± 74 m upward in 38 years. The vertical rate of treeline shift is found to be c. 119 ± 19 m per decade. Phenology has changed significantly from the year 1982 to 2015 (34 years). The time series data of GIMMS-NDVI from NOAA-AVHRR confirms the increase in the length of the season and greening trend at the treeline. The average start of the growing season (SOS), the length of growing season (LOS) and the end of growing season (EOS) have advanced in the past treeline ecotone of 1976. We used mean monthly surface air temperature and precipitation to correlate with the phenological and greening trend. The alpine treeline ecotone upward shift, phenological changes, and greening is expected in such warming scenarios. This study confirms that there is a significant upward shift of alpine treeline ecotone in eastern Himalaya with lengthening of growing season and greening over alpine treeline ecotone.

Keywords: Himalaya, Alpine treeline ecotone, NDVI, Elevation, Phenology

Abstract Id: 1479
DISCRIMINATION AND CLASSIFICATION OF HORTICULTURAL CROPS USING AVIRIS-NG IMAGING SPECTROMETER


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Accurate mapping of horticultural crops using multispectral remote sensing has been a challenge due to poor discrimination using less number of discrete bands and mixed pixel effect. Present study has been undertaken to explore potential of hyperspectral remote sensing data to discriminate and map eight horticultural crops in Sabour Bhagalpur region of Bihar, India using both ground based spectroradiometer (FieldSpec3 for ASD, USA) and air borne AVIRIS-NG instrument through collaborative experiment of ISRO and NASA during February 2016. The four tier hierarchical statistical techniques has been proposed for discrimination of fruit crops which includes one-way analysis of variance (ANOVA), Classification and regression tree analysis (CART), Jaffries-Matusita (JM) Distance and Linear Discrimination Analysis (LDA). The pre-processed ground reference spectral data collected using both ASD and from AVIRIS-NG image were statistically analyzed using ANOVA to find significant wavebands for discrimination. CART technique was applied on significant wavebands to select most sensitive wavebands. Spectral separability between each pair of fruit crops was computed using Jeffries-Matusita (JM) distance technique. The performance of selected wavebands for spectra collected from both spectroradiometer and AVIRIS NG image were also evaluated by using linear discriminant analysis (LDA). The significant bands found through one way ANOVA analysis were further reduced by CART. The resultant 10 optimum spectral bands were identified for both the sensors. The JM distance for all combination pairs of crops was found above 1.98 irrespective of sensors used indicating all pairs were separable both ground and AVIRIS NG collected spectra. Discriminative power of the wavelengths was further assessed on the basis of overall accuracy using LDA. Overall accuracy and kappa coefficient for spectroradiometer was 93.51% and 0.9248 respectively and 91.67% and 0.9047 for AVIRIS-NG. A comparative evaluation of multispectral and hyperspectral remote sensing was attempted and revealed potential of hyperspectral data for better accuracy.

Keywords: AVIRIS NG, discrimination, fruit crops, CART, LDA, JM-distance.

Abstract Id: 1480
INTEGRATED APPROACH FOR MEASUREMENT OF SPATIAL ACCESSIBILITY OF MATERNITY HEALTHCARE IN URBAN AREAS

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Provision of equitable access to healthcare services is a key priority for any nation. There are wide variety of flow catchment area (FCA) methods have been extensively used to estimate the spatial accessibility to healthcare services. However, these methods capture the only interplay between the availability (supply) and accessibility factors. In India, the landscape of healthcare availability in urban areas is heterogeneous in nature, it ranges from high speciality clinics to individual physician to unskilled practitioner, the quality of care and affordability varies accordingly. In this context, present flow catchment area methods can overestimate the healthcare demand. Thus, the present research proposes an integrated approach to analyze the spatial accessibility covering multiple dimensions of healthcare parameters. This approach can help in efficient resource planning while estimating the proper healthcare demand. The innovativeness in the research is consideration of spatial affordability based competition into two step flow catchment area method. This study compares an integrated spatial accessibility method and two step flow catchment area (2SFCA) method. The proposed approach is illustrated on Mumbai, which has the high spatial variability of maternity healthcare services. The results indicated that proposed model is efficient in the measurement of spatial accessibility of healthcare services.

Keywords: Affordability, maternity healthcare, spatial accessibility, resource planning

Abstract Id: 1481
In-flight radiometric calibration of satellite optical sensors require a large number of field measured data (sub-satellite ground based measurements of atmospheric parameters and surface reflectance data) synchronous to satellite pass. This requires more number of field campaigns, resulting in much greater human efforts which in turn makes it a tedious and time taking process. Also, traditional approach for radiometric calibration requires the use of radiative transfer code, the accuracy of which in turn affects the accuracy of the calibration of the satellite sensors. This study estimates the calibration coefficients with only one date data by utilizing the artificial targets for high resolution optical sensors. Two independent approaches were used for the estimation. One being the vicarious calibration and using radiative transfer code 6S, which is popularly used world-wide and other being physics based simple analytical approach. Both the vicarious and analytical approach show almost the similar results with difference less than 5% in the estimated mean value of multiplicative factors. The insignificant difference between the results estimated from the two methodologies shows the potential of analytical approach with one date data and artificial targets for the estimation of the calibration coefficient without using radiative transfer model. This exercise will help in the radiometric calibration of upcoming high resolution optical sensors using one date ground measurements only.

Keywords: Radiometric calibration, artificial targets, vicarious calibration, analytical approach

Abstract Id: 1482
Snow Water Equivalent (SWE) is essential for various hydrological, meteorological, and climatological applications as well as for snow melt runoff modelling and flood forecasting especially in region like North Western Himalayas (NWH). Space-borne passive microwave remote sensing is the only technique that can operationally deliver information on SWE or snow depth and, thus, aid the runoff estimation. These passive microwave sensors has limited application in Himalayan region as the signals get saturated around depth of 1 m in dry snow conditions and the spatial resolution of passive sensors are very coarse. Recently Indian Space Research Organisation (ISRO) has launched new microwave satellite SCATSAT-1 in September 2016, which is a Ku band scatterometer. As Ku band is highly sensitive to snow water equivalent, daily gridded data from SCATSAT-1 at 2.25 km resolution from December 2016 to April 2017 has been used to compute change in snow water equivalent (Δ SWE) for NWH using one layer Radiative Transfer (RT) Model. The model works on the basis of change detection technique on the temporal variation of radar backscatter. The RT model has been calibrated by ground observed snow water equivalent data for Dhundi, Himachal Pradesh, India with high correlation accuracy. The calibrated model was then used to estimate snow water equivalent for whole North Western Himalaya region covering the states of Uttarakhand, Himachal Pradesh and Jammu & Kashmir with range of Δ SWE from -99 to +495. The resulting SWE accumulation estimates are found consistent with the in-situ SWE measurements.

Keywords: Ku band scatterometer, Snow water equivalent, SCATSAT

Abstract Id: 1483
COMMUNITY BASED RISK MAPPING AGAINST VECTOR-BORNE DISEASE OUTBREAK USING GEOSPATIAL TECHNOLOGY

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Malaria is vector-borne disease spread by the female anopheles mosquitoes. In 2015, 214 million new cases of malaria worldwide was identified in 95 countries and territories. There were an estimated 438,000 malaria deaths worldwide. Thus, effective preventive measures are needed to control this threat. The geographic distribution of anopheles mosquitoes at the community level is often lacking, and yet this knowledge is vital to target resources for malaria prevention efforts. Currently, field data sampling in remote rural areas is a challenge. It may be complicated and require skilled person. Upon this, developing the methodology to collect the information of larvae distribution in rural areas by easy and simple way for local people would be effective to predict and prevent the potential malaria outbreak. This study has demonstrated the methodology for collecting larvae sample images using smart phone microscope in collaboration with the local community in Lao PDR, and analyzed the anopheles habitat and patient distribution for malaria case management, and correlation based on spatial analysis of environmental factors. The methodology of collecting and identifying anopheles larvae samples using a combination of smartphones, microscopes and community based sampling was verified. This methodology could be extended to the other vector-borne diseases such as dengue, which requires quicker response against the outbreak. As dengue tend to spread in urban areas, the methodology to risk mapping could be improved by incorporating other data such as geo-tagged social media information. The report of the initial study to be presented how integrating community-based data and information with other geospatial data effectively works to predict and prevent the outbreak of diseases.

Keywords: vector-borne disease, community empowerment, risk mapping, outbreak prevention, malaria

Abstract Id: 1485
DECLINING WATER LEVEL: A CASE STUDY IN SHAHZAD RIVER BASIN
LALITPUR (U.P) INDIA

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Fresh water is an important natural resource and an elemental component for life which there is no substitute. Compared to surface water bodies, ground water are less prone to contamination by chemicals, soil sediments etc. Thus due to this, dependency on groundwater has indiscriminately increased regardless to considering recharge capacity of aquifer and other environmental factors. The study was carried out in the Shahzad River basin, which is an important tributary of river Jamini of Betwa basin in Bundelkhand region of Uttar Pradesh. In this study ASTER data of 30 m resolution was used to delineate Shahzad watershed. Since Shahzad is a rainfed basin thus rainfall plays an important role in irrigation, domestic supply and industrial use in the area. Rainfall data analyzed for 37 years (1979-2015) indicates the declining trend in average annual rainfall. Decrease in rainfall has imposed the pressure and led to the over extraction of ground water in the area. An assessment of depth to water level in the Shahzad river basin has been attempted to know the groundwater resources. The secondary data from CGWB and other sources have been collated and analyzed using GIS. The depth to water level monitored by CGWB from the selected key-well have been utilized for the preparation of maps in GIS. Pre-monsoon and Post-monsoon data from selected key-wells has been used to analyse the trend of water level fluctuation in the river basin. Pre-monsoon data has been categorised into five classes viz. 2-4, 4-6, 6-8, 8-10 and 10-12 mbgl, similarly Post-monsoon data have also been categorised into five classes viz. <2, 2-4, 4-6, 6-8 and 8-10 mbgl using defined interval classification. Furthermore, water table fluctuation map was prepared using pre and post-monsoon data and have been classified into defined interval of five classes viz. -0.5-0, 0-1, 1-2, 2-3 and 3-4. These zones are of generalized nature and liable to local variation in the depth to water level. In general the depth to water level in the entire study area ranges from 3.48 to 10.35 mbgl during pre-monsoon and 1.25 to 10.03 mbgl during post-monsoon. Besides this questionnaire based survey was conducted in the limited accessible villages to validate the results. The study shows that both quantitative and qualitative approaches indicate in the same direction that is marked by the declining trend in the water level. There is urgent need for planners and decision makers to come forward with proper planning, implementation, operation and continuous monitoring for sustainable development and management of water resource.

Keywords: ASTER, water level, GIS, water-level fluctuation

Abstract Id: 1486
INNOVATIONS AND NEW STANDARDS FOR VILLAGES MAPPING IN INDONESIA

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Rural development is one of the priority programs in Indonesia today. Until one billion Rupiah villages fund will be granted for each village. Rural development requires comprehensive planning. This requires a village map and village information system. All this must be prepared with the principle of alignment, empowerment and acceleration. The research was conducted on several types of villages in Indonesia. From suburbs villages, typical rural villages, villages in forest areas, coastal and small islands villages, villages in isolated locations until to indigenous villages. The research was conducted by survey and focus group discussion with the participants of village development activists. The result of this study is that village development requires large-scale maps of up to 1: 5,000 but does not require the geometric quality prevalent on topographic map of 1: 5,000. This inaccuracy affects the accuracy of the village area and on the amount of village funds, but all are within the limits of tolerance.

Keywords: Rural Development, Mapping, Spatial Information

Abstract Id: 1487
A WEBGIS BASED GEO-CITIZEN INFORMATION SYSTEM FOR DISASTER MANAGEMENT

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Natural and man made disasters are common occurrences in the modern world and creating inevitable life, property and economic losses. However, by implementing relief operations immediately and in a coordinated way, it is possible to minimise the damages occurred by these disasters. Even though, the use of technology in disaster situations is a challenge in traditional systems. To keep pace with the race in technical advancement of the world, the role of space technology has now become a vital tool in disaster risk management and by providing timely information to manage the challenging natural disasters growing across the world. However, most of the time the main challenge faced by many countries during disaster events are lack of real-time data and lack of accurate space-based information. Most of the countries do not have space technology thus, the real-time data and gathering special information is a critical challenge.

Considering the fact, an application was developed by combining remote sensing, GIS and mobile communication technologies to report the disaster occurrence, location and magnitudes, to collect data on the site and to identify appropriate remedial measures to be taken by the respective authorities. Therefore, this research is focused on developing a web based Geographic Information System (WebGIS) that can be used in both ground operational and decision making levels.

The developed system has several components to face the common challenges occur during disaster relief operations. The system has been tested for its accuracy. Though it was developed initially as a military application, it can be used for commercial, academic and other practical situations.

Keywords: Disasters, Mobile communication, WebGis, Remote sensing, GIS

Abstract Id: 1490
DEVELOPMENT OF ORCHARD INFORMATION SYSTEM USING GEOINFORMATICS

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This study focuses on the application of Geoinformatics in the development of rendered and reliable Orchard Information System (OSI) from 2003 to present (2017) conditions and development of orchards in district Haridwar and its nearby region. Uttarakhand, it becomes the 27th state of India on 9 November, 2000 and located between 28° 43’-31° 27’ N Latitudes and 77° 34’-81° 02’ E Longitudes. After becoming an Indian state government agencies, public organizations, industries were started thinking to setup new industries and businesses here. Resultant in 2002 The State Industrial Development Corporation of Uttarakhand Limited (SIDCUL) an enterprise of government of Uttarakhand was founded in Dehradun, which broadly promotes industries and develops industrial infrastructure mainly in four districts Dehradun, Haridwar, Kotdwar and Udhamsingh Nagar. Therefore development of industrial and urban areas since 2003 has continuously growing rapidly to till today.

In proposed study we have focused on Haridwar to monitor and understand the dynamics of industrial and urban growth on the account of felling of Orchard. A large number of Orchard and agriculture farms were occupied by industrialists and builders in rural areas of district Haridwar, so we are trying to analyse present situation and circumstances take place due to felling of Orchards in excess using Geoinformatic. Geoinformatic (GIS and GPS) play a vital role for temporal study of degradation of orchards. Use of GPS (Global Positioning System) device provides geo-location of orchards in form of latitude and longitude, calculate the exact position of orchards in Haridwar district. In this study, we are using high spatial resolution images that have potential for mapping of vegetation (orchard). High spatial resolution data is useful for continuous monitoring and updating of maps. The open source tool is being used in this study to integrate data from different sources like GPS point, analytical data.

Keywords: Orchards, Geoinformatics, GIS, Mapping.

Abstract Id: 1491
USE OF MULTI TEMPORAL NDVI FOR EXTRACTING CROPPING PATTERN IN KRISHNA MIDDLE SUB BASIN

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Around 70% of world fresh water is used for irrigation. Due to increase in population there is a demand for more food production, which require extensive use of irrigation network system. Untimely and delayed rainfall has also increased the problem for timely supply of irrigation water through canal network.

The study was conducted to map out different crop groups in krishna middle river basin. Within Kharif crop group irrigated and un irrigated and were separated based on temporal profile of NDVI generated from AWIFS data. These temporal profile were extracted by using ground truth points from multi temporal NDVI data. The study was carried out for two years 2015-16 and 2016-17. When temporal frequency of data is increased a clear difference between different crop groups was observed. Finally a thematic map for different crop group was obtained and accuracy check was carried out by using ground truth data collected from field. It showed 70 percent overall accuracy for identifying cop groups. For identifying kharif irrigated it and Rabi it has an accuracy level above 85 percent, for identifying two season and annual crops it had an accuracy of 65 percent

Keywords: Temporal profile, Frequency, Crop Group

Abstract Id: 1492
BUILT-UP AREA CLASSIFICATION USING THE COMBINATION OF MICROWAVE AND OPTICAL SENSOR DATA

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In the past 3 decades, increase in the use of remote sensing has enabled us to constantly keep an eye on the changes in land use. With the wealth of data available today, along with the growing technology, we are able to conclusively give statistics on the subtle changes in land use management along with the intensity. These statistics are paramount for urban/rural planning and infrastructure building. During execution of National LULC project using multi-temporal AWiFS data, it was noticed that classification of small built-up areas was not very accurate. The objective of the study is to understand the suitability of microwave and optical data combination to improve the classification of built-up area. Microwave remote sensing has enabled us to choose from wide variety of imaging parameters for better estimation. Combination of Microwave and Optical sensors produced unique spectral and structural information for better classification. We have used RISAT (Medium Resolution) C-band SAR data along with AWiFS and LISS IV multispectral data to accurately segregate built-up area from other land use class. To achieve the objective, we have made use of polarimetric scattering model-based decomposition methods proceeded by different supervised and unsupervised techniques for classification and segmentation. Results from different classification techniques are compared to find the optimal classification method. Optical sensors have been used in combination of microwave data to obtain speckle free classification results and for selection of training sites for supervised classification. The classification is tested on 5 different sized, village to city level, built-up areas of India.

Keywords: Microwave, RISAT, AWiFS, LULC, Built-up

Abstract Id: 1493
GEO-SPATIAL MAPPING OF VEGETATION USING UAV PHOTOGRAMMETRY

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UAV imagery is becoming one of the prominent sources these days for obtaining high resolution aerial imagery. And it is being used vigorously in manipulating and recreating 3D Environment using Photogrammetric and computer vision approach. UAV acquired images are being widely used for high resolution digital surface modelling, reconstruction and monitoring of glacier, large Scale Mapping, forest-fire monitoring, disaster management, mapping urban and suburban areas, environmental and natural resources monitoring and many more. UAVs for aerial photography have been promoted as the new way to map large areas efficiently. Tests have shown that to be true. The cost of the technology is comparable to that of GNSS survey and the results are comparable with much greater resolution. This is a major leap forward.

The objective of this paper is to Geo-spatially locate the trees in the study area for GIS mapping using UAV Imagery. Point cloud data generation is one of the sub-objectives of this research, which is further exploited for segmentation or classification. Point cloud data is created from the imagery using photogrammetric computer vision approach, which is nothing but three dimensional reconstruction of the study area. For extracting vegetation cover in the area of study, various classification parameters were used. The results demonstrate a GIS map mentioning location of trees in the area of study with other attributes available for the surroundings.

Keywords: UAS, Point Cloud segmentation, UAV Photogrammetry, Vegetation extraction, GIS

Abstract Id: 1494
APPLICATIONS OF SPACE BASED TECHNOLOGY (SBT) AND INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) TO STRENGTHEN DISASTER RESILIENCE

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Space-Based Technology (SBT) and Information and Communication Technology (ICT) are emerging as important tools for strengthening disaster resilience through collecting and sharing reliable disaster-related data and information. While through SBT, data can be collected from the top over a large area, the ICT can provide house-level data from the ground in real-time. SBT, especially remote sensing is one of the fastest means for acquiring data for analysis of pre-disaster and post-disaster situations. Satellite data with its favourable synoptic view and repetitive coverage offers a possibility for mapping and monitoring in disaster affected areas through emergency observations undertaken by various regional and international initiatives such as Sentinel Asia and International Charter for Space and Major Disasters. Data acquired by SBT are being used for rapid damage assessment. On the other hand, ICT such as latest generation of mobile phones and their state-of-the-art applications have brought revolutions in mapping even in remote locations as well as disseminating early warnings to the “last mile”. Mobile phones can determine and provide locations to its users and recent advances in mobile phone applications have made it possible to users to collect, manage, and share geo-spatial data. With geo-spatial data handling capabilities, the latest generation of mobile phones can be used very effectively for Community-Based Disaster Risk Management (CBDRM), including early warnings and possibly emergency evacuations at local level, given the high penetration of mobile phones to most of the developing countries in recent years.

This paper examines the possibility of augmenting the capacity of the local governments as well as at the communities to collect and share reliable data and information related to hazards and exposures at local level in Armenia, Bangladesh, Fiji and the Philippines to strengthen their disaster resilience and support for disaster preparedness and timely post-disaster response, recovery, and reconstruction for reduction in loss

Keywords: Space-Based Technology, ICT, Disaster Resilience

Abstract Id: 1495
COMPARATIVE STUDY OF POINT CLOUD DATA GENERATED FROM SMALL UAV PLATFORM AND TLS

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Computer vision based photogrammetric technique for low aerial platforms has expedited the information extraction from consumer grade camera. It has advantages of the colored 3D point cloud, easier to handle, precise geometric information, faster acquisition with minimum physical labour, and other such qualities for documentation purposes, mapping, guiding, and remote surveying. It may avoid the requirements of the big facility to carry out processing tasks and promote crowdsourcing. Point clouds (X-Y-Z-R-G-B) are used in our paper. Our work in this paper is an investigation on the accuracy of point cloud obtained from unmanned aerial vehicle (UAV) imagery through computer vision based photogrammetry. The independent parameters used in the study are based on geotag accuracy and model generation. Due to a problem with on-board IMU and GPS sensor, automatic geotagging was not performed. The data co-register follow up by utilising a set of distributed ground control points. UAV images are processed at full resolution, half resolution and one-fourth resolution respectively in order of higher information extraction. A quantitative methodology has been developed for objective and data dependent assessment of errors generated from the algorithm that extracts dense surface point cloud. The generic approach is to use geotagged images to avoid uncertainty caused by uncontrollable data errors. Ground surface and building roof is extracted by generating sections along NS and EW directions and verified with terrestrial laser scanner (TLS). As the conclusion of the study is in progress, it is observed that the ratio of extracted information to point cloud density with respect to TLS model is 40 times better for ground surface and 22 times better for roof surface. Hence, UAV data can match side by side with TLS derived data.

Keywords: Computer vision, Photogrammetry, Point cloud, GCPs, Error assessment.

Abstract Id: 1497
Due to its unique topographic, physiographic and diverse socio-economic characteristics, North Eastern Region (NER) of India is one of the most challenging regions. One of the objectives of setting up the North Eastern Space Applications Centre (NESAC) at NER is to promote the capacity building in the field of geospatial technology by setting up a regional level infrastructure.

Since inception, NESAC has been imparting training on the utility of geospatial technologies. There is large demand for of training programs, particularly at NER due to limited institutions availability in the region. NESAC has taken the lead role to conduct different training activities which can be broadly categorized into three viz. 1) basic courses 2) theme oriented/advanced courses & 3) tailor made courses. In recent years, NESAC has regularly been imparting two 15 days long training courses, one in basic course and the other in advanced course on geospatial technology. Current year, the advance course was on UAV remote sensing application. The applications oriented tutorial for project implementation like EPRIS implementation training is regularly imparted at NESAC and the third category is the customized tailored made capsule module as and when requested by user department like the customized training programme for NDRF officials on use of geospatial technology imparted recently.

With the objective to increase the trained manpower with an appropriate course curriculum, an outreach training facility is being established which will facilitate developing multi level training programs to meet the demands specific to NER. The focus is therefore to initiate, plan and implement the:
- Appropriate course curriculum specific to different type of training program
- Starting new certificate courses and tailor-made courses
- Starting of Joint Training / Diploma programs with institutions in India (like IIRS) and international level (like ITC)
- Expanding the outreach activity benefitting user departments utilizing tele-education and e-learning/ distance learning programs.

Keywords: Outreach, Training, Geospatial Technology, North East India

Abstract Id: 1500
GIS BASED ANALYSIS OF ACCESSIBILITY OF URBAN GREEN SPACES IN FOUR WARDS OF DELHI

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Urban green spaces are a necessary part in every region as they promote a healthy and interactive lifestyle among citizens of a country. But accessibility to each urban green area remains a prime concern in a locality as with increasing population the built-up area has increased and most green areas lie far away from a residential area. With the help of network analysis four wards of North West Delhi at different green space hierarchical levels were studied. Results show that parks at all hierarchical levels are not normally distributed especially at higher levels. The regions with high green density can also have low accessible residential area in terms of green spaces around due to high ratio of private green spaces and highly scattered population. This study will help planners analyze and further develop areas with deficient green spaces and maintain them for a sustainable future.

Keywords: Urban Green Spaces(UGS), Private Green Spaces, GIS, Network Analysis, Usable Green

Abstract Id: 1501
GIS BASED LANDSLIDE HAZARD ZONATION MAPPING ALONG NH- 58 BETWEEN RISHIKESH TO KAUDIYALA VILLAGE OF TEHRI GARHWAL AND PAURI GARHWAL DISTRICTS, UTTARAKHAND, INDIA

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Landslide Hazard Zonation (LHZ) refers to the division of a land surface into homogeneous areas or domains and their ranking according to degrees of actual potential hazard caused by mass movement. Landslide is a destructive geological process which causes damage to life, property, roads, bridges, and houses occurring especially in the Himalayas region. The study area falls in the parts of Tehri and Pauri Garhwal districts of Uttarakhand, India. Study area covers an area of 625km2 with a perimeter of about 100 km. It falls under Survey of India Toposheet No: 53J/8. The area extends from 78° 15′ 00′′E to 78°30′00′′E longitude and 30°00′00′′N to 30°15′00′′N latitude. Remote sensing (RS) and Geographical Information System (GIS) has been used for preparation of database, analysis, modeling and output. Landsat 8 and Sentinel images, Digital Elevation Model (DEM), geological map (GSI), toposheets (SOI) data have been used for LHZ mapping. Various important terrain parameters such as lithology, structure, drainage, slope, land-use/ land-cover, geomorphology, etc. thematic maps were generated for a proper LHZ mapping. High resolution data of Google Images used for identification of site specified risk identification. The validation was done by GPS field data. The resultant landslide susceptible map has been classified into five categories very low, moderate, high and very high. Since the study area is a part of Garhwal Himalaya which is highly landslide susceptible so an attempt has been made to map along NH-58 from Rishikesh to Kaudiyala village which would be helpful in reducing the damage and loss of lives by proper planning for various construction purposes.

Keywords: Landslide Hazard Zonation mapping, NH-58, GIS, Garhwal Himalaya

Abstract Id: 1502
STUDY OF MINERALOGICAL DIVERSITY AND SCATTERING CHARACTERISTICS OF LUNAR EQUATORIAL REGION USING CHANDRAYAAN-1 DATA

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Mineral mapping of lunar surface is significant to understand the origin, evolution, geological history of the Moon. Advancements in orbital satellite sensor technology has allowed discriminating the minerals on lunar surface using hyperspectral data. Moon Mineralogy Mapper (M³) is an imaging spectrometer that has provided the first high-resolution spatial and spectral map of the entire lunar surface. Moon Mineralogy Mapper (M³) on board the Chandrayaan-1 project of India, which gives Visible/Near-Infrared (NIR) spectral data (hyperspectral data) of the Lunar surface to gain insights on the surface mineralogy. Band ratio and spectral profiling methods are used for identifying minerals. 1 µm and 2 µm band depth were used to detect the Olivine and Calcic-Pyroxene rich sites. Mini-SAR of Chandrayaan-1 is the very first kind of hybrid polarimetric radar flown outside the Earth's orbit. The hybrid polarimetric architecture of mini-SAR allows the measurement of the Stokes parameters and backscatter properties of various lunar geological features. The radar backscatter along with the parameters circular polarization ratio (CPR), relative phase (δ) and m (Degree of polarization)-χ (Poincare ellipticity) decomposition technique were used to study the scattering mechanisms, surface/sub-surface roughness. SAR is a powerful tool to study the physical and geometrical properties of lunar morphological features and the magnitude and characteristics of SAR backscatter and m-χ decomposition parameters are critical in understanding the morphology and nature of deposits associated with lunar surface features. In this paper Mineralogical diversity and Scattering characteristic of Byrgius Crater, King Crater, Maunder Crater, Taylor Crater and Descartes Crater were investigated using Chandrayaan-1 data.

Keywords: Chandrayaan-1, Hyperspectral, Moon Mineralogy Mapper, Mini-SAR, Band depth.

Abstract Id: 1504
According to United Nation’s International Strategy for Disaster Reduction, Asia has the highest number of fatalities from natural disasters of any region, and within Asia, the countries of Himalayas have the greatest number of disasters and casualties. There are several reasons for this vulnerability, the mountains are young and dynamic and still tectonically very active, the intense monsoon rainfall leads to flooding and landslides, and the extreme relief contributes to the instability of both the land itself and the infrastructure built on it. In Uttarakhand state, India subjected to frequent occurrence of natural disasters like Cloudburst. Flooding due to Cloudburst is the extreme form of Natural disaster. This leads flash floods, landslides, house collapse, dislocation of traffic and human casualties on large scale. River morphology might deliver valuable insights into the historical characteristics of tectonic deformation of the region beneath it. Consequently, analysis of channel evolution could provide a promising means of exploring the spatial distribution tectonic activity. Different geomorphic indices like Hypsometric Integral (Hi), Basin Elongation Ratio (Eb), Drainage Basin Asymmetry (AF), Longitudinal River Profile, Transverse profile, Stream Gradient Index (SL) for the watershed to develop knick points in the watershed. In this study Geomorphic indices were investigated to characterize terrain pattern and comparison the watershed basin of the tributaries of Alaknanda river, namely Birahi Ganga and Nandakini River. Nandakini river watershed covering a total area of 546.763232 sq km and Birahi Ganga watershed covering a total area of 296.604728 sq km. Both of these tributaries of Alaknanda river are many times affected by cloudburst and Landslides.

Keywords: Hypsometric Integral, Basin Elongation Ratio, Drainage Basin Asymmetry, Longitudinal River Profile, Transverse profile, Stream G

Abstract Id: 1505
SPECIES-WISE DISCRIMINATION OF AREA UNDER AGROFORESTRY USING SATELLITE DATA IN LUDHIANA DISTRICT

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Agroforestry is intimate combination of cultivating trees and agricultural crops with one another and is an ancient practice that farmers have used throughout the world. Agroforestry is an integrated self-sustainable land use management system that is not only capable of producing food from marginal agricultural land but also capable of maintaining and improving the quality of environment. Therefore, reliable data on area under agroforestry is of vital importance which is not available as there is no scientific and standard methodology for estimation of area under agroforestry. Further species wise discrimination is all the more difficult therefore not much work has been done in this area. In this study, an attempt has been made, to estimate area under agroforestry particularly for different species using remote sensing satellite data. Usually traditional method of maximum likelihood classifier both supervised and unsupervised have been used but modern machine learning algorithms and soft computing techniques like random forest, support vector machines and neural network has also been applied in this study for discrimination of various tree species. The study was conducted in Ludhiana district of Punjab using Resourcesat-1 (IRS-P6) LISS IV imagery and Sentinel-2 data of Ludhiana district. Three different tree species are grown in Ludhiana for agroforestry purpose viz, Populous trichocarpa popularly known as Poplar, Eucalyptus globus popularly known as Eucalyptus and Melia azedarach popularly known as Deg. These tree species are delineated using various classifiers including traditional maximum likelihood classifier and modern machine learning algorithms and soft computing techniques like random forest, support vector machines (SVM) and neural network (ANN). These techniques are compared for their accuracy using various parameters like overall accuracy, kappa coefficient etc.

Keywords: Species wise, agroforestry, SVM, ANN, Random forest

Abstract Id: 1506
ANALYSIS OF POLARIZATION ORIENTATION ANGLE SHIFT ON HIGH-RESOLUTION SPACEBORNE X-BAND AND C BAND DATA

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Polarization orientation angle can be defined as the angle between the semi major axis of the polarized wave and the horizontal axis along the line of sight. When the microwave strikes any irregular target surface the Polarization orientation angle (POA) shift occurs. This leads to the misinterpretation of the features after implementing decomposition modelling. This study focuses on analysis of Polarization orientation Angle (POA) shift on high resolution spaceborne data. In this study the fully polarimetric data of RADARSAT-2 and TERRASAR-X spaceborne sensors in X-band and C band respectively were used. The datasets for the dates 12Feb 2015 and 24 Feb 2015 were acquired of Bias river basin situated in Manali region of Himachal Pradesh. This area covers the vegetation, Urban and the open land surface supporting all types of scattering mechanisms. The effect of Polarization orientation angle (POA) shift was analysed on C band and X band datasets of the study area separately using the yamaguchi decomposition technique. The decomposition of both the datasets was with and without Polarization orientation angle (POA) shift compensation was done. The change in the backscatter for all the three scattering mechanisms were analysed. Volume scattering is overestimated however double bounce and surface scattering is under estimated in decomposition model due to POA shift. It was concluded that POA shift compensation is very essential to avoid misinterpretation of decomposition modelling results.

Keywords: Synthetic aperture radar (SAR), Polarization orientation angle (POA), Yamaguchi decomposition, POA compensation

Abstract Id: 1511
AN ASSESSMENT OF HEAT IMPACTS ON HEALTH USING THERMAL ZONATION TECHNIQUES

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Complex land use patterns in urban areas of India have significantly affected the land surface temperatures. High diurnal temperatures in urban areas can negatively influence the health of the population and therefore are imperative to study. Thus, an attempt has been made in this research to understand these impacts (both direct and indirect) on human health and well-being of the people of Gurugram city in state of Haryana using various indicators and reference from the previous indicative studies in this light. This study tries to investigate the association between the escalating temperatures of the city and increasing number of cases of heat related illness. The open source remotely sensed data (Landsat 5 and Landsat 8) of the summer season (April-June) is used to calculate the average land surface temperature (LST) of the city and further hotspots were identified to conduct primary health survey. Moreover, a primary level of medical data has been used to understand the spatial and health dynamics based on the LST. A total of 78 samples have been taken during the random sample survey to support the hypothesis. Moreover, cases with heat-related illness in most of the hotspots were positively correlated to the areas of higher land surface temperature. Acceptable agreements on the relationship between the two variables were obtained. The approach so applied in this study can be expanded at the national level to examine the impact of heat on human being. This information would help government to provide better living condition and quality of life. Also, the output may be interest of urban health care professional, law makers, planers and the social workers.

Keywords: Land surface temperature, heat, health impacts, heat stroke, Gurugram

Abstract Id: 1513
The point of maximum slope on the reflectance spectrum of vegetation between red and near infrared wavelengths, termed the red edge position (REP). Red Edge Position (REP) is a very sensitive indicator of vegetation stress. As the accurate estimation of the REP is dependent on widths of the bands, the high spectral resolution of spectroradiometers offers the potential for determining the REP of vegetation canopies at various stress levels. REP estimation techniques such as lagrangian interpolation, inverted Gaussian curve fitting and polynomial fitting is suitable for continuous Hyperspectra sampled at 1 nm. This paper checks precision of these three techniques to estimate REP for field Hyperspectra of crops sampled at 1 nm. Precision of the technique is decided based on the variance of REP estimation. Results indicate that the Inverted Gaussian produce minimum variance for REP estimation compared to other two techniques.

Keywords: Red Edge Position, Hyperspectra, lagrangian interpolation, Polynomial fitting, Inverted Gaussian

Abstract Id: 1514
UTILITY OF HIGH RESOLUTION SATELLITE IMAGE FOR DIGITAL SUB-DIVISIONS OF FIELD MEASUREMENT BOOKS - A CASE STUDY OF SELECTED VILLAGES IN ANDHRA PRADESH

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The individual survey number sketches are maintained as Field Measurement Book (FMB). It is a description of systematically organised land sub-divisions in an area describing any individual land properties. It provides spatial integrity and unique identification of each and every land sub-division. It is required to maintain adequate, accurate and up-to-date data and easily retrievable land records for establishing the ownership rights. The main objective of the study is to regenerate a spatially accurate, legally supportive and operationally efficient sub divisional cadastral database and assess the accuracy of sub-division parcels of selected three villages of Guntur district in Andhra Pradesh. To achieve this, village cadastral maps, FMBs, Record of Rights (RoR) and Adangal records have been used. This study mainly focuses to evaluate the measures of digital sub-divisions by using High Resolution Satellite Imagery (HRSI) and Global Positional System (GPS). The comparisons show that around 80% of the sub divisional parcel boundary can be derived with acceptable accuracy and precision meeting the standards of cadastral survey. The result shows that the use of very high resolution satellite imageries can reduce the cost, time and human resources as compared to the other survey methods. Large deviations in sub-division areas were due to unclear boundaries, modifications of boundaries or faulty measurements of the sketches.

Keywords: cadastral maps, sub divisions, adangal, field measurement book, HRSI, RoR

Abstract Id: 1515
HYPER-TEMPORAL ACTIVE FOREST FIRE DETECTION BY INSAT3D/3DR OVER INDIA

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Forest fires occur regularly during summer seasons in tropical countries and causes are mostly anthropogenic. The scale may range from small fires with little impacts to very large fires having serious large-scale impacts. It is necessary to locate the active fire areas not only for managing the forest fire but also for a number of other studies related to environmental and ecological impacts. The problem has become more serious than years before. INSAT-3D and INSAT-3DR having six channel imager is capable of detecting large forest fires at every 15-minute interval. The MIR channel (centred around 3.9 µm) and TIR channel (centred around 10.75 µm) are used in a multi-channel contextual algorithm for active forest fire detection. Inputs to the algorithm include geo-referenced BT (in Kelvin) for MIR and TIR-1 channels along with satellite viewing geometry (satellite elevation, sun elevation, satellite azimuth, sun azimuth, satellite zenith and sun zenith angle). Dynamic mask of cloud comes from another algorithm developed for INSAT-3D. Another combined static mask having land/sea and non-forest areas is developed and used. The pixel is flagged as potential fire if MIR and TIR-1 channel BT crosses a dynamic threshold defined with sun zenith and the difference of the BT of MIR and TIR-1 is crosses a predefined threshold value. The last test see that the difference of MIR and TIR-1 departs substantially from the non-fire background (contextual test) to confirm it as fire pixel. The output is generated as KML file for each acquisition. The improvement in thresholds and algorithm parameter values through a sensitivity analysis has brought down the false fire alarms drastically. The index of agreement (d) obtained from inter-product comparison (INSAT-3D vs MODIS) shows that the science product of active forest fire from INSAT-3D and INSAT-3DR is useful for monitoring large forest fire events.

Keywords: Active Fire, Forest, MIR, TIR, INSAT, MODIS

Abstract Id: 1517
SNOW COVER MAPPING OF GORI GANGA VALLEY, KUMAON HIMALAYA IN UTTARAKHAND

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The Himalayas has become a focus of research interest in the field of glacier dynamics and its impact on hydrology highly populated downstream watersheds. But systematic and regular monitoring of glaciers are very few. The present paper focuses on Milam glacier, largest glacier in Goriganga valley which is under retreat and is focus of other hydrological issues. So to end this problem, there is need of regular monitoring of Himalayan glaciers which will not only fulfill scientific purpose as well as improve the knowledge about the water resources to the society. Thus, the main goal of the present work is to study glacier dynamics on Milam Glacier which includes monitoring and mapping snow cover. For the present study the data will be generated with the help of Remote Sensing and GIS techniques.

Milam Glacier is the largest glacier in Goriganga basin and is the second largest glacier after Gangotri glacier in Kumaon-Garhwal region of Himalaya. It originates from the east slope of Hardol (7151 masl) and Trisuli (7074 masl) peaks and flows towards south for about 18 kilometres covering an area of 54.95 sq.km with an estimated ice volume of 5.5 km3. Five tributary glaciers join Milam from right and two from left side. The study area falls within the Topographical no. 62 B/2, 62 B/3 as well as 62B/4. Data set used for snow cover extent extraction is MODIS (snow cover product, an 8-day repeated period coverage) (2000-till date), Resource sat 1-AWiFS (2003-till date), and Landsat series (1972-till date) with ASTER images.

Keywords: Kumaon Himalaya, Goriganga Valley, Snow cover mapping, Remote Sensing and GIS techniques, MODIS and Landsat series

Abstract Id: 1518
RICE CROP PHENOLOGY ASSESSMENT USING SCATTEROMETER

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The study involves the analysis of OSCAT (Ku-band) fine resolution 2.225 Km scatterometer data for rice crop phenology assessment during monsoon season of Madhya Pradesh and Uttar Pradesh in India for year 2013. These states mainly occupy the central and Gangetic region of India. The main objective of the study is to characterize spatial and temporal signatures of land crop cover using Scatterometer backscattering coefficient with synergistic use of NDVI and environment data for the assessment of crop phenology to derive the start and end of the growing season, moment of maximum greenness for rice crops. In this context, an Alternate day composite data of OSCAT has been chosen for from June to November with 10 days composite INSAT 3A NDVI (Normalized Difference Vegetation Index), Temperature and Rainfall.

The analysis shows that the rice crop is having dual peak backscatter variation in profile which shows the transplanting, tillering and maturity stages at different dates. HH and VV polarization of OSCAT are taken for analysis and variations in both polarizations are identical in nature. The backscatter minima is found at the beginning of the heading stage in the vegetative period. This is due to increase in tillers and after pre heading stage backscatter increases up to pre maturity stage. In the maturity stage decrease in backscatter is observed due to increase in roughness in the crop canopy. Regression analysis has been done by taking independent variables as OSCAT HH, VV and dependent variables as day of year (DOY), NDVI, Temperature and Rainfall. Further linear fit model is applied for the examination of heading stage and maturity stage. High temporal resolution of the OSCAT has an advantage to monitoring crop phenology even in the presence of clouds when optical techniques are not feasible.

Keywords: OSCAT, Rice, Crop Phenology

Abstract Id: 1519
IMPROVEMENTS IN PRECIPITATION FOR BEAS RIVER BASIN USING FULLY COUPLED WRF-HYDRO

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Fully coupled atmosphere-hydrology model system was integrated with the Weather Research and Forecasting (WRF) model, in order to account for the surface processes. The model simulations were tested for uncoupled as well as coupled WRF-Hydro phases. The fully-coupled WRF-Hydro model simulations has more significance compared to only WRF model simulations.

Keywords: WRF, WRF-Hydro, Precipitation, Runoff, Surface fluxes

Abstract Id: 1520
From past few years, recent developments in Unmanned Aerial Systems with integration of advance technology has brought a new dimension in large scale as well as small scale mapping industry. Recently large areas are being mapped using aerial photography with the application of UAVs. Using these state of the art techniques a new age of surveying is being evolved with versatility and better approach in 5D (3D + time and cost dimensions).

Generating High Resolution Digital surface Model or DSM often demands highly accurate data. Images captured through unmanned aircraft are processed through methodologies ranging from classical photogrammetry to modern photogrammetric computer vision. This research shows all the different parameters important for a high resolution DSM generation using UAS as the source of image acquisition. In DSM generation process, point cloud generation is very crucial for a better result, for which algorithms such as SIFT, SURF are used in Matlab for running SFM or Structure from Motion algorithm to derive Point Cloud.

This research explains about all the reduction phase’s requirement such as camera calibration, orientation parameters and effects of GCP in a surface model. Contours are also created using the same approach in an extensive manner. Using various algorithm linked to commercial as well as open-source platforms were studied and analysed to get the results. These methodologies are compared to assess the efficiency and productivity. The results are compared for accuracy assessments.

Keywords: UAV photogrammetry, Digital Surface Model, UAS, 3D reconstruction, SFM, Point cloud

Abstract Id: 1521
A river is a blessing for all up growing city. While a city expand with full swing its population and economy also increase proportionally. Khulna is likely a city with a population density of 25000/km² and having only one river inside the city named Mayur river denoted as city heart. The Mayur river is located 22O46’55.5” (22.78210) N 89O32’18” (89.53830) E in south-western Bangladesh and downstream of the well-known Ganges delta region. The river is about 11.69 km long with 2 meters (7 feet) elevation and varies by width widely at different chains. The drainage basin of Mayur is bounded between 22O51’15” N and 22O45’01” N latitude and 89O29’31” E and 89O34’25” E longitude which covers an area of 39.89 km² and the elevation varies between 1.5 to 5 m above mean sea level. This tiny river drains out about 75% of the Khulna City Corporation (KCC) effluents of 242,028 L per day and to be regarded as a very important component of the city drainage system. Excessive waste dumping and infrastructural modification along the river bank enhances mass deposition thereby lowering the river depth. For the future of the city revitalization of this river was a necessity and it was done by KCC. In general, it seems the purpose of river revitalization to return the river to its natural state. So KCC tried to revitalize the river through massive cleaning and developing a linear park on the bank of the river to represents its usefulness and to retain its proper shape and functionality. The study was conducted by spatial data and satellite images (Landsat images) with a time series analysis to observe the effectiveness of the revitalization process. By interpreting spatial data by different relevant software’s will detect the ultimate change of covered area, width and depth of the river.
INFLUENCE OF CLIMATE ON SEASONAL SOWN AREA - A MEDIUM TERM ANALYSIS

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Agriculture is a sector that has high dependence on climate, especially rainfall. In India, where the sowing of kharif crop is heavily dependent on the South-West monsoon, the relationship between agricultural sown area and weather parameters is much more significant. The present work focuses on determining the influence of these weather parameters on seasonal sown area in India by studying the correlation between sown area and parameters like rainfall and temperature along with altitude.

Fractions of all the weather parameters and sown area for a period of eleven years (2005-06 to 2015-16) were computed in a 5km x 5km grid and regression analysis was done on these inputs to arrive at the correlation between them. The sown areas have been obtained from annual Land Use Land Cover (LULC) maps generated under the project “National Land Use Land Cover Mapping using Multi-Temporal AWIFS Data”. The correlation between sown area and various parameters like monthly rainfall, number of rainy days, peak rainfall intensity, peak intensity to total rainfall ratio, and temperature was studied. This work presents the results for a few example areas which have predominantly rainfed agriculture in the kharif season, like the states of Andhra Pradesh, Karnataka and Madhya Pradesh.

Though many factors like crop type, soil type, economic condition of farmers, and government policies towards agriculture all play a role in the changes observed in sown area over a period, the effect of rainfall on kharif sown area is evident from the results of this study. The effect of temperature, on the other hand, is not conclusive.

Keywords: Agriculture, Sown Area, Rainfall, Temperature

Abstract Id: 1523
REGIONAL ALGORITHM FOR RETRIEVAL OF COLOURED DISSOLVED ORGANIC MATTER IN INDIAN COASTAL WATERS USING IN-SITU AND OCEANSAT-2, OCM DATA

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Coloured Dissolved Organic Matter (CDOM) is the dissolved part of the organic matter of water which passes through 0.2 micron meter filter and absorbs the light in visible and ultra-violet part of the electromagnetic spectrum. This study presents a new regional algorithm for CDOM estimation at 412 nm in Indian coastal waters using band ratio of remote sensing reflectances (Rrs) at 490nm and 555 nm. CDOM slope (S412-443) varies from 0.0015-0.0127 with a mean value of 0.0067 in the Indian coastal waters. CDOM absorption coefficient (412 nm) varies between 0.017-5.957 m$^{-1}$ with mean value of 0.77 m$^{-1}$. A total no of N=444 data points (NOMAD + Indian) have been used to derive new algorithm. Out of total data, 117 data points correspond to Indian coastal waters and other 327 data points correspond to NOMAD dataset (bottom depth <50 meter). An exponential equation is obtained using the ratio (Rrs490/Rrs555) to derive CDOM with R2=0.58. The same has been applied to Oceansat-2, OCM radiance data and the variability in Indian coastal region has been studied.

Keywords: oceansat-2 OCM, CDOM, retrieval, coastal waters

Abstract Id: 1524
GEO-SPATIAL MAPPING OF VEGETATION USING UAV PHOTGRAMMETRY

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UAV imagery are becoming one of the prominent source these days for obtaining high resolution aerial imagery. And it is being used vigorously in manipulating and recreating 3D Environment using Photogrammetric and computer vision approach. UAV acquired images are being widely used for high resolution digital surface modelling, reconstruction and monitoring of glacier, large Scale Mapping, forest-fire monitoring, disaster management, mapping urban and suburban areas, environmental and natural resources monitoring and many more. UAVs for aerial photography have been promoted as the new way to map large areas efficiently. Tests have shown that to be true. The cost of the technology is comparable to that of GNSS survey and the results are comparable with much greater resolution. This is a major leap forward.

The objective of this paper is to Geo-spatially locate the trees in the study area for GIS mapping using UAV Imagery. Point cloud data generation is one of the sub-objective of this research, which is further exploited for segmentation or classification. Point cloud data is created from the imagery using photogrammetric computer vision approach, which is nothing but three dimensional reconstruction of the study area. For extracting vegetation cover in the area of study, various classification parameters were used. The results demonstrate a GIS map mentioning location of trees in the area of study with other attributes available for the surroundings.

Keywords: UAV Photogrammetry, Point Cloud Segmentation, Vegetation Extraction, GIS, Geo-Spatial mapping

Abstract Id: 1527
FEASIBILITY STUDY OF RAILWAY LINE EXPANSION FROM VEYANGODA TO PANADURA, UNDER COLOMBO SUBURBAN RAILWAY PROJECT (CSRP)

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Sri Lanka Railways operates the country’s railway network, which includes about 1,450 km of track connecting main cities of all nine provinces in the country. However, the railway network is not adequately expanded to cater the present-day requirement within the Colombo and its suburbs. Accordingly, Sri Lanka Railways plans to modernize the railway network of Colombo metropolitan area under Colombo Suburban Railway Project (CSRP). Accordingly, the railway line from Veyangoda to Panadura (72km) required to be expanded with additional rail tracks. However, there are lot of permanent buildings and temporary settlements located in either side of this railway line, which is extending through highly populated areas of the Colombo district. Therefore, a complete feasibility analysis of the railway expansion is essential. Hence, this research is mainly focused to analyses the feasibility of railway line expansion from Veyangoda to Panadura. It comprises with map the existing railway line and identifying the properties to be acquired from either side of the railway line. Accordingly, several attempts have taken to conduct a ground survey to demarcate the properties within 50m from the existing railway line but never been succeed due to the strong protests of occupied people. Therefore, the challenge of mapping the existing railway line and the adjacent buildings and temporary settlements have accomplished by utilizing low-cost drone with multispectral camera. The captured aerial images were used to generate 2D and 3D image maps. Based on 2D maps the building features were extract by applying automatic and manual methods. Feasibility analysis is performed based on the extracted features and collected ground based non-spatial data. Finally the accuracy of building extraction and rail track was tested with several samples. The results demonstrate that drones can provide an ideal platform for railway mapping in Colombo and its suburbs.

Keywords: Railway mapping, drone, feasibility analysis, railway expansion

Abstract Id: 1528
VERTICAL DISTRIBUTION OF AEROSOLS AND CLOUDS DURING TWO CONTRASTING MONSOONS OVER INDO-GANGETIC PLAIN

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In this paper, we discuss about the vertical distribution of aerosols and clouds in association with rainfall over selected test sites of Indo-Gangetic Plain (IGP) during contrasting Indian Summer Monsoon Rainfall (ISMR) of 2013 and 2014. The objective of the study is to find the differences in the aerosols and cloud vertical distribution in the atmosphere during different rainfall conditions of 2013 and 2014 ISMR where the former witnessed normal rainfall conditions while the latter observed drought condition over the region. For this we considered aerosol and cloud profile products of Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) and daily gridded rainfall product of India Meteorological Department (IMD) at spatial resolution of 0.25º x 0.25º during June to September months of 2013 and 2014. The CALIPSO data, after applying required quality checks, is processed for Aerosol and Cloud Occurrence Frequencies (AOF and COF) with respect to height. The variation of AOF and COF are analysed along with monthly rainfall statistics over the given test sites. Along with these, Aerosol Optical Depth (AOD) and Cloud Fraction (CF) of Moderate Resolution Imaging Spectroradiometer (MODIS) on-board Aqua satellite are also analysed to find the association of aerosols and cloud cover and their effect on precipitation over the study area.

Keywords: ISMR, AOF, COF, AOD, CF

Abstract Id: 1529
DETAILED NOISE MAPPING AT A CITY CROSSING USING LASER DATA AND GOOGLE IMAGE

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Traffic noise is a menace for health. Noise levels at roadway crossings are increasing with growing traffic in India. Vehicles of different types, i.e., heavy and light, keep on moving randomly from different directions with varying flow making prediction of noise levels around a city crossing very challenging. Noise levels vary in decibels and frequency compositions at different time of a day. The space, time, and frequency varying noises at a typical developing city crossing in Jais, UP, India is tried to be characterized and showcased as high resolution noise maps. Terrain data were captured at 100 m stretch in different sides around Bahadurpur, Jais crossing using Total Station, GPS, and Laser scanner. Data were processed to extract building, tree, and other obstructions. Important ground type information were determined using classified google images for the area. Noise data were captured at 11 strategic locations around roads on 5 days at different time intervals. 3 important time intervals were chosen based on predominant traffic flows present at the crossing. Noise data, terrain data, ground type information, and the environmental data were incorporated inside a semi-empirical noise propagation model to predict noise levels. It is predicted as equivalent sound pressure levels- SPL in dB(A) at different locations and hours. Further, the predominant noise frequencies present at the crossing at different hours at different locations were also determined. Predicted noise levels with frequencies were plotted in GIS environment as noise maps. Predicted noise maps were compared with measured data and found to be accurate by ±5 dB on average. The detailed noise maps indicate the extent of noise exposures at different parts of the crossings in dB(A) -SPL, and dB(A)-Hz at different time of a day, which show how much the roadside shops and buildings are effected by noise pollution.

Keywords: Noise map, Laser data, GIS, image, GPS, Noise Prediction

Abstract Id: 1530
This paper proposes optimum coverage of mobile signals in an area by minimum number of Mobile Base Transceiver Stations using 3D Geovisualisation. The technique used demonstrates the ability of 3D GIS through 3D Viewshed Analysis to rule out the extra and unwanted number of high transmitting power mobile towers in a densely populated area, which can be replaced by low transmitting power repeaters after proper survey. This will result in less radiation hazard to the population in the direct line of sight and also cut down huge investment costs from the telecom industry’s perspective. Signal strength predicted by 3D viewshed analysis takes into account factors like terrain height, building height and distance from tower, which will be compared with field measurements for validation of the model generated. The study will be providing a detailed insight on the selection of suitable sites for MBTS erection, optimization of signal coverage and minimizing radiation hazard.

Keywords: MBTS - Mobile Base Transceiver Station, GSM- Global System for Mobile communication, LTE - Long Term Evolution, CDMA

Abstract Id: 1532
Assessment of three-dimensional (3D) forest structure is very crucial as it impacts the microclimate and regulates several physical and biological processes. Terrestrial laser scanning (TLS), also known as terrestrial LiDAR (light detection and ranging), has limited spatial coverage compared to spaceborne and airborne LiDAR, but has the potential to reduce uncertainty of field-based measurements. It is a non-destructive ground-based method that can retrieve the 3D vegetation structure at plot level with high accuracy. TLS data acquisition was done using a Terrestrial Laser Scanner-Riegli VZ-400, which operates at 1550 nm wavelength. Multiple scans were merged to create the 3D model of forest. The plot was extracted from the merged scan data with the help of the strip reflectors placed at the corner trees of the plot. From the plot, individual trees were extracted and from the extracted trees, the inventory parameters, viz., diameter at breast height (dbh), height and canopy projection area (CPA) were measured. TLS derived dbh and field dbh were found to be highly correlated with R² value of 0.99 and RMSE of 2.02 cm. The linear relationship of TLS derived height and field height was with a high R² value of 0.89 and RMSE of 2.44 m. TLS derived CPA and field CPA showed a strong linear relationship with R² of 0.98 and RMSE of 9.93 m². TLS is an important tool for 3D data acquisition of individual tree parameters. Recent advances in terrestrial LiDAR technology have made it possible to study vegetation structure characteristics and forest biomass/carbon.

Keywords: Terrestrial Laser Scanning, Point cloud, 3D modelling, Forest structure, Inventory parameters

Abstract Id: 1533
Climate change has huge significant impact on the Indian summer monsoon that results in change in the pattern of rainfall. To analyse this impact, a case study has been done in the Brahmani and Baitarni River basin, Odisha. This region has received frequent and heavy rainfall that caused various hazardous floods in the history that leads to huge loss of lives, properties, crops and tourism. This study has aimed to analyse the trend in the rainfall and discharge data using past 34 years long term ERA(European Reanalysis)-Interim daily rainfall and India-WRIS(Water Resources Information System) discharge data from 1980-2013. The main focus is to analyse the trends in the monsoon season. The discharge data contain the data of two hydro-meteorological stations Ananadpur and Jenapur of Baitarni and Brahmani River respectively. The trend analysis has been done using Mann-Kendall test i.e. non-parametric test at $\alpha = 0.05$ significance level. The results of this test show the significant increasing trend in the daily rainfall and discharge data. There is also insignificant increasing trend in the rainfall data in the month of June and July but less significant increasing trend in the month of August and September. In the month of July for Ananadpur and June and September for Jenapur hydro-meteorological stations, discharge data has insignificant decreasing trend. The discharge data of both the stations have also less significant decreasing trend in the month of July and August and insignificant increasing trend in the month September for the Ananadpur hydro-meteorological stations. This study concludes that the significant trends exist in daily rainfall and discharge data but less and insignificant trends exist in the monthly data of monsoon season. The results obtained can be further used for statistical modelling and for the development of tourism.

Keywords: Trend Analysis, Brahmani and Baitarni River basin, Mann-Kendall Test, ERA-Interim, India-WRIS

Abstract Id: 1536
ESTIMATION OF RUN-OFF POTENTIAL USING RAINFALL AND RUN-OFF MODELING IN DOON VALLEY

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A study has been done to solve the water scarcity problem in the Doon Valley, Dehradun by using the rainfall and run-off harvesting method. The rainfall and run-off plays a very significant role in the sustainable development and management of water resources in a catchment. The run-off harvesting can be made possible only by the estimation of run-off potential. Natural Resources Conservation Services Curve Number (NRCS) that was earlier known as the Soil Conservation Service (SCS) is used to estimate the run-off potential. Rainfall-Runoff modeling has been used to estimate the run-off potential by using Remote Sensing (RS) and Geographic Information System (GIS) technique. Curve Number (CN) is the run-off coefficient that can be estimated on the basis of Hydrological Soil Group (HSG), land use and Antecedent Moisture Condition (AMC). The range of CN values is from 0 to 100. High CN value indicates high surface run-off and vice-versa. AMC is the moisture condition before five days actual rainfall. The processing of RS data and overlaying of GIS data has been done using ERDAS Imagine and Arc-GIS software respectively. Digital Elevation Model (DEM) has been used to derive the slope map of this region. Slope corrected CN map was also generated to obtain the accurate results from rainfall-runoff modeling. The monthly average run-off potential generated for the Doon valley is varying from 195 cumec to 703 cumec. The result shows very high surface run-off in the urban region of Dehradun district that will be enough for run-off harvesting to solve water scarcity problems. This concludes that urban region has generally high run-off potential. The run-off potential obtained can be further used for water balance analysis in the catchment.

Keywords: Rainfall-Runoff modeling, Curve Number, AMC, HSG, Water balance analysis

Abstract Id: 1540
INVESTIGATING THE DYNAMIC RESPONSE OF THE ANZALI LAGOON TO SEA-LEVEL CHANGES USING MULTI-SOURCES REMOTELY SENSED DATA

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Caspian Sea, the biggest inland water body worldwide, is characterized by rapid sea-level changes, about 3 m oscillation, during the 20th century. These sea level fluctuations results in back-barrier lagoon formation. Regarding to the unique condition of CS and its dynamic fluctuations which alter the coastal areas it seems necessary to monitor the effect of these dramatic fluctuations on shrinkage and expansion of connected water bodies (e.g., Lagoons). Therefore, this study was conducted to find the dynamic response of the Anzali lagoon, the largest freshwater reservoir of the southern Caspian Sea, to the Caspian sea-level changes during the last 42 years, 1975 (before CS the low-stand) to 2016 (after CS high-stand) using the remotely sensed data. For this purpose, an automatic procedure including the combination of the Tasseled- Cap and texture filter methods was applied on the existing Landsat satellite imagery and to extracting the shoreline and calculating the area and perimeter of the Anzali Lagoon, during the study period. The sea level changes of the CS, were extracted from the multiple altimetry satellites data including; TOPEX, Jason1, OSTM, Jason3. Finally the relationship between the relative sea level variability and shoreline changes of the Anzali lagoon was studied. Results show that there is a positive linear correlations between area of Anzali Lagoon and Caspian Sea relative water level with the values of Pearson correlation coefficient and coefficient of determination of 0.832 and 0.6919, respectively. This linear relation indicates that Anzali lagoon is directly affected by Caspian Sea level fluctuations.

Keywords: Remote sensing, Shoreline change, Altimetry satellite data, Anzali Lagoon, Caspian Sea

Abstract Id: 1542
IDENTIFICATION OF POTENTIAL WATER SOURCE FOR BUTUAN CITY, NORTHEASTERN MINDANAO, PHILIPPINES THROUGH WATERSHED DELINEATION AND CHARACTERIZATION

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In Butuan City, Northeastern Mindanao, Philippines, majority of the people's water for domestic and agricultural usage comes from the Taguibo Watershed; which resonates for it be declared as a Forest Reserve since September 1997. Taguibo Watershed supplies more than 40,000 concessionaires or more than 200,000 individuals in Butuan City with a clean and potable water. However, as the City is continually developing and the population is also increasing, the demand for potable water in City also escalates. Especially during rainy seasons wherein the sourcing of water from Taguibo Watershed is limited due to its turbid river water. In this study, we attempt to locate and delineate watersheds within the proximity of Butuan City that can be considered as other possible sources of potable water. This is done by analyzing the characteristics of these prospect watersheds and compare it to the characteristics of Taguibo Watershed. These characteristics includes the watershed's soil classification, slope, runoff potential, land-cover and the river discharge. A 10-m Synthetic Aperture Radar - Digital Elevation Model (SAR-DEM) was mainly utilized as the main source of elevation data during the watershed delineation and hydrologic characterization. Landsat 8 Operational Land Imager (OLI) of 2017 with a 30-m by 30-m spatial resolution was utilized for the land-cover classification using the Maximum Likelihood algorithm. Upon determining these potential watersheds, those less probable areas were still considered by creating their equivalent rehabilitated models in terms of land-cover. With this study, the implementers and the law-makers would be guided on the possible watershed areas that could be explored to be another source of domestic water; which can greatly aid in Butuan City's problem of water supply.

Keywords: water source, delineation, watershed, physical characterization, Butuan City

Abstract Id: 1543
Using toilets with septic tanks are used in a town like Thiruvallur in Tamil Nadu as under ground sewerage system is yet to be completed. The septic tanks are in each housing plots with a bore well at one corner and septic tank in other corner. The street storm water drain, accommodates water from as well as kitchen waste water. The toilet solid and liquid waste is collected in the septic tank and dumped in faraway rivers or tanks by sewerages transport lorries or tractors once in 6 months or some times a year. When the town does not homogeneous aquifer to allow the seepage from 5year old cement or brick tanks to drian uniformly and disposed of in aquifer excepting area under 100 m with from the bank of the river like Cooum river where soil is with highly permeable sand deposits. In other areas has aquifer with clay and sand stone and the seepage is trapped with various pathogens which are resistant to antibiotics.

This paper suggest management of septic tanks with sewerage system using an advanced electronic sensors circuit. The effect of septic tanks on ground water quality is studied to identify possible water bourne deceases with 1:500 GIS of the town, with mapping of each house hold, sewerage lines, septic tanks ground water wells, over head tanks,water bodies etc. The water borne deceases in this area in summer and rainy season diseases with identified by more than for fifty GPS points with culture tests with at least one more set of data in summer and another after rains.

The larva of Aedes aegypti, the yellow fever mosquito, can spread dengue fever, chikungunya, Zika fever, Mayaro and as yellow fever viruses breeds in fresh water collected even in container to old tyres, bushes, fresh water pits. The other water borne diseases spread by Vector, Bacterial infections, skin diseases etc from the dirty water from open sewage lines and drains.

Completing under ground drainage system may take a year or two in part of study area. The over head tanks may be provided with small cameras to watch and clean in time to prevent vector deceases. Sensors net work may be created in linking septic tanks to warn the residents to remove sewerage, and to replace leaky tanks. Removing all unwanted things which can hold good water which breeds Dengue Aedes aegypti in June to August every year, unnecessary plants which provide breeding space for Dengue and allied mosquitoes residents can get help from Govt hospitals for preventive care, immunization without wasting time. The Geo spatial net work with hospital will be a tool to monitor water borne deceases. Delay in diagnosis or treatment has taken away monarch like Akbar who succumbed water borne disease, “Dysentery”. The electronic systems like the one manufactured by Fujitsu, Japan, biotoilets, monitoring sensor network to identify and remove blocks in underground lines and sewerage tanks. The paper aims at explaining the need of electronic monitoring system for Thiruvallur by 3D Geo spatial visualization.

Keywords: septic tanks, Thiruvallur, Aedes aegypti, Waterborne diseases, resistant to antibiotics

Abstract Id: 1545
IMPROVED MANGROVE ASSESSMENT USING WORLDVIEW 2 AND TANDEM-X HIGH RESOLUTION IMAGERY

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Monitoring of mangrove vegetation in the current changing climate, is the key forest management task. Traditional field based assessment of vegetation type has spatial limitation which is more time consuming, costly, and challenging in mangrove ecosystems. However, recent development both in active (LiDAR, SAR) and passive (Worldview 2, IKONOS, Quickbird etc.) remote sensing allow us to monitor even early basis. In this study, we identified mangrove vegetation types in Sundarbans East Wildlife Sanctuary, Bangladesh by means of three-dimensional classification of high resolution (WorldView 2; 2 x 2 m) and SAR (TanDEM-X; 12 x 12 m) image as a pioneer basis in Mangrove ecosystem. A total of 13 layers (All 9 bands of WorldView 2, 4 Normalized Difference Vegetation Indices and TanDEM-X based canopy height) were classified following the Iterative Self-Organizing Data Analysis Technique Algorithm. Vegetation types were assigned based on field inventory data based on abundance of species which was confirmed by expert knowledge and Google Earth@ image visual interpretation. Five mangrove types along with other 5 non-mangrove types were separated. Heritieria fomes, Excoecaria agallocha, Sonneratia apetala were identified as single species dominant type. Two mixed vegetation types were formed in varying proportion of Avicennia officinalis, S. caseolaris, Nypa fruticans, Lianas and cane. The mixed vegetation type Heritieria fomes and Excoecaria agallocha was missing as species were separated more accurately because of high resolution image (2 m) which in most cases smaller than the canopy of a single tree. The accuracy assessment and coverage will be incorporated in full version. Findings of this study will contribute to monitoring verification and reporting systems, especially in vegetation change detection and improved blue carbon assessment in mangrove.

Keywords: High resolution satellite image, Species identification, and Sundarbans Reserved Forest

Abstract Id: 1546
GEOMORPHOLOGIC ANALYSIS OF MULETA RIVER BASIN USING HIGH RESOLUTION DEM AND GIS

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Muleta river is one of major tributaries of Mindanao River Basin. Muleta was instrumented with the aim of understanding the interrelatedness of various variables. This paper focuses on morphologic characteristics of the watershed in relation to flooding and proneness to erosion using high resolution digital elevation model (DEM) data and geographic information systems (GIS) tools. The river basin is located in the Southern portion of the Philippines with an area of 1,050.39 km². Geomorphological parameters were calculated and analyzed through spatial analysis in ArcGIS and MapWindow GIS tools. Geomorphologic features of the basin is important in any hydrological processes relative to the development and management of soil and water resources. Elongated shape and size of the basin reflect the volume of water that can be generated by the rainfall. However, it has smaller form factor and circularity ratios indicating that the watershed has low susceptibility to flooding due to its high permeability. A more elongated shape facilitates the runoff of rain water which has greater tendency to favor erosion process. Watershed with low form factor indicates a flatter peak flow for longer duration. Flood flows of such elongated basins such as in Muleta are easier to control than of the circular watershed. Further, the lower drainage density value indicates slower storm response giving lower runoff yield. The terrain is predominantly undulating with high instability as manifested by high dissection index value. Dendritic drainage pattern is observed which manifests composition of fairly homogeneous rock without control by the underlying geologic structure. More dendritic pattern is formed when longer time of drainage formation. Integrated analysis of the relief features and drainage texture show that the watershed has higher tendency to erosion processes but has low susceptibility to flooding.

Keywords: DEM, geomorphologic, GIS, river basin

Abstract Id: 1547
Rice is the staple food of the country grown over the entire year. There are three main seasons for rice cultivation and they are named according to the seasons of harvest of the crop, i.e. Autumn, Kharif or Winter and Boro or summer or Rabi. Major Rabi Rice growing states lie in the coastal part of the country i.e. Andhra Pradesh, Karnataka, Telangana, Odisha and West Bengal. They together consist of 9 per cent of total Rice area. Accurate and timely forecasting of crop yield is a cornerstone for monitoring crop production and planning purpose, but the efficiency of the current system for near real-time forecasting may be improved by applying the remote sensing based approach. This study explored a novel approach for predicting the yield of Rabi Rice using Vegetation Condition Index (VCI) derived from remote sensing data. Historic data of last 14-years (2003-2016) of NDVI (Normalized Difference Vegetation Index) was used to derive the VCI. NDVI products (MOD-13A2) of MODIS instrument on board Terra satellite at 16 days interval from first fortnight of November to second fortnight of March (10 fortnights) were used to calculate the NDVI. District wise historical yield data was taken from DES. Study was carried out for 32 major Rabi Rice growing districts of Andhra Pradesh (6), Karnataka (4), Telangana (5), Odisha (8) and West Bengal (9). Stepwise regression technique were used to quantifying the relation between district wise VCI and historical yield. Strong relation (R^2) between the VCI and district wise DES yield was observed i.e. 0.45-0.97, 0.39-0.80, 0.70-0.95, 0.33-0.89, 0.25-0.70, for Andhra Pradesh, Karnataka, Odisha, Telangana and West Bengal, respectively. Except for 2 districts, the relationship was found to be statistically significant in all the districts. In 22 out of total 32 districts, the relative deviation between DES yield and VCI estimated yield

Keywords: Vegetation Condition Index, Rabi Rice, Remote Sensing, Yield forecasting

Abstract Id: 1548
Impacts of Climate Change in the Southern Aravalli Rajasthan

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Climate change is one of the greatest challenges of our time. Fossil fuel burning and deforestation have emerged as principal anthropogenic sources of rising atmospheric carbon dioxide (CO2) and other greenhouse gases and consequential global warming. Rajasthan, the largest state of India area-wise falls within the areas of great climate sensitivity. The vicissitudes of climate are likely to have a considerable impact on the physical and socio-economic fabric of the state. In more recent times, Rajasthan has experienced severe and frequent spells of droughts than any other region in India. The Aravalli hill region of South Rajasthan served its area and the people as a rich resource area providing forest products; fuel wood; fodder; timber; water through springs, streams and rivers; minerals, rich forest clad habitat; safe and secured locations to former rulers and their public. The environmental status has changed alarmingly during last six decades with ruthless destruction of forest cover over the hills followed with increase in soil erosion, sediment transportation, siltation, drying-up of lakes, dams and surface water sources, lowering of water table from 5 to 10 m to 50 to 100 m. The continuous change in the nature of rainfall, increasing pressure of population and livestock on the water resources in the South Rajasthan and depletion of environmental resources particularly, vegetation, soil resources have led to decline to water-table.

Keywords: rathore

Abstract Id: 1549
Due to the recent revolution of Geo Intelligence (GeoINT) technology, the products derived from freely downloaded satellite imagery, being an important parameter to provide the information of the associated changes happening over the Earth's surface. From the open sources such as United State Geological Survey (USGS), EARTHDATA sites having a registered user, it is adequate to extract coarser to medium scale terrain variables. In the present study, Landsat Satellites operating from 8-14 µm has been used to compute the Land Surface Temperature (LST) for a given terrain in 30m spatial resolution.

In the present study, Landsat data (of L5, L7 and L8) sensors has been used to assess the LST over two sites representing snow covered and vegetation terrain of high relief terrain respectively. For the snow covered terrain, a part of Karakoram has been considered to find out the link between changes in LST wrt change in surface area. Similarly Uttarakhand vegetated terrain has been studied to find out the rapid LU/LC changes due to the 2016 forest fire. In the snow region, the slow terrain changes (for path:row 148-35 from 1991 to 2016) and in the second site, the rapid LU/LC changes (for path-row 145-39, 146-39 and 145-40 from 2013 to 2016) has been considered. Using single and split window algorithms LST of the given terrain has been measured. The models are realised in spatial modeller tool of ERDAS software.

The result shows that in Karakoram area, the temperature rises relatively more in non-snow than snow areas leading to 6% depletion of snow areas. Similarly, LST analysis shows that there is sudden rise of temperature (>200C) in April 2016 and that is supported with reported data. Hence open source data and its derived products can enrich existing geo-spatial database by considering both static and dynamic terrain attributes.

Keywords: Mountain GeoINT, Landsat, Land Surface Temperature

Abstract Id: 1550
MANAGEMENT OF RISK AND OF COMMUNICABLE DISEASES BECAUSE OF FLOATING POPULATION IN THIRUVALLUR TOWN

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Thiruvallur town the District and Taluk headquarters has a recorded history of 5000 years was ruled by Ancient king to Mohamedan kings till the establishment of Europian and finally British which have left marks in terms of Jain, Siva, Vishnu temples, mosques, churches etc. The people pray at these places from far and near at Ten thousand to lakh on auspicious days apart from residents from 60000 population in the town. The pilgrims on foot to famous Thiruttani and Thirumala Temples visit the temples at the town and add stress on maintaining civic amenities. The railway and road ways are carrying staff, students, and public to offices, courts, markets. The goods transported by heavy vehicles to Thiruvallur marketing centre has also created an unusual pressure on health facilities.

The study identifies hot spot using 1:500 Gis of the Town with Geo Eye and Cartosat high resolution satellite data which is 14 sq km size. Out of which defunct water bodies occupies 5 sq km. The people have to live in about 9 sq km area accommodating temples, schools, colleges, banks, show rooms of major jewelers, multi level supermarkets etc. The workers travelling to firms to multinational firms, Kakkalur industrial estate etc adds to issue of health care. Railway and roadway have to adopt real time monitoring to transport accident victims for trauma care as Govt and Private multi specialty hospitals receive hundreds of victims in a month.

Health Gis is created for education, religious, marketing in Geo spatial format linking with data base in attribute tables, for various seasons with sample data sets dividing the town in to Old Thiruvallur Town, Municipality area near Railway line, Kakkalur panchayath, Selai to Collectoreate

Keywords: High density of residents, Floating population, trauma, health care, historical town

Abstract Id: 1551
Thiruvallur town the District and Taluk headquarters has a recorded history of 5000 years was ruled by Ancient king to Mohamedan kings till the establishment of European and finally British which have left marks in terms of Jain, Siva, Vishnu temples, mosques, churches etc. The people pray at these places from far and near at Ten thousand to lakh on auspicious days apart from residents from 60000 population in the town. The pilgrims on foot to famous Thiruttani and Thirumala Temples visit the temples at the town and add stress on maintaining civic amenities. The railway and road ways are carrying staff, students, and public to offices, courts, markets. The goods transported by heavy vehicles to Thiruvallur marketing centre has also created an unusual pressure on health facilities.

The study identifies hot spot using 1:500 Gis of the Town with Geo Eye and Cartosat high resolution satellite data which is 14 sq km size. Out of which defunct water bodies occupies 5 sq km. The people have to live in about 9 sq km area accommodating temples, schools, colleges, banks, show rooms of major jewelers, multi level supermarkets etc. The workers travelling to firms to multinational firms, Kakkalur industrial estate etc adds to issue of health care. Railway and roadway have to adopt real time monitoring to transport accident victims for trauma care as Govt and Private multi specialty hospitals receive hundreds of victims in a month.

Health Gis is created for education, religious, marketing in Geo spatial format linking with data base in attribute tables, for various seasons with sample data sets dividing the town in to Old Thiruvallur Town, Municipality area near Railway line, Kakkalur panchayath, Selai to Collectoreate

Keywords: AVRIS, Water quality

Abstract Id: 1553
MULTI-YEAR SATELLITE OBSERVATIONS AND TREND ANALYSIS OF ATMOSPHERIC POLLUTANT CONCENTRATIONS OVER INDIAN REGION

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Continuous measurements of atmospheric trace gases are available at present from various that can be utilized to monitor long term changes of concentrations. Off late, satellite remote sensing has helped to address this aspect to a great extent by providing high quality data with high spatial coverage. Satellite observations provide a handle for the overall monitoring of atmospheric trace gases on a global scale.

Since the atmospheric pollutant NO2 has a relatively low life time in atmosphere, the anthropogenic emissions of the compound is concentrated, or, higher, at the source region of emissions. Thus through remote sensing it is now possible to identify the areas with high emissions by monitoring the tropospheric NO2 concentrations. Streets et al., 2013 details the potential of OMI satellite products for identifying the source regions around the globe. CO observations provided by AIRS platform are valuable since it is providing CO emission levels at different altitudes.

The present investigation utilizes the level-3 data product of tropospheric NO2, columnar SO2, and surface CO concentrations over the Indian region from 2005 to 2014 and reveals interesting results on the identification of hotspots, quantification of levels of concentrations over different geographical zones over the country and also the general trends on air quality inferred from the frequency distributions. A comprehensive multi-year analysis of trace gases over the Indian region is undertaken using the data from OMI and AIRS. The investigations have helped to track and monitor the emissions from major sources spread across the country.

Keywords: SATELLITE, TRACE GAS

Abstract Id: 1555
ROAD EXTRACTION AND ITS CONDITIONING MONITORING FROM AVRIS DATA FOR URBAN DEVELOPMENT

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Hyperspectral Imagers can be used for urban development. Road conditioning motoring is a prime issue in India and accurate and timely assessment is required better transportation facilities. In this paper, road extraction and preliminary case study of road conditioning monitoring strategy is discussed. AVRIS dataset of Ahmedabad district is considered for experimentation. Also strategy for the separation of road area and other areas also discussed.

Keywords: Road, AVRIS, Urban

Abstract Id: 1557
CHARACTERIZING SAR BACKSCATTER FROM CROP COVER BY TREATING CROP COVER AS THREE LAYER MEDIUM

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SAR backscatter from crop covered field is affected by the plant characteristics along with the moisture content of crop and the underneath soil. The structure of a plant is largely determined by the relative proportion of its constituents. In case of wheat crop, head, leaf and stem are its main constituents. In order to get an insight into the characteristics interaction of SAR to wheat, the crop was segmented in to three components namely, stem, leaf and head of the wheat plant. The effectiveness of the layering approach to characterize SAR backscatter form wheat crop is demonstrated using high-incidence angle RADARSAT-2 SAR response to wheat crop acquired over parts of Mathura and Bharatpur districts during grain filling stage. A detailed ground experiment & lab analysis were carried out for the measurements of volume, wet biomass, dry biomass and moisture of all the three constituents of wheat plant (i.e. head, leaf and stem), plant height, plant density along with moisture & surface roughness of the underneath soil cover. In order to test the effectiveness of layering approach of considering wheat plant as a three layered medium, stepwise regression analysis have been performed between SAR backscatter and wheat biophysical parameters.

Results of regression analysis obtained by considering wheat plant as single medium, have been compared with the results of the stepwise multiple regression analysis performed between SAR backscatter and the segmented values of wet biomass, moisture and volume. Comparison of results not only indicates the significant improvement in the values of (R2) and F-statistics, but also shows the considerable reduction in significance of F-statistics by considering the wheat crop as a three-layered medium. Finally an attempt has been made to characterize the SAR backscatter from wheat crop covered agricultural land with the help of layer-wise biophysical parameters along with underneath soil properties.

Keywords: SAR Backscatter, 3-Layer approach, Wheat Head, Wheat Leaf, Wheat Stem

Abstract Id: 1558
SAR remote sensing has been widely used for agricultural mapping and monitoring. All weather capability of SAR data makes it advantageous to acquire information of agricultural crops during monsoon season. Several studies have been carried to show the potential of SAR data for retrieval of structural and biophysical parameters to estimate crop phenology. The focus of this research was Kharif crops discrimination using backscatter responses of C-band MRS mode dual polarimetric SAR data of RISAT-1 for Kharif crops. The study area chosen for this research was the agricultural field of Dehradun Valley. RISAT-1 data were processed to generate backscatter image and speckle filtering was also performed to minimize the noise appearing in the data for a particular area due to unexpected high backscatter return from the similar type of objects within SAR resolution cell. Both the polarimetric channels HH and HV were used for the backscatter based analysis at different stages of the agricultural crops. Sugarcane, paddy and maize were the main Kharif crops of the study area and the field data for different growth stages were collected. Different backscatter responses were recorded for Kharif crops. Due to unique structural property and dielectric behavior of crops a unique range of backscatter was obtained for individual crops. Backscattered responses obtained from SAR data for HH and HV polarizations were used for crop classification. On the basis of obtained results and literature review of previous research works, this study strongly recommends SAR data for parameter estimation and classification of agricultural crops.

Keywords: Kharif crops, RISAT-1, MRS, Backscatter, Classification

Abstract Id: 1559
COMPARISON OF RADIATIVE TRANSFER EQUATION AND SINGLE CHANNEL ALGORITHMS FOR RETRIEVING LAND SURFACE TEMPERATURE USING LANDSAT-8 SATELLITE DATA

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Land surface temperature (LST) is the key parameter which in land surface processes, energy balance, crop evapotranspiration, water allocation and planning from small to larger extant on globe. Now a days, LST retrieval algorithms become a research interest globally using various satellite data at different spatial resolution. In the present study, the main aim is to retrieve land surface emissivity and temperature over the parts of North India using Radiative Transfer Equation (RTE) based method and Single Channel (SC) method for the period of 2014-15 using Landsat-8 thermal infra-red sensor (TIR) data. The main task in LST retrieval is removing the atmospheric attenuation effects and calculation of land surface emissivity (LSE) with vegetation variability which was incorporated in LSE. So, NDVI was estimated as proxy of vegetation which is varied with crop cover. Upwelling and downwelling path radiance with atmospheric transmittance are estimated from MODTRAN model for TIRS. These are incorporated in estimation of complex process of LSE using apparent radiance received by sensor. RTE and SC algorithms assimilate the thermal radiance measured at sensor level, accompany with emissivity. At study area, LST varied from 16.5°C to 39.4°C for 2014-15. NDVI pixels were compared with LST pixels for understanding the LST association with NDVI. A strong negative correlation was observed between NDVI and LST, especially in vegetated areas. However, calculation of emissivity due to change in vegetation with spatial scale is complex and matter of future research studies.

Keywords: Land surface temperature, Radiative Transfer Equation, Single Channel algorithm, Landsat-8, Land surface emissivity

Abstract Id: 1561
REMOTE SENSING TO ADVANCE SUSTAINABLE MINING PRACTICES

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This paper outlines applications of both active (radar/LiDAR) and passive (multispectral/hyperspectral) sensors for monitoring mine environment and mine safety. Examples are cited from various remote sensing platforms including satellite, aircraft and Unmanned Arial Vehicles (UAVs). These platforms are evaluated for their suitability to monitor mining environments on the basis of spatial, spectral and temporal resolutions. Examples are drawn from monitoring different aspects of mining such subsidence, pit slope stability, mine water quality, mine tailings, mine rehabilitation, engineering inspections, abandoned mines, and land cover land use changes. As a concluding remark, the recent advancements in the remote sensing systems are projected in a futuristic visualisation of a smart sensor network for advancing sustainable mining practices.

Keywords: multispectral, hyperspectral, LiDAR, SAR, UAVs

Abstract Id: 1564
DEVELOPMENT OF SATELLITE BASED REAL TIME CROP FIRE ALERT SYSTEM

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Crop stubble burning both in summer and winter seasons has emerged as a menace in the northern states of India, causing severe environmental problems. Though the state Governments have made it a punishable offence, yet the conviction is very poor, for want of timely information. The paper describes the development of Satellite based Real Time Crop Fire Alert System to provide real time crop fire information to the enforcement agencies. Data made available from MODIS and Suomi satellites of USA through NRSC, ISRO, Hyderabad have been used to identify Active Fire Points on daily basis. Though it is a course resolution data, yet because of its daily repeat cycle it can indicate major fire points on daily basis. As the resolution of the satellite providing daily data is very course, fire occurring in more than 6.5 ha only is captured on daily basis.

During the paddy and wheat seasons of 2016-17 Active Fire Locations were observed in all the major crop growing districts of the state of Haryana during the harvesting period of each crop. During the paddy and wheat harvesting 12900 and 4300 major crop fire points, respectively, were observed clearly indicating that the menace is much more severe in the paddy compared to wheat crop.

The crop fire locations being received through the satellite on daily basis were sent directly to enforcement officials through SMS alert so as to initiate immediate action through an android based ‘Crop Fire Alert’ application. The SMS alert directs to a link which opens the crop fire map indicating the fire locations for the day. By clicking at the location, it will indicate the name of the village and latitude and longitudes of the crop fire point to enable enforcement agencies to locate the fire point on the ground.

Keywords: Crop Residue Burning, Modis, Suomi, Crop Fire Alert System

Abstract Id: 1566
VIDEO SIGNAL SENSITIVITY TO TEMPERATURE VARIATION IN CHARGE COUPLED DEVICES

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Si based optical imaging detectors (Charge Coupled Devices) are illuminated both from front side (semiconductor growth direction) and back side (opposite to semiconductor growth direction). Selection of direction of illumination is based on sensitivity requirement in wavelength region of interest. In back illuminated detectors, photons are directly impinged on the active epitaxial layer. Depth of absorption vary depending on wavelength of radiation. Shorter wavelengths get absorbed near the exposed surface (exposed to EM radiation) of epitaxial layer. Longer wavelength radiations get absorbed deeper into the Epi layer towards the buried channel. Depth of absorption (DoA) is a function of wavelength and temperature. DoA decreases with increase in die temperature. The generated free carriers (electrons) are pulled by the electric field under application of gate voltages. Carriers generated by shorter wavelength receives lower field strength. Hence, higher possibility of getting recombined before being pulled by the electric field. With increase in temperature the probability of getting pulled by the electric field decreases further. Hence, some of the carriers may get lost due to recombination. On the contrary, due to high depth of penetration carriers generated by higher wavelength receives greater field strength and hence, greater probability of detection. Moreover, the field strength is also a function of total number of carriers stored under a gate for a given bias. This is one reason which may lead to signal amplitude dependent band specific sensitivity to temperature variation. Detection probability is usually defined as an electro-optical parameter known as quantum efficiency. So, in these device, shorter wavelengths show a greater sensitivity to temperature variation compared longer wavelength. Similarly, front-illuminated detectors are also show sensitivity to temperature variation in a slightly way. This paper discusses CCD based detector sensitivity with respect to temperature variation.

Keywords: CCD, back side illuminated, depth of absorption

Abstract Id: 1567
SPECTRAL PROPERTIES AND REFLECTED CURVES OF THE SEDIMENTARY ROCKS IN SYRIA USING RADIOMETER MEASUREMENTS

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This research aims at studying the spectral reflectance intensity of the revealed sedimentary rocks in Syria, to draw their reflected curves and to discriminate their kinds by using radiometric measurements. This study covered different kinds of rocks consisted of limestone, Dolomitic limestone, Dolomite, iron deposits, phosphate, gypsum, sands, marl, clay and soils, which are related to different ages from Triassic till recent Quaternary.

The reflected rays were measured by using radiometer apparatus provided with filters for multi-spectral scanners (TM, MSS, and SPOT), the recorded information was treated according to the used equations in the apparatus. The reflectance intensity was calculated for each kind of the measured rocks with different channels, and then was shown graphically. Also, the medium reflectance intensity curves of these rocks was symbolized in each kind of the scanners, in addition to the relative value of reflection which was determined in different spectral channels to cancel the shadow where we get the best information which help in designing and developing field, aerospace, and remote sensing survey equipment to recognize the mentioned rocks accurately.

We have got the following results through this research:
1-The reflectance intensities, generally, being with gradual rise from the first till the forth channel in TM, MSS while this intensities in the second channel in SPOT are low.
2-Sedimentary rocks take different reflectance in all scanners. The lowest reflectance being with the Quaternary soil, Iron deposits, Littoral sand, soft limestone, organoenous limestone, Dolomitic limestone, Clay Phosphate, Gypsum, hard Limestone, till the marl which has higher reflectance intensity. The reflectance intensities for these rocks vary according to there kind, structure, color changes and rotten degree.
3-The Quaternary soils take the lowest reflectance values in all scanners as the follows MSS (0.08 - 0.16), TM (0.05 - 0.14) and SPOT (0.1 - 0.12).
4-Studies have shown the possibility of recognizing various sedimentary rocks through using radiometric measurements, consequently on space images. This effect is clearer if a ratio of reflection values between different canals has done which help in producing lithological Maps for rocks which are relatively similar to each other.

Keywords: multi-spectral scanners, TM, MSS, SPOT, lithological Maps

Abstract Id: 1569
We report and describe methods and findings from monitoring, through remote sensing captured from space an ongoing armed conflict in Marawi City in the northwest Mindanao, located southern Philippines that has been under siege since 19 May as government forces fight to push joint force of ISIS militants and so-called Maute group, a local terror group from the area. Time series synthetic aperture radar (SAR) imagery from Sentinel 1A were used to analyze the progression of destruction wrought mainly by the airstrikes or bombing done through the use of aircrafts with air-to-ground ordnance; ground artillery fires, grenade launchers, gunfires and burning. Changes in SAR backscatter in the co-and cross-polarized C-band images and ratios were validated through comparison with high-resolution satellite imagery (HRSI) that are intermittently (due to weather conditions, cloud cover and night-time limitation) available for the area. We analyse the extent of the devastation, the type of effect and pinpoint possible causes of changes that have occurred as a result of the military operation. A typology of building damage is suggested based on rule-sets. Precise georeferencing and terrain correction is key correct analysis of SAR datasets. Results from this analysis can be used as reference for future reconstruction and rehabilitation of the city in post-conflict era.

Keywords: armed conflict, Marawi, Maute, ISIS, war, damage, destruction, reconstruction

Abstract Id: 1571
ACCURACY ASSESSMENTS ON INTERIOR AND EXTERIOR ORIENTATION PARAMETERS OF BUILT-IN CAMERA OF PORTABLE DEVICES

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Smart portable devices developed rapidly in recent years. Tablets and smartphones are more common for people. The resolution of the camera in these devices is also rising. In particular, after built-in GNSS, gyroscopes, accelerometers and other MEMS sensors, the device is more convenient than general digital cameras. However, the stability of the interior orientation parameters of the built-in camera has to be tested. The position and attitude provided by the built-in sensor, is sufficient as a direct geo-referencing of the shooting images, also yet to be assessed. Therefore, this study will be based on former research results about non-metric digital camera used in close-range photogrammetry. We will design experiments to explore the accuracy of interior and exterior orientation. This study has two issues. First, the interior orientation stability of the portable devices: we will repeat shooting the coded calibration targets by the same model four tablets and by a single tablet. Then we get interior orientation parameters by camera calibration in iWitness Pro. Second, the accuracy of GNSS and gyroscopes in portable devices: We analyze the precision of GNSS and attitude by the same model four tablets, then compared with e-GNSS.

Keywords: Close-range Photogrammetry, Portable Computing Devices, Camera Calibration, Accuracy Assessment

Abstract Id: 1572
Turbidity, an important quality parameter of water from its optical property point of view, its measurement on field in distributed manner is tedious and time consuming. Generally, band rationing, or regression analysis between turbidity concentration and band reflectance, approaches have been adapted to retrieve turbidity using multispectral remote sensing data, those result in qualitative rather than quantitative estimates of the turbidity. Over the past two decades, advances in sensor technology have overcome this limitation of earth observation systems, with the development of hyperspectral sensor technologies. Hyperspectral systems have made it possible for the collection of several hundred narrow contiguous spectral bands in a single acquisition. The hyperspectral remote sensing is emerging as the more in-depth means of investigating spatial, spectral and temporal variations in order to derive more accurate estimates of information required. In this article, the capabilities of the NASA’s very recent Airborne Visible/Infrared Imaging Spectrometer Next Generation (AVIRIS-NG) airborne hyperspectral remote sensing data to map water quality of Chilika Lake, Odisha has been discussed. In the present study, spectral similarity analysis, between the spectral characteristics of AVIRIS-NG data and spectral library generated on field for the different concentrations of turbidity using field spectro-radiometer, has been done to quantify turbidity in the part of Chilika Lake, Odisha, India. For this kind of water quality mapping, a spatial spectral contextual image analysis technique “Spectral Angle mapper (SAM)” has been evaluated. It was found that, almost at each location in the lake under consideration, the field spectra matched with the image spectra. The observed turbidity at each location was also very much falling in the estimated turbidity class range. It was observed that the spectral similarity approach provides more quantitative estimate of turbidity.

Keywords: turbidity, airborne hyperspectral remote sensing, spectral analysis, spectral library, spectral similarity analysis, SAM

Abstract Id: 1573
Every year during monsoon, most part of India is affected by flood - a natural menace. It not only cause huge damage to infrastructure but also loss of life. In recent years, incidences of flash flood have increased which can be seen in climate change scenario. Therefore, at this stage, it is pertinent to study areas of flash incidences. The Jia-dhal basin of north east Himalaya is one such basin which frequently experiences flash flood events. The present study aims to assess the flash flood vulnerability and risk in the Jia-dhal basin using satellite data.

Satellite remote sensing data were used in this study to extract topographic variables such as slope and drainage density and land use land cove (LULC). Soil types also play important role in flash flooding, thus soil types layer was included in assessing of flash flood vulnerability. Furthermore, flood risk analysis was performed village wise and is categorized into different classes i.e. land use vulnerability, infrastructural vulnerability, and population vulnerability. Factors such as agricultural area for land use, roads for infrastructural, and population density, and demographic details for population vulnerability were considered. Significance of the factors in terms of their importance in causing the flash flood and their risk in different segments of the society is ranked based on AHP and knowledge based weighting. The results obtained in this study were validated with field examinations.

Keywords: Flash flood, vulnerability, risk analysis, remote sensing technology, AHP
Groundwater is a major source of water supply for drinking, irrigation and industrial activities in many countries. Reductions in ground water storages have implications for the water cycle because, groundwater supplies the base flow in many rivers and it supports evapotranspiration in high water table regions. Regular and systematic monitoring of groundwater resources is necessary for its effective management to support the water needs of the environment and its citizens. With traditional measuring techniques, it is difficult to estimate Groundwater storage changes over large geographic regions. NASA's Gravity Recovery and Climate Experiment (GRACE) satellite has improved the ability to estimate components of the hydrological budget for many large-scale basins throughout the world (Rodell and Famiglietti, 2002; Han et al., 2005; Yirdaw et al., 2008; Leblanc et al., 2009; Famiglietti et al., 2011). Since its launch in March 2002, GRACE has recorded gravity anomalies at monthly time intervals using twin satellites that travel 220 km apart in identical orbits. After atmospheric and oceanic effects are accounted for, the remaining signal on monthly to interannual timescales is mostly related to variations of terrestrial water storage (TWS). TWS anomalies measured by GRACE are representative of variations in snow and ice cover, surface water storage, soil moisture, and groundwater storage. As a result, Grace derived total water storage (TWS) is a useful tool for calculating changes in groundwater storage. The present study is carried over Andhra Pradesh & Telangana states, India. In this study groundwater storage (GWS) is calculated using GRACE TWS data. And GRACE derived GWS is compared with field observations. At the regional level, it was found that GRACE-derived groundwater storage estimates are comparable with the field observations.

Keywords: GRACE, TWS, Groundwater storage

Abstract Id: 1575
MAPPING OF LONG-TERM SNOW COVER AREA VARIABILITY AND ITS CURRENT STATUS (2016-17) IN NORTH WESTERN HIMALAYAN RIVER BASINS USING REMOTE SENSING


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Snow cover is one of the most important land surface parameters in global water and energy cycle. Large area of North West Himalayan (NWH) mostly receives precipitation in terms of snow. The major share of discharge in rivers of NWH comes from snow and glacier melt. The hydrological models used to quantify this runoff contribution uses snow covered area (SCA) along with hydro-meteorological data as essential inputs. In this context, information about SCA is essential for water resource management in NWH region. Regular mapping and monitoring of snow cover by traditional means is very difficult due to scanty snow gauges, inaccessible terrain. Remote sensing has proven its capability of mapping and monitoring snow cover and glacier extents in those area with high spatial and temporal resolution. In this study, 8-day snow cover products from MODIS and 15-daily snow cover fraction product from AWiFS were used to generate long term SCA maps (2000-2017) for entire NWH region. The variability of 8-daily SCA and its current status has been analysed. The problem of persistent cloud cover in the snow cover products of MODIS was resolved using an innovative two tier Geo-Spatial-Temporal Approach (GSTA). The SCA mapped through GSTA has been validated using AWiFS derived SCA. The current status analysis of SCA has indicated that the SCA of 2016-17 has smashed all the past records of extent of snow cover in most of the river basins of NWH. In 2nd week of February 2017, around 67% of NWH region was snow covered. The comparison of SCA during 1st week of March and April in year 2016-17 against 2015-16 indicate 7.3% and 6.5%, increased SCA in current year. This increased SCA may increase the snow melt contribution to the basin in early- and mid-spring, which may also lead to increased risk of hydro-meteorological disasters.

Keywords: Snow Cover Area, North Western Himalaya, MODIS, AWiFS

Abstract Id: 1576
MULTI-TEMPORAL MODIS FOR DETECTION AND PUBLISHED LITERATURES FOR VALIDATION OF PHYTOPLANKTON BLOOMS IN SABAH AND SARAWAK, MALAYSIA

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The coastal region of Sabah, Malaysia is mostly affected by harmful phytoplankton blooms (HPB) that often cause massive fish kills and sometimes human casualties. Lack of a well-agreed, transparent and reproducible method, aperiodic nature and limited (technical) ability to monitoring HPB at large regional scale, have all led to reinforced methodological improvement for bloom prediction, scientific management of coastal water resources and regulatory attention. MODIS (MODerate Resolution Imaging Spectroradiometer) is one of the well validated ocean color sensor that enables acquiring high spectral resolution images, with short revisit time, freely accessible and bay-wide coverage. Yet, the relative efficiency of MODIS (MODerate Resolution Imaging Spectroradiometer)-derived Chl-a (Chlorophyll-a), ABI (Algal Bloom Index), and nFLH (normalized Fluorescence Line Height) have not been compared in coastal regions of Malaysia. Fifteen MODIS Level 2 images acquired between 2005 and 2013 were considered as time series data that matches HPB events mentioned in previous studies. As the historical real time in-situ data collection is often difficult (inaccessible) and thus unavailable this project had to validate results obtained from literatures, assuming that though in-situ, would indicate HPB location at least during MODIS acquisition dates. Variations of HPB affected areas with temporal and spatial scales derived from bloom indices are shown in color maps. Reliability of bloom information was measured by subjectively comparing HPB results provided by indices and previously published results (in-situ based study literatures). ABI outperformed Chl-a and nFLH indices based on comparisons in both normal and HPB conditions occurring in the coastal waters of Sabah and Sarawak. So, it could be stated that ABI is reliable and useful for MODIS and other ocean color remote sensors to detect HPB conditions. The configuration and reliability retrieved from MODIS-ABI allow their application in different likely tropical region as automated HPB monitoring systems and coastal water management programs.

Keywords: MODIS, Phytoplankton bloom, Sabah and Sarawak, Malaysia, Ocean color remote sensing

Abstract Id: 1577
MONITORING, ASSESSMENT AND COMBATING DESERTIFICATION USING HIGH RESOLUTION SATELLITE DATA

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Desertification is one of the major environmental problems, affecting the living conditions of millions of people all across the world. Inventory and monitoring of the desertification status are the primary requirement in preparation of mitigation plan to combat desertification. Objective of the present paper is, therefore, to prepare spatial inventory of desertification status which provides information on the spatial extent of the area under desertification, its type and severity. Multi-season Landsat TM data of 30 m spatial resolution, pertaining to the years 1991, 2000 and 2016, have been analysed to prepare desertification status map (DSM) on 1:25,000 scale for parts of Pali district, Rajasthan state in western India. Monitoring and assessment of the desertification has been carried out for a period of 25 years. Preparation of desertification combating plans, which can be implemented at the ground, requires DSM at cadastral scale. Therefore, DSM has also been prepared on 1: 10,000 scale using very high spatial resolution data of Resourecsat-2 LISS-IV. Spatial information on land use, desertification status (extent, type and severity) extracted from the above DSM map and the information on topography and morphology, inferred from Cartosat-1 images (2.5-meter spatial resolution, panchromatic stereo) have been used to suggest locale specific actions for combating desertification.

Keywords: Land degradation; desertification

Abstract Id: 1582
DROUGHT SEVERITY IDENTIFICATION AND CLASSIFICATION OF LAND PATTERN USING LANDSAT 8 DATA BASED ON SPECTRAL INDICES AND MAXIMUM LIKELIHOOD ALGORITHM

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The drought is a natural disaster and hard to predict its occurrences. It has severe impact on world’s economy, ecology, and agriculture sector, whereas millions of people are affected. In the year 2013-2014, Vaijapur tehsil has faced one of the severe and exceptional drought occurrences in terms of scale, dispersion, period and scale. The research study attempts to assess the adeptness of satellite based drought indices for observing the spatio-temporal extent of agricultural drought events. The Land Use Land Cover (LULC) has classified in six classes Vegetation, Settlement, Barren land, Harvested land, Hill with rocks and Water bodies using Maximum Likelihood supervised algorithm. An efforts have been made to analyze the drought condition using multi-date Landsat 8 images in Vaijapur tehsil which falls in drought prone areas. The severity of drought was determined and defined based on the Normalized Difference Vegetation Index (NDVI), Vegetation Condition Index (VCI), Soil Adjusted Vegetation Index (SAVI), and Temperature Condition Index (TCI). However, the drought severity were classified into three groups of severe, moderate, and normal. The research has proved that the entire study area was affected by a severe drought condition in 2013-2014.

Keywords: Drought Severity, Spectral Indices, Supervised Classification, Landsat Data, LULC.

Abstract Id: 1584
PRODUCTION OF AIRBORNE LASER SCANNER SKILLED ADVANCED UNMANNED AIR VEHICLE

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By means of providing dense, precise, low-cost and periodical point clouds and accurate three-dimensional digital surface and terrain models of target areas, Airborne Laser Scanning (ALS) became respectable in a short time in remote sensing technologies and accepted as an alternative method to the photogrammetry especially in financially strong European Countries and USA. However, the technique could not be utilized sufficiently in underdeveloped or developing Countries due to the high cost of ALS equipment consists of Global Navigation Satellite Systems (GNSS) and Inertial Measurement Unit (IMU) mounted aircrafts, airborne laser scanner, and high capacity work stations.

To provide the utilization of ALS technique in underdeveloped and developing Countries which have financial problems, we generated a low-cost airborne laser scanner skilled advanced unmanned air vehicle in the scope of a National Research and Development Project. The device is able to provide very accurate and high-resolution ALS data in target areas with advanced properties such as novel ALS gimbal design and real time kinematic positioning. In the paper, the precise point clouds and the quality of generated digital surface model achieved from novel device are presented with visual and statistical approaches in a preferred test area which includes open, forest, and built-up terrain formations. The quality of presented three-dimensional model was validated by model-to-model comparison with a reference model acquired with terrestrial laser scans in the test area.

Keywords: UAV, ALS, GNSS, IMU, RTK, ALS Gimbal

Abstract Id: 1585
DEVELOPMENT OF DATA-DRIVEN MODEL USING BAYESIAN STATISTICS, AND REMOTE SENSING TECHNIQUES FOR CONSTRUING NONLINEARITY IN LULC TRANSFORMATIONS

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Machine learning techniques help in construing the complexities of combinatorial analyses. Application of these techniques helps in assessing the significance of causal factors on spatial events. This work attempts to identify the hotspots of possible randomness in terms of land use / cover changes using machine learning and remote sensing techniques. Transformations in an urban landscape pattern are a consequence of congregation of different spatial and aspatial factors. Furthermore, there is a huge possibility that the characteristics of these factors may vary in spatio-temporal domain. Hence, it is difficult to investigate an urban event using a unidimensional approach. Nonlinearity of urban events can be tackled using techniques which are effective in considering and representing the possible transitions of causal factors from one state to another with probabilistic / possibilistic values. Hence, Bayesian model is employed in this study using historical and current data sets. Firstly, the study area is segregated into different grids. Spatiotemporal assessment of land use / cover changes and transition of LULC class from one to another is performed for the years between 1992 and 2014 for each grid. Then, current landscape pattern is quantified using a proposed landscape indices termed as fuzzy-Shannon’s heterogeneity index for different grids. It is developed by modifying conventional Shannon’s heterogeneity index. The results obtained from the application of fuzzy-Shannon’s heterogeneity index and spatiotemporal assessment of LULC changes and transition of LULC class from one to another are fed into the Bayesian model to determine the land use / cover changes hotspots. Results of the Bayesian model also helps in identifying the factors which are the most significant actors in inducing randomness in LULC transformation. Hotspots obtained from the proposed model are witnessing unprecedented changes in LULC. Therefore, it can be inferred that results are in sync with the actual scenario.

Keywords: Data driven model, Machine learning, Bayesian statistics, hotspots, fuzzy-Shannon’s heterogeneity index

Abstract Id: 1589
EFFICACY OF AIRBORNE HYPERSPECTRAL DATA FOR MINERAL DEPOSITS (PB, ZN, CU) IN JAHAZPUR BELT OF BHILWARA DISTRICT, RAJASTHAN

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Multi-spectral space borne data (Aster, Hyperion) have been successfully employed in the field of mineral exploration to identify key minerals in different parts of the world. With the availability of airborne hyperspectral data (AVIRIS-NG), it is possible to identify specific minerals due to its better spectral and spatial resolution. These data spans from visible to infrared region of EMR spectrum. Specific bands in SWIR region are very useful in detection of hydrothermally altered hydroxyl bearing minerals related to base metal deposits. Furthermore, geospatial analysis also helps in preparation of mineral potential zones by integrating hyperspectral image processing output, coupled with ground information like geology, field spectra and geochemical analysis of rocks / minerals / soil samples. The present study highlights the efficacy of hyperspectral remote sensing data (AVIRIS-NG) along with the field spectroradiometer observations in Jahazpur belt of Bhilwara district of Rajasthan. The study area is comprised of quartzite, dolomite, phyllite and tuff which act as host rocks for Pb, Zn and Cu minerals. The airborne AVIRIS-NG Level-2 data (atmospherically-corrected surface reflectance) contains 425 bands in VNIR-SWIR region (380 - 2510 nm) at 5 nm band interval with 8.1 m spatial resolution. Field spectroradiometer (SVC HR-1024) records the spectra of different objects in 1024 channels continuously. Preliminary results obtained after matching of field, image, lab and USGS library spectra. It has been observed that Dolomitic Limestone [(Ca, Mg) CO3] shows an absorption dip at 2313 nm due to CO3 absorption. Laterite which is characterized by clay minerals of kaolinite group has an absorption feature at 2201 nm and Carbonaceous Phyllite has strong absorption dip at 2192 nm. Though there is difference in magnitude, but above results shows that there is consistently good matching of absorption features in image spectra with that of field and lab spectra taken by Spectroradiometer.

Keywords: Mineral Exploration, AVIRIS-NG, Spectroradiometer, Spectral Matching

Abstract Id: 1593
ALGORITHM DEVELOPMENT FOR RETRIEVAL OF BIOPHYSICAL PARAMETER FROM ISRO’S FUTURE GISAT MISSION

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The thriving development of land-surface ecosystems modeling and environmental monitoring systems has resulted in an urgent demand for high-quality, long-term consistent biophysical parameters such leaf area index (LAI). Canopy radiative transfer (CRT) based methodology has been developed to retrieve agricultural LAI at spatial scale at regular temporal interval. ProSail CRT model was customized for GISAT (Geo-stationary Imaging Satellite) MX-VNIR. MX-VNIR cover spectral range from 450-520, 520-590, 620-680, 770-860, 710-740 nm and 845-875 nm. The model was calibrated using three year measured ground data over six ground sites representing diverse cropping pattern and representing different agro-climatic zones in Punjab and Madhya Pradesh state of India. The model was further customized for RS-2 AWIFS first three bands to evaluate its performance at spatial scale. CRT model was first run over different agriculture season of India over Punjab and Madhya Pradesh for year 2015, 2016 and 2017 using AWIFS data. The model showed overall 20 to 36% deviation from mean measured with RMSE ranging from 1.0 to 2.2. The maximum deviation in retrieved LAI was observed in kharif season due to background water cover for rice area. To assess the model performance for GISAT MX-VNIR bands, recently concluded airborne AVIRIS-NG data was used. AVIRIS-NG bands were convoluted using relative response function for all six GISAT MX-VNIR spectral bands as Gaussian. Generated six bands were then used to retrieve LAI over Kota and Maddur region. Retrieved LAI showed 17% deviation from mean measured with first four bands of MX-VNIR. Further improvement was observed up to 12-15% from mean measured for other four bands. These four bands showed ability to pick leaf biochemical and morphological properties for retrieval of LAI using radiative transfer model. The developed methodology will be use to generate operational agricultural LAI at regular interval using GISAT MX-VNIR data.

Keywords: LAI, GISAT, AVIRIS, Canopy Radiative transfer model

Abstract Id: 1597
Development of human resources in developing countries assumes importance in applying space science and technology for sustainable development of the region and managing disasters through education and skills development programs. The primary motivation is to impart sufficient knowledge at all levels starting from educators, working professionals and decision making officials to empower them reach their individual potential. This would help these workforces to be self-sufficient without looking forward to other countries, especially during national crisis.

The main challenge to the international effort in capacity building to reduce gaps between the developing and developed countries is the large variability in teaching methodologies and medium of instruction. International training programs undertaken at the Indian Institute of Remote Sensing, Dehradun, India have participants from different regions, thus challenging the trainers to manage multi-cultural and multi-ethnic learning environment. Participants come from different higher education systems each with diverse missions, history, and societal context. How to bridge the differences in culturally dependent learning and teaching styles related to cultural identity and heritage in a time bound training.

An effort has been made to develop an approach through a customized survey questionnaire, which brings out pertinent highlights of analysis and review based on feedback through a customised survey conducted from the participants of International courses and training programmes organised at Dehradoon in Indian Institute of Remote Sensing (IIRS). The survey questionnaire is divided into broad vertical-themes covering major aspects related to Education, Academic, benefit from the course, amenities-infrastructure, etc. The most important and pivotal part in sample collection is the human-touch given to felicitate participants so that unbiased and open views are received, which includes translating questionnaire to language of participants in case of customised courses for specific countries and then retranslating back in English for deciphering the feedback.

Outcome and findings suggests the gap-areas and strengths in the practices being followed for conduction of international courses at IIRS and CSSTEAP in specific, which may also be useful to any organisation conducting international courses with participants form various counties across different continents.

Keywords: Survey, Questionnaire, IIRS, CSSTEAP, feedback, training, international-participants, courses.

Abstract Id: 1601
RADIOMETRIC AND GEOMETRIC CALIBRATION OF MEDIUM RESOLUTION SAR OF RISAT-1

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To ensure the long term stability of the space borne Synthetic Aperture Radar (SAR) system, periodic evaluation of radiometric and geometric performance of the Space-borne/Air borne microwave SAR sensors and its validation has become mandatory for accurate data products to the Remote Sensing user community. SAR calibration can be performed using point targets (corner reflectors, Active Radar Calibrator) and distributed targets (Amazon rain forest). Corner reflectors provides one of the best solutions to use as standard point targets because of their retro reflective nature over large view angles coupled with stable Radar Cross Section (RCS) characteristics. In 2012, ISRO launched first indigenously developed C-band SAR sensor, Radar Imaging Satellite (RISAT-1) with unique capabilities of imaging modes, polarizations, swaths and resolutions. India being a country of diversified natural resources, a suitable imaging mode with medium resolution of 25m, left looking and descending node operating at 360 incidence angle with 25 days repetivity is planned to cater the dedicated civilian applications. During operational phase of RISAT-1, Medium Resolution SAR (MRS) systematic coverage data was analyzed regularly over designed square trihedral corner reflectors deployed in established microwave Calibration-Validation Site at National Remote Sensing Centre, Hyderabad. Point Target Analysis is performed and various SAR image radiometric quality parameters viz Peak Side Lobe Ratio, Integrated Side Lobe Ratio, Impulse Response Width, calibration factor and geometric accuracy are derived from the RISAT-1 calibrated data products for different imaging orbits. The experience gained in conducting external calibration exercise for RISAT-1 and its potential scope to extend for future ISRO’s National and Internationally collaborated space borne and airborne EO SAR sensors (RISAT-1A, NISAR etc..) are envisaged. The specifications of established Cal-Val site, details of data sets considered, design, development and orientation of corner reflectors, discussions on achieved radiometric and geometric calibration results are presented in this paper.

Keywords: corner reflectors, RISAT-1, point target, calibration, validation

Abstract Id: 1602
Drought is a condition of prolonged low rainfall leading to acute water shortage which has a huge social and economic impact. Drought is classified as meteorological, hydrological, agriculture and socio-economic drought. According to UNICEF, 266 districts across 11 states in India were declared drought prone in 2016. Chhatarpur is a drought affected district of Bhundelkhand region, M.P., India. Around 60% of agricultural land of the district was transformed to fallow land, which has reduced the agricultural productivity by approximately 35% due to the effect of drought during year 2015-16. Therefore, assessment and monitoring of agriculture drought is very essential activity for supporting management and mitigation planning. In the present study, Standard precipitation index (SPI) was used to identify and characterize the meteorological droughts. Impact of each meteorological drought on agriculture system was assessed using Vegetation condition index (VCI), Temperature condition index (TCI), and Vegetation temperature condition index (VTCI) derived from MODIS data. SPI was computed using daily gridded precipitation data provided by Indian Meteorological Department (IMD) (spatial resolution: 0.25 degree) of 21 grids covering entire Chhatarpur district. During last 15 years (2000-2015), the most severe meteorological drought had occurred during year 2003-04 with an intensity of -1.797 (SPI). VCI, TCI and VTCI were also calculated for Rabi seasons of all the 15 years. The results of agricultural drought mapping using VCI were compared with results of agricultural drought assessment using multiple indices (VCI, TCI, and VTCI). It was observed that VCI fails to accurately map actual extent of agricultural drought during sowing period. This limitation of VCI is mainly contributed to its dependence on vegetation index (NDVI) for drought mapping. However, combination of multiple indices give better assessment of agricultural drought condition during entire season. The study has highlighted the importance of using multiple indices for agricultural drought mapping.

Keywords: Land surface temperature, Normalized difference vegetation index, Vegetation condition index, Temperatures condition index

Abstract Id: 1604
SOIL CLASSIFICATION USING AIRBORNE HYPERSPECTRAL DATA
EMPLOYING VARIOUS APPROACHES

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Hyperspectral remote sensing technology is one of the advance technology for detailed land cover feature extraction. Hyperspectral remote sensing datasets contain large number of contiguous spectral bands with a narrow spectral bandwidth which enables identification of peculiar absorption features for distinguishing different type of soils. The potential of airborne hyperspectral remote sensing data (AVIRIS-NG) was tested for distinguishing black and red soils in the ICRISAT area near Hyderabad, Telangana. The AVIRIS-NG data captured in 432 narrow contiguous bands (346-2505 nm) with spectral sampling of 5 nm bandwidth and a 4m ground pixel size was used in this study. AVIRIS-NG data (L1R) was first spectrally subsetted by identifying and removing bad bands by visual inspection. The spectrally subsetted data was atmospherically corrected and converted to surface reflectance using FLAASH module. The data was finally georeferenced using the IGM module parameters. Optimal spectral bands from the reflectance data were selected on the basis of different characteristics of various soils. Data dimensionality reduction technique MNF was also performed to extract noise free components. Total five classes including red and black soils were considered for land cover classification. Pixel based classification techniques such as SAM and SVM were performed on the reflectance as well as MNF transformed data. SVM was again performed on data containing noise free MNF components and the selected optimal spectral bands. In the resultant classified output of reflectance data, SVM classifier provided higher accuracy and was able to classify black and red soil in a better way than SAM technique. The results also suggested that use of MNF components and specific spectral bands altogether improvised the classification of black and red soil.

Keywords: AVIRIS-NG, Soil classification, Spectral Angle Mapper (SAM), Support Vector Machine (SVM), Minimum Noise Fraction (MNF)

Abstract Id: 1605
INTRA- AND INTERSPECIES VARIATION IN PHOTOSYNTHETIC ACTIVITY OBSERVED THROUGH OSP 5+ FLUOROMETER DURING LEAF FLUSHING PHASE IN DECIDUOUS FOREST SPECIES

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Chlorophyll fluorescence has been regarded as an indicator of the photosynthetic activity of plants. We investigated intra- and inter species variation in photosynthetic activity of three deciduous tree species viz., Kanju (Holoptelea integrifolia), Rohini (Mallotus phillipensis) and Shisham (Dalbergia sissoo) of 13-year old plantation during the leaf flushing phase. The experiment was carried out in Bhakra forest range, Terai Forest Plantation Division, Haldwani, India during April of 2016 and 2017. Photosynthesis rate and fluorescence of leaves were recorded using chlorophyll fluorometer (OS5p+) and photosynthesis system (CI-340) respectively across species and leaf age. Results demonstrate a strong positive relationship between photosynthetic rate and fluorescence. The positive relationship was observed between photosynthetic rate and chlorophyll fluorescence (Rd). Photosynthesis rate (Pn) across species was higher while intra-species variation across leaves was relatively lower. Shisham in the study area had the highest rate of photosynthesis (Pn=16 ± 2.6, Rd=3.72 ±0.20) than other species. The present study is an effort towards enhancing understanding of vegetation activity applying concepts of fluorescence spectroscopy.

Keywords: Deciduous forests, photosynthesis rate, chlorophyll fluorescence

Abstract Id: 1606
IMPACT OF CLIMATE CHANGE ON HYDROLOGICAL REGIME OF A BASIN

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The important parameters that affect hydrologic process are climatic variables such as maximum-minimum temperature and precipitation. Impact of these variables on hydrology at basin scale is an important factor for efficient management of water resources. In this study the impact of climate change on hydrological regime of Beas basin up to Mandi was studied using Remote Sensing (RS) and Geographic Information System (GIS) in which a physically based and semi-distributed hydrological model of Soil and Water Assessment Tool (SWAT) was used to simulate the basin hydrology. Topographic parameters were derived from remote sensing data and land use and soil parameters were analyzed in a GIS environment. SWAT model performance was found in close agreement with the observed and simulated values with correlation coefficient (R) of 0.81 when it was ran from 1993 to 2005 period for calibration purpose. Water balance scenarios for future climatic conditions with different time periods of early century (2010-2040), mid century (2045-2070) and end century (2075-2098) were simulated using the model for climate change scenarios of representation concentration pathways (RCP) 4.5 and 8.5. Only meteorological forcings were changed during simulation and other parameters were kept same to remove the effects of land use change. A decreasing trend was observed in the total precipitation received by a decrease in 13%, thus explaining a decrease in runoff values by an average of 8% for both RCP scenarios. Also, an increasing trend was observed in the temperature values by an increase of 47%, explaining a decrease in snowmelt contribution to runoff by 50%.

The results obtained in this study, suggests that climate change impacts hydrological regime of Beas basin significantly. These results obtained easily and quickly using RS and GIS can help planners and policy makers in future development of the basin area with respect to water resources management.

Keywords: Hydrological Modelling, SWAT, Climate Change Impact, RS and GIS

Abstract Id: 1607
DEVELOPMENT OF GIS-BASED ALGORITHM FOR AUTOMATICAL Delineation of Small Rivers using Precise DEM

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Recently, as national attention on environment has increased and as demands on supports for analysis of water environment data using GIS have been increased for quick and accurate response to water environment-related issues, Korean Reach File (KRF) based on spatial network data has been developed and provided, which supports spatial analysis of water environment data. However, water environment data of small rivers for use when estimating ecological flows of small rivers that water quality and flow rate were unmeasured, have not yet been constructed. Hence, in this study, Catchment Area Algorithm and Program were developed using precise digital elevation model (5m DEM) to define and divide catchment areas of small rivers.

The procedure for developing a program for delineation of catchment areas is as follows: Design of a method for dividing catchment areas, development of algorithm, and development of module. In order to divide the catchment areas, precise DEM and a flow direction map based on the DEM were used. Developing an algorithm for dividing the catchment areas of small rivers is a three-step process of extraction of catchment grid, extraction of boundary points and delineation of boundary. As to a catchment delineation module, an Add-in module based on ArcGIS produced by ESRI company has been developed for productivity and availability of the program.

The results of dividing the catchment areas showed that the catchment areas of the small rivers based on the precise DEM were well divided. However, it was also found that the catchment areas were not divided, which appeared in flat areas such as paddy, fields and urban areas, or areas with drainage facilities. In addition, it took a long time to calculate due to the size of precise DEM, so it is considered that an algorithm for improving it is should be developed.

Keywords: Precise DEM, Small River, Catchment Delineation, Korean Reach File

Abstract Id: 1610
EVALUATION OF SPECTRAL INDICES AND MULTIVARIATE TECHNIQUES FOR MONITORING OF CROP WATER DEFICIT STRESS

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This study was conducted to understand behaviour of ten rice genotypes for different water deficit stress levels. The spectroscopic hyperspectral data in the range of 350-2500 nm was recorded and relative water content (RWC) of plants was measured at different stress levels. The optimal wavebands were identified through spectral indices & multivariate techniques and prediction models were developed. A new water sensitive spectral index was developed and existing water band spectral indices were also evaluated with respect to RWC. These indices based models were efficient in predicting RWC with R square values ranging from 0.73 to 0.92. The contour plotting using the ratio spectral indices (RSI) and normalised difference spectral indices (NDSI) was done in all possible combinations within 350-2500 nm and their correlation with RWC were quantified to identify the best index. Spectral reflectance data were also used to develop partial least squares regression (PLSR) followed by ANOVA and multiple linear regression (MLR), support vector machine regression (SVR) and random forest (RF) models to calculate plant RWC. Among these multivariate models, PLSR was the best model for prediction of RWC with R square as 0.96 and 0.95 for calibration and validation respectively and Root mean square error of prediction (RMSEP) as 5.48. The results indicate that PLSR is a robust technique for identification of water deficit stress in crop. The methodology developed would help for its further use in high-throughput phenomics of different crops for water deficit stress.

Keywords: Water deficit stress, Relative Water Content (RWC), PLSR, SVR, MLR

Abstract Id: 1612
Synthetic Aperture Radar (SAR) Calibration is a vital exercise for quantifying and qualifying the overall end-to-end system performance including the Ground Data Processing Systems. Calibration ensures long term stability on which the integrity of all data subsequently derived. The success of an external calibration procedure is directly influenced by basic characteristics of the calibration target which include large Radar Cross Section (RCS), wide RCS pattern, small physical size, good structural strength and better signal to clutter ratio. For this purpose, corner reflectors are found to be very attractive radar targets as they exhibit a large stable RCS over a wide angular range and relatively robust for field-use during the calibration campaign. Characterization of RCS of corner reflector is very important to deliver a completely calibration product to scientific user community, as Calibration Factor (K) is the prime parameter to generate target’s backscatter coefficient in SAR images. Moreover, RCS of corner reflector is highly sensitive to interpolate orthogonality, plate curvature and plate surface irregularities at a given operating frequency.

Conventional as well as polarization specific corner reflectors of different dimensions and shapes having various RCS are designed at National Remote Sensing Centre, Hyderabad to perform radiometric, geometric and polarimetric calibration of space borne/airborne SAR systems. These corner reflectors are characterized by measuring its scattering properties along elevation and azimuth profiles in a controlled environment i.e., anechoic chamber at L, S, C and X band frequencies and polarization combinations. Details of designed corner reflectors for SAR operating frequencies and their measured RCS patterns in co/cross polarization, the implications of fabrication and orientation errors of corner reflectors on peak RCS value are presented in this paper.

Keywords: Radar Cross section, corner reflector, calibration, SAR

Abstract Id: 1615
DETERMINING THE HYDRO-CLIMATIC ACTIVITIES USING GEOSPATIAL MODELING TECHNIQUE

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In today's world, climate change and sustainable development are very important parts of research. Many countries are spending many money and resource to these climatic studies. These studies should be precise & accurate with optimum time limit. Hence there is a need of an effective methodology so that these climatic studies can be made effective and precise. Using this methodology, several fields of spatial application can be supported i.e. flood modelling and storm water drainage designing (by calculating runoff and infiltration). This model can also be utilised in the agriculture scenario that how crops will behave with respect to land use and land cover, enhanced use of pesticides can also be directed using this approach. Siltation and sedimentation can also be calculated. Many other spatial significance may arise by preparing this methodology. The aim or objective of this study is to provide a suitable method in the aspect of hydrology and climate monitoring so that this method can be adopted by anyone as an optimum way to sort climate and weather related studies. For this purpose, the study area is taken from Gujarat, India. As a part of methodology, initially preparation of land use land cover map than spatial representation of earth information i.e. soil than it involves simulation of 30 years of weather data. Major parameter will be land use land cover changes, solar, rainfall precipitation, wind, relative humidity. All these parameters will be taken as input to this research method. Major outcomes will be as -1- Modelling i.e. Hydrological and land cover changes 2- Simulation i.e. for weather assessment 3 - visualization of climate spatial data 4 - Validation and comparison. Final product methodology will also be validated using systematic approach. Based on the output, a desirable conclusion will be made and further future scope application will be projected.

Keywords: Optimum methodology, Climate, Hydrology, sustainability, Geospatial technique, GIS, land use land cover, simulation, modelling,

Abstract Id: 1617
A DEEP REGRESSIVE FRAMEWORK FOR HIGH SPATIAL RESOLUTION REMOTE SENSING IMAGERY OBJECT DETECTION

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Automatically detecting geospatial objects from complex high spatial resolution (HSR) remote sensing imagery is a profound but challenging task. Due to the advances of powerful feature representation ability of deep learning, object detection from HSR remote sensing imagery is feasible. However, traditional object detection methods based on handcrafted features or convolutional neural networks (CNN) are low-efficient and procedure-complex (e.g. region proposal generation independent of classification and location). In order to detect the objects with an end-to-end framework, a novel object detection framework based on deep regressive (DR) framework has been proposed for HSR remote sensing imagery. The proposed DR framework models the classification task and detection task with a regression function in an end to end manner, which adopts a joint classification and detection manner and does not need to generate extra region proposals for object representation. In addition, the proposed DR framework draw the experience of a recursive soft non-maximum suppression (soft-NMS) to further improve the detection accuracy, which decays the detection scores of all the other objects as a continuous function of their overlap with the consideration of non-maximum scores for the predicted bounding boxes. Extensive experiments have been validated and experimented on a publicly available ten-class object detection dataset and shows superior performance.

Keywords: high spatial resolution imagery, object detection, deep regressive, soft-NMS

Abstract Id: 1619
Globally floods are one of the most frequent and most damaging disasters in terms of loss of property and human life. India is one of the most affected countries in the world affected by flood disaster on an annual scale, second only to Bangladesh. In India, the northwestern part of the country is dominated by Himalayan Mountains and flooding in these areas is different as compared to other low relief and plains areas of India in terms of source of floods, travel time and volume of floods. In North Western Himalaya (NWH) most of the floods are flash floods caused by high intensity precipitation or more popularly known as cloud burst. The presence of moraine dammed glacier lake also possess high threat of Glacier Lake Outbursts Floods (GLOF) in this area, as demonstrated by 2013 Kedarnath floods. The other source of floods can be breaching of landslide dammed artificial river lakes. In all these cases, the time of travel of flood water from source to outlet or human habitation located along these river valleys is only a few minutes to a few hours. Hence, any flood warning activity in NWH should be done by taking into consideration all these unique factors. Current study has used 3-day advance weather forecast in NWH using double nested domain of Weather Research and Forecasting (WRF) model (9 km for outer domain and 3 km for inner domain) for entire monsoon of 2015, 2016 and ongoing monsoon of 2017. The model is run using National Centre for Environmental Prediction (NCEP) Global Forecasting System (GFS) 0.25 degree data as initialization state. The WRF outputs were at 3 hourly time scale. Based on historical and current data of Indian Meteorological Department (IMD) 0.5 degree daily rainfall grids, validation of few events of 2013-2016 monsoon has been done, giving simulation accuracy of WRF in rainfall prediction above 100 mm of 60%, but overall pixel wise correlation coefficient R2, is low at 0.2-0.3. The forecasted precipitation of every three hours is used hydrological modelling system (HMS) for flood hydrograph generation at various outlets of study area. Currently, part of Beas river basin, Upper Ganga basin up to Haridwar and Yamuna basin up to Poanta Sahib are tested for near real-time flood forecasting. Limited validation of simulated river flow hydrograph for Uttarkashi and Joshimath sites are done using historical data of 2005-2007 monsoon using Central Water Commission (CWC) discharge data with R2 of 0.6-0.7 for two stations. The output of hydrological models in terms of flood hydrograph is used for flood inundation scenarios along river reaches using 1-D Hydro-Dynamic (HD) modelling to see the probable areas which can come under flood inundation. In 2015 monsoon, the flood event of 05 to 08 August 2015 in part of Beas river basin in Mandi District of H.P. near Dharampur has caused very high damages. This event was forecasted well in advance of three days by WRF-ARW model. During the non-flood season the cloud free cartosat-1 images of upper Ganga basin has been acquired before and after 2013 flood disaster to map the flood affected areas of this area. The Majors Rivers of NWH are also selected to make buffer of 100m, 200m and 500m on both sides to identify and map the flood vulnerable areas. Flood frequency analysis considering 25, 50, and 100 years floods also being done along with DAM break and GLOF modelling of vulnerable lakes of study area to identify the flood vulnerable areas using geospatial modelling approach. In this method, flood inundation scenarios (actual or frequency based) is overlaid with Land Use Land Cover (LULC), roads, settlements etc. to identify probable flood hazards areas. Next, based on class and present conditions of buildings, roads or crop/forest type, the overall vulnerability of area to flooding is assessed. The test sites of this detailed flood vulnerability study is few sites in NWH such as critical river stretches of Mandakini river basin, upper Ganga and Yamuna basin and parts of Beas river basin and later all areas of NWH will be covered. This study has shown how an integrated approach can be used for flood early warning and vulnerability assessment in mountainous areas.

Keywords: Flood, WRF, Hydrological model, vulnerability, Himalaya
Abstract Id: 1621
INSAR BASED GLACIER DYNAMICS STUDY USING C-AND L-BAND SAR DATASETS IN PART OF NORTH WEST HIMALAYA

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This work has utilized freely available C-band Synthetic Aperture Radar (SAR) data from Sentinel-1 and 1A satellites and ALOS-PALSAR-2 PolInSAR data for glacier dynamics study of Gangotri glacier of North West Himalaya. PALSAR-2 data was provided by JAXA announcement of opportunity science project and Sentinel data was taken from Alaska SAR facility. Earlier studies using Interferometric SAR (InSAR) data has suffered from loss of coherence due to high temporal resolution of SAR images and high glacier velocity. Glacier velocity was derived using InSAR based method using 6 day temporal interval (28 Dec 2016 to 03 Jan 2017) images from Sentinel-1 and 1A satellites from and 28 day interval (22 March - 19 April 2015) for PALSAR-2 satellite. High coherence was obtained for main glacier in both the data sets, which resulted accurate line of site (LOS) glacier velocity estimates for glacier. In both cases, SRTM-x band 30 m DEM was used to remove topographic phase due to its better vertical accuracy. ALOS-PALSAR-2 during shows the mean velocity of 5.4 to 7.4 cm day⁻¹ during 28 day time interval for full glacier and main trunk glacier respectively. This is after gap of 19 to 21 years that InSAR data has given suitable data for glacier velocity estimation. In addition TANDEM-x data of year 2012 and 2013 was also used to derive temporal elevation changes due to dynamic snow/ice in condition of Gangotri glacier. This study highlights use and applicability of InSAR data sets for glacier dynamics study. This study will help in refining algorithms to be used for such studies using upcoming NASA-ISRO SAR (NISAR) InSAR data sets.

Keywords: SAR, InSAR, Glacier Velocity, Dynamics, Gangotri

Abstract Id: 1626
OPEN SOURCE PYTHON Tools for Time Series Analysis of Water Related Space Based Geo-Physical Products

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These days, long time series (TS) of remote sensing (RS) data sets are readily available in different temporal and spatial resolution formats, recorded by a large number of satellites. The amount of data is huge, as it contains multi-temporal (3 hourly, sub-daily, daily, 8 to 14 daily) data of various hydro-logical parameters (wind, rainfall, temperature, snow cover etc.) from the last 10 to 30 years. For processing and analyzing such data sets, high-performance machines and supercomputers are required that can optimise computation-time and achieve better results. Specific tools are required for the analysis of TS of RS data, and traditional methods of commercial data analysis have limitations as they cannot process data in multiple temporal and spatial resolution formats. We have utilized open source tools and libraries with Python - a popular open source language, for the analysis of time series TRMM data (from 1999 to present), MODIS (2000-2017) and SCATSAT-1 (2016-2017). The dataset originally had a spatial resolution of 25 km, 0.5 km and 2.25 km, which we converted and processed in multiple grid formats. This data can be used for running Variable Infiltration Capacity (VIC) Macroscale Hydrologic Model. Various statistical measures such as mean, maximum, minimum and standard deviation have been estimated for user-specified geo-locations. Zonal statistics and point-based statistics have also been calculated with user-defined time and spatial resolutions.

Keywords: Python, MODIS, TRMM, SCATSAT-1

Abstract Id: 1627
The agricultural activity of Gomukhi river basin only depend on well and river irrigation systems. The irrigation like paddy and sugarcane cultivated the along with the river flowing area. At here other area mostly dry conditions defend on the rainfall. The increased demand of water in agriculture and other different sectors and restriction of water resources, necessitate the planning of groundwater recharge. In this study, groundwater potential zone are delineated by combining remote sensing, GIS and techniques. Groundwater potential zones prepared using various thematic layers viz. geology, geomorphology, slope, land-use, lineament, drainage, soil texture, and water level, water depth. These thematic layers and their features were assigned suitable weights on the Saaty’s scale according to their relative significance for ground water occurrence. The assigned weights of the layers and their features were normalized by using Analytic Hierarchy Process (AHP) and finally the selected thematic maps were integrated using weighted overly techniques. The process was integrated in the GIS environment to produce the groundwater potential prediction map of the Gomukhi river basin. The groundwater potential of Gomukhi river basin found to 17.21 % excellent, 24.17% good, and 29.65 % moderately, 19.52 % low and 9.46 % very low ground water exploration zones identify. The total village of Goumkhi river basin is 150 out of 29.20 % of villages excellent to good, 29.46 % moderately,32.79% low to very low ground water potential villages and 8.55 % reserved forest area respectively. The groundwater potential zone map was finally validated using the groundwater depth and post monsoon water level data from 26 wells respectively in the study area.

Keywords: AHP Methods, Potential Zone, GIS, Remote sensing, Overlay Analysis.

Abstract Id: 1628
MULTI-CRITERIA LAND SUITABILITY ANALYSIS FOR AGRICULTURE IN PERAMBALUR TALUK USING REMOTE SENSING, GIS AND TECHNIQUES

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Soil component plays a major role in agriculture, Landuse land cover, land capabilities, soil erosion, slope, soil depth, soil texture, soil moisture, pH and availability of nutrient like organic carbon, phosphorus, potassium concentrations are affects the agricultural production. GIS based multi-criterion approach used to analyze land suitability for agriculture. The “Analytic Hierarchy Process (AHP)” method commonly used in landuse suitability analysis have been utilized in this study. In determinant the weights of the parameters, experts’ opinions were consulted and correlation analyses were used to decide the ranks of influencing criterion whereas pair wise comparison matrix is used to determine the weights. The agricultural land suitability map generated and classified into five categories according to the land suitability classification of the United Nations Food and Agriculture Organization. The scores for sub-parameters showing internal variations within the criteria assigned based on field work and reported norms in published literature. About 13.93% (46.92 sq.km) of reviewed area is classified in the class ‘highly suitable’, 37.80 % (127.325 sq.km) in ‘moderately suitable’, 21.16% (71.275 sq.km) areas are marginally suitable and 10.37% (34.93 sq.km) areas fall in currently not suitable. While the amount of 14.66 % (49.38 sq.km) land that is permanently not suitable for agriculture and 2.08% (7.02 sq.km) land is occurred water body. The land suitability classes like, ‘highly suitable’ and ‘not suitable’ in suitability maps are specifically estimated than the classes ‘moderately suitable’ and ‘marginally suitable’ both in producer’s as well as user’s point of view. The study is very much helpful to assess the land suitability for agriculture in Perambalur taluk.

Keywords: Remote sensing, GIS, FAO and AHP Techniques.

Abstract Id: 1629
COASTAL VULNERABILITY INDICES: CONSTRAINTS AND OPPORTUNITIES OF NAGAPATTINAM REGION, TAMILNADU, INDIA

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Coastal vulnerability and sensitivity indices accept that the addition of socio-economic variables defining the vulnerable areas. Incorporation of socio-economic variables in a GIS based coastal vulnerability index for shoreline management of Nagapattinam. a socio-economic sub-index was developed to contribute potentially one third of the overall index score, the other components consisted of coastal forcing and coastal characteristic sub-indices. All variables were ranked on separately 1-5 scale with 5 being the most vulnerable. The variables were integrated with sub-indices and the sub-indices were combined to produce the overall index.

Most previously developed coastal vulnerability/sensitivity indices acknowledge that the addition of socio-economic variables would assist in defining vulnerable areas. The area of Nagapattinam having the greatest influence from the socio-economic index as might be expected, given its sheltered position and high level of infrastructure of the 11 areas, Velankanni has the highest score in the coastal forcing sub-index, followed by Vettaikaraniruppu, while Velanganni is dominated by the coastal characteristics sub-index as is the Nagapattinam. The final results of the combined index were tested under representation of the socio-economic index. Suggestions are put forward to prevent this problem in any future developments.

Keywords: Vulnerability Indices, Coastal Zone Management, Nagapattinam, GIS.

Abstract Id: 1630
ESTIMATING TEMPORAL LAND SURFACE TEMPERATURE AND VEGETATION COVER OF NAGAPATTINAM COASTAL ZONE, TAMIL NADU, USING GEOSPATIAL TECHNIQUES.

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Understanding the relationship between Land surface temperature and Vegetation cover is seriously important to manage semi-arid region. However, information on how environmental factors influence the Land surface temperature and vegetation cover in semi-arid area is lacking. This paper investigates the application of Remote Sensing and GIS for detecting LST and NDVI for assessing its impact on Nagapattinam region. The land surface temperature acquired from the LANDSAT TM and TIR band, for monitoring the land surface temperature and its variations in the different periods (1995-2015). The areas such as Nagapattinam, Akkaraipet, Samanthanapet, Velankanni, Vizunthamavadi, Vettaikaraniruppu, Thirupundi, Thalainayar, Karapidagai, Kovilpathu, Thirukkuvalai, Manakkudi, Thittacheri, Melvalakkarai and Keeramber observed high temperature changes. Increasing trend in temperature is attributed due to anthropogenic activities on coastal Environment in Nagapattinam. In the climate results shows that the average annual Maximum temperature ranges from 32.11 °c, to 33.35 °c, Minimum temperature ranges from 24.58 °c, to 25.60 °c, the average rainfall changes is 265.6 mm to 250.6 mm respectively and Relative humidity ranges from 73.60 % to 79.44 %. The NDVI maps indicates that the Vegetation of Nagapattinam region are significantly decreased during August, 1995 and September 2000. But compared with previous year suddenly vegetation cover increased in September 2005, ranges from (-0.51 to 0.70). In the October 2010, Based on the results of NDVI of Nagapattinam, Velankanni, Nagore, Segal, Enangudi, Pandaravada, Pappakovil, Karuguni, Keelaiyur, and Vallam, the areas vegetation cover shows decreasing from the year of 1995-2010. But in the later time from June, 2015 slightly increased in the areas like Ambal, Nagapattinam, Velankanni, Panakkudi, Puthagaram, Palaiyur, Tirupundi, Vilunthamavadi, and Vettaikaraniruppu.

Keywords: Land surface Temperature, Normalized Difference Vegetation Index, change detection, Remote Sensing and GIS.

Abstract Id: 1631
Petroleum exploration & exploitation has caused increased attention, concern for several decades, due to its non-renewable energy resource nature with scarcity and depletion. Petroleum exploration requires integration and updating of multi-source geo-scientific information for creating a clear understanding of subsurface gas- and oil-bearing formations. Multi-spectral aerospace remote sensing data has become the successful spatial geo-scientific information provider for petroleum exploration when integrated with data of other geo-exploration tools such as seismic, gravity, magnetic and well using GIS.

This paper present review on present status as well as prospects of satellite RS & GIS applications in petroleum exploration. During recent years, several major oil companies, successfully used satellite RS-GIS techniques for basin wide assessment of petroleum favorable areas by GIS aided integration and analysis of multi-spectral RS derived geological inputs such as identification of sedimentary basin, lithological identification, geomorphology and terrain information, geological structure and tectonic information etc. A well-known phenomenon called seepage (both macro and micro), associated with hydrocarbon reservoirs is the leakage of hydrocarbons from deep accumulations to the surface. Long-term hydrocarbon seepages have been documented to locally alter surface due to geochemical and biological processes induced by microbial activity. Recently, hyperspectral RS data has been successfully used for the detection of micro-seepage by identification and mapping of altered clay minerals, bleaching of red beds and geo-botanical effects of vegetation stress. Hyperspectral satellite derived indices such as Hydrocarbon index, mineral index, vegetation indices, and Spectral Angle Mapper & spectral unmixing digital classification techniques. Very few studies showed the potential utility of satellite SAR (Synthetic Aperture Radar) data and DInSAR for offshore petroleum exploration by identification of micro-seepage in sea, and detection of land subsidence due to long-term extraction of oil in reservoir, respectively. Although recent years and past multi-spectral RS-GIS techniques have been successfully used for petroleum.

Keywords: DInSAR, RS & GIS

Abstract Id: 1632
GEOSPATIAL OBSERVATIONS OVER THE WESTERN HIMALAYA FOR GLACIER RETREAT AND GLACIAL HAZARDS

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Rising global temperature and variability in the precipitation have significant impact over the Himalayan glaciers. Recent findings have reported the low altitude glaciers are retreating fast compared to high altitude glaciers. Himalayan glaciers have a large spatial variation in glacial retreat and mass loss due to their unique climate setting, altitude, topography etc. Accelerated melting has generated various glacial ponds (glacial lakes) over the Himalayan region, which has become upcoming threat for the region. The remote sensing have provided a better mean for the analysing the glacier retreat and glacial hazards in a vast and unapproachable glaciated terrain. Chandra, Bhaga and Miyar sub basins of Chenab basin, cover a major glacierized zone of Lahul and Spiti region of western Himalaya. The basins have more than 400 glaciers and >1400 km2 glacierized area. Recent and historical satellites data were used for the monitoring of glacier retreat and glacial hazards over the selected region. The glaciers of this region are retreating with the alarming rate (13-20 ma-1) and have lost significant glacier area. Due to this accelerated retreat, some new lakes have been formed and some of them have expanded up to a hazardous situation. The proglacial lakes of Chandra basin like Samudra tapu and Gepang gath have also been expanded. The volume of Samudra Tapu and Gepang Gath lakes of the Chandra basin from 3.4 million m3 to 67.7 million m3 and 1.5 million m3 to 27.5 million m3 respectively during the last 43 years (1971-2014). It is also observed that the expansion is significantly high during 2009-2014. Thus it is observed that the geospatial techniques are helpful to monitor the glaciers health and preventing options for the upcoming hazards.

Keywords: Geospatial techniques, glaciers retreat, glacial hazards, western Himalaya

Abstract Id: 1652
JAXA-ISRO SPECIAL SESSION

(CROP PRODUCTIVITY DERIVED FROM EO SATELLITES)
GEOGLAM ASIA RICE TEAM AS WELL AS JAPAN'S ACTIVITY USING ALOS-2

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The Asia-RiCE initiative (http://www.asia-rice.org) has been organized to enhance rice production estimates through the use of EO, and seeks to ensure that Asian rice crops are appropriately represented within GEOGLAM (Group on Earth Observation Global Agriculture Monitoring). Asia-RiCE is composed of national teams that are actively contributing to the Crop Monitor for AMIS and developing technical demonstrations of rice crop monitoring activities using both Synthetic Aperture Radar (SAR) data (Radarsat-2 from 2013; Sentinel-1 and ALOS-2 from 2015; TerraSAR-X, Cosmo-SkyMed, RISAT, and others) and optical imagery (such as from MODIS, SPOT-5, Landsat, and Sentinel-2) for 100x100km Technical Demonstration Sites (TDS) as a phase 1 (2013-2016) and main rice produce region (wall-to-wall) in Indonesia and Vietnam as a phase 2 (2016-2017) in Asia. with satellite -based cultivated area and growing stage map. The Asia-RiCE teams are also developing satellite-based agro-met information for rice crop outlook, crop calendars and damage assessment in cooperation with ASEAN food security information system (AFSIS) for selected countries (currently Indonesia, Thailand, Vietnam and Japan; http://www.afsisnc.org/blog), using JAXA's Satellite-based Monitoring Network system as a contribution to the FAO AMIS outlook (JASMIN) with University of Tokyo (http://suzaku.eorc.jaxa.jp/cgi-bin/gcomw/jasm/jasm_top.cgi).

Keywords: GEOGLAM, Asia Rice, FAO, ALOS-2, AFSIS
SAFE FOR AGRICULTURE APPLICATION

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Space Applications for Environment (SAFE: http://www.eorc.jaxa.jp/SAFE/) was established in 2008 as one of international cooperation initiatives of EOWG (Earth Observation Working Group, pre-Space Applications Working Group) of APRSAF (Asia-Pacific Regional Space Agency Forum). The purpose of SAFE is to contribute to the solution to various environmental problems with space technology. Asia-Pacific region has various environmental problems such as Climate change, Rapid industrial development with economic growth and Food security. The use of space technology (especially satellite data) enables wide and long term monitoring of environmental change, which leads to the lower risk of environmental change and the solution of environmental problems. SAFE Prototyping line-up have 20 completed and 7 ongoing. “Agriculture Application” is one of the important SAFE prototyping target areas for Food security. 4 prototyping were completed and 3 prototyping are ongoing in Cambodia, Myanmar and Indonesia.

Keywords: JAXA, APRSAF, SAFE, Agriculture
RICE CROP NUTRIENT MONITORING - FROM DRONES TO EO

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Rice is a unique crop which has a great significance to the entire human population as it provides more than one fifth of the calories consumed worldwide. Nearly 90% quota of the total rice production is produced in Asia and it is the staple food in most of the Asian countries. When considering rice as an agricultural commodity in practical perspective, factors which affect the final yield is of utmost importance. Climate, soil and availability of water which are the basic factors that affect the yield are beyond the control of the farmers. However, factors like nutrient supply for an optimum yield can be controlled and should be adjusted with proper monitoring and inspection. Providing nutrients for specific locations at the right time with proper monitoring techniques will ensure a high yield with good quality.

With the availability of satellite earth observation data, spectral characteristics of plants can be observed to analyze important parameters of a given crop type which would otherwise be invisible to the naked eye. As of now, the major application of the use of satellite data are limited only to analyze the general status of large scale cultivations due to the limitations such as resolution, presence of clouds and atmospheric effects which are inherent to satellite observations and therefore does not provide opportunities for farmers in their decision making process. When considering drones as remote sensing platforms to collect data in the field of agriculture, they have many advantages over satellites since they are inexpensive flying platforms which can accommodate multi spectral sensors capable of providing data with very high resolution.

In this study, a drone is used as a remote sensing platform to monitor rice crop Nitrogen level which is the most vital nutrient for paddy in order to draw up a relationship which would help farmers in taking correct decisions. The focus is to collect the spectral information of paddy through a sensor mounted on a drone with varied levels of Nitrogen and establish a relationship between different levels of Nitrogen and spectral responses which can then be used as a benchmark for different practical scenarios thereby maximizing the return for farmers and safeguarding the soil from possible damage through an excess fertilizer usage. An experimental rice plot is designed near Ayutthaya, Thailand and different levels of Nitrogen fertilizer are added and drone images will be collected in Red, Green, Red Edge and NIR spectral bands periodically at various crop cycle stages. It is expected to find the relationship of nutrient levels, satellite data derived chlorophyll levels, changes in time and finally the relationship to the rice yield. Research work will be expected to provide appropriate relationship and establish the possibility of using drone for yield estimation in small scale farms leading up to the development of a basis to be used in yield estimation through satellite multi spectral data for large scale rice fields.

Keywords: Drones, Rice
Crop production forecasts using satellite remote sensing data is an important application of remote sensing data in India. Indian Space Research Organization (ISRO) has extensively invested in developing space based infrastructure for operational crop monitoring. Three tier imaging system namely LISS-III, LISS-IV and AWiFS sensors, have been extensively used for Rabi crops and for Kharif crops RISAT-1 C band SAR has been used mainly for rice monitoring. Early work started with Crop Production Forecasting (CPF) project, leading to a more comprehensive FASAL (Forecasting Agricultural Output using Space, Agro-meteorology and Land based Observations) program. Under FASAL program techniques were developed for multiple forecasts of crops at national scale and institutionalization of operational use of remote sensing was done leading to formation of Mahalanobis National Crop Forecast Centre (MNCFC) by Ministry of Agriculture in 2012. New space based systems are being planned for generating Agro-Met advisories along with capacity enhancement for high spatial and temporal resolution imaging to address minor crops.

Encouraged with successful demonstration of the use of remote sensing and geospatial technology for crops, a pilot project called CHAMAN (Coordinated Horticulture Assessment and Management using geoinformatics) was initiated for better horticulture inventory and management using remote sensing, GIS and collateral field data. Basic aim of the project is for area assessment and production forecasting of 7 major horticultural crops namely, Banana, Mango and Citrus, Potato, Onion and Tomato and Chili in selected districts of major states in India. Geospatial applications for horticultural development and management planning and detailed scientific field-level studies for developing technology for crop identification, yield modeling and disease assessment are also being done. Results from few case studies of these projects will be presented.

Keywords: Remote Sensing, FASAL, RESOURCESAT, CHAMAN
AGRICULTURAL AND AGRO-MET SERVICES FROM VEDAS AND MOSDAC PORTALS

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VEDAS (Visualization of Earth Observation Data and Archival System) and MOSDAC (Meteorological and Oceanographic Satellite Data Archival System) are the two portals for visualization and archival of Land and Weather information.

VEDAS has various information system including Crop & Vegetation monitoring where multi-resolution and multi-temporal NDVI data are available for visualization and time-series analysis. Apart from NDVI, soil moisture, temperature and rainfall data are also available. Web-based geospatial data analysis and spatial data comparison are also possible.

MOSDAC is a warehouse of weather and ocean data obtained from Indian satellite data. Apart from data near-real-time (NRT) and short-term forecast are also available to the users on various weather parameters. A visualization tool is also available to see the NRT data and forecast.
Accurate regional crop growth monitoring and yield estimation are critical to informing national food security and famine early warning and agricultural crop management. Significant effort is made while imparting education at post-graduate level for bringing new advances into geospatial technology for crop productivity modeling. Various techniques ranging from simple spectral yield model (statistical regression between area-based yield to satellite derived vegetation index) to remote sensing based simplified light use efficiency (LUE) model and integrated approaches that uses combination of geospatial data (remote sensing, soils, topography), climate models (WRF/RegCM) and crop simulation models (EPIC/DSSAT-CERES Family). As a part of early deriving indicators of early warning and food security, geospatial approach comprising satellite derived phenological metrics, agrometeorological data and AGROMET-Shell (FAO) was tested for generating crop condition and water limited yield of rain-fed crops. On national scale, LUE models are being tested for estimating primary productivity of cropland using multi-source geospatial data.

From climate change view-point, the integrated use of climate scenario from global circulation model (GCM), crop models and geospatial data (e.g. topography, soil and land cover) within GIS shown immense potential for projecting spatially the subtle changes in productivity of major crops (rice and wheat) occurred due to climate change in mountain agroecosystem.

Further, the convergence of an emerging technologies viz. drones, hyperspectral imaging and wire-less sensor network and smart-phone would have scope for improving farm-scale crop productivity assessment and enables smart-farming.
JAXA-ISRO SPECIAL SESSION

(AGRO-MET INFORMATION DERIVED FROM EO SATELLITES)
The agricultural information is important for the food security as well as the food market economy for many countries in the world, however, it is not easy to obtain the actual one especially for developing countries. Remote Sensing technology is expected to use for understanding the actual agricultural status and the production. JAXA has conducted some projects to monitor and estimate the agricultural activities and its production by providing the agro-meteorological information derived from its relevant satellites such as GCOM-W1, ALOS-2 and Himawari-8. JASMIN is the abbreviation for JAXA's Satellite base Monitoring Network system, and it aims to deliver the agro-meteorological information to the member countries such as Japan, the Philippines, Vietnam, Thailand and Indonesia under the framework of FAO's AMIS(Agro-Meteorological Information System). Under the JASMIN framework, the agro-meteorological data such as satellite based precipitation, drought index, solar radiation, land surface temperature, soil moisture and vegetation index are generated based on the current ground condition as well as the anomaly information for early warning in country scale with 5 - 50 km spatial resolution and 15-day time resolution. In order to improve its accuracy/reliability of the information, research for updating the algorithms and validation are conducted for some countries in the region.

Keywords: JAXA, JASMIN, FAO-AMIS, Agricultural Information
The Remote Sensing Technology Center of Japan (RESTEC, http://www.restec.or.jp) has been developing and operating the Agro-Meteorology information services for business partners include Japan Aerospace Exploration Agency (JAXA) and Asian Development Bank (ADB). The services are mainly utilized for food security purpose (rice production outlook activities in JAXA’S Asia-RICE, ADB’s Greater Mekong Sub region Agriculture project) and for insurance development purpose (Weather Index-based Insurance).

Keywords: Agro-Meteorology, JAXA, ADB, Weather Index-based Insurance
REMOTE SENSING AGRO-METEOROLOGY: INDIAN EXPERIENCES

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Short and medium-term weather anomalies such as cold and heat waves, sudden outburst of pests and diseases, heavy or unseasonal rainfall, hailstorm, cyclones, flood, drought at different crop growth stages strongly affect farm-level crop production. Till recently, quality of agro-met advisories to farmers of India were solely dependent on quality of medium-range weather forecast. It was felt that real-time and large-area agro-meteorological information through synoptic observations from satellites could provide ground reality. The blending of satellite-based dynamic information and weather forecast can facilitate to issue better advisories to farmers twice in a week. Three working groups were formed among ISRO, IMD, NCMRWF, ICAR to strengthen the agro-met service called Gramin Krishi Mausam Seva (GKMS) at district-to-block level to improve weather forecast, develop core operational agro-met products and value-added information.

Several operational core land products such as land surface temperature, rainfall, surface insolation, fog, daily reference evapotranspiration have been developed at 4 km spatial resolution using INSAT suit of satellites and operationalized through IMDPS (INSAT Meteorological Data Processing System). In addition, daily and composite normalized difference vegetation index (NDVI) at 360m spatial resolution from OCM-2 and daily surface soil moisture / soil wetness index at 12.5 km from SMAP L-band radiometer are available as operational products. It has been demonstrated that quality of weather forecast of India improved through real-time updates of initial conditions of NWP model on different land surface products such as vegetation fraction and land surface albedo from INSAT satellites than using monthly climatology. Work is in progress to develop value-added information required for stage-specific advisories on irrigation scheduling and early warning for pest-disease, agricultural drought, heat wave etc.

Keywords: Satellite Remote Sensing, Agro-meteorology, Gramin Krishi Mausam Seva (GKMS)
BHUVAN PERSPECTIVES FOR AGRO-METEOROLOGY

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Bhuvan (Sanskrit word for Earth) is a Geoportal of Indian Space Research Organisation (ISRO), hosted presently through URL http://bhuvan.nrsc.gov.in, allowing host of services covering visualization of multi-date, multi-platform, multi-sensor satellite data, thematic map display and analysis, free download of data and products, timely information on disaster, information gathering through crowd sourcing and project specific geospatial applications. It is available in multiple languages. Bhuvan is growing day by day with more services, products, and applications apart from the robust infrastructure backend.

Bhuvan is now growing geographically in terms of its hosting and computing infrastructure. Bhuvan 2D, a browser based web geoportal showcasing Indian Earth Observation Capabilities through online rendering of Multi-sensor, Multi-resolution and Multi-temporal IRS imageries. It is developed using robust Open Source IT and Geospatial technologies like UMN MapServer, GeoServer and Postgres with PostGIS to organize the satellite imageries and map data. JavaScript, PHP (widely-used general-purpose scripting language), OpenLayers (Opensource JavaScript library), jQueryUI (Powerful JavaScript library for creating stylish user interfaces), Cascading Style Sheets (CSS for describing the look and feel and formatting documents written in markup language) are used for making dynamic, interactive and rich Web application.

A responsive, intuitive mapping interface with image and map data and different GIS capabilities make Bhuvan a versatile platform. Bhuvan enables users to share and overlay maps and Geospatial feature data through services that implement the OGC standards. Bhuvan services are OGC complaint such as WMS and WPS towards Interoperability and can be consumed either as WMS/WMTS and plotted on any compatible clients/Web browsers.

Bhuvan has worthy satellite images of high resolution for the entire country and also vast amount of information on various natural resources. The multi-temporal availability of such information along with features derived from satellite images up to village level, makes Bhuvan rich in terms of contents. Bhuvan has more than 100 Web/Mobile applications in governance sector and is a dynamic platform being used in multiple application domains.

The lecture will encompass the functional features of Bhuvan, its unique services including Bhuvan 2D and 3D, the free data downloads with products on climate and environmental sciences, thematic information being disseminated by Bhuvan for spatially enabled decision making, specific Web applications in various sectors including Agriculture, Rural Development, water resources, irrigation, Mobile Applications for geotagging / crowd sourcing etc... Ultimately, the lecture will demonstrate the usefulness of various products of Bhuvan towards agro-meteorological applications.
There is a huge requirement of trained professionals in the field of satellite agrometeorology and allied aspects to cater the needs of providing agromet services (crop monitoring, early warning, agro-advisory and climate-smart agriculture including adaptation) both in private and public sector.

Agrometeorologists and agricultural experts all over the world have now keen interest to access and learn the use of a wealth of satellite observational data, product and services flowing from highly sophisticated meteorological and environmental observation satellites. Indian Institute of Remote Sensing (IIRS), as an unit of ISRO has developed various training and education programmes (short-term to long duration) to build capacity of agricultural professionals in the field of satellite agrometeorology and agro-informatics for achieving sustainable agriculture. Training programmes are tuned to meet requirement of fresh graduates to policy makers including academia. Capacity building on satellite observations for agromet services mainly achieved through formal and informal training (workshop, tutorial, short-term courses, distance learning and diploma/ PG courses). IIRS also periodically conducts training programmes for the benefit of agricultural community from foreign countries through CSSTEAP and ITEC Programme. Major emphasis of training is on use of earth observation in agrometeorological research and build capacity to generate satellite based agrometeorological products and services which are highly relevant to operational agrometeorological tasks. Satellite agrometeorological aspects including agromet information generation, crop forecasting, drought monitoring, geospatial crop water accounting, agro-climatic crop suitability, climate change impact assessment and carbon accounting are addressed practically through integrated modern tools (remote sensing, GIS, crop model, climate models, agrometeorological data and open-source software).
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