APPLICATION OF REMOTE SENSING IN ENVIRONMENTAL MANAGEMENT pdf

1: MA in Remote Sensing & Geospatial Sciences Â» Earth & Environment | Boston University

The application of remote sensing in water resources research and management mainly lies in one of the three categories: mapping of watersheds and features, indirect hydrological parameter estimation and direct estimation of hydrological variables.

Sedimentation mapping and monitoring xi. Event mapping and monitoring xii. With the availability of remotely sensed data from different sensors of various platforms with a wide range of spatiotemporal, radiometric and spectral resolutions has made remote sensing as, perhaps, the best source of data for large scale applications and study. In this review, the most commonly used applications of the technique in environmental resources mapping and modeling. Applications of remote sensing in hydrological modeling, watershed mapping, energy and water flux estimation, fractional vegetation cover, impervious surface area mapping, urban modeling and drought predictions based on soil water index derived from remotely-sensed data is reported. The review also summarizes the different eras of sensors development and remote sensing and future directions of the remote sensing applications. This can be maximized by using data from multiple sensors However, since data from these sensors are acquired in multiple resolutions spatial, spectral, radiometric , multiple bandwidth, and in varying conditions, they need to be harmonized and Synthesized before being used Thenkabail et al. This will help normalize for sensor Characteristics such as pixel sizes, radiometry, spectral domain, and time of acquisitions, as well as for scales. Also, inter-sensor relationships Thenkabail, will help establish seamless monitoring of phenomenon across landscape. Urban Mapping Applications The majority of remote sensing work has been focused on natural environments over the past decades. Applying remote sensing technology to urban areas is relatively new. With the advent of high resolution imagery and more capable techniques, urban remote sensing is rapidly gaining interest in the remote sensing community. Driven by technology advances and societal needs, remote sensing of urban areas has increasing become a new arena of geospatial technology and has applications in all socioeconomic sectors Weng and Quattrochi, Urban landscapes are typically a complex combination of buildings, roads, parking lots, sidewalks, garden, cemetery, soil, water, and so on. Each of the urban component surfaces exhibits a unique radiative, thermal, moisture, and aerodynamic properties, and relates to their surrounding site environment to create the spatial complexity of ecological systems Oke To understand the dynamics of patterns and processes and their interactions in heterogeneous landscapes such as urban areas, one must be able to quantify accurately the spatial pattern of the landscape and its temporal changes Wu et al. Hydrological Applications Since launch of the first Earth Resources Technology Satellite, ERTS-1 , scientist have used remotely-sensed data from different sensors to characterize, map, analyze and model the state of the land surface and surface processes. With the help of new algorithms, new hydrological information were extracted from remotely-sensed data and used in hydrological and environmental modeling. These new information and hydrological parameters have increased our understanding of the different hydrological processes by helping in quantifying the rate and amount of water and energy fluxes in the environment. The ability of these sensors in providing various spatiotemporal scales data has also increased our capability in looking into one of the challenges of environmental modeling, mismatch between scales of environmental process and available data. The role of remote sensing in understanding hydrological processes and fluxes across different spatial and temporal scales can be tremendous, if appropriate spatial and temporal resolution remotely sensed data are available under ranges of bands. The application of remote sensing to water resources has been increasing in recent years. The application of remote sensing in water resources research and management mainly lies in one of the three categories: Water Pollution control Since water is an excellent neutral blackbody radiation, TIR radiometric data can be coupled with fluid dynamics and heat transfer theories to evaluate and refine existing mathematical and physical hydrodynamic models. Aerial TIR data can be effectively used for such a purpose. Many researchers investigated the use of remotely sensed MSS data for water quality mapping in inland and estuarine systems. Remote sensed data for mapping chlorophyll and other water quality parameters has also been reported. Developed regression models to represents best relationships between salinity, turbidity, total suspended solids and chlorophyll concentrations and the corresponding mean radiance values from LANDSAT MSS data for San francisco Bay and Delta. The V, C, CIR sensors are used for pollution control related to agriculture, forestry, mining, and land development activities. Soil water and drought monitoring for early-warning applications With the advent of grid-based remotely-sensed rainfall data, the application of crop water balance models for crop monitoring and yield forecasting has gained increased acceptance by various international, national and local organizations around the world. Soil water is a key state variable in hydrological modeling and determines the partitioning of rainfall into runoff and deep percolation, and also controls the rate of evapotranspiration ET. Although the estimation of actual evapotranspiration ETa is the ultimate goal of many researchers for hydrological and agronomical applications, it is often difficult to quantify and requires expensive instrumentation. For monitoring large areas using remotely sensed data, the water balance approach provides an operational advantage in terms of data availability. While the energy balance models are mainly driven by the thermal data, the water balance models are driven by rainfall. The most widely used water balance technique for operational use is the FAO water balance algorithm that produces the crop water requirement satisfaction index WRSI , which is also known as the crop specific drought index CSDI. All these combine to make Remote Sensing a veritable tool for obtaining baseline information for establishing baseline conditions of an area at the preproject analysis stage, as well as monitoring changes in the environmental conditions of such area after the project has been dc-commissioned. Eedy has described GIS and Remote sensing as a veritable tool in environmental assessment because it: Application of Remote Sensing in Coastal Ecosystem Management Based on remote sensing a variety of data pertaining to the coastal zone like, identification of plant community, biomass estimation, shoreline changes, delineation of coastal landforms and tidal boundary, qualitative estimation of suspended sediment concentration, chlorophyll mapping, bathymetry of shallow waters, etc. Mangroves Management Satellite remote sensing has been found to be a very valuable application tool in forest management including mangroves, not only in monitoring, but also carrying out relevant observations, which can bring out the impact of deforestation on global climate. Remote sensing of change detection is a process of determining and evaluating differences in a variety of surface phenomena over time. We should note that the whole life support system air, water, soil faunal, floral, in short all biophysical and ecological constituents of nature are useful to man. The actual exploitation or use of resource during the transformation of neutral stuff into commodity or service to serve human needs and aspiration called resource development Mitchell, should be met with environmental impact assessment. Remote sensing and geographic information systems is the only technique that can provide holistic approach to the study of total environment while still make visible the different process ort interrelationships that exist within the different biophysical components. When all of these are done, we will have ecodevelopment Falkenmark, , and balance environment. More advanced spatial and modeling techniques are required to support the decisions of managers and policy makers. This involves shifting of emphasis from basic geographic data handling to manipulation, analysis and modeling in order to solve real world problems.

2: Impact of Remote sensing and GIS in Environmental Sciences

This paper examines the practical contribution of remote sensing to environmental management at the sub-regional scale. The framework for environmental management at a sub-regional scale in the United Kingdom is the County Structure Plan.

Numerical models of the atmosphere have revolutionized the preparation of weather forecasts, although rather than reducing the need for observations such models have increased awareness of the importance of data through assimilation schemes. Indeed, the accuracy of forecasts relies crucially upon how well the initial state of the atmosphere can be described and this requires detailed measurements throughout the entire depth of the atmosphere. Over the last half century, the increasing availability of low cost computers and sensors has enabled a move away from a reliance on the collection of weather data at traditional sites and enclosures. However, perhaps the greatest contribution to improving accuracy in weather prediction and monitoring is the advent of new observing systems based on satellite and airborne platforms. These technologies have completely revolutionized the networking of conventional meteorological instrumentation and have facilitated a colossal advance in both the spatial and temporal scale of weather measurement Chapman et. In view of the great benefit provided by spaceborne Earth-atmosphere remote sensing, there were strong efforts to construct Earth observing satellite systems in the past. During the following decades several satellite systems with different sensors provided data for a wide range of atmospheric parameters that enhanced our understanding of Earth-atmosphere processes and dynamics. Nowadays, operational satellite systems provide invaluable measurements of atmospheric parameters at regular intervals on a global scale Thies and Bendix, Meteorological parameters measured by remote sensing Radiation: Radiation energy and its spatio-temporal distribution is the driver for atmospheric dynamics. To understand weather and climate, measurements of the radiation that enters and leaves the Earth-atmosphere system are necessary. Wind fields derived from satellites provide continuous area-wide information about atmospheric dynamics in a high spatial and temporal resolution. Such information is of great benefit as an input parameter for numerical weather prediction. Thus, atmospheric motion vectors, derived by tracking atmospheric features e. Water vapour is the principal greenhouse gas in the atmosphere and a key compound of the global climate. It is important for many atmospheric processes, such as radiative transfer, circulation dynamics, cloud formation, precipitation and the greenhouse effect. Information about the distribution and variability of atmospheric water vapour is critical for understanding these processes controlling the Earth radiative budget and the hydrological cycle. As a response on the increasing human impact on the evolution of the global climate and on the stratospheric ozone layer much effort has been made to understand the underlying chemical and physical processes and the role of anthropogenic gas emissions. To fulfill this objective there is a clear need for global observation of gas emissions and concentrations in the Earth atmosphere system. Aerosols in the troposphere are a major climate forcing parameter, due to the direct and indirect aerosol effect. Despite this importance there are still significant uncertainties concerning the physical and optical properties of tropospheric aerosols and their interaction with global climate. This is mainly due to the inadequate quantitative knowledge of global aerosol characteristics and their temporal variability. To evaluate the aerosol radiative effects together with the magnitude and the potential variability of the aerosol climate forcing it is therefore essential to monitor aerosols on the global scale. Clouds â€” identification and properties: In the past, various cloud classification techniques have been developed for the different satellite systems and for a variety of purposes. Typical cloud parameters that can be derived from satellite data and that are useful for such investigations comprise cloud-top height, cloud optical thickness, cloud effective particle radius, cloud liquid water path and cloud phase. Precipitation is a key factor of the global water cycle and affects all aspects of human life. Because of its great importance and its high spatial and temporal variability, the correct spatio-temporal detection and quantification of precipitation has been one of the main goals of meteorological satellite missions.

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Precipitation retrieval from satellite data can provide area-wide information in regions for which data from rain gauge or radar networks are sparse or unavailable Thies and Bendix, Cloud Classification image based on an Infrared geostationary satellite source:

3: Remote Sensing Sensors and Applications in Environmental Resources Mapping and Modelling

Remote sensing from airborne and space borne platforms provides valuable data for mapping, environmental monitoring and disaster management.

Reproduction is permitted for noncommercial purposes. This article has been cited by other articles in PMC. Abstract The history of remote sensing and development of different sensors for environmental and natural resources mapping and data acquisition is reviewed and reported. Application examples in urban studies, hydrological modeling such as land-cover and floodplain mapping, fractional vegetation cover and impervious surface area mapping, surface energy flux and micro-topography correlation studies is discussed. The review also discusses the use of remotely sensed-based rainfall and potential evapotranspiration for estimating crop water requirement satisfaction index and hence provides early warning information for growers. The review is not an exhaustive application of the remote sensing techniques rather a summary of some important applications in environmental studies and modeling. With the availability of remotely-sensed data from different sensors of various platforms with a wide range of spatiotemporal, radiometric and spectral resolutions has made remote sensing as, perhaps, the best source of data for large scale applications and study. In this review, we summarize some of the most commonly used applications of the technique in environmental resources mapping and modeling. Applications of remote sensing in hydrological modeling, watershed mapping, energy and water flux estimation, fractional vegetation cover, impervious surface area mapping, urban modeling and drought predictions based on soil water index derived from remotely-sensed data is reported. The review also summarizes the different eras of sensors development and remote sensing and future directions of the remote sensing applications. Evolution and advances in remote sensing satellites and sensors for the study of environments There are eight distinct eras of remote sensing; some running parallel in time periods, but are distinctly unique in terms of technology, concept of utilization of data, applications in science, and data characteristics e. These are discussed below: Airborne remote sensing era: The airborne remote sensing era evolved during the first and the Second World War Avery and Berlin, , Colwell, During this time remote sensing was mainly used for the purposes of surveying, reconnaissance, mapping, and military surveillance. Rudimentary spaceborne satellite remote sensing era: Spy satellite remote sensing era: During the peak of the cold war, spy satellites such as Corona Dwayne et al. Data was collected, almost exclusively, for military purposes. The data was not digital, but was produced as hard copies. However, the spin-off of the remote sensing developed for military purposes during the above 3 eras spilled over to mapping and slowly into environmental and natural resources applications. Meteorological satellite sensor remote sensing era: This was an era when data started being available in digital format and were analyzed using exclusive computer hardware and software. This was also an era when global coverage became realistic and environmental applications practical. The Landsat-6 failed during launch. These satellites have high resolution nominal 2. At this resolution, only Landsat is currently gathering data with global wall to wall coverage. This is, by far, the most significant era that kick started truly wide environmental application of remote sensing data locally and globally. Earth Observing System era: Applications of sensor data have become wide spread and applications have multiplied. Institutions and individuals who never used remote sensing have begun to take an interest in remote sensing. The new millennium era Bailey et al. These are basically satellites and sensors for the next generation. These include Earth Observing-1 carrying the first spaceborne hyperspectral data. The private industry era began at the end of the last millennium and beginning of this millennium see Stoney, This era consists of a number of innovations. Second, a revolutionary means of data collection. This is typified by Rapideye satellite constellation of 5 satellites, having almost daily coverage of any spot on earth at 6. Third, is the introduction of micro satellites, some under disaster monitoring constellation DMC , which are designed and launched by surrey satellite technology Ltd. Fourth, is the innovation by Google Earth http:

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4: GIS and Remote Sensing in Environmental management, EIA and Audit Course - PCDN : PCDN

The application of remote sensing in this process is illustrated by reference to a range-of uses of panchromatic and false colour air photography. The County Struc-tPresented at the Remote Sensing Society Annual Conference, Durham, December

As natural disasters increase in both intensity and severity around the world, the Asian region continues to suffer a disproportionate number of hazard events and related losses in lives, infrastructure, stability, and economic progress. In the period â€" alone, Asia accounted for one third of 1, flood disasters worldwide and nearly 60,people were killed in floods[1]. A flood is an overflow of an expanse of water that submerges the land. Flood hazards are the most common and destructive of all natural disasters and are a constant threat to life and property. Each year, flood disasters result in tremendous losses and social disruption worldwide. As increasing human activity downstream of rivers results in greater flood damage; floods themselves are also increasing in size and frequency due to human activities in the upstream section of the river system[3] In recent years, risk-based approaches have received increasing attention as a viable means to manage flood hazards. Hazard risk and vulnerability assessment HRVA examines the hazards that may affect a community in order to determine the risk that each hazard event poses to both the community as a whole and to vulnerable elements in the community. In Pakistan, floods have been recognized as a major natural calamity. The country has a long history of flooding from the Indus River and its tributaries and the floods of , , , , , , , , , , and attest to its destructive nature and its adverse impact on lives and property in Pakistan. More than three million homes were destroyed and persons lost their lives in the great flood of Three years later in , floods demolished over 10 million houses while lives were lost with other losses amounting to a Rs. Towards the end of September , an unprecedented flood occurred, inflicting damage nationwide in Pakistan worth about Rs. The catastrophic flood of surpassed all previous records with damages estimated at Rs. Sindh is the south eastern province of Pakistan. The province is associated with the longest river of Pakistan which stretches to about miles km long. Originating in the Tibetan Plateau in the vicinity of Lake Mansarovar in the Tibet Autonomous Region, the river runs a course through the Ladakh district of Jammu and Kashmir, then enters the Northern Areas Gilgit-Baltistan flowing through the North in a southerly direction along the entire length of the country to merge into the Arabian Sea near the port city of Karachi in Sindh. Climate is not uniform over the Indus Basin. It varies from subtropical arid and semi-arid to temperate sub-humid in the plains of the Sindh and Punjab provinces, and alpine in the mountainous highlands to the north. Annual precipitation ranges between mm and mm in the lowlands to a maximum of mm water equivalent on mountain slopes. Snowfall at higher altitudes above m accounts for most of the river runoff. Alluvial land in Pakistan is known to be a flood-prone area. Earth observation techniques can contribute to finding out more accurately what causes floods. Together with flood hazard mapping, earth observation techniques can be used to assessing damage to property, infrastructure, and agricultural crops. The uses of remotely sensed data in identifying the trends of river channel migration and as source of input data for determining river behaviour has been gaining popularity in recent years. One of the main characteristics of remote sensing is its capability to generate a large amount of information frequently and spatially, becoming a powerful tool for monitoring changing aquatic environments. Remote sensing data has been used to document water quality estimate water depths and monitor river channel changes and aquatic habitat[]. Object-based analysis of multispectral imagery was introduced early on in remote sensing literature[7]; however, the object-based approach has largely been ignored in favour of pixel-based methods which have been easier to implement[8]. One of the advantages of object-based image analysis is the multitude of additional information that can be derived from image objects compared to the amount of information available from individual pixels[9]. This study aims to determine flood hazard, flood extended areas, and proposed flood shelters using remote sensing and geographic information systems tools. An effort was made to prepare a flood hazard zone map and a proposed flood shelter map using GIS and remote sensing techniques and incorporating a satellite image, topographic map. This study also attempts to exploit the capabilities of remote sensing and GIS techniques to suggest an appropriate methodology for flood hazard mapping. Study Area The study area is located in the south-eastern part of Nepal and seven districts of Sindh province Figure 1. Sindh lies in a tropical to subtropical region; it is hot in the summer and mild to warm in winter. Annual rainfall averages about seven inches, falling mainly during July and August. The province is mostly arid, with scant vegetation except for the irrigated Indus Valley. Location Map of Study Area 2. Image analysis Flood hazard depends on many factors such as flood inundation and topography of the area and etc. Enumerate the flood extended area mapping were followed few steps. Figure 2 presents the flow diagram of object-based image analysis for flood extended mapping. Compared with pixel-based methods, this approach shows better classification results with higher accuracy as it uses both spectral and spatial information[4,10,11]. The basic step in eCognition image analysis is to segmentation a scene where information of single pixels is aggregated into homogeneous image objects. Multiresolution segmentation, which was used in this study for object-based image analysis, groups areas of similar pixel values into objects; homogeneous areas result in larger objects, heterogeneous areas in smaller ones. Therefore several segmentations were tested with different parameters until the result was satisfying.. In the pre-processing stage, an NDVI image was created using the customised feature in the form: Land and water mask index values can range from 0 to , but water values typically range 0 to This information was used to develop suitable classification algorithms for flood inundation mapping. Flow diagram of flood extended mapping Figure 3. Flow diagram of flood shelter analysis The next step was to define classes and insert class hierarchy. Image objects were linked to class objects and each classification link was stored in the membership value of the image object to the linked class. Image objects were classified using user-defined rules. Objects with an area smaller than the defined minimum mapping unit were merged with other objects. The classified inundation map was exported to shape file format for further processing and flood hazard processing and flood shelters and modeling. Acquired datasets of stream order, river, digital elevation model and land cover including all of the data that a flood under such circumstances would include. One of these is slope which is an essential topographic factor that guides the flood potential of spatial areas. Slope data layers were generated using the digital elevation model of the study area. Vegetation poses a major restraint to flooding; vegetation reduces runoff and helps in percolation. Euclidea n allocation calculates for each cell the nearest source based on Euclidean distance and calculates the direction in degrees to the nearest source. Normally, all nearest source areas are flood-prone areas. Euclidean allocations of stream order were generated. Euclidean distances of rivers were generated and short disease from river ranked flood potential. In order to combine the datasets, they must be set to a common scale. Each dataset data is then reclassified to rank the potential hazard location. Then reclassify date sets came to a common scale ranges from 1 to 5. Each raster was assigned ranks at the time of reclassification: Once, all the four raster layers are created using the models developed, they are overlaid together to produce the final flood hazard map of Shind province. The weighted layers were created in order to reduce the number of inputs in the final weighted overlay. The results were validated with the recent flood map of Sindh province. Providing flood shelter in flood-affected areas is very important. Flood shelters provide flood-affected people with areas to run to for shelter and keeps them safe while the flood rages Digital elevation model, land cover, settlement, road and flood map were used to model suitable locations for flood shelter. Each datasets data were then reclassified to rank the suitability of locations for flood shelter. Once all four raster layers have been created using the models developed, they were overlaid together to produce the final suitability flood shelters location map of Shind province Figure 3. They were then weighted according to a percentage of influence and combined to produce a map displaying suitable locations for the proposed flood shelter. Results were selected and the optimum site identified for the new flood shelter from alternative sites. Flood hazard zoning map 3. Flood shelter suitability map Table 1. The flood inundated a total area of km2 in Sindh province km2, in Naushahro Feroze district, km2 in Shikarpur district, km2 in Sukkur distric, m2,in Khairpur district, km2 in Ghotki district, km2 in Jacobabad district, and km2 in Larkana district. The modeled result indicated a very high hazard area km2 out of a total area of km2 of Sindh province. The results were validated using the Pakistan flood data. Some km2 area was observed to be less flood hazard-prone and this can be attributed to human interventions, particularly infrastructure to regularly reroute water build-up from floods. Conclusions Based on the results of this case study for Sindh province, it can be concluded that geospatial technology provides the best potential to analyze and provide results required for prompt and effective decision-making on floods. The object-based remote sensing technique and geographical information systems were used to classify the extent of floods. Object-based classification systems allow different rules for different classes that can be used further for similar types of flood mapping. The studies support the conclusion that information derived from different imagery can be very valuable to operational users for planning flood-related emergency response. Natural flood disaster is common and cannot be stop. Remote sensing is an efficient tool for flood mapping and suitability analysis and can be useful for emergency response and disaster preparedness. Our gratitude goes especially to Mr. World Disaster Report Oxford University Press, [3] D. High spatial resolution hyperspectral mapping of in-stream habitats, depths, and woody debris in mountain streams. Geomorphology, 55, â€", [7] R. Canadian Journal of Remote Sensing 31 2: Enschede, the Netherlands, 13â€"15 June,

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5: Remote sensing - Wikipedia

The journal 'Remote Sensing Applications: Society and Environment' (RSASE) focuses on remote sensing studies that address specific topics with an emphasis on environmental and societal issues - regional / local studies with global significance.

Play media This video is about how Landsat was used to identify areas of conservation in the Democratic Republic of the Congo , and how it was used to help map an area called MLW in the north. Passive sensors gather radiation that is emitted or reflected by the object or surrounding areas. Reflected sunlight is the most common source of radiation measured by passive sensors. Examples of passive remote sensors include film photography , infrared , charge-coupled devices , and radiometers. Active collection, on the other hand, emits energy in order to scan objects and areas whereupon a sensor then detects and measures the radiation that is reflected or backscattered from the target. RADAR and LiDAR are examples of active remote sensing where the time delay between emission and return is measured, establishing the location, speed and direction of an object. Illustration of remote sensing Remote sensing makes it possible to collect data of dangerous or inaccessible areas. Remote sensing applications include monitoring deforestation in areas such as the Amazon Basin , glacial features in Arctic and Antarctic regions, and depth sounding of coastal and ocean depths. Military collection during the Cold War made use of stand-off collection of data about dangerous border areas. Remote sensing also replaces costly and slow data collection on the ground, ensuring in the process that areas or objects are not disturbed. Other uses include different areas of the earth sciences such as natural resource management , agricultural fields such as land usage and conservation, [6] [7] and national security and overhead, ground-based and stand-off collection on border areas. For a summary of major remote sensing satellite systems see the overview table. Applications of remote sensing[edit] Further information: Remote sensing geology and Remote sensing archaeology Conventional radar is mostly associated with aerial traffic control, early warning, and certain large scale meteorological data. Other types of active collection includes plasmas in the ionosphere. Laser and radar altimeters on satellites have provided a wide range of data. By measuring the bulges of water caused by gravity, they map features on the seafloor to a resolution of a mile or so. By measuring the height and wavelength of ocean waves, the altimeters measure wind speeds and direction, and surface ocean currents and directions. Ultrasound acoustic and radar tide gauges measure sea level, tides and wave direction in coastal and offshore tide gauges. Light detection and ranging LIDAR is well known in examples of weapon ranging, laser illuminated homing of projectiles. LIDAR is used to detect and measure the concentration of various chemicals in the atmosphere, while airborne LIDAR can be used to measure heights of objects and features on the ground more accurately than with radar technology. Radiometers and photometers are the most common instrument in use, collecting reflected and emitted radiation in a wide range of frequencies. The most common are visible and infrared sensors, followed by microwave, gamma ray and rarely, ultraviolet. They may also be used to detect the emission spectra of various chemicals, providing data on chemical concentrations in the atmosphere. Spectropolarimetric Imaging has been reported to be useful for target tracking purposes by researchers at the U. They determined that manmade items possess polarimetric signatures that are not found in natural objects. These conclusions were drawn from the imaging of military trucks, like the Humvee , and trailers with their acousto-optic tunable filter dual hyperspectral and spectropolarimetric VNIR Spectropolarimetric Imager. These thematic mappers take images in multiple wavelengths of electro-magnetic radiation multi-spectral and are usually found on Earth observation satellites , including for example the Landsat program or the IKONOS satellite. Maps of land cover and land use from thematic mapping can be used to prospect for minerals, detect or monitor land usage, detect invasive vegetation, deforestation, and examine the health of indigenous plants and crops, including entire farming regions or forests. Weather satellites are used in meteorology and climatology. Hyperspectral imaging produces an image where each pixel has full spectral information with imaging narrow spectral bands over a contiguous spectral range. Hyperspectral imagers are used in various applications including mineralogy, biology, defence, and environmental measurements. Within the scope of the combat against desertification , remote sensing allows researchers to follow up and monitor risk areas in the long term, to determine desertification factors, to support decision-makers in defining relevant measures of environmental management, and to assess their impacts. Overhead gravity data collection was first used in aerial submarine detection. Seismograms taken at different locations can locate and measure earthquakes after they occur by comparing the relative intensity and precise timings. Ultrasound sensors, that emit high frequency pulses and listening for echoes, used for detecting water waves and water level, as in tide gauges or for towing tanks. To coordinate a series of large-scale observations, most sensing systems depend on the following: High-end instruments now often use positional information from satellite navigation systems. The rotation and orientation is often provided within a degree or two with electronic compasses. Compasses can measure not just azimuth i. More exact orientations require gyroscopic-aided orientation , periodically realigned by different methods including navigation from stars or known benchmarks. Inverse problem Generally speaking, remote sensing works on the principle of the inverse problem. While the object or phenomenon of interest the state may not be directly measured, there exists some other variable that can be detected and measured the observation which may be related to the object of interest through a calculation. The common analogy given to describe this is trying to determine the type of animal from its footprints. For example, while it is impossible to directly measure temperatures in the upper atmosphere, it is possible to measure the spectral emissions from a known chemical species such as carbon dioxide in that region. The frequency of the emissions may then be related via thermodynamics to the temperature in that region. The quality of remote sensing data consists of its spatial, spectral, radiometric and temporal resolutions. Spatial resolution The size of a pixel that is recorded in a raster image â€” typically pixels may correspond to square areas ranging in side length from 1 to 1, metres 3. Spectral resolution The wavelength of the different frequency bands recorded â€” usually, this is related to the number of frequency bands recorded by the platform. Current Landsat collection is that of seven bands, including several in the infrared spectrum, ranging from a spectral resolution of 0. The Hyperion sensor on Earth Observing-1 resolves bands from 0. Radiometric resolution The number of different intensities of radiation the sensor is able to distinguish. Typically, this ranges from 8 to 14 bits, corresponding to levels of the gray scale and up to 16, intensities or "shades" of colour, in each band. It also depends on the instrument noise. Temporal resolution The frequency of flyovers by the satellite or plane, and is only relevant in time-series studies or those requiring an averaged or mosaic image as in deforesting monitoring. Cloud cover over a given area or object makes it necessary to repeat the collection of said location. In order to create sensor-based maps, most remote sensing systems expect to extrapolate sensor data in relation to a reference point including distances between known points on the ground. This depends on the type of sensor used. For example, in conventional photographs, distances are accurate in the center of the image, with the distortion of measurements increasing the farther you get from the center. Another factor is that of the platen against which the film is pressed can cause severe errors when photographs are used to measure ground distances. The step in which this problem is resolved is called georeferencing , and involves computer-aided matching of points in the image typically 30 or more points per image which is extrapolated with the use of an established benchmark, "warping" the image to produce accurate spatial data. As of the early s, most satellite images are sold fully georeferenced. In addition, images may need to be radiometrically and atmospherically corrected. Radiometric correction Allows avoidance of radiometric errors and distortions. The illumination of objects on the Earth surface is uneven because of different properties of the relief. This factor is taken into account in the method of radiometric distortion correction. Topographic correction also called terrain correction In rugged mountains, as a result of terrain, the effective illumination of pixels varies considerably. In a remote sensing image, the pixel on the shady slope receives weak illumination and has a low radiance value, in contrast, the pixel on the sunny slope receives strong illumination and has a high radiance value. For the same object, the pixel radiance value on the shady slope will be different from that on the sunny slope. Additionally, different objects may have similar radiance values. These ambiguities seriously affected remote sensing image information extraction accuracy in mountainous areas. It became the main obstacle to further application of remote sensing images. The purpose of topographic correction is to eliminate this effect, recovering the true reflectivity or radiance of objects in horizontal conditions. It is the premise of quantitative remote sensing application. Atmospheric correction Elimination of atmospheric haze by rescaling each frequency band so that its minimum value usually realised in water bodies corresponds to a pixel value of 0. The digitizing of data also makes it possible to manipulate the data by changing gray-scale values. Interpretation is the critical process of making sense of the data. Image Analysis is the recently developed automated computer-aided application which is in increasing use. Object-Based Image Analysis OBIA is a sub-discipline of GIScience devoted to partitioning remote sensing RS imagery into meaningful image-objects, and assessing their characteristics through spatial, spectral and temporal scale. Old data from remote sensing is often valuable because it may provide the only long-term data for a large extent of geography. At the same time, the data is often complex to interpret, and bulky to store. Modern systems tend to store the data digitally, often with lossless compression. The difficulty with this approach is that the data is fragile, the format may be archaic, and the data may be easy to falsify. One of the best systems for archiving data series is as computer-generated machine-readable ultrafiche , usually in typefonts such as OCR-B , or as digitized half-tone images. Ultrafiches survive well in standard libraries, with lifetimes of several centuries. They can be created, copied, filed and retrieved by automated systems. They are about as compact as archival magnetic media, and yet can be read by human beings with minimal, standardized equipment. Data processing levels[edit] To facilitate the discussion of data processing in practice, several processing "levels" were first defined in by NASA as part of its Earth Observing System [17] and steadily adopted since then, both internally at NASA e. Level Description 0 Reconstructed, unprocessed instrument and payload data at full resolution, with any and all communications artifacts e. A Level 1 data record is the most fundamental i. Level 2 is the first level that is directly usable for most scientific applications; its value is much greater than the lower levels. Level 2 data sets tend to be less voluminous than Level 1 data because they have been reduced temporally, spatially, or spectrally. Level 3 data sets are generally smaller than lower level data sets and thus can be dealt with without incurring a great deal of data handling overhead. These data tend to be generally more useful for many applications. The regular spatial and temporal organization of Level 3 datasets makes it feasible to readily combine data from different sources. While these processing levels are particularly suitable for typical satellite data processing pipelines, other data level vocabularies have been defined and may be appropriate for more heterogeneous workflows. This section does not cite any sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed.

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6: Remote Sensing Applications: Society and Environment - Journal - Elsevier

To expose participants to applications of GIS and remote sensing in environmental management To introduce participants to the role GIS plays in the EIA process To develop a sound basis for understanding the operation of GIS and Remote Sensing in environmental management.

Written by Kenneth Markowitz Tuesday, 15 December This Information Brief outlines those potential applications. Environmental Enforcement The U. These applications include estimations of primary production, biomass, crop yields, and to chart, vegetation type, deforestation, desertification, forest boundaries, forest harvest, soil erosion, and bush or forest fires. Passive sensors have also been used to observe and monitor changes associated with storm, flood, and fire damage. Forestry Forestry applications for passive remote sensors include tree species surveys, monitoring clearcut operations, planning and observing burn areas, and studying successional forest growth. Forest Service USFS relies primarily on the data from Landsats 5 and 7 for forest monitoring because of the low cost and large scene size. Landsat data is particularly applicable to forest change monitoring because data from previous Landsat missions is archived and available for accurate comparison with data from the current Landsat mission. Active sensors are valuable tools for monitoring crop regulation compliance, forest clearing, and for taking general inventories of world forest densities. Agriculture The United States Department of Agriculture USDA is conducting research to determine the potential uses of remote sensing both aerial and satellite in the agricultural sector. Promising applications include measuring leaf area indices LAI - a quantitative indicator of leaf stress , identifying soil properties by their spectral signals, evaluating crop productivity, and providing a valuable data source for crop simulation models. Once the characteristics and geographic coordinates of the field section are in a computer, additions such as water, pesticides, and fertilizers can be efficiently controlled in response to the specific needs of each section thereby reducing the amount of pollutants introduced to the environment while producing healthier crops. The sensor may also help predict migration routes. Active sensors have also been used to track oil spills, effluent discharges, and algal blooms. Wetlands and Watersheds Wetlands monitoring may employ a combination of land-observation and ocean-observation satellites. Furthermore, using algal productivity as an indicator, scientists are able to monitor whether high levels of nutrients pollute areas of a watershed. The EOS satellites, beginning with the Terra, were designed specifically for monitoring climate conditions, including the observation of aerosols, cloud cover, fires, ocean productivity, pollution, solar radiation, sea ice, and snow cover. MODIS and ASTER data can forecast severe weather with a great degree of reliability, potentially saving states millions of dollars in unnecessary evacuation and emergency response. The NERL conducts research that leads to improved methods to predict human and ecosystem exposure to harmful pollutants. FY Program Summary, 2 A topographic map is one that is defined by displaying elevation and landform information, usually in the form of contour lines. FY Program Summary. Forensics 63, , and George Brilis et al. Digital Methods, 2 J. Forensics , 29 providing an overview of the use of aerial photography, topographic mapping, and photgrammetry in environmental enforcement actions. Building More Effective Linkages, December ,

7: Earth Observation in EO-MINERS - Methods, sensors and apps - Remote sensing application

Remote sensing and Geographic information system (GIS) plays a key necessary role in environmental mapping, mineral exploration, agriculture, forestry, geology, water, ocean, infrastructure coming up with, and management, etc. Remote Sensing and GIS has mature as a serious instrument for assembling info on nearly every side of the world for a.

8: Environmental Applications of Satellite Remote Sensing

remote sensing technology (light blue text) and environmental treaties (purple text). The proliferation in multilateral environmental agreements began in earnest after the Stockholm Conference on the Environment in

9: Use of Remote Sensing for Environmental Management | HubPages

products, for both public and private land management entities, using remote sensing geospatial analysis to support energy development and environmental assessments. Myriad platforms provide the data for these analyses, including satellite and airborne.

APPLICATION OF REMOTE SENSING IN ENVIRONMENTAL MANAGEMENT pdf

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