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Research Paper Engineering

Relevance of Remote Sensing and GIS in Water Resoureces Engineering

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ABSTRACT

Remote sensing can play useful role in harnessing available water resources wealth. Remote Sensing and GIS techniques become potential and indispensable tools for solving many problems of water resources in civil engineering. Remote sensing observations provides data on earth's resources in a spatial format, GIS co-relates different kinds of spatial data and their attribute data, so as to use them in various fields of water resources engineering. Different themes namely, terrain, geology, hydrology, drainage, land use and so on can be extracted from remote sensing data. All the above thematic information along with their attributes can be integrated to solve many problems of water resources engineering. Uses of remote sensing and GIS are Watershed Management, Irrigation management, Drought management, Soil moisture estimation, Reservoir sedimentation, Flood monitoring. This paper mainly focuses on the relevance of RS & GIS on the above mentioned fields.

Keywords : Remote sensing, GIS, Water resources Engineering

I. Introduction

Remote sensing is the acquisition of information about an object or phenomenon, without making physical contact with the object. In modern usage, the term generally refers to the use of aerial sensor technologies to detect and classify objects on Earth by means of propagated signals (e.g. electro-magnetic radiation emitted from aircraft or satellites) [8]. Remote sensing makes it possible to collect data on dangerous or inaccessible areas.

Remote Sensing (RS) data and Geographical Information System (GIS) play a rapidly increasing role in the field of hydrology and water resources development [8]. Although very few remotely sensed data can be directly applied in hydrology, such information is of great value since many hydrologically relevant data can be derived from remote sensing information.

Other uses include different areas of the earth sciences such as natural resource management, agricultural fields such as land usage and conservation. The process of remote sensing is also helpful for city planning, archaeological investigations, military observation and geomorphologic surveying.

II. Water Resources Engineering

Remote sensing observations provides data on earth's resources in a spatial format, GIS co-relates different kinds of spatial data and their attribute data, so as to use them in various fields of civil engineering. Such as:

A) Watershed Management.
B) Irrigation Management.
C) Drought Management.
D) Soil Moisture Estimation.
E) Reservoir Sedimentation.
F) Flood monitoring

A. Watershed Management

Proper planning and management is essential for conservation of water and land resources for optimum productivity. GIS provides a common framework for watershed management data obtained from a variety of sources. GIS can be a powerful tool for managing potential impacts on human activities due to processes like precipitation, surface and ground water flow, flood, etc. From derived DEM (Digital Elevation Model), we can delineate the water flow path and inter basin relationship and location of dams, canal works and flood protection work can be carried out effectively. For management various hydrological models can be developed among them the most complex model is water balance model as they simulate all components in a water balance on and below the earth's surface and also in the atmosphere to a certain extent. Hydrological processes to be modeled in time and space in a water balanced model include (1) precipitation, which usually serves as a model input, (2) evapotranspiration, (3) runoff (surface, subsurface), (4) storage change in the unsaturated zone, (5) ground water flow [10].

Watershed degradation of soil and land resources could be mapped and monitored via remote sensing for reclamative measures. The mapping of soil degradation involving salinity/alkalinity, water logging, erosion, desertification, shifting cultivation, wetlands, etc. are successfully done in various regions using satellite imagery.

B. Irrigation Management

Irrigation is the largest consumer of fresh water.

As water scarcity becomes more acute and competition for fresh water intensifies better irrigation management will be required to achieve greater efficiency in the use of this valuable resource. Remote sensing from space, which can regularly provide objective information on the agricultural and hydrological conditions of irrigated area, has a great potential for enhancing the management of irrigation system.

In Netherlands, Schotten et al. [9] used eight ERS-1 SAR precision images with a 12.5 m resolution to identify potatoes, sugarbeats, wheat, maize, onions, peas, grass and orchards with a field based maximum likelihood classifier. The images were captured during growing season. Field size varied from 1 to 20 ha and an overall classification accuracy of 80% could be obtained after an extensive ground survey.

C. Drought Management

The drought assessment is based on a comparative evaluation of satellite observed green vegetation cover of a district

in any specific time period, with that of similar period in previous years. NDVI images derived from NOAA AVHRR data are used for these purpose. This nationwide early warning service has been found to be useful for providing first alert of drought conditions [11].

Carbone et al. [4] concluded that the examination of spatial patterns of simulated yield improved county production estimates and identified vulnerable areas during droughts.

D. Soil Moisture Estimation

As soil moisture controls the water balance in the crop root zone and also in the estimation of surface runoff, many attempts were made to retrieve soil moisture data from airborne and space borne multi spectral remote sensors. Bastiaanssen [2] presented a review of studies on soil moisture estimation based on remote sensing.

Recent attempts to convert thermal infrared measurements into soil moisture maps are based on surface roughness [3]. Major contrast between the dielectric constant of water (~80) and dry soil (~3.5) produces very different propagation characteristics of the electromagnetic wave in soils having different moisture levels. Microwave radiometry reflects the moisture conditions in the top 10cm of soil. Airborne microwave radiometry with spatial resolutions of a few meters has shown greater success [6] compared to space borne passive microwave with very course spatial resolution.

E. Reservoir Sedimentation

Generally, suspended sediment causes the most serious pollution of water bodies. This not only reduces the reservoir storage and its life but also restricts the use of water for the intended multiple purposes.

Surface concentration of suspended sediment load was estimated for many reservoirs and lakes in India by Chakraborti et al. [5].

Remote sensing can be used in the following ways to monitor sedimentation [1]:

- Inventorying the watershed runoff potential for taking steps to min. sediment in the runoff and max. clear water discharge.
- Identification and declination of flood front during a storm event and establishing co-relation between flood front extent and storm magnitude to predict future impact.
- Mathematical modeling of sedimentation by co-relating reflectance values with sedimentation rate.

F. Flood Monitoring

Floods are regular phenomena in many parts of the world including India. Flood damage surveys are essential not only to assess the extent and severity of damage caused by the floods periodically in river valleys but also for economic evaluation of flood control measures. The effectiveness of existing flood control works in containing the flood can be assessed vulnerable reaches identified for strengthening. New structures can be planned wherever necessary.

Near real time monitoring of number of flood events of Indian rivers viz. Brahmaputra, Ganga, Kosi, Jhelum, and Godavari has demonstrated that valuable information can be provided regarding flood affected areas for planning flood relief activities [7].

III. Future Scope

Impact of remote sensing on hydrology will be significant in future for several reasons.

- It has the ability to provide spatial data rather than point data.
- It has the potential to provide measurements of hydrological variables.
- It has the ability to provide long-term globe-wide data for remote and generally inaccessible regions of the Earth at regular intervals.

IV. Conclusion

Remote sensing relevance in different fields of water resources discussed reveal the strong potential of use of remote sensing for water resources planning and management.

Studies have suggested that the use of remote sensing data in hydrology and water resources could yield very high benefit/cost ratios from savings in flood damages and in improved planning for irrigation and hydro electric production.

Progress in water resources research depends on the availability of adequate data for model development and validation. Remote sensing plays a vital role in this process.

REFERENCES

[1] Balakrishnan P., Issues in water resources development and management and the role of remote sensing, Report at ISRO-NNRMS, Bangalore, India(1987). | [2] Bastiaanssen W.G.M., "Remote sensing in water resources management: the state of the art", International water management institute, Sri Lanka, (1998). | [3] Bastiaanssen W.G.M., Pelgrum H., Droogers P., de Bruin H.A.R. and Menenti M., "Area-average estimates of evaporation, wetness indicators and top soil moisture", Agricultural and forest meteorology, 87 (1997). | [4] Carbone G.J., S. Narumalani and M. King, "Application of Remote Sensing and GIS Technologies with Physiological Crop Models", Photogrammetric Engineering and Remote Sensing, 62. | [5] Chakraborti A.K., Rao V.V., Raju P.L.M., and Prasad V.H., "Remote sensing in water resources", Proc. of the silver jubilee seminar, IIRS, Dehradun, India (1992). | [6] Chenzy A., Schmugge T.J., Calvet J.C., van Oevelen P., Grosjean O., and Wang J.R., "Airborne microwave radiometry on a semi-arid area during HAPEX-Sahel", J. of hydrology 188-189 (1997). | [7] Ramamoorthi A.S., "IRS-1A data utilization in flood studies" Natural resources management: A new perspective, ed. by Karale R.L. NNRMS, Bangalore, India(1992). | [8] S. Kumar "Basics of Remote sensing and GIS" | [9] Schotten C.G.J., Wan Rooy W.W.L., and Jansen L.L.F., Assessment of the capabilities of multi-temporal ERS-1 SAR data to discriminate between agricultural crops, International Journal of remote sensing, 16(1995). | [10] Schultz G. A., "Remote sensing in Hydrology", J. hydrology, 100(1988). | [11] Thiruvengadachari S., Space technology for disaster warning and management (4th session of scientific and technical committee for IDNDR 1-5 Feb,1993). | | Websites: | [12] www.google.com | [13] www.wikipedia.com | [14] www.isro.org | [15] www.spatialhydrology.com | [16] www.satimagingcorp.com

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