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"APPLICATION OF REMOTE SENSING AND GIS FOR FLOOD DISASTER MANAGEMENT: A THEROTICAL APPROACH"

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ABSTRACT

Remote Sensing techniques are used to measure and monitor the real extent of the flooded areas, to efficiently target rescue efforts and to provide quantifiable estimates of the amount of land infrastructure affected. Now a days various satellite data of the cloud free environment with high resolutions is available. If the data for the flood period is not acquired, from post flood satellite data one can get which will helpful to the demarcation of the flood zone.

The remotely sensed data along with topographical maps may used in GIS for the demarcation of the flood zone and for the creation of TIN and DEM. For the demarcation of flood zone in ARC-GIS buffer analysis technique is most useful. Instead of this technique like overlay analysis may used for the study of temporal changes. For the analysis of the roads and railway lines affected by the flood, network analysis is the best technique. For the image analysis the ERDAS imagine software is important one. In spite of these the softwares like BASINS 4.0, GEOMATICA, GRASS and like that many others are available at free of cost. Like GIS softwares satellite data is also available free of cost from Global Land Cover Facility.

1.0 Introduction:

Floods are probably the most recurring, widespread, disastrous and frequent natural hazards of the world. India is one of the worst flood-affected countries, being second in the world after Bangladesh and accounts for one fifth of global death count due to floods. About 40 million hectares or nearly 1/8th of India's geographical area is flood-prone [G.Venkata Bapalu Rajiv Sinha].

Now a day's research methodology in geography is changing continuously. Among them Remote Sensing & GIS technology is more important. Remote Sensing is a tool and technique similar to mathematics. Using sophisticated sensors to measure the amount of electromagnetic energy existing an object or geographic area from a distance and then extracting valuable information from the data using mathematical and statistical based algorithms is a scientific activity. Remote Sensing functions with spatial data collection techniques like cartography and GIS.

The earth is constantly under observation from dozens of satellites orbiting the planet and collecting image data of the earth surface and its environment. Remote Sensing has the variety of applications but this technique is more powerfully used to solve the problems of environmental hazards, like Flood, drought, Tsunami etc.

2.0 Objectives:

The major objective of the present research paper is to describe the role of the Remote Sensing and GIS technology in the flood management. However the specific objectives are as under

1   To give probable research methodology for flood management by using GIS.
2   To comment on the role of Remote Sensing and GIS in the flood Management.
3   To suggest various GIS techniques for flood management.
4   To explain the sources of satellite data and GIS softwares.

3.0 Probable Research Methodology:

For the flood disaster management by using remote sensing and GIS requires special type of research methodology. The required research methodology is depicted in the following diagrams.

Rayat Shikshan Sanstha's, A.S.C.College, Ramanandnagar (Burli), Tal. Palus, Dist. Sangli. (M.S.)
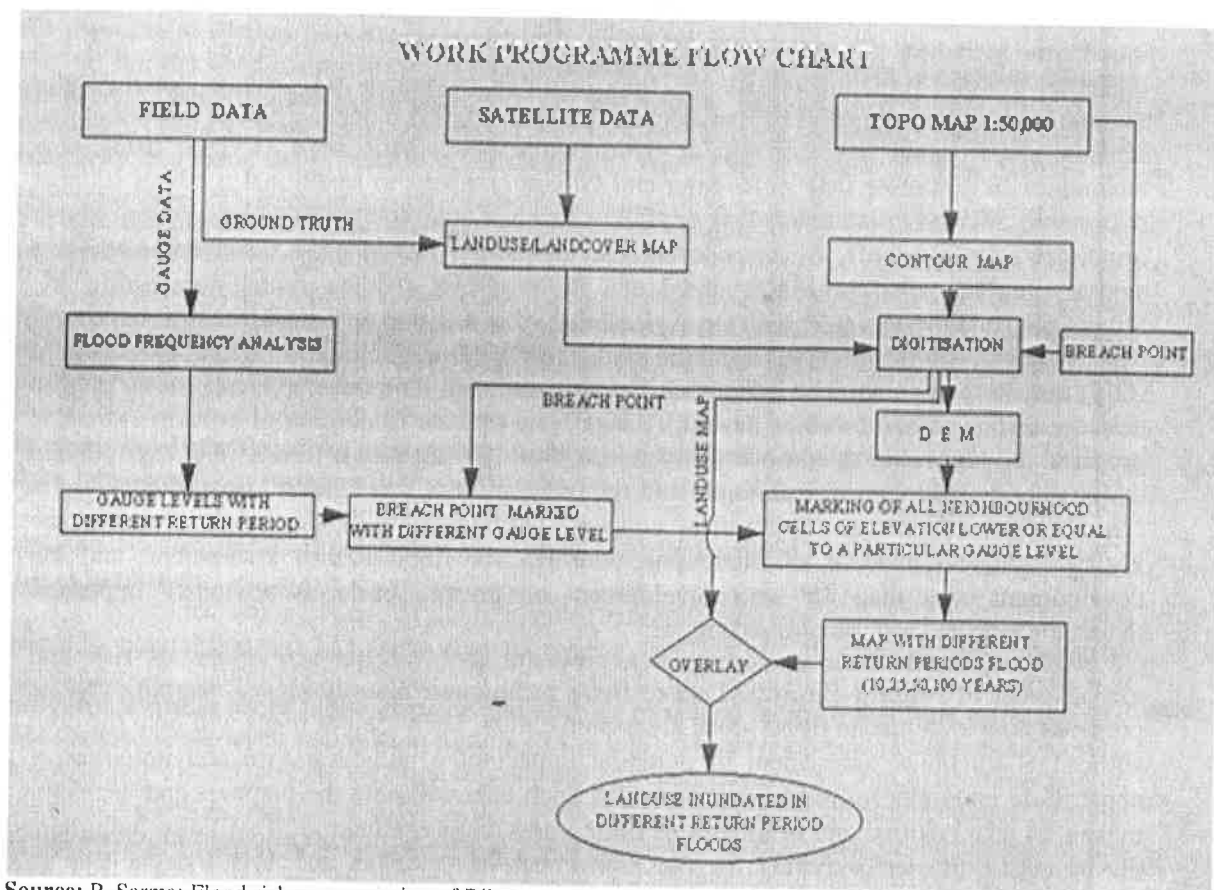
Source: P. Sarma: Flood risk zone mapping of Dikrong sub basin in Assam
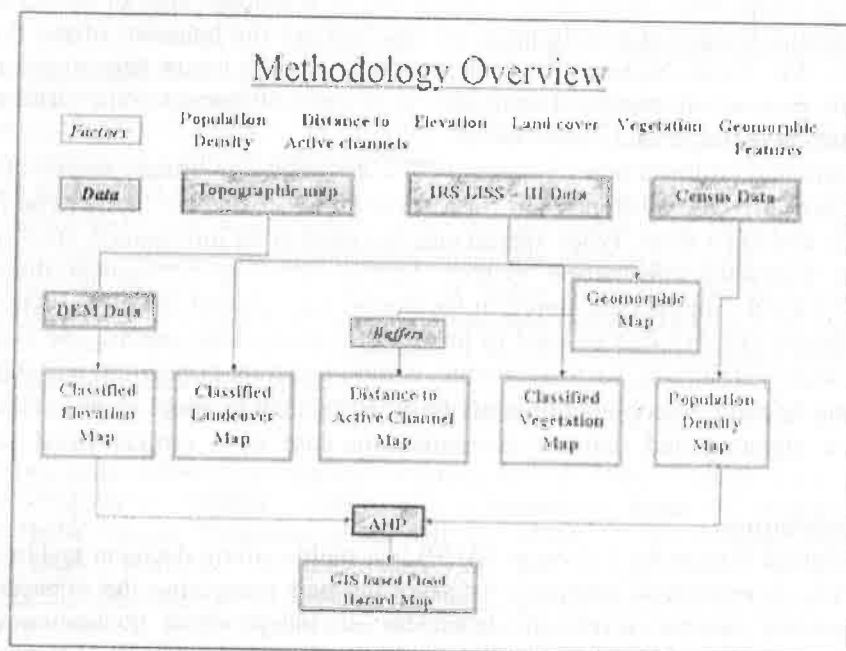
Source: Dinand Alkema and Muhammad Zulkarnain Abd Rahman: Digital Surface Model   (DSM) Construction and Flood Hazard Simulation for Development Plans in Naga City, Philippines,

4.0 Role of Remote Sensing and GIS in Flood Management:

Flood management and control are necessary not only because floods impose a curse on the society, but the optimal exploitation of the land and proper management and control of water resources are of vital importance for bringing prosperity in the predominantly agricultural based economy of the diversely populated country. This cannot become technically feasible without effective flood hazard maps. Flood hazard mapping and flood

inundation modeling are the vital components in flood mitigation measures and land use planning, and are prerequisites for the flood insurance schemes [G.Venkata Bapalu Rajiv Sinha]. Flood forecasting and its management by hydrological models are most important and sensible river basins. Investigation of hydrological phenomena such as flood using new techniques like satellite data processing and GIS in compare to traditional methods is most reasonable. As many parameters (i.e. rainfall, watershed area, soil type and land cover...) have important role in runoff, by considering the mentioned factors in a watershed and their analysis in GIS environment a model can be produced for the runoff forecasting (K. Solaimani, Banihashemi S.M. and Dr. A. Rasuli)

Remote Sensing (RS) technique with the available geographic information system (GIS) may help to construct a set of flood hazard map, and land development priority map to help the responsible authorities develop, design, and operate flood control infrastructure and prepared aid and relief operations for high-risk areas during future floods. The GIS plays a major role in flood control technique, and the integration of this data in a spatial database is crucial, especially for a development country. The role of GIS as a tool to enable the visualization and analysis of inundation with RS for flood hazard assessment, and the development of a map for land development on priority basis, is obviously important [Kimiteru Sado and Md. Monirul Islam].

Nowadays GIS is emerging as a powerful tool for the assessment of risk and management of Natural Hazards. Due to these techniques, natural hazard mapping can be prepared now to delineate flood prone areas on the map. Such kind of maps will help the civil authorities for quick assessment of potential impact of a natural hazard and initiation of appropriate measures for reducing the impact. Such data will help the planners and decision-makers to take positive and in time steps during pre- disaster situation. It will also help them during post -disaster activities for the assessment of damages and losses occur due to flooding. Moreover, GIS provides a broad range of tool for determining areas affected by floods or forecasting areas likely to be flooded due to high discharge of the river. With the help of sequential images of certain area, we can find out the behavior of the flood routing and damages [Mr. Falak Nawaz, Mr. Mohammad Shafique]. It can help to promote public awareness in disaster management activities as a part of focusing the dissemination of forecast at the grass-root level [Farah Aziz].

Geographic Information System (GIS) provides a broad range of tools for determining area affected by floods and for forecasting areas that are likely to be flooded due to high water level in a river. When spatial data are used in an information system, one tends to speak of a spatial information system. Spatial data has a physical dimension and geographic location. Spatial data stored in the digital data base of the GIS, such as a Digital Eelevation Model (DEM), can be used to predict the future flood events. The GIS data base may also contain agriculture, socio-economic, communication, population and infrastructural data. This can be used, in conjunction with the flooding data to adopt an evacuation strategy, rehabilitation planning and damage assessment in case of a critical flood situation (P. Sharma).

5.0 GIS Techniques:

Analytical Hierarchical Process (AHP) is a multi-criteria decision making technique, which provides a systematic approach for assessing and integrating the impacts of various factors, involving several levels of dependent or independent, qualitative as well as quantitative information. Use of GIS will provide supplementary data in Hydrology for such analysis and will lead to easier interpretation and understanding of flood phenomena and characteristics. The use of Digital Elevation Model (DEM) can be effectively used for simulation to get a complete model of the flood affected area. The combination of the land cover, physiography and geology can be done with the help of the overlay analysis technique. In spite of these the factors like population density, agricultural land use and urban land use can also overlaid. The buffer analysis technique can use for the prediction of the possible areas being submerged when water level will increase by specific interval. Like overlay analysis and buffering the Network Analysis technique may be used for the analysis of the transportation network which is useful during the flood period for the evacuation measures.

6.0 Sources of Remote Sensing Data and GIS Softwares:

For the flood management the remote sensing data is available from the various sources. They are: IRS -1C, LISS -III data, IRS -1C PAN data, IRS -1C WiFS data, ERS SAR, RADARSAT SAR, multi-temporal images can be used. For the estimation of flood-affected frequency and flood depth NOAA AVHRR images can be used. Inspite of these sources the satellite images are also free of cost available from Global Land Cover Facility. In addition, Topographic maps and Village boundary maps are also use full for the micro level analysis and management of the flood problems.

Digital image processing can be carried out using ERDAS IMAGINE and EASI/ PACE image processing software. The former may used for creation of digital map database, rectification of PAN, LISS -III, WiFS data, while the later may used for classification of LISS - III data and fusion of LISS -III+ PAN data (YK Srivastava, Binod Doley, DK Pal, RK Das, S Sudhakar, S Adiga KV Venkatachary, SK Srivastava). CARTOSAT 2 data is also available at large scale. Digitization of infrastructure layers, natural features and integration of thematic layer with satellite data may carry out using ARC/ INFO software. Without this the softwares like ILWIS, GEOMATICA can also use for the analysis of the data. The softwares like GRASS, BASINS 4.0 and like this many other GIS softwares are available free to download from the internet.

7.0 Conclusion:

Space technology is one of the best-suited means for the assessment of damage brought about by natural disasters like flood. Remote sensing satellites provide synoptic view, repetitive coverage and high-resolution images. This advanced high-resolution sensor technology has provided immense scope to the mapping and analysis of natural hazards like flood using Remote Sensing and Geographic Information System (RS & GIS). The development in the remote sensing and GIS provide the base for the flood disaster management, rescue work, future determination of the flood hazard. In this period of the development of the science and techonology remote sensing is the source of the collection of the data while the GIS are the techniques of the analysis of the data. That's why the remote sensing and GIS are the techiniques which are interdependent one.

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