NATURAL RESOURCES DATA MANAGEMENT SYSTEM (NRDMS) AND NATIONAL SPATIAL DATA INFRASTRUCTURE (NSDI)

NRDMS Programme aims at promoting R&D in emerging areas of Geo Information Science and Technology. Studies supported under the Programme contribute to development of methods and techniques for operationalising the concept of local level planning. Building the required human resource base is an important priority of the Programme. Outputs of the studies are useful in drawing up local level planning strategies in support of the 73rd and 74th Constitutional Amendment Acts relating to the Panchayati Raj Institutions (PRIs) and Urban Local Bodies (ULBs). Sharing of spatial data by data providing agencies in the framework of Spatial Data Infrastructure (SDI) is an essential prerequisite. The National Spatial Data Infrastructure (NSDI) has thus been a major initiative. Several activities have been completed towards the above goal during the year 2011-12. Based on a set of broad framework approved earlier by the Union Cabinet, a draft National Policy on Data Sharing and Accessibility has been drawn up for the consideration of the Cabinet. It has been decided to implement State Spatial Data Infrastructures (SSDI) countrywide using the experiences gained in the establishment of State Geo Portal prototypes. Studies have been completed in areas like Cartographic Generalisation, Disaster Management (floods and landslides). Fresh studies have been initiated in areas like Spatio-temporal Data Analysis, Sensor Web Enablement, Marine GIS, Digital Heritage, and Hyper Spectral Remote Sensing. Technical capacity has been built through a series of training and user awareness workshops amongst the scientific and the end user communities.

1. National Policy on Data Sharing and Accessibility

As per the Cabinet decision, the National Policy on Data Sharing and Accessibility (NDSAP) was assigned to Department of Science and Technology, during 2010. Over the last one year through intensive public consultations and several Inter-Ministerial meetings, the draft policy document and implementation guidelines have been evolved. Proactive mandatory sharing of data acquired through public funds has been a major approach in the Policy. Four types of accesses to data – open access, automatic registered access, authorized registered access, and restricted access – have been defined for providing access to government-owned data sets. The policy document has been submitted for Union Cabinet for approval.

2. Provision of Interoperable Web Map Service (WMS) for Open Series Maps (OSM) of Survey of India

In order to facilitate access to Open Series Topographic Maps of Survey of India, a method has been devised. Using the method, interoperable Web Map Service (WMS) for the OSM data has been operationalised. The WMS is OGC-compliant and is accessible from the India Geo Portal. Operational scale WMS (Figure 5.49) for the State of Andhra Pradesh in its entirety and for a part of Maharashtra has been released by the Hon'ble Minister of Science & Technology and Earth Sciences in the Third meeting of the National Spatial Data Committee (NSDC) held in New Delhi on 20 October 2011. Two training Workshops have been organised for the senior officials of Survey of India at Hyderabad on 21-22 November 2011 and at New Delhi on 7-8 December 2011 for preparing OSM data for provision of WMS on a routine basis.

Fig. 5.49: Interoperable Web Map Service for a part of Andhra Pradesh showing various topographic features accessed through India Geo Portal

Re-engineering of OSM data for setting up an interoperable data node in SOI to store the topographic OSM data for provision of Web Feature Service (WFS) and Web Feature Service – Transaction (WFST) is being investigated currently. WFS-T will be useful in faster updation of topographic data and sharing.

3. Concurrent visualisation of Web Map Services of SOI and NRSC on India Geo Portal

As a single window access mechanism to access geo-spatial data from multiple sources, the India Geo Portal has been upgraded to access the WMS of SOI OSM data and that of NRSC concurrently (Figure 5.50). The mechanism provides for concurrent viewing of geo spatial data sets from both the sources over the web to update old data sets, detect changes, and facilitate quick referencing. Similar services from other data providing agencies are expected to help visualize data sets to support decision making

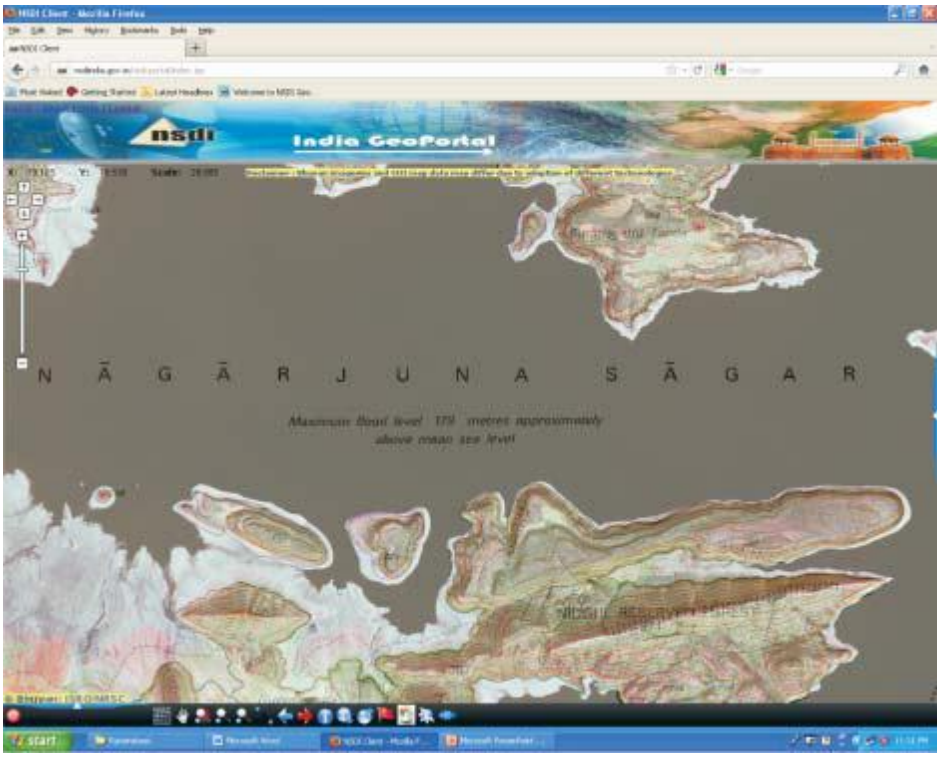

Fig. 5.50: Concurrent visualization of topographic data from SOI and IRS multi spectral imagery from NRSC on India Geo Portal

4. National Mirror Committee for TC 211 of ISO

NSDI has facilitated setting up of the National Mirror Committee coordinated by Bureau of Indian Standards (BIS) for the Technical Committee 211 (TC 211) of the International Standardisation Organisation (ISO). The Mirror Committee will help evolve and adopt national geo-spatial data/ process standards in harmony with the international standards from ISO's TC 211. The existing mechanism of standards development of NSDI is proposed to be involved in the activities of the BIS's National Mirror Committee.

5. Landslide Hazard Mitigation Programme

Under Landslide Hazard Mitigation Programme, site specific studies have been undertaken in three areas i.e. Naptha – Jhakri in H.P. Ooty in Tamilnadu and Munnar in Kerala. All these three sites have been instrumented to collect real time data on various parameters including surface and sub-surface to understand the underlying causal effect of landslides and develop an early warning system based on the monitoring of the active slopes. The exercises will help in developing the thresholds of parameters responsible for triggering landslides. Based on the studies, it would be easier to design suitable preventive measures for controlling landslides.

6. Urban Flood Risk Mapping of Chennai City

Urban Flooding is of great concern to the Planners in India with cities like Mumbai, Chennai facing havoc during monsoon season. In order to provide S&T solutions for urban flood

mitigation and management in Chennai City, a joint project with the State Govt. has been initiated. Efforts have been made to develop a detailed spatial database of city, analyse models and suggest mitigation measures. Airborne Laser Terrain Mapping (ALTM) has been used to collect data on high resolution topographic information to develop Digital Elevation Model (DEM) with an accuracy of about 15cm in altimetry. The process involves use of laser pulses emitted from the instrument fitted on Aerial Platforms like Air Plane, Helicopter to measure the variation of the ground thus help in generating much needed elevation data of the terrain. Photogrammetric process has been used in mapping physical features like buildings, trees, roads, culverts, bridges, drainage network with high positional accuracies. These features invariably influence the flooding process that occurs due to high imperviousness and encroachment of natural drainage. Other attributes like rainfall, observed runoff in rivers, socioeconomic condition of people, shelters, medical facilities have been collected through ground survey and integrated with spatial information in Geographical Information System. The integrated database acts as decision support for planners and administrators by provision of physical, socio-economic and environmental information required for mitigation and management planning. Flood Simulation Modeling using tools like MIKE 21 and SWMM with input of topography and other spatial, non-spatial parameters has been attempted for predicting scenarios for different quantum of rainfall. Resulting output of flood risk maps thus would help in identification and quantification of areas and facilities that may be inundated for a given rainfall i.e 10cm or 20cm. The information derived from the simulation will quantify stress on typical urban infrastructure like roads, electricity, communications for quick response from the authorities to avoid loss of human life and damage to property. Some of the outputs for tank encroachment (Figure 5.51) and river flood modeling (Figure 5.52) are given below:

Fig. 5.51: Velachery tank encroachment in Chennai Fig. 5.52: Flood inundation in Adyar (Chennai), 2005

7. Tsunami Wave Propagation Modeling of Nellore Coast

Tsunami, a gigantic wave with longer wavelength and large energy travels with a speed of 300 km/h and above in open seas. The waves have a very low profile in open seas with wave heights less than 0.5m. As they reach the coast, with shallow bathymetry raises to devastating heights of even 15-20 m with large masses of water columns entering land and sweeping off the coastal features like buildings, bridges, and other natural and man-made features. Activities have been launched to understand propagation of Tsunami after it is generated due to uplift of ocean floor caused by massive earthquake of magnitude above 8.0. The MIKE21, a powerful modeling tool has been used to simulate tsunami wave propagation. A model has been developed with source parameters that caused 2004 tsunami (Figure 5.53) and validated with observations from coastal

tidal observations and similar model outputs of NGI, Norway. Validated model has been further used to predict possible scenarios in assessing tsunami arrival time and wave height at the shore.

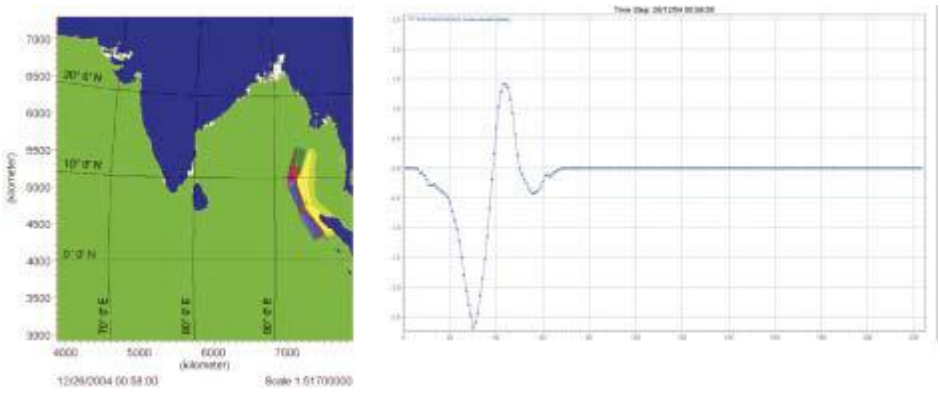

Fig. 5.53: Output of Tsunami Wave Propagation Model with source parameters that caused 2004 Tsunami

8. National Geotechnical Facility (NGF)

In order to develop the capacity for geotechnical engineering particularly for rock and soil testing, an advanced laboratory – the National Geotechnical Facility (NGF) - has been set up in Survey of India, Dehradun. NGF has been equipped with state of the art equipment that can handle edge cutting research in the area of Geotechnical Engineering. At present, the country is focusing on developing infrastructure facilities like dams, metros, highways, bridges, underground construction and micro-hydel projects. All these require high standard soil and rock testing facilities to develop the foundation design and maintain the performance of the facilities at optimal level. NGF is expected to support implementation of such major infrastructure projects. Recently a Step Frequency Ground Penetrating Radar has been acquired from the Norwegian Research Council that is technically collaborating with NRDMS to set up the NGF.

9. Sensor Networks & Web Enablement (SWE) Initiative

The goal of the SWE Initiative has been to enable all types of Web and/or Internet-accessible sensors, instruments, and imaging devices to be accessible and where applicable, controllable via the Web. The vision has been to define and approve the standards foundation for "plug-and-play" Web-based sensor networks. Sensor location has been usually a critical parameter for sensors on the Web and the Open Geospatial Consortium (OGC) - world's leading geospatial industry standards organization- has been developing standards for the Sensor Web. Under the interdisciplinary SWE Initiative, researchers from a wide variety of fields like Telecommunication, Web Technologies, Geo-spatial Technologies, Domain Modelling, and Regional Planning etc. have been brought together to a common platform. Leading R & D Institutions like IISc, Bangalore; ISI, Kolkata; IIT, Madras; NPL, New Delhi; ISRO, Bangalore; JNU, New Delhi are participating in the initiative. As a part of this on-going activity, a Rural Automatic Weather Station (RWAS) has been developed and its communication aspects have been re-configured based on SWE Standards & Protocols. Data from a set of 100 AWS have been acquired and logged on to centralized data logger located at IIT Madras for common access and use. One season weather data has been provided to IITM, Pune; IMD, New Delhi; and NCMRWF, New Delhi and other weather modeling communities for analysis and validation.

Availability of GPS sensor on AWS provides information on exact location of the unit and facilitates its integration with other collateral information in a GIS framework.

10. The India Digital Heritage (IDH)

The goal of the Indian Digital Heritage (IDH) project has been to develop Geo-Information & Communication Technologies (geo-ICT) and demonstrate their utility in preserving, using, and experiencing India's vast heritage in digital form. A multi-disciplinary team of professionals from the fields of Technology, Archaeology, Anthropology, Architecture, Social Sciences and Culture have been contributing to this unique initiative. A host of data and technologies like 1:500 scale two-dimensional spatial data, Terrestrial Laser Scanning of monuments for 3D data, Ground Penetrating Radar Systems (GPRS)-(Step Frequency) for buried monuments/ scripts/ coins, Computer Vision techniques for visualization, immersive technologies for touch and feel are being used in the creation of the Indian Digital Heritage. A group of leading institutions like National Institute of Advanced Studies, IISc, Bangalore; IIT Bombay; and Archaeological Survey of India is involved in the activities. Preliminary results for Hampi – a heritage site in Karnataka – are available.

11. Application of Geo-spatial technologies in Ecosystem Restoration & Management – A case study of Kolleru Lake

Kolleru - a shallow fresh water lake in Andhra Pradesh – has degraded over the years to marshy wet lands due to various anthropogenic activities like aqua culture, fish cultivation etc. Recognising the need for restoring the ecology of this Ramsar site to its original form, an R & D initiative to develop and demonstrate appropriate Geo-spatial Technologies has been launched with the involvement of academic institutions like Andhra University, Visakhapatnam; Acharya N.G. Ranga Agricultural University, Hyderabad; Jawaharlal Nehru Technological University, Hyderabad; SRKR Engineering College, Bhimavaram; EPTRI, Hyderabad; APSRAC, Hyderabad; NRSC, Hyderabad; and Govt. of Andhra Pradesh. The scientific framework for this initiative includes ALTM survey, generation of 10K maps, pollution studies, hydrology and water discharge studies, ecology and environmental studies, defining the Lake Geometry, bathemetry, contours, DEM and creation of an International standards based Kolleru Geospatial Information System (KGIS). The KGIS will facilitate spatial data sharing on the Lake with the stakeholder community.

12. Programme on Hyper spectral Remote Sensing (HSRS)

A space borne hyper spectral sensor is capable of monitoring both static and dynamic targets at higher spectral and spatial resolution with greater accuracy. Analysis of a hyper spectral scene involves decomposition of each pixel in an image into its constituents, where these are represented by spectra of relatively pure material, that are themselves extracted from the scene. Identity of these constituents is determined by comparison with 'library' spectra of known materials measured in the field or in the laboratory. A hyper spectral sensor, using reflected solar radiation (0.4 micrometers - 2.5 micrometers wavelength range), captures the unique spectra, or 'spectral signature', of an object, which can then be used to identify and quantify the material(s) of which it is composed. A network of research institutions/ universities like IIT Bombay, IARI

New Delhi; Annamalai University, Chennai; JNTU Hyderabad; University of Madras; IIRS Dehradun; Institute of Remote Sensing, Anna University, Chennai etc. have been supporting the implementation of this initiative. Equipment like Spectral radio meter, Gonio meter, and ENVI software have been provided as a central facility. While creation of spectral library for man made and natural features has been a major focus of the Initiative, standards based preliminary spectral library has been created and tested for around 50 features over the past years. Human resource development and creation of expertise in various institutions/ universities have been the other objectives.

13. International Collaboration/ Participation

A Memorandum of Understanding (MoU) has been signed with the Natural Resources Canada (NRCan) for launching a collaborative project on development of SDIs in India in November 2009. As a follow up of the MoU, a work plan has been drawn up between NSDI/ DST and NRCan for pursuing collaborative activities during the visit of the DST delegation to Canada in June 2011. 'Spatial Data Infrastructure (SDI)' and 'Natural Disaster Management (Landslides)' are the two key areas for collaboration between NRCAN and DST. Some of the specific sub-areas that may immediately engage attention include 'Geo-spatial Policy', 'Geo Portal Development (landslides)', 'GI management', 'Knowledge Exchange', and 'Academic Exchange Visits'.