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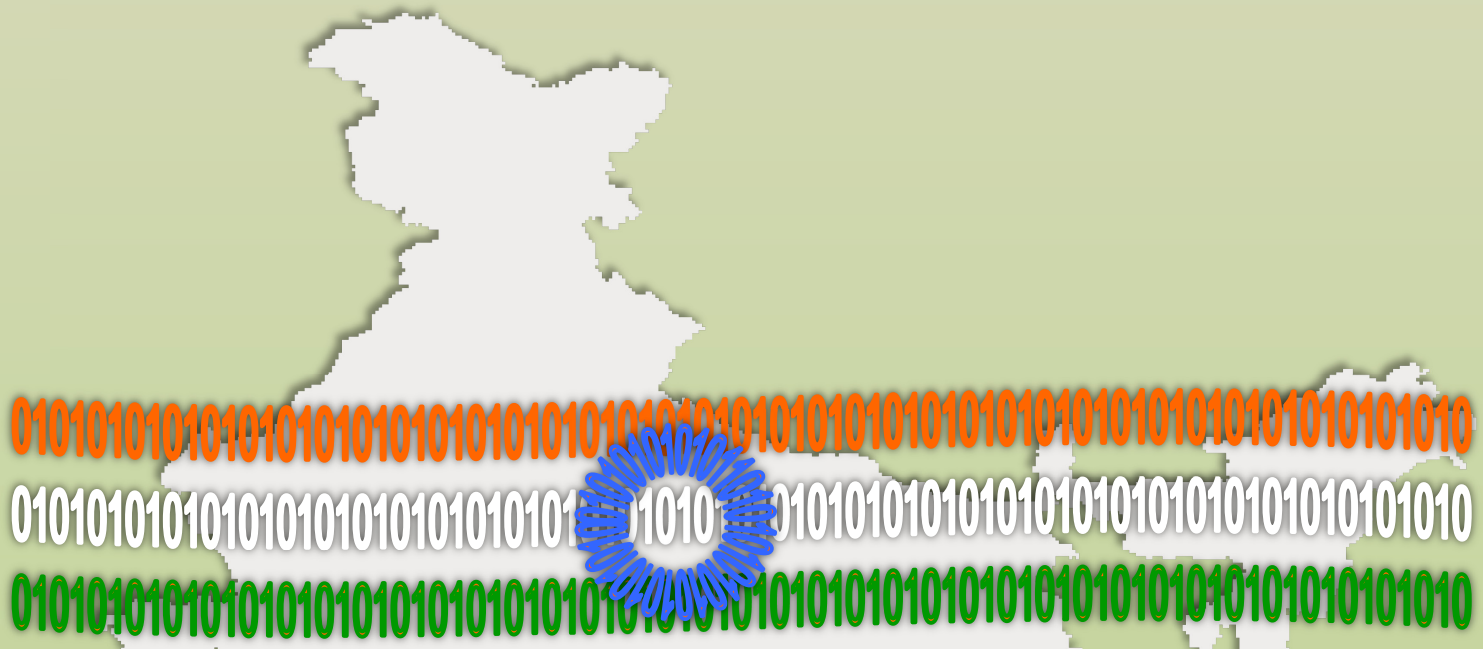
Special issue on Geomatics for Digital India



INDIAN SOCIETY OF GEOMATICS

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ISG Newsletter

Special Issue: Geomatics for Digital India

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Inside this issue:

From the Editor's Desk

Dear Members,

This issue of ISG Newsletter is a special edition brought out on the occasion of National conference of ISG jointly organised with ISRS on the theme of Digital India. We have tried to present a bouquet of geospatial applications befitting the theme of digital India.

In this issue, Dr J. R. Sharma and Mr. A. K. Bera have given the main features of WARIS portal which is an achievement of many years of dedicated research and coordination on water resources information for the country. Dr A. S. Rajawat and Mr. Arun Sharma describe the Himalayan glaciers information system developed by SAC.

Dr. K. Venugopal Rao briefs about the efforts of NRSC in attaining geospatial governance in urban planning & infrastructure monitoring. The work entails bringing smartness in cities using Bhuvan platform.

Crop insurance using remotely sensed data is a nascent area of applications having profound value for farmers. Dr Shibendu Ray and Dr Seema Sehgal give the details of Indian efforts in the background of international systems. Mrs. Pushpalata Shah presents update on the very successful weather information system, MOSDAC, developed by SAC. As a digital repository of national data, NNRMS-NRR is described by Mr. Rajendra Gaikwad & Mr. S. A. Sharma.

Recently, SAC Ahmedabad organized workshop on NISAR, a collaborative Mission between ISRO and JPL/ NASA (USA) to be launched in 2020. Dr Anup Das presents the highlights of the second NISAR Science and Applications Workshop.

Overall the issue presents a wide variety of geospatial Inputs to digital India.

I thank the contributors and columnists for cooperation and Gaurav Jain for excellent compilation and C P Singh for a nice cover page design.

Hope to see you in Jaipur and get your feedback.

R. P. Dubey
Editor
(rpdubey@hotmail.com)

Also in this issue:

ISG Executive Council

Editorial Board - ISG Newsletter

Data for Development: India-WRIS WebGIS

Web Enabled Water Resources Information System of India

J. R. Sharma* and ***A. K. Bera,*** Regional Remote Sensing Centre, West, ISRO, Jodhpur.
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"*Empowering citizens with accurate, adequate and contemporary information on the state of water resources to enable enlightened public's involvement in water management decisions*." In the emerging knowledge society and widespread use to Information Technology, up-to-date information on water resources is vital to support economic development, improve the quality of life as well as to conserve the nature and the environment; hence, an operational water resources information system at national level is essential for planning and development of the country.

Water Wealth of India

Water is one of the most important renewable natural resources supporting life. With the increasing population of India as well as its all-round development, the utilization of water is also increasing at a fast pace. India with 16% of the world's population, 2.45% of the world's land resources has only 4% of the world's fresh water.

On an average, India receives annual precipitation (including snowfall) of about 4000 km^3 or BCM, (1 BCM = 1 km^3). However, there exist considerable spatial and temporal variations in the distribution of rainfall and hence in availability of water in time and space across the country. It is estimated that out of the 4000 km^3 water, 1869 km^3 is average annual potential flow in rivers available as water resource. Out of this total available water resource, only 1123 km^3 is utilizable (690 km^3 from surface water resources and 433 km^3 from ground water resources). The water demand in the year 2000 was 634 BCM and it is going to be 1093 BCM by the year 2025. Efforts therefore, need to be made to increase the utilizable quantity by conservation, improving efficiencies and increasing supply sources.

Challenges in Water Resources Sector

India is facing several challenges in water sector at present. These include large spatial variations of water availability and demand in space

Table 1: Water Resources – India at a Glance

Water Resource at a glance	Quantity - BCM	%
Annual precipitation (Including snowfall)	4000	100.0
Precipitation during monsoon	3000	75.0
Evaporation + Soil water	2131	53.3
Average annual potential flow in rivers	1869	46.7
Estimated utilizable water resources	**1123**	**28.1**

Source: Water Resources at a Glance 2011, CWC, New Delhi, (http://www.cwc.nic.in)

and time, increasing water demand, reduction of available water resources, increasing water scarcity, low water use efficiency, deterioration of water quality, waterlogging and soil salinity in irrigated command areas, floods and droughts, increasing competition/conflict with the environment, increasing competition/conflict within sectors and within society (urban versus agriculture, upstream versus downstream, haves versus have-nots, national versus international), fragmentation approach for management of water/ management of shared resources, requirement of spatial inventory for large number of water infrastructure, significant changes in land use/land cover; demographic utilization (sectoral water utilization and its temporal changes), addressing the impact of climate change on water availability and economy etc.

The National Water Policy of India (2012) emphasizes planning, development and management of water resources that need to be governed by common integrated perspective considering local, regional, state and national context, having an environmentally sound basis, keeping in view the human, social and economic needs. All water related data, like rainfall, snowfall, geomorphological, climatic, geological, surface water, ground water, water quality, ecological, water extraction and use, irrigated area, glaciers, etc., should be integrated with well-defined procedures and formats to ensure online updation and transfer of data to facilitate development of database for informed decision making in the management of water. All hydrological data, other than those classified on national security consideration, should be in public domain. However, a periodic review for further declassification of data may be carried out. A National Water Informatics Center should be established to collect, collate and process hydrologic data regularly from all over the country, conduct the preliminary processing, and maintain in open and transparent manner on a GIS platform.

Geospatial Technologies in Water Resources Management

Space-borne observations and GIS are used in India for measurement of hydrological variables over geographic space. These studies include irrigation performance evaluation in canal commands, surface waterlogging & soil salinity/ alkalinity mapping, reservoir sedimentation, flood mapping & damage assessment, flood forecasting & inundation simulation, rehabilitation & relocation studies, irrigation infrastructure mapping & assessment of potential created, catchment area analysis, flood hazard zone mapping, inventory of glacial lakes/ waterbodies, water resources assessment, water budgeting and water balance modelling, hydrological and snowmelt runoff modelling, watershed management etc.

Surface water inventory through remote sensing was the application in the beginning. Now remote sensing applications have witnessed a phase transition from resource mapping to decision-making. It has thus become one of the most vital tools for evaluation of the physical attributes of water resources in the country.

Water information in Public domain - Initiative of India-WRIS Project

Dissemination of data in public domain constitute the most important aspects of the water resources management, as this

requires multi stakeholder's involvement, people's participation and information sharing to increase transparency, public awareness and further this elevates the importance of water information and enlighten public involvement in water management. It provides adequate and contemporary information on the state of water resources which are must for planning and water resources management strategy. This, in turn, will ensure increase in public awareness about the crucial issues related with water and attract their participation in management, planning and development of water resources of the nation leading towards the holistic goal of water security.

In order to assess the present status of water resources to address the challenges, the first requirement is reliable and operational water resources information system at national level. Looking at this CWC and ISRO are jointly executing the project "Generation of Database and Implementation of Web enabled Water resources Information System in the Country" short named as 'India -WRIS WebGIS' since January 2009. In this regard, a Memorandum of Understanding (MoU) was signed on December 3, 2008 between the Central Water Commission (CWC), Ministry of Water Resources, Govt. of India, New Delhi and Indian Space Research Organization (ISRO), Department of Space, Govt. of India, Bangalore.

India-WRIS WebGIS provides a 'Single Window' solution for comprehensive, authoritative and consistent data & information of India's water resources along with allied natural resources in a standardized national GIS framework (WGS-84 datum and LCC projection) with tools to search, access, visualize, understand and analyse the data for assessment, monitoring, planning, development and finally Integrated Water Resources Management (IWRM). It aims for "Empowering citizens with accurate, adequate and contemporary information on the state of water resources and enlightened public involvement in water management decisions"

India-WRIS portal Services

India-WRIS portal has six main modules:

1. WRIS Info Discovery: Helps the user in search through all the layers of India-WRIS and discover information for the area selected by the user.
2. WRIS Explorer: Geo-Visualization, 35 Sub Information Systems grouped under 12 themes, Temporal Analyst, Watershed Information system and WRIS Wiki.
3. WRIS Connect: Live Telemetry data, Data Download, Reservoir Module, Automatic Map and Report Generation modules.
4. Share Success Story: Platform for sharing success stories in the Water Resources sector.
5. Water Resources Planning and Management: Create Your WRIS, 2D-3D Linked View, Collaborative planning
6. Input data builder: To keep the data in India-WRIS up-to-date with facilities to update spatial as well as non-spatial data.

India-WRIS : Major milestones accomplished

The database for India-WRIS Web GIS is highly complex with numerous sources in-

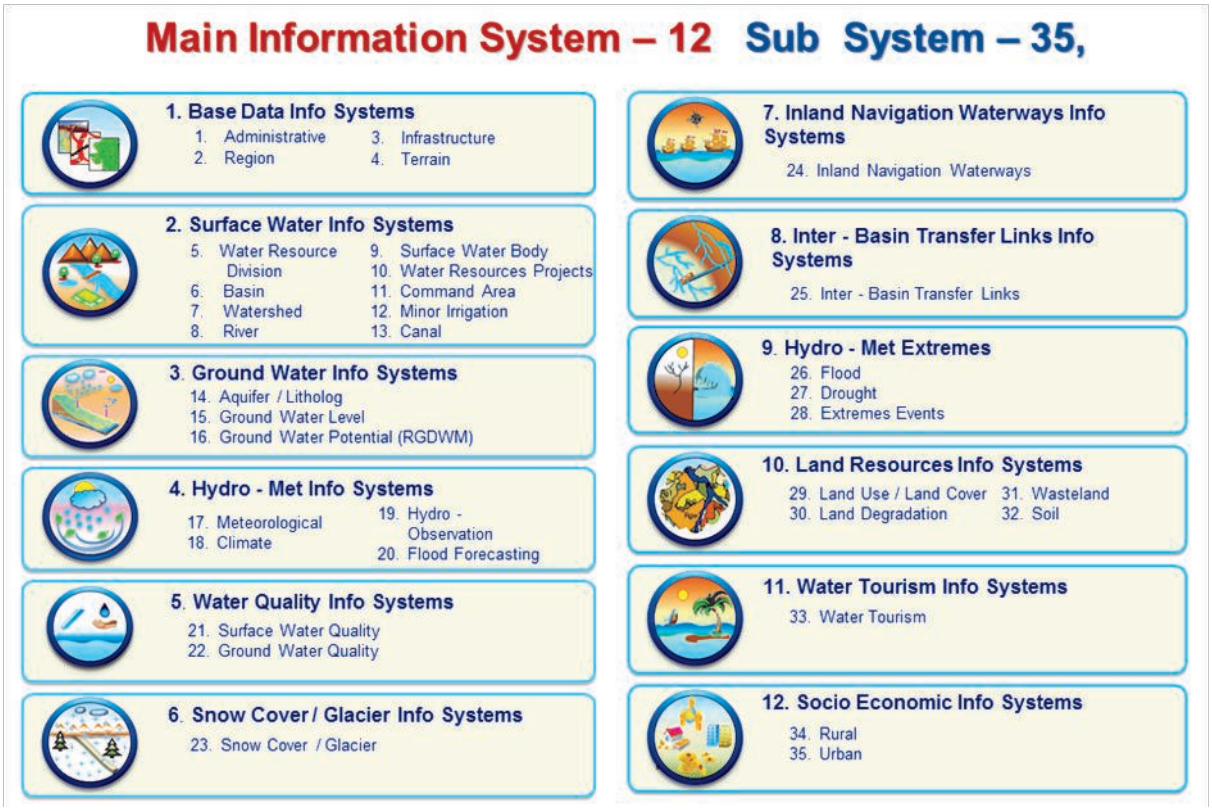

Figure 1: WARIS Portal

volved. Much of the data is spatial in nature but the amount of associated data is very large, and also having time series data. The creation and management of such data is a colossal feat in itself and requires state of the art tools. The database standards and relationship have been developed for all type of data.

Mapping of major hydrological assets of the country

Cartosat-1 along with Resourcesat-1 LISS IV data have been used extensively for creation of spatial inventory of all water resources assets of the country with large number of associated attributes for each asset (dams, reservoirs, barrages/weir/anicuts, irrigation projects, hydrological observation sites etc.) Details of major water resources assets at country level are given in Table -2 on the next page.

Basin wise stream ordering

The River network for entire country has been digitized using LISS-IV + Cartosat imagery. The length of river network is 42,86,044.55 km of 15,160 rivers & tributaries.

Stream ordering (Strahler, 1957) has been done first sub-basin wise, and then it has been integrated at basin level as well as country level. The length of various order streams are: 1st Order (2422321.85 km), 2nd Order (856831.84 km), 3rd Order (466609.95 km), 4th Order (257332.45 km), 5th Order (132435.61 km), 6th Order (70161.03 km), 7th Order (38322.54 km), 8th Order (23245.37 km), 9th Order (9481.29 km), 10th Order (8897.19 km) and 11th Order (964.41 km).

Table 2: Major hydrological assets

Sl. no	Spatial Layer Details	Number/ Area	No. of Attributes
1.	No. of Major & Medium Irrigation Projects	1747	55
2.	No. of Lift irrigation Schemes	352	15
3.	No. of ERM Projects	131	50
4.	No. of Hydro Electric projects	222	17
5.	No. of Powerhouses	293	39
6.	No. of Dams	4575	34
7.	No. of Barrages/Weir/Anicuts	540	51
8.	No. of Reservoirs	4517	38
9.	Total Length of Canal	324600 km	3
10.	No. of Hydro-Structures	114709	6
11.	Waterlogged Areas in Major & Medium Command	17192.79 km^2	5
12.	Salt Affected Areas in Major & Medium Command	10345.41 km^2	5
13.	No. of Surface Water bodies	798909	5
14.	Area under Surface Water bodies	48379.89 km^2	-
15.	No. of Inter Basin Transfer Links	30	8
16.	No. of Inland Navigation Waterways	6 (4487 km)	15

Delineation of Hierarchical Hydrological Units of the Country (Basin , Sub Basin, Watershed)

The hydrological unit is considered scientific and appropriate base water resources studies. The hydrologic unit boundary is important for determining what areas are involved in contributing runoff, sediment, and pollutants. Watershed approach is more rational because land and water resources have optimum interaction and synergetic effect. Traditionally, hydrological unit boundaries have been delineated using a visual interpretation of topographic maps. This method, referred to as "manual delineation", is tedious and time consuming, but historically was considered to be the most effective and accurate method of delineation. However, the quality and accuracy of manual delineations are dependent on the scale of the topographic map used, and the delineator's interpretation of the map.

Mapping of water bodies at country level

Drainage network, digital elevation model and other ancillary data have been used in India-WRIS project to demarcate

Table 3: Hierarchy and codification of hydrological units of the country

Hydrological Unit	Number	Size Range (km^2)	Code
Water Resource Region	6	8247 - 2085387	A - E
Basin	27	669 - 808337	1 - 27
Sub basin	101	669 - 124867	XYZ
Watershed	4566	200 - 1800	1 - 99

hydrological units boundaries through a semi-automated approach. Different level of hydrological units, viz., water resource region, basin, sub-basin and watershed have been delineated using similar methodology expect the criteria for identification of pour point. Validation and finalization process of boundaries adopted at each level also varies. There are: 27 basins, 101 sub-basins and 4566 watersheds in the country.

The total number of water bodies in the country are 7,98,909 (4,52,449 having area greater than 0.5 ha and 3,46,460 having area less than 0.5 ha). The total area covered by these water bodies is 48,379.89 km^2.

Basin wise Reports

Basin wise report has been generated for each river basin of India based on the outcomes of this project. The report contains valuable latest information of the basin on all aspects of water resources and allied water resources: major water resources projects, hydro-meteorological observations,

Table 4: Basin wise number of water bodies

Sl. No.	Name of the Basin	No. of Water bodies
1	Indus (up to Border)	19601
2	Ganga	276947
3	Brahmaputra	16037
4	Barak and others	2482
5	Godavari	61914
6	Krishna	39575
7	Cauvery	42642
8	Subarnarekha	22215
9	Brahmani and Baitarni	26514
10	Mahanadi	124045
11	Pennar	8923
12	Mahi	5277
13	Sabarmati	3247
14	Narmada	13994
15	Tapi	5317
16	WFR South of Tapi	21272
17	EFR-Mahanadi &Pennar	29537
18	EFR -Pennar& Kanyakumari	58390
19	WFR -Kutch & Saurashtra	19620
20	Minor Rivers	1656
	Total	**799205**

surface and ground water development scenario, topographic characteristics, climatic variability, land use/land cover pattern and allied natural resources along with socio-economic profile of the basin.

Conclusions

The efforts of India-WRIS project through development of Web GIS is primarily for data and information in public domain and further development as Decision Support System; which is likely to bridge the gaps in utilising advanced technologies for developing a holistic approach for sustainable development and management of the water resources of the country. Awareness programmes have to be organized across the country for effective participation of common people in efficient water management practices. Training and capacity building programmes are also required for water resources managers and other stakeholders for imparting the latest knowledge and technology in the area of water resources management.

Country needs paradigm shift for water management as water by very nature for its management requires active cooperation and involvement of individuals and communities; water has to be treated as an economic good to promote its efficient use after basic needs, those of drinking water and water for sanitation are met; water-using activities need to be regulated keeping in mind the local geo-climatic and hydrological situations; foster technological innovations, interventions and excellence in water management, planning, observations, purification, desalinisation, use efficiency, harvesting & recharge, water infrastructure efficiency, reuse, improved efficiency in finding new sources, quality improvements, awareness raising & capacity building towards water in general and water borne, water related, water based & water washed diseases in particular etc. and provide 'Actionable Vision' which is achievable, executable, scalable and sustainable; and lastly, water portal with all the current data in usable formats, accessible to all citizens and work towards "Spatial participatory management and governance of water resources towards protection, conservation and regulation for equitable and sustainable use, to reshape, economy, society and environment".●

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App Space

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Bhuvan POI

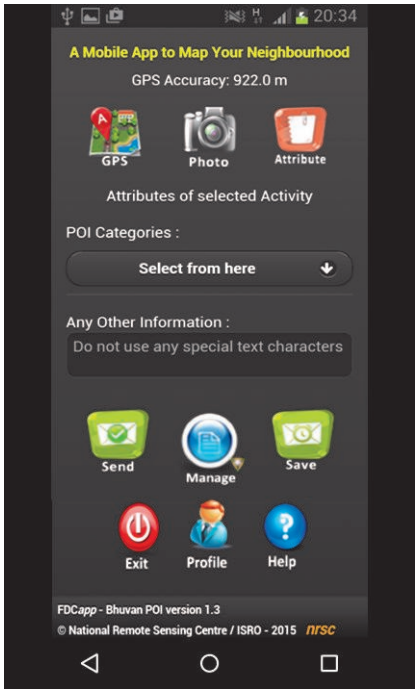
This application is designed to enable users to build a Point of Interest database in India using crowd sourcing technique of Bhuvan Geo-Platform. The App has features to collect mobile device GPS data, take Photographs of the point of interest and capture attribute details of the location. The data can be sent to Bhuvan Server either immediately or later.●

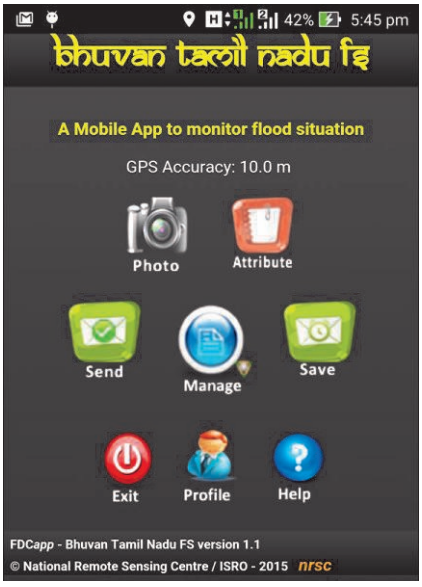
Bhuvan Tamil Nadu FS

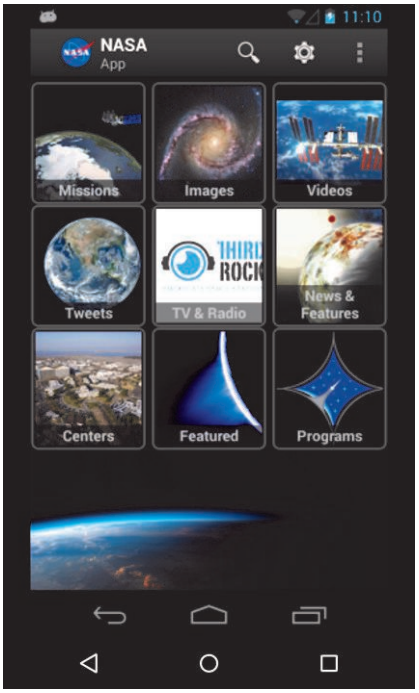
Bhuvan Tamil Nadu FS App is a user-friendly mobile application enabling field data collection and reporting of geo-tagged flood information. This mobile app provides a platform for controlled crowd sourcing to build spatial database on Bhuvan Geo-platform. The app can be downloaded from http://bhuvan3.nrsc.gov.in/bhuvanapp/bhuvanapp_tnfloods.php.●

NASA App

The Official NASA App for Android enables space enthusiasts to explore and discover the latest images, videos, mission information, news, feature stories, tweets, NASA TV and featured content shared by NASA. The App also provides live streaming videos from the High Definition Earth Viewing (HDEV) experiment on the International Space Station.●







Web based Himalayan Glacier Information System

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Introduction

Large volume of spatial and aspatial data on Himalayan glaciers in Indus, Ganga and Brahmaputra Basins was systematically generated in GIS environment at SAC under "Monitoring snow and glaciers of the Himalayan region" a joint project of DOS and Ministry of Environment, Forests and Climate Change. The glacier information is prepared from Indian remote sensing satellite Resourcesat-I AWiFS data of period 2004-07 for all glaciers located in India or outside but contributing to rivers in India. The Western Indus region outside India is mapped using AWiFS data of period 2007-11.

A robust, user friendly Open Source Web based Himalayan Glacier Information System (HGIS) is developed jointly by SAC and CEPT University, Ahmedabad to facilitates users to selectively display, query, analyse, compose maps / graphs and print, spatial and aspatial information on glaciers. HGIS aims to provide baseline information on about 35,000 glaciers of entire Himalaya, Trans Himalaya including Karakoram region distributed in the 3 major basins. The information on glacier comprises of 1) glacier inventory maps and 2) glacier inventory data sheet. The glacier inventory map comprises of glacier morphology features like accumulation zone, ablation zone (both ablation zone ice exposed and debris covered) and other glacier features like snout location, de-glaciated valleys, distribution of moraines and glacier lakes like supra-glacier lake and moraine dammed/ peri -glacier lake. The Inventory datasheet provides information on about 40 glacier parameters related to glacier Identification, Dimension, Orientation, Elevation, Primary Classification, Form, etc. as per global standards. The spatial map and datasheet are linked by unique glacier identification number (galc_id) which is a key field present in all corresponding glacier related point, polygon or line layers in GIS. The inventory was carried out to fill the data and information gap on the status of glaciers in the Himalayan Region. HGIS provides a basis for assessing the glacier inventory data which has applications in studies related to climate change, water resource planning, hydropower site selection and mitigation of glacial lake outburst flood (GLOF) hazards.

The Open Source web based HGIS comprise of 4 major functions

i. **Display:** Displays feature for basic layers and selected layers. Some of the basic glacier layers are:

- Basin boundary
- Sub-basin Boundary
- International/country Boundary
- Glacier outlines (having Glacier Data Sheet attached as attributes)
- Glacier morphology layer
- Glacier snout
- Glacier centreline

ii. **Smart Filter:** Permits multiple querying on the glacier information within a Basin (Indus, Ganga and Brahmaputra) or any of the 55 Sub-basins. Query is

possible for:

- Identification number (given as IN5O 62P05 027)
- Dimension (Area: Glacier total area, Accumulation area, Ablation area, ice exposed area. Length: Glacier Total length, Ablation length, Mean glacier length and Width: glacier ablation mean width)
- Orientation (Eight direction scale viz. E, W, N, S, NE, NW, SE, SW)
- Elevation (Snout elevation, Snow line elevation, Highest elevation, Mean elevation of glacier, glacier lake elevation, etc.)

iii. **Graph Generation**: Interactive graph generation based on selected glacier parameter for selected sub-basin(s). The spread for each class range can be decided interactively by user.

iv. **Map Composition and Printing**: The glacier features can be interactively displayed on the monitor and can also be saved as image file. The image file can be printed by using the print icon. Limited map graph composition with facilities for editing title and comments/notes for each map/graph are inbuilt for interactive editing. Fixed legends are provided with map and graph.

Approach

The approach to HGIS development can be divided in three 1) HGIS web design and development 2) HGIS data base preparation (mosaicking and standardisation) and 3) populating data sets into HGIS.

The Open Source Web based HGIS uses the Web-based multi-dimensional spatial data approach that: 1) is interfaced with GIS for the analysis and visualization of spatial GIS database in vector format; 2) permits the combination of GIS database with multidimensional information 3) allow the user to access the databases via OGC standard using any internet browser.

The basic HGIS architecture is divided in to two parts one is web server architecture and other is database server architecture. The Web GIS is a GIS that. In general, Web-GIS application uses web technology, with a web browser as client for sending the request, and a web server for responding to the request. The non-spatial Web applications usually contains only Web server but in case of Web GIS due to voluminous amount of data there is an additional server called data or map server. This server handles the vector data. The generic layered architecture of Web GIS consists of three layers namely user interface layer, application layer and database layer.

The clients access the system by interacting with the user interface layers that takes the input and shows the output from the system. It involves graphical user interface therefore it must be designed cautiously so that the user can understand it easily. The application layer provides the map visualization functions like panning, zooming etc. It provides the others functions also like querying, etc. The database layer handles the data present at distributed sources. The HGIS software design and development comprised of review of existing information Systems / Decision Support System (DSS) like Glacier Land Ice Measurements from Space (GLIMS), International Centre for Integrated Mountain Development (ICIMOD) & Water Resources Information System (WRIS), etc.

Results and Discussions

The glacier and other layers mapped as per 15'*15' grid were organised as a mosaic to create a Basin level single seamless layer in GIS. The large volume of spatial and aspatial Primary and Derived datasets on glaciers are incorporated in HGIS. The major components of HGIS and interactively obtained results are discussed below.

Basic Information

The HGIS front page GUI (Fig. 1) comprises of drop down menu for a) About HGIS, b) MetaData, c) Documents (research papers, technical Guidelines used in preparation of data sets), d) User Guideline (know how on using the HGIS) and e) Geo-visualisation (for interactively viewing and analysing the glacier data). Few expandable satellite images and glacier field photos are also displayed on this GUI. A 'Latest News' Section on HGIS is also available. The basic functions of on screen zoom-PAN using scaling tool and cursor are provided. The current cursor position coordinates and scale are always displayed on the variable screen.

Geo-Visualization

The HGIS Geo-Visualization GUI has varied capabilities. This web page displays the major Indus, Ganga and Brahmaputra Basin boundaries with international boundaries in the back ground (Fig. 2) and allows users to interactively choose any one major basin and its sub-basins (Fig. 3) for display, query, and graph generation. Selected sub-basin (s) glaciers are displayed as a) glacier outlines b) glacier morphology with legend (Fig. 4). The glacier morphology features like accumulation area, ablation area-ice exposed, ablation area debris covered, deglaciated valley, supra glacier lakes and moraine dam / periglacial lakes can be displayed. An option for display glacier snout as point location and centreline of glacier is also provided. On selecting any individual glacier, 5 attributes for that glacier are displayed on screen (identification number, glacier total area, maximum elevation and mean elevation and simultaneously the detailed inventory datasheet information is also displayed in the scrollable "Selected Glacier Information" panel (Fig. 5).

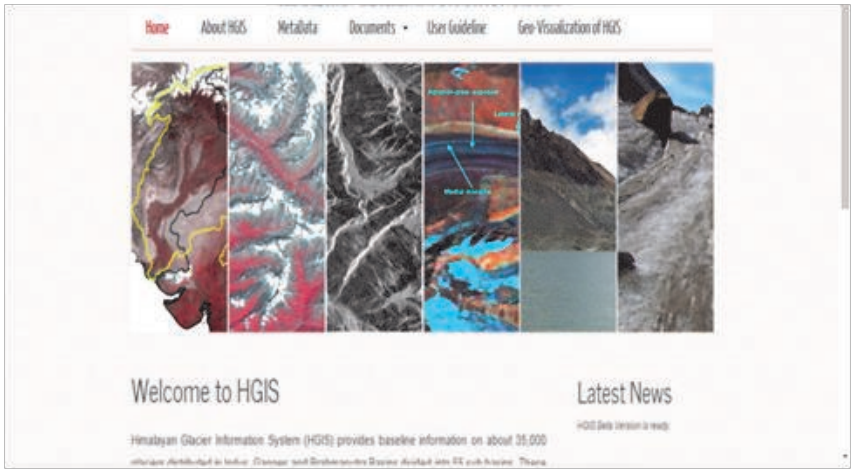

Figure 1: Home Page GUI for HGIS

Multi-parameter query applied using "Smart Filter" helps user to identify and display only the queried glaciers (Fig. 6). The smart filter query can be applied to one sub-basin /multiple sub-basins as well as one parameter / multiple parameter attributes. Users can interactively generate graph using the various glacier parameters for sub-basin (s) (Fig. 7). The parameter and class interval can be decided interactively. Users can compose maps /graphs and do limited editing to the title of

the graph / map, comments/ notes and save as printable file for printing using printer settings. The maps compositions are appropriately composed with legend and north arrow and scale as standard (Fig. 8). A print "icon" is provided in the GUI for map / graph composition, printing and saving to file for later use. ●

Figure 2: HGIS Geo-Visualisation GUI

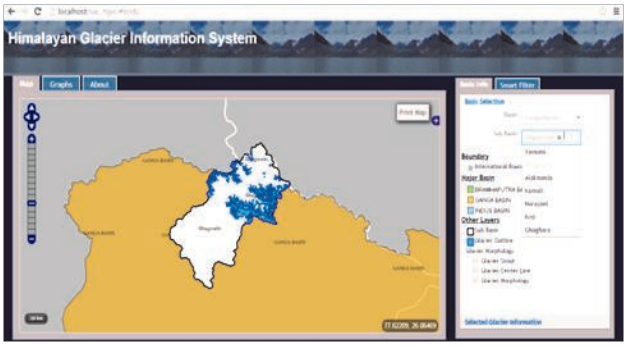

Figure 3: Glacier outlines displayed within the selected Bhagirathi sub-basin, Ganga Basin

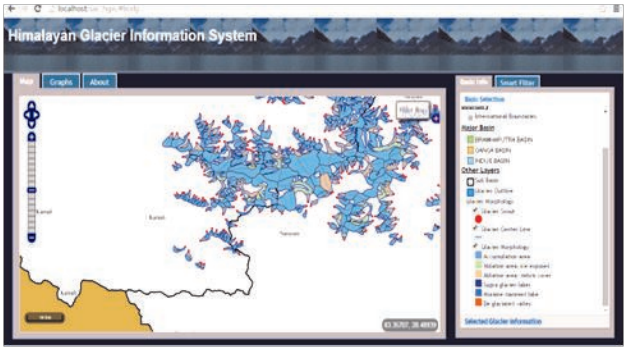

Figure 4: Glacier Morphology with legend for all glaciers in selected sub-basins (zoomed-in view)

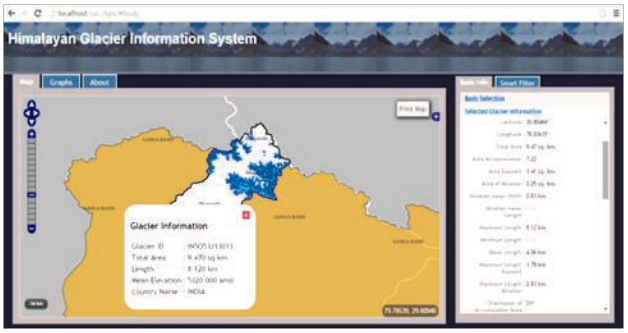

Figure 5: *Key details of Selected glacier displayed alongside with complete datasheet on side panel*

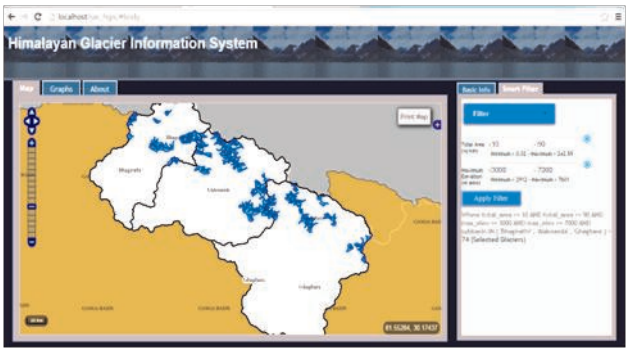

Figure 6: *Query Results: Only those glaciers selected through "Smart Filter" query are displayed*

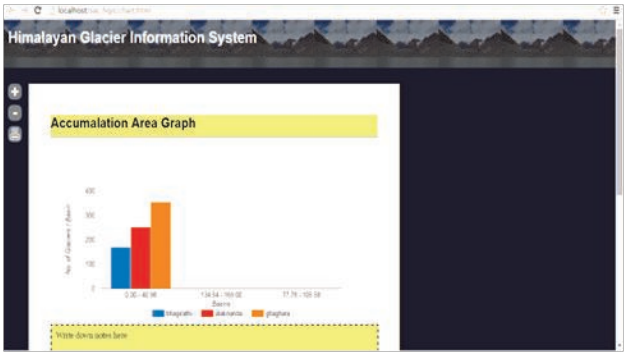

Figure 7: Interactively generated graph can be saved to file and printed through print Icon

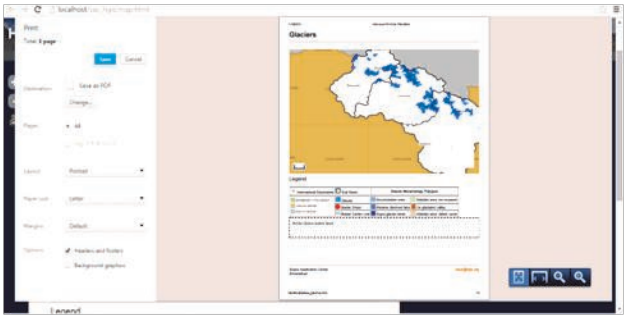

Figure 8: Printing of Map

Towards Geospatial Governance

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Geospatial technology has becoming the core solution provider to deliver better services across many areas of administration in many programs of the government. This has led to governance process from E-governance to G-governance. NRSC has been working in developing geospatial governance applications in urban planning and infrastructure monitoring in association with respective ministries.

Geospatial Governance in Urban Planning

Traditional methods and procedures for urban planning based on hard copy /CAD based maps are tedious, time consuming and lacks the transparency. In view of this , Ministry of Urban Development (MoUD) and NRSC has developed a comprehensive Web based Geospatial solution on Bhuvan (http://bhuvan-noeda.nrsc.gov.in/projects/bhuvannuis/) for providing facilities to share the existing 152 NUIS towns GIS databases, updating ,and creation of new spatial and attribute data as required for Master Plan preparation by the respective Urban Local Bodies(ULB). Approvals as prescribed within the ULB administrative hierarchy for database creation, modification, and finalization have been implemented for preparation of Master Plan as online services. Nation wide training and capacity building has been imparted for 2500 planners in the respective ULB. For support of ULBs audio video training material is made available through Bhuvan-NUIS. The state town planning departments areusing Bhuvan-NUIS for preparationof Master Plans forthe NUIS Towns. MoUD has included Bhuvan-NUIS as national guidelines for preparation of Master Plans in revised Urban and Rural Development Plan Formulation and Implementation (URDPFI - 2014) guidelines. Bhuvan-NUIS will be used for preparation of GIS based Master Plan for Atal Mission for Rejuvenation and Urban Transformation (AMRUT) 500 towns.

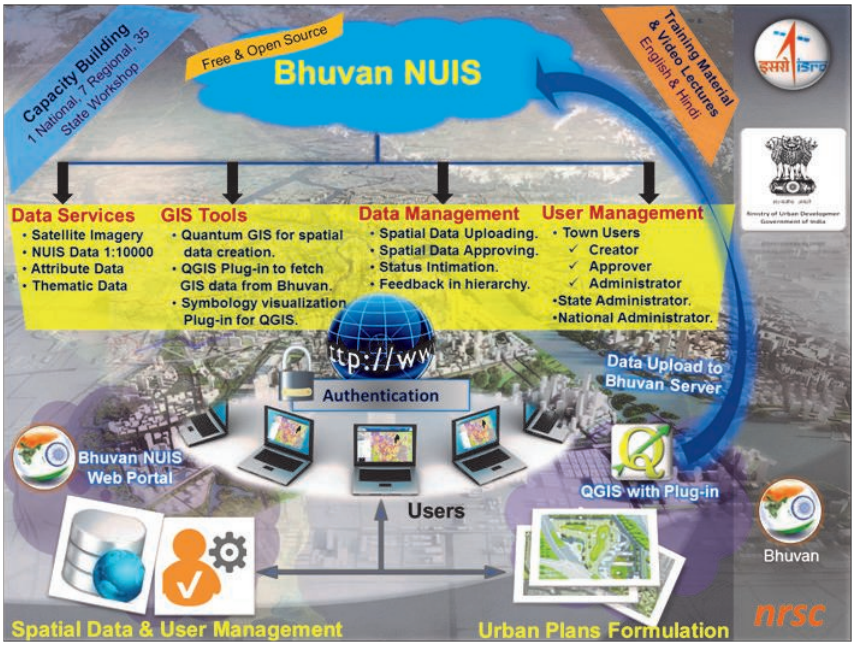

Figure 1: Bhuvan NUIS

Geospatial Governance in Infrastructure Monitoring

Geospatial technology also complements infrastructure monitoring such as oil and gas pipelines, which is traditionally monitored by helicopter survey and manual walkers periodically. These traditional practices are time consuming and sometimes risk to the life also. In order to overcome the present problems and shortcoming of infrastructure monitoring, NRSC in collaboration with GAIL has come up with the solution of using geospatial technology for monitoring of GAIL pipeline. Web based geospatial solution on Bhuvan is provided (http://bhuvan-staging.nrsc.gov.in/app_team/bhuvangail_ver42/login/login.php) to GAIL.As alternative to present monthly helicopter survey, very high resolution satellite data is being used for identifying encroachments within Right of Usage (ROU) like buildings, roads, diggingetc. The technology has been established over GAIL Dahej to Vijaypur gas pipeline (610 km). Based on the results it is proposed to extend for pipe line network of GAIL of about 15,000 line-km using the constellation of satellites to ensure monthly/bi-monthly coverage.

Figure 2: Geospatial Governance in Infrastructure Monitoring

Crop Insurance and Remote Sensing

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Indian Agriculture is subject to various risks and disasters. Crop damages and yield loss happen due to natural calamities, such as floods, cyclones, droughts, hailstorms, pests/diseases, fires and various other extreme weather events. Recent examples of wide scale heavy rains and hail storm in Northern India, during February-March, drought conditions in Kharif, 2015 and white-fly attack of Cotton crop in Punjab and Haryana showed the vulnerability of the farming community to natural disasters. Hence, crop Insurance is essential in order to protect farmers from yield loss. Crop insurance as a concept for risk management in agriculture has emerged in India since the turn of the twentieth century (AIC, 2015).

Crop Insurance Programmes of India

Crop insurance concept in India dates back to early twentieth century, when In 1915 Mr. J.S. Chakravarthi of Mysore State proposed a rain insurance scheme. The first crop insurance program was introduced in 1972-73 by the 'General Insurance' Department of Life Insurance Corporation of India on H-4 cotton in Gujarat. Later based on the approach (Homogeneous Area approach) given by Prof. V.M. Dandekar (known as the Father of Crop Insurance in India), General Insurance Corporation of India (GIC) introduced a Pilot Crop Insurance Scheme (PCIS) from 1979. Using the experience of PCIS, the Comprehensive Crop Insurance Scheme (CCIS) was introduced in 1985, as the first nation-wide scheme. 15 States and 2 UTs participated in the CCIS during 1985 to 1999. CCIS was discontinued after Kharif 1999 and replaced by the improved and expanded "National Agriculture Insurance Scheme" (NAIS), which continues till date. Since NAIS brought forth its own problems, modified NAIS (MNAIS) was formulated and implemented on a pilot basis in 50 districts from the Rabi season of 2010–11. Meanwhile, public-and private-sector insurance companies also launched Weather Based Crop Insurance Scheme (WBCIS) on a pilot basis in 2007–08. In November, 2013 Government of India introduced a comprehensive National Crop Insurance Programme (NCIP) by merging NAIS/MNAIS, WBCIS and CPIS (Coconut Palm Insurance Scheme).

Remote Sensing for Crop Insurance

Various studies have shown that remote sensing has the potential for crop damage assessment and crop yield forecasting. Ray et al. (2015b) has summarized the use of remote sensing data for extreme weather impact assessment on crops. Thus, it has the capability to play strong role to support crop insurance. Leeuwet al (2014) has summarized the potential and use of remote sensing, both in claim and index based insurance. According to the above authors, the scope for application of remote sensing by the insurance industry in index insurance is due to (1) indices can be constructed that correlate well with what is in-

Table 1: Examples of International Programmes of using Remote Sensing for Crop Insurance

Programme	Organization	Description	Reference
Remote sensing-based Information and Insurance for Crops in Emerging economies ("RIICE")	A joint venture of IRRI, GIZ, SARMAP & SDC	Uses SAR data and Rice model (Oryza2000) for Rice area mapping and yield forecasting	www.riice.org
Rainfall and Vegetation Index Plan	USDA Risk Management Agency	Uses NDVI for Apiculture	Hellmuth et al., 2009
Index-Based Livestock Insurance (IBLI)	International Livestock Research Institute (ILRI)	MODIS NDVI for insuring Kenyan pastoralists against drought-related livestock mortality	Chantarat, et al. 2013
Crop Damage Assessment	USDA Risk Management Agency	Medium resolution remote sensing data is used to verify cases suspect of fraud	Burnett, 2005
Flood risk stratification	USA Federal Emergency Management Authority	Insurers using Flood Insurance Rate Maps	http://www.fema.gov/flood-insurance-rate-map-firm

sured; (2) these indices can be delivered at low cost; and (3) it opens up new markets that are not served by claim-based insurance. However, the limited adoption of remote sensing in insurance results from a lack of mutual understanding and calls for greater cooperation between the insurance industry and the remote sensing community. There are many international programmes, which use remote sensing data for support to crop risk assessment and crop insurance (Table 1).

Remote Sensing for Crop Insurance in India

The insurance programme in India is dependent upon two types of indices. While NAIS/MNAIS are based yield based index, WBCIS is based on weather based index. Crop Cutting Experiments (CCE) are carried out to get information on crop yield. The number of CCEs required for MNAIS is 4 at Village Panchayat level for major crops and 8 for other crops. Considering around 2.5 lakh village panchayats in the country, the number of CCEs required for administering the Crop Insurance scheme is too

large and difficult to manage. Also the data derived from CCEs, conducted by conventional methods under General Crop Estimation Survey (GCES), is time consuming and hence delays payment of insurance claims to farmers. The P K Mishra Committee formed to examine the loopholes, if any, of the implementation of the Crop Insurance schemes of India suggested, among various other measures, i) GPRS-enabled and camera-fitted mobile phones/smart phones or hand-held machines in conducting CCEs, ii) rationalize the number of CCEs by remote sensing techniques and satellite images (Mishra, 2014).

In India, use of remote sensing data for crop area estimation, yield forecasting, drought assessment is being operationally carried out (Ray et al., 2015a). However, these activities are mostly implemented at district level. Crop assessment at field/village level is still challenging task because of many reasons including, very small field size with highly diversified cropping pattern, requiring high spatial resolution data; unavailability of high spatial resolution data at required temporal frequency (5.8 m LISS IV data is available once in 48 days); very limited availability of cloud-free data during Kharif season; difficulty in translating the commonly used remote sensing based index NDVI (Normalized Difference Vegetation Index) to crop yield; unavailability of digital geo-coded information for all farmlands, etc. Irrespective of these challenges, there have been pilot studies to explore remote sensing based index for crop insurance (Rao, 2010). There has been another set of studies to explore the role of remote sensing data to optimally plan the crop cutting experiments (Murthy et al., 1997, Ray et al., 2015a). A study by World Bank in Bihar state of India showed that by using satellite data to target CCEs, costs of implementation of CCEs can be reduced by a factor of 4 or payout accuracies increased by a factor of 2. Ray et al. (2015a) found that efficiency of stratification for CCE increasing significantly by using remote sensing data.

Pilot Study on Remote Sensing for Crop Insurance

In 2014-15, Department of Agriculture & Cooperation sanctioned a project to Mahalanobis National Crop Forecast Centre (MNCFC) for carrying out Pilot Studies to evaluate use of Remote Sensing Technology for better crop yield assessment for crop insurance. MNCFC conducted the Study jointly with 2 ISRO Centers (SAC & NRSC), India Meteorological Department, Agriculture Insurance Company, State Remote Sensing Centers and State Agriculture Departments. This Study was conducted for 14 Districts in 7 States in Kharif season and 12 Districts in 6 States in Rabi Season. During Kharif season crops considered are Rice, Cotton, and Guar while in Rabi season the crops were Wheat, Rice and Sorghum. In each District around 20-30 Crop Cutting Experiments (CCEs) were supervised by the officials from the above organizations. More than 600 Experiments were supervised by participating agencies.

The advanced technologies implemented for these CCEs include (i) use of smart phones with GPS facility for collection of CCE data and photographs which were sent to central server (Bhuvan), real time (ii) satellite based remote sensing data (both microwave and optical) were used to select CCE sites, iii) Multi-level yield modeling using Remote Sensing and Crop Simulation Model

(DSSAT) was carried out. The satellite data used for the study include Resourcesat-2 LISS III (23 m)/Landsat 8 (30 m) for crop map and NDVI (Normalized Difference Vegetation Index); RISAT-1 Microwave SAR (25 m) for Rice Map, Transplanting date & Biomass; Resourcesat 2 AWiFS (56 m) for Sowing Date; MODIS (500/250 m) for fAPAR (Fraction of Absorbed Photosynthetically Active Radiation), LSWI (Land Surface Water Index) and INSAT 3A data for insolation.

The analysis had multiple approaches:

- Finding relation of crop yield with sowing/ transplanting date, NDVI & RISAT derived biomass (Chakraborty et al., 2005);
- Yield estimation using DSSAT crop simulation model (Jones et al., 1998), after incorporating sowing date from remote sensing, and its relation with CCE yield;
- Use of Monteith's semi-empirical model for wheat yield estimation (Tripathy et al., 2014) and its relation with CCE yield .

The conclusions of the study are as follows:

- Use of Remote Sensing Parameter (sowing date) in Simulation Model (DSSAT) showed high predictive capability for yield
- Yield derived from purely Remote Sensing based Semi-physical models was also significantly related to observed yield values
- Use of multiple parameters was found to be more useful in yield zone stratification (e.g. Biomass & Transplanting Date from Rice)
- It is better to plan CCE based on yield zones (using models), rather than only remote sensing index

However, it was observed that one year study was not sufficient for deriving conclusion. There is a need to validate the above findings. Hence, in October 2015 a programme called **KISAN (C[K]rop Insurance using Space technology And geoiNforamitcs)** was launched by the Ministry of Agriculture & Farmers Welfare, which proposes to carry out the study in 4 districts (one in each state) in 4 states (Haryana, Karnataka, Madhya Pradesh & Maharashtra) during Kharif, 2015 and 8 districts in those states in Rabi, 2015-16 and generated block level yield estimates using remote sensing and other collateral data. The project also envisages use of Drone/UAV based very high resolution images for improving the accuracy of yield estimation. ●

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Interesting Websites

Pushpalata B. Shah, Space Applications Centre, ISRO, Ahmedabad; pushpa@sac.isro.gov.in

1	http://nisar.jpl.nasa.gov/missionthemes/applications/2015appws	NASA-ISRO SAR Mission Applications Workshop: Linking The Applied Science Community to Mission Data.
2.	http://www.crazyengineers.com/threads/isros-made-in-india-radar-can-track-space-debris.80643/	ISRO's made in India RADAR can track space debris
3.	http://spl.gov.in/nsss2016/	Forum for the presentation of new results and discussion on recent developments in the areas of atmospheric and space sciences, planetary science and exploration, and astronomy.
4.	http://www.iaria.org/conferences2016/SPACOMM16.html	Design and analysis of microwave radiometer systems; Modem microwave technology; Interplanetary communications.
5.	http://www.mtt.org/dmls.html	Distinguished microwave lecturers
6.	http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6410022	Overview of Inter-calibration of Satellite Instruments.
7.	http://www.aticourses.com/fundamentals_synthetic_ aperture_radar.htm	ATI's Fundamentals of Synthetic Aperture Radar course.
8.	http://spl.gov.in/nsss2016/	Forum for the presentation of new results and discussion on recent developments in the areas of atmospheric and space sciences, planetary science and exploration, and astronomy.

GIS Jobs Posting (November 2015)

Organization	Designation & Job Requirements
NOKIA HERE Solutions Navi Mumbai, Maharashtra	**GIS Analyst**: Navigation Database Management: Names, Addresses, Speed Categories, Functional Class of Roadways, Intersection Coding,, Administrative and Postal Coding, Data Quality Checks.
Cyient Ltd. Noida, UP	**Jr.GIS Engineer**: GIS Database Creation using Source Material, Quality Checks and Analysis of Navigational Data.
WAPCOS Ltd. Gurgaon, Haryana (Govt. of India Undertaking)	**GIS Analyst:** GIS based integrated database organization, Satellite Image Interpretation & LU/LC Mapping (1:10 K Scale), Aquifer Mapping , Cadastral Mapping and updation with High Resolution Satellite Image, Drainage & Water Supply Network, Master Planning Projects.
Geo EYE Mapping Corporation New Delhi	**GIS Engineer:** CAD/CAM/ GIS & Implementing Geo-spatial Technology Applications.
R K IT Solutions New Delhi	**GIS Consultant:** End to end experience of at least one GIS project for underground assets like cables, pipelines etc. Geo-referencing Point Assets of BSNL, QC/QA of application, data editing training to users, data validation, project monitoring, co-ordination with field Units
Kandla Port Trust Gujarat	**GIS Specialist**: Geo-referencing , Digitization and Ground Verification of Base Maps for KPT , GIS-MIS Integration , Total Station Survey , Capacity Building of KPT Officials, Proficiency in GIS Applications Development for Urban Planning.
Saral Infotech System Noida, UP	**GIS Engineer**: Experience in developing web-based GIS Applications using Linux, Apache, Java Servlets and PostGIS/PostgreSQL, Geoserver, and GDAL/OGR, Google Maps, ArcGIS Server
Podium Infotech Pvt. Ltd. New Delhi	**GIS Engineer**: GIS database Creation, Quality Control, Good understanding of Software Packages like ArcGIS, MapInfo, ERDAS Imagine, AutoCad, Smallworld.
iConcept Solutions Hyderabad, Telangana	**GIS Engineer**: Efficient GIS database design and development of custom GIS applications , Project documentation and project coordination
Dimension India Networks Pvt. Ltd., Noida, UP	**GIS Engineer**: CAD/CAM/GIS & Implementing Geospatial Technology Applications
IIRS, Dehradun	**Jr. Research Fellow**: M.Sc. Geo-informatics
SNL Financial Ahmedabad, Gujarat	**Project Manager**: GIS Data Management
Rolta India Limited Visakhapatnam, Andhra Pradesh	**Lead Engineer**: Photogrammetry, Remote sensing & GIS Projects

Geoinformatics Education & Career

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Geospatial solutions are gainfully used and many applications are demonstrated by agriculture sector, national mapping agencies, defense and R & D organizations. Currently Geospatial Technologies and tools are increasingly integrated by many companies and organizations in enterprise IT solutions. Lead is taken by urban planning organizations, power and gas transmission and distribution companies, port and roads developers, telecom companies, public works departments, surveying and positioning solutions providers, BIM solution providers, 3D modeling and LiDAR companies in design and development of Geoinformatics based solutions and services. Geospatial Industry is recruiting Geoinformatics professionals and IT engineers with required GIS skill. This calls for assigning appropriate credits for programming, database management and GIS web services development in Geoinformatics curriculum and introducing Geoinformatics core and electives papers in engineering and management education (Telecom Management, Power Management, Urban & Real Estate Planning) to provide industry ready professionals for mentioned sectors. This is reflected in recent GIS job postings as shown on page 22.

GoI has mandated use and applications of geospatial technologies in planning, implementation and monitoring of national projects pertaining to infrastructure, energy, rural development, management of cities and governance under 12th Five year plan. Funds allocation made by Union Budget 2014-15 (Table 1) has provided business opportunities for Geospatial Industry for tasks pertaining to mapping, surveying, EO and allied data processing and applications development for project planning, implementation and monitoring and career opportunities for GI professional in survey- mapping- GIS operations, database creation-QA/QC-software development and GIS project management.

Table 1: Union Budget 2014-15 Funds Allocation for GI Relevant Projects (Partial List)

National and State Highways	$6298.95 million
NHAI for Industrial Corridor Study	$83.31 million
Jal Marg Vikas on Ganga River	$699.88 million
Rail Development in North-East	$163.63 million
Detailed Project Reports for linking of the rivers of India	$16.66 million
Delhi Power Reforms	$33.32 million
Delhi Water Reforms	Rs. 500 crores
Metro Projects in Lucknow and Ahmedabad:	$16.66 million
100 Smart Cities	$1176.47 million
Smart Governance	$16.66 million

Railway Budget announced adoption of geospatial technologies for mapping of Railway's vast land assets for better management and usage.

MHRD 2013 report on NATIONAL TASK FORCE ON GEOSPATIAL EDUCATION has well documented increasing demand for geospatial professionals. Geoinformatics training Institutes and professional societies (ISG, ISRS, CSI, IETE) need to design and conduct industry relevant certificate and diploma courses for preparing required GIS skilled workforce. GIS Industry is categorized in to 4 segments viz. Services, Data Generation, Software and Hardware. Job opportunities are very good in all 4 segments for candidates having demonstrated skill of GIS server programming, project management, field survey and data conversion. Many Indian companies are involved in data conversion work and like in IT, India is fast emerging as a major centre for data conversion work.●

News Desk

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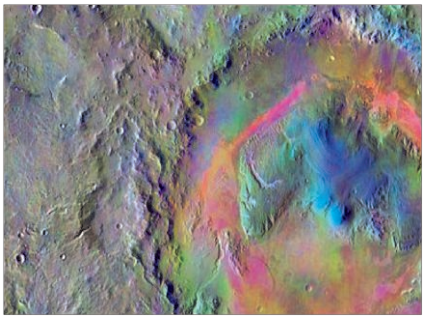
NASA Spacecraft Nears 60,000th Lap around Mars

NASA's Mars Odyssey spacecraft completed its 60,000th orbit since arriving at the Red Planet in 2001 on the 23rd June 2015. On Dec. 15, 2010, it became the longest operating



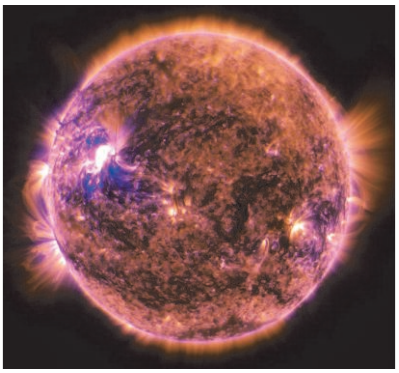
spacecraft ever sent to Mars, and continues to hold that record today. Odyssey, which discovered widespread water ice just beneath the surface of the Red Planet, is still going strong, serving as a key communications relay for NASA's Mars rovers and making continued contributions to planetary science. Odyssey currently is completing an adjustment to an orbit that will position it to pass over Martian terrain lit by early morning sunlight rather than afternoon light. ●

Monster Black Hole Awakens After 26 Years of Slumber

On June 15, 2015, astronomers spotted an X-ray burst from a familiar location. V404 Cygni, a system containing a black hole and a star locked in orbit around each other, located within the Milky Way, some 8,000 light-years away from Earth in the swan constellation, Cygnus. The last time V404 Cygni X-ray burst was spotted in 1989. ●

NASA Observatory Captures Stunning Solar Flare

A magnificent solar flare was sighted by NASA's Solar Dynamics Observatory in the early hours of June 25. Solar flares are powerful surges of radiation on the sun caused by the release of magnetic energy, which can last for minutes or even hours. Radiation emitted from such flares can agitate the atmospheric layer in which GPS & communications signals operate.●



MOSDAC: Dissemination of Weather Alerts in the Digital World

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The Meteorological and Oceanographic Data Centre (MOSDAC) is window to the core met-ocean data services and information services related to weather and climate. It provides Near Real Time (NRT) data from INSAT (3A, 3D and KALPANA), Megha-Tropiques and SARAL missions and EUMETCAST data to Operational Agencies under the Ministry of Earth Sciences like National Centre for Medium Range Weather Forecasting (NCMRWF) and India Meteorology Department (IMD) other than researchers and academia.

MOSDAC has forged ahead from being a data provider to a citizen centric weather alerts dissemination system. The alerts are supported with an online decision support system for extreme weather based alerts and warnings. Other than data from Indian missions, MOSDAC also fetches and provides international data sets from EUMETCAST and ECMWF in near real time. The availability of these data has steered the model development and refinement activity for forecasting and nowcasting (a short term forecast valid for 6 hours) of weather events. The models are operationally executed as part of the automated chain of events including data acquisition, data reception, data products generation, forecast model execution, data products archival and dissemination with relevant metadata. The decision support systems are developed around the alerts and warnings generated through these models.

Recently introduced alerts and decision support subsystems are focused around (i) NOWCAST for Cloud burst in Western Himalayan Region (ii) NOWCAST for heavy rainfall across India (iii) Heat wave prediction (iv) Satellite based Heat wave observation (v) Cyclone track prediction with intensity (vi) Heavy Rain Event

1. NOWCAST (forecast valid for six hours from the time of forecast) related to cloud burst over Western Himalayan Region. The nowcast is updated on a half hourly basis and is valid for six hours. Alerts associated with the cloudburst include names of cities or towns impacted and the radius of influence of the cloud

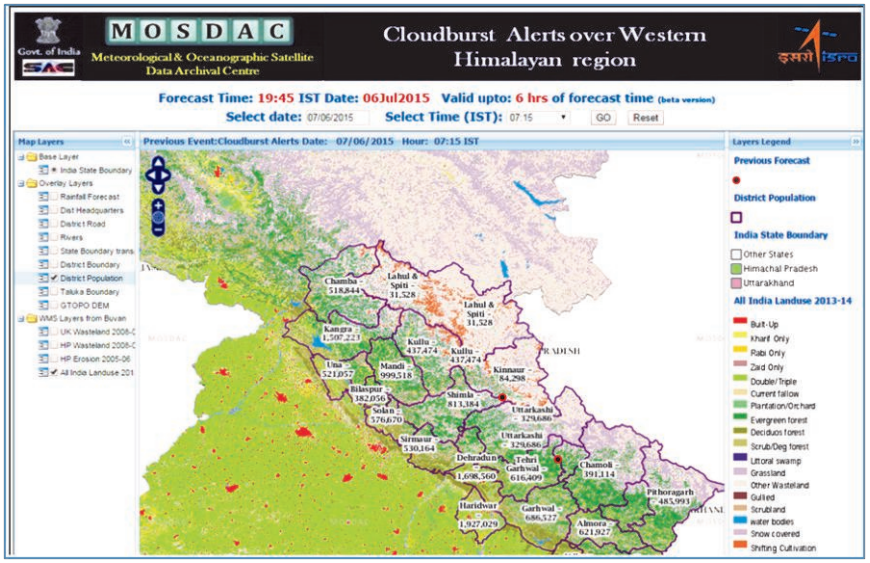


Figure 1: Nowcasted cloud burst locations with reference layers of land use and district wise population Projects (Partial List)

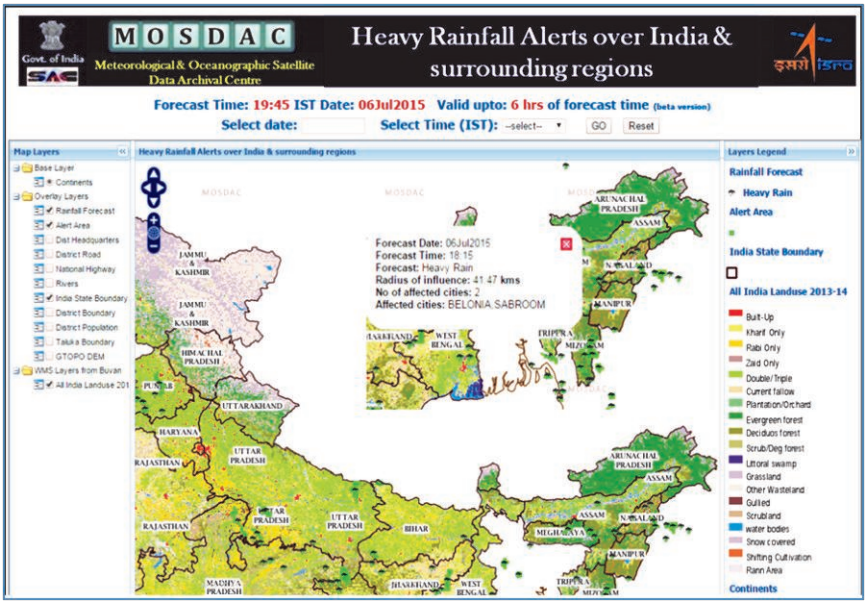


Figure 2: Nowcasted heavy rain locations with reference layers of land use and district bounds

burst. To assist the decision making process collateral layers such as land use, DEM, district population, district headquarters, roads, rivers, taluka boundaries with taluka names are made available as interactive web GIS layers. (Fig. 1)

2. NOWCAST related to heavy rain across Indian landmass. This is also updated on a half hourly basis. Layers available for interactive display are same as those provided in the Cloud burst related decision support system.(Fig. 2)

3. NWP model forecast for heavy rain (updated at 12:30 hours on a daily basis) (Fig. 3)

4. **Heat Wave Prediction:** This prediction is season based and is provided for the next 24 hours and 48 hours. It is available as a GIS layer where the collateral data such as districts, talukas etc can be overlaid interactively. (Fig. 4)

5. **Cyclone track prediction along with cyclone intensity:** This prediction is preceded by the cyclogenesis warning on MOSDAC web site. There is always a possibility of the genesis reducing to a mild depression and finally getting dissipated. In the case where the genesis grows into a full blown cyclone the predicted tracks are also displayed (Fig. 5) The timely warning of Cyclone Phailin helped the administration in taking preventive measures such that there is no loss of life.

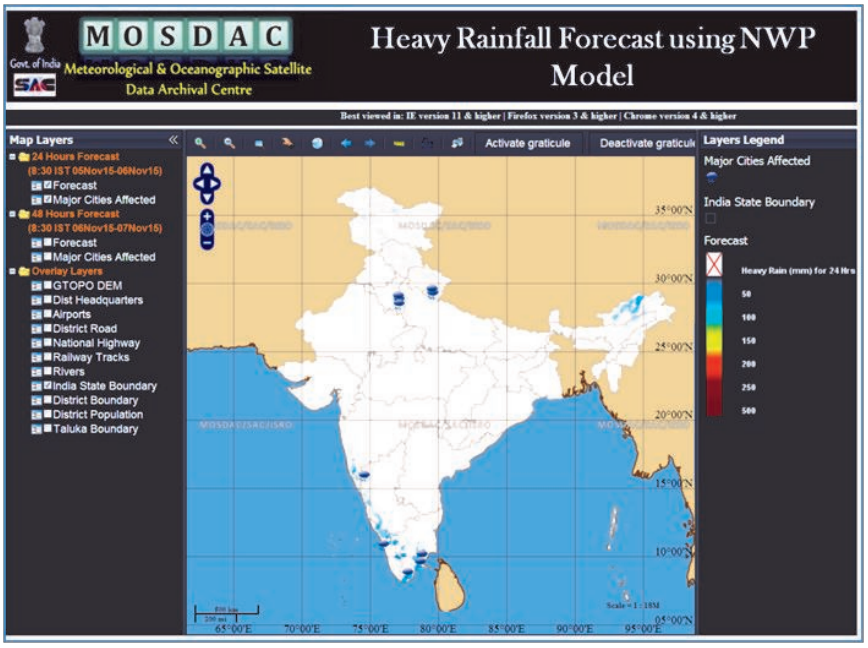


Figure 3: Predicted heavy rain locations

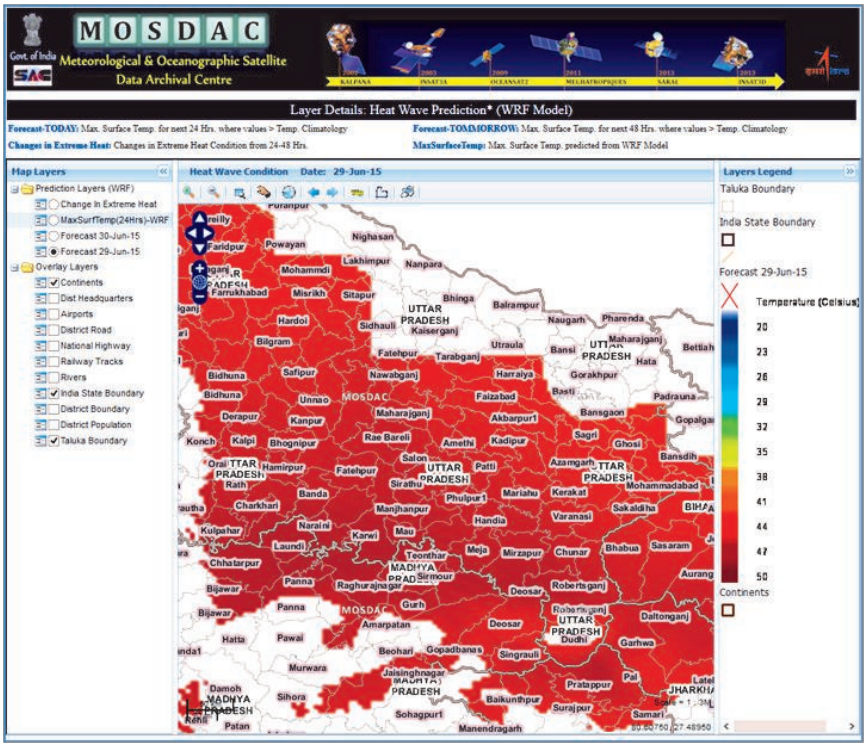


Figure 4: Predicted heat wave areas with reference layers of taluka

6. Half hourly heavy rain (greater than 5mm per hour) event with details of met sub divisions (Fig. 6).

7. The weather forecast and weather alerts are also available on Android devices (Fig. 7) through a free weather app.

The latest induction into MOSDAC is a new class of products called science products. Scientific studies using SARAL ALTIKA data in conjunction with related data sets led to a variety of science data products.

i. Sea Ice Occurrence Probability (SIOP) for each day from January 1 to December 31, generated with major input data being SMMR-SSM/I-SSMS sea ice concentration data over Antarctic Region.

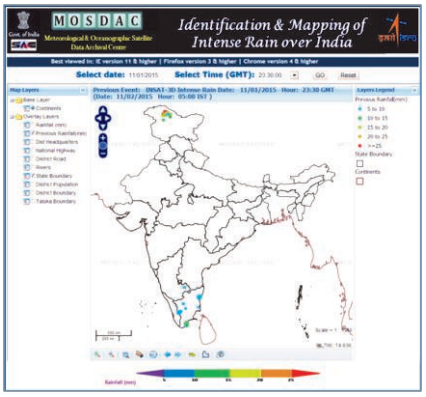


Figure 6: Depiction of heavy rain event

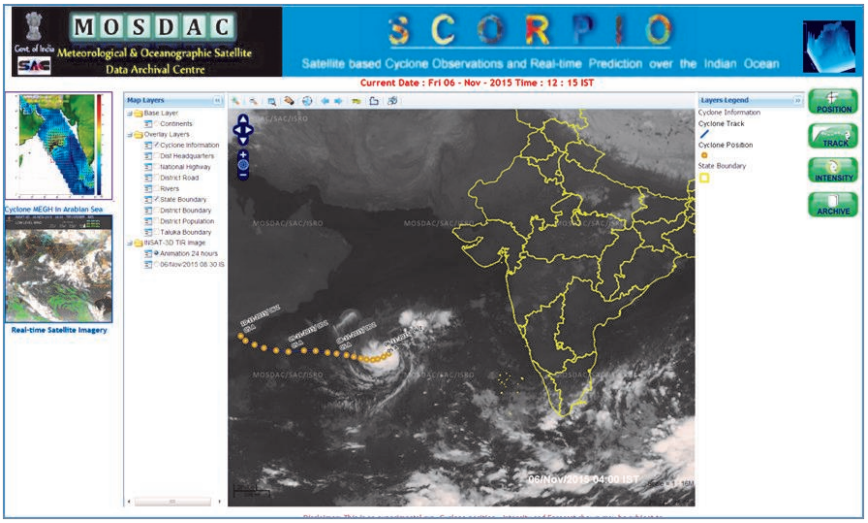


Figure 5: Cyclone visualisation with predicted track

ii. Inland Water Height over Ukai and Brahmaputra river, derived using Altimeter Interim Geophysical Data Record (IGDR), GDR, ECMWF Pressure fields and total electron content (TEC) maps produced by Global Ionosphere Maps (GIM) (Fig.8).

iii. River discharge database for Godavari river for the period 2002-2015 using

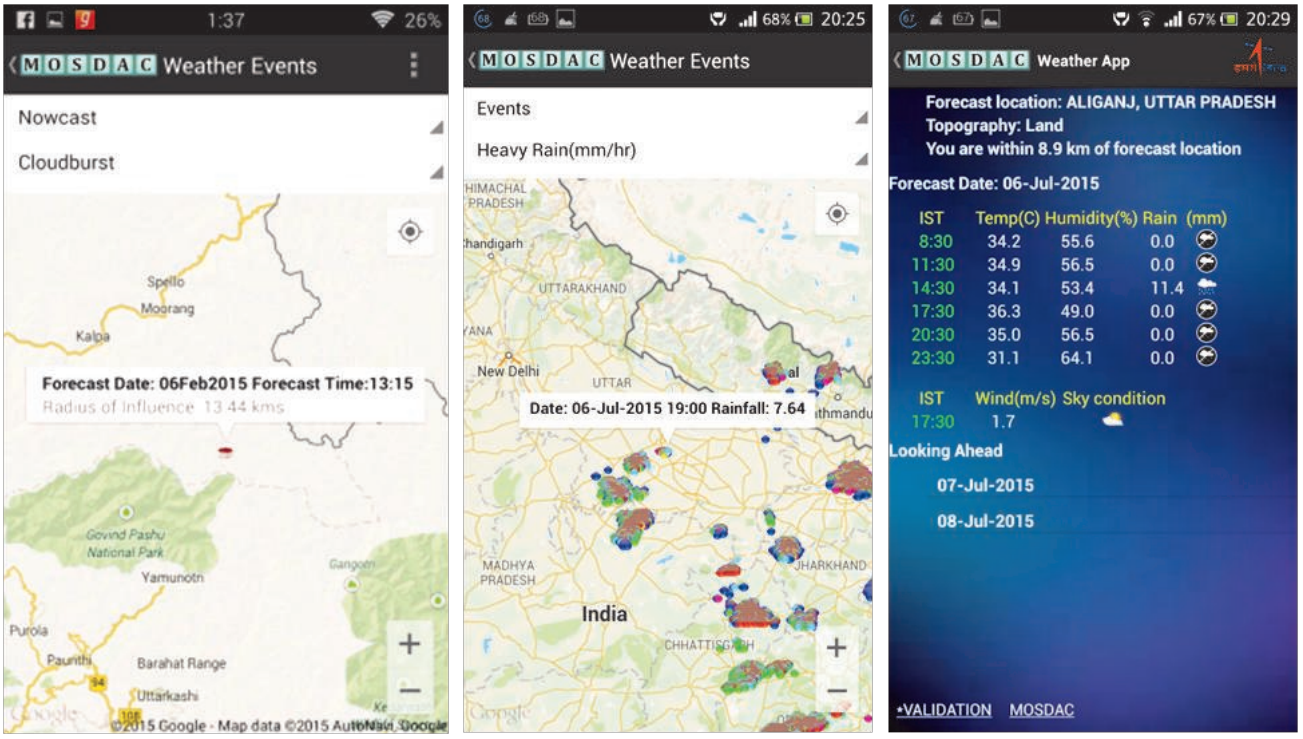


Figure 7: Display of cloud burst (Nowcast), heavy rain (Event) and 3 hourly weather forecast on Mobile

ENVISAT, JASON-2 & SARAL ALTIKA data (Fig.9).

iv. Wave power product – a renewable energy resource available from ocean waves over India region. This is available as two products (a) Inter annual monthly product and (b) Monthly climatology of ocean wave energy. These products are generated using JASON-2 and SARAL ALTIKA data (Fig. 10).

v. Global Ocean Surface Currents – generated using merged Altimeter, Scatterometer and AVHRR data (Fig.11)

These science products are available on MOSDAC on free download. In future it is proposed to provide all the geo physical products generated from INSAT-3D as a geo database thereby making way for many more science products relevant to society at large.●

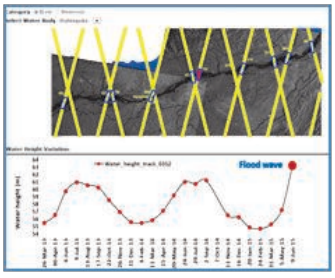


Figure 8: Water Height

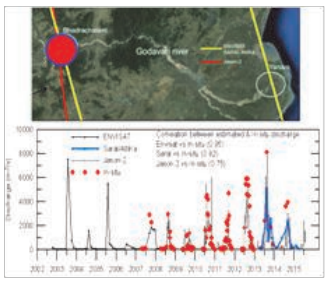


Figure 9: River Discharge

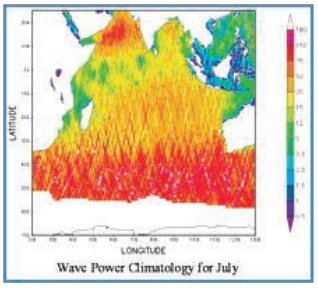


Figure 10: Wave Power Climatology

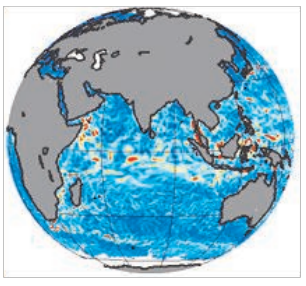


Figure 11: Ocean Currents

ISG Chapters Activities for the Year - 2015

N. S. Mehta, Secretary, ISG, Ahmedabad; nsmehta55@gmail.com

Chapters & Activities

ISG has Twenty One -Local Chapters located at Ahmedabad, Ajmer, Bhagalpur, Bhopal, Chennai, Dehradun, Delhi, Hissar, Hyderabad, Jaipur, Mangalore, Mumbai, Mysore, Pune, Shillong, Trichi, Jammu and Kashmir, Vadodara, VallabhVidya Nagar (VV Nagar),Visakhapatnam and Trivendrum.

There is a good progress in activities carried out by Chapters and also in the formation of new Chapters. Two new chapters at Hissar and Thiruvanthapuram were opened and Bhopal & Trichy Chapters revived. Dehradun Chapter is at advanced stage of revival. In addition to this, there is a initiative in opening of few more chapters at Ludhiana, Lucknow / Kanpur and Varanasi. ISG has given guidelines to all chapters to conduct Science Day (28th Feb), Technology Day (11th May) and GIS Day (20th Nov) every year. Brief activities carried out by various chapters are as follows:

Ahmedabad Chapter

i) Talk on “”Geomatics for Earth Awareness and Sustainable Development” as a part of “Earth Day’’ celebration at AG Teachers High School, Ahmedabad on April 22, 2015. Mainly High school students participated in this programme. Lectures delivered on (1) “Sustaining Earth and its environment” by Dr Ajai, (2) “Monitoring earth from space” by Shri R P Dubey, (3) Video on Mars/ Moon; and (4) Interaction and panel discussion organized with Dr Shiv Mohan, Shri I C Matieda, Shri N S Mehta, Prof Anjana Vyas, Dr Alpana Shukla and Shri S A Sharma along with speakers.

ii) Organised a popular lecture on ‘’Recent Advances in Imaging Spectroscopy Research and Applications with AVIRIS-C and AVIRIS-NG” by Robert O Green, NASA on May 11, 2015 as part of National Technology Day celebration at SAC, Ahmedabad.

iii) One day workshop on “Introduction to Remote Sensing, GIS & its applications” together with eiTRA & IEEE-GRSS at Umiya Campus, Ahmedabad on May 28 2015. Lectures were delivered on (1) “Introduction to Remote Sensing and Applications” by Dr Ajai; (2) “Introduction to Microwave Remote Sensing & Applications” by Dr Shiv Mohan; (3) “Ocean/Atmosphere Applications” by Dr P K Pal; (4) “ Introduction to GIS and applications” by S. A. Sharma; and (5) “Satellite data processing” by Dr M P Oza. The workshop was attended by about 30 participants from various scientific and academic institutes. This workshop was organized in collaboration with IEEE-GRSS and eiTRA.

iv) One day ToT workshop on ”LandUse / LandCover Mapping” together with CEPT University at IET Campus (Ahmedabad University) on August 22, 2015. About 15 faculty members and 80 students have participated. These participants were from various colleges like CEPT University, H. K. Arts College, Government College, Gandhinagar and Department of Geography of Gujarat University, M.G.Science College and M.S.University, Vadodara. This workshop was designed to learn to use satellite imagery for mapping of landuse/landcover. The experts through lecture-cum-demonstrations have given in-depth knowledge on visual image interpretation, digital image interpretation, mapping procedure, issues to be taken care of while mapping, process and method of satellite image development, landuse identification from microwave remote sensing, levels of classifications and extraction of geological features.

Ajmer Chapter

Organized 2 Day National Conference on “Geomatics for natural resources and climate change with special reference to rain – fed agriculture and water resources” during October 8 -9, 2015 at MDS University, Ajmer. The Symposium is organised jointly by MDS University, RRSC – West and local chapters of ISG & ISRS.

Bhagalpur Chapter

Bhagalpur Chapter has extended its activities amongst school children of Bhagalpur district. ‘Science for Society , Bihar’ – an important organization of DST, Govt. of India- has requested the ISG- Bhagalpur Chapter to co-ordinate and enlighten the school students about the application of Remote Sensing and GIS in different spheres of life. Dr R. K. Sinha, Chairman, ISG- Bhagalpur Chapter delivered a special lecture on focal

theme "Understanding Weather and Climate" of 23rd District Children's Science Congress-2015 with reference to RS-GIS application. About 250 students & school teachers were enlightened.

Bhopal Chapter

With the persuasion and active support of Dr. P.K. Verma, the Bhopal Chapter is revived. New EC elected under the Chairmanship of Dr. N.K. Choubey, and carried out activities related to awareness of RS & GIS among school children at: i) Maharani Laxmibai Girls Higher Secondary School, Begamgunj, dist. Raisen on August 07, 2015 and ii) Mahatama Gandhi Memorial Higher Secondary School, Hoshangabad on September 04, 2015. Dr. N.K. Choubey, Chairman, ISG – Bhopal Chapter delivered the lecture, where large no. of students participated.

The Chapter also organized two Workshops during August 6 – 7 & 17 – 18, 2015 on use of thematic maps prepared using RS & GIS for sustainable use of water resources to the concerned Govt. Officials of the Patharia Block of Damoh Dist. Dr. N.K. Choubey, Chairman and Dr. Swati Jain, Vice – Chairman of the Chapter explained the details of thematic maps. The Chapter has plan to carry out such activities at more places such as: Indore, Chatarpur, Narsighpur, Badwani and Ashok Nagar.

Hissar Chapter

New Chapter opened recently under the Chairmanship of Dr. R.S. Hooda, Chief Scientist, HARSAC, Hissar and Secretary Dr. Anup Kumar.

Hyderabad Chapter

The Hyderabad Chapter revived last year carried out following activities during this period.

(i) National Water Day: Celebrated National Water Day on March 23, 2015 jointly with IIIT, Hyderabad. They also associated local NGO's working in the field of conservation of water. The programme included lead lectures on WARIS and Demo on Bhuvan.

(ii) Remote Sensing Celebrations: ISG – Hc and ISRS – HC jointly organized GIS and RS based activities on August 12, 2015 at NRSC, Hyderabad. The Chief Guest Padamsree Dr. M.S.Y. Prasad delivered the talk on Space Policy.

(iii) GIS Day - 2015:ISG – HC in association with Centre for Environment Institute of Science and Technology, Jawaharlal Nehru Technological University, Hyderabad (JNTUH) , Telangana, organised one day workshop on Geospatial Technologies on Environmental Planning and Management" on 21st November, 2015.Dr.T.Kishen Kumar Reddy Rector, JNTUH was the Chief Guest, Dr.A.Jaya Shree Director , IST, JTNUH presided over the function and Sri. B. Gopala Krishna, Dy. Director, (DPPA&WAA) & Dr. R. Nagaraja, CGM RC from NRSC, ISRO were the guests of honour.

Pune Chapter

GEOVISION - 2015: ISG-Pune chapter conducts GEOVISION series of workshops every year. This year's GEOVISION is planned sometime during Dec.2015 – Jan. 2016 on the topics of "Agricultural Informatics" and "Smart Cities". The Pune Chapter also instituted an "Best Project Award" for research scholars.

Tiruchirappalli Chapter

Chapter revive recently. New EC elected under the Chairmanship of Dr. C.J. Kumanan and Secretary Dr. J. Saravananavel.

Thiruvananthapuram Chapter

Chapter formed under the Chairmanship of Dr. Suresh Das, Executive Vice – President of KSCSTE and Secretary Dr. L. Gnanappazham, Assistant Professor, IIST.

Vadodara Chapter

Under UGC DRS programme organized National Seminar on "Impact of Climate Change on Biodiversity" on March 25, 2015, jointly with Department of Botany, Faculty of Science at M.S. University, Vadodara. ISG Vadodara Chapter in association with Department of Botany, The M.S. University of Baroda, ISCA and IWSA (Vadodara Chapters) organized aNational workshop on "Hyperspectral Remote Sensing of Natural Resources", during September 6 – 12, 2015. 25 students working in the field of Hyperspectral Remote Sensing participated in the event.

Vallabh Vidyanagar Chapter

ISG VV NAGAR Chapter & SPEC COLLEGE VADTAL jointly organized a special talk on GIS Technology & Applications on 3/8/2015 at SPEC COLLEGE VADTAL and talk delivered by Dr. P.M.UDANI. 170 + students of BCA, BBA, MBA and all faculty members of BCA/ BBA and MBA attended.

ISG VV Nagar Chapter & A . N . P A T E L P G Institute, Anand jointly organized a special talk on Digital India & Role of GIS at A.N. Patel PG Institute, Anand on 10/8/2015 and talk delivered by Dr. P.M. Udani. 150 + students of M.Sc. IT and M.Sc. Physics and all faculty members of IT, BCA/ MCA and M.Sc. Physics attended.

ISG VV Nagar Chapter & SPEC College Vadtal jointly organized a special talk on GIS and GPS Technology & applications on 17/10/2015 at SPEC College Vadtal and talk delivered by Dr. S O Khanna & Dr Himnshu Kapse. 100+ students of BCA, BBA and all faculty members of BCA and BBA attended.

ISG VV Nagar Chapter & NVPAS College, V V Nagar jointly organized a special talk on GIS Technology on 24/10/2015 at NVPAS college. Talk was delivered by Dr. S. O. Khanna 150 + students of NVPAS & VP Science College and faculty members of BCA, M.Sc.IT, B.Sc. Environment Science attended.

ISG VV Nagar chapter organized special lectures for members of ISG V V Nagar chapter, faculty members and students of P G Diploma in Geoinformatics, MCA and M.Sc. IT. One lecture each by Shri P D Yadav on GIS Database Management on 12/9/2015 and Shri Shashikant Patel on Image Processing Fundamentals on 18/8/2015, were delivered.

ISTAR conducted 21 Days NRDMS (DST) Sponsored Geospatial Technologies Training program with Technical Support from ISG VV Nagar Chapter & ISG Main body during 23-11-2015 to 13-12-2015. 35 Faculty members from Engineering College, Science College, BCA/MCA College, & Agriculture University-Anand participated. Keynote Speech was delivered by Dr Ashok Kaushal (Formerly Scientist C-DAC).

Financial Support to Chapters

Once in a year, the ISG provides funding support to organize the mandatory activities such as Science day, GIS day and Technology day to the Chapters. This year on request, Society has funded Ahmedabad, Ajmer, Pune, Vadodara and VV Nagar Chapters for carrying out various activities.

NNRMS – Natural Resources Repository (NRR)

Rajendra N Gaikwad, S A Sharma and NRDB Team
Space Applications Centre, ISRO, Ahmedabad; g_rajendra@sac.isro.gov.in

Introduction

NNRMS ((National Natural Resources Management System) programmes provides service, through a spatial data repository of ISRO popularly known as Natural Resources Database (NRDB). NNRMS portal of ISRO and widely recognised as a portal which supports NSDI metadata 2.0 standard and provides thematic information in various areas like Wetland, Snow cover, Desertification, LUSE and many more to user community. This provides thematic information which can be of essential use for planning, research group, and decision makers.

NNRMS is available in Rastrabhasha, Hindi and became more popular for its search engine in Hindi language. The objective providing portal with use of such language is to make it available to all village level community of the country.

The spatial information generated under various ISRO projects is archived for systematic retrieval as required by various users of NNRMS. A National Natural Resources Repository (NRR) using infrastructure of distributed GIS data servers, and networks established at SAC (Space Applications Centre), Ahmedabad. The NRR databases for spatial information is available and through common standards called NNRMS standards.

Figure 1: NNRMS Portal Home Page

The NNRMS standards subsequently became a base for NSDI participating agencies to bring first OGC compliance metadata standards and published as NSDI Metadata 2.0 standard which is available on website www.nsdi. indiaportal.gov.in. The standards now referred as a India metadata standard for spatial dataset. Almost 14 participating agencies under NSDI followed these standards and published individual organisation metadata on NSDI portal. NNRMS stands among these organisations and also regularly updates its information on NSDI portal.

The information about thematic layer and web map is accessed through NNRMS portal (www.nnrms.gov.in) Home Page of the Portal is shown in Figure-1; it allows users to search a particular data and provides detail information with standard symbology which normally not observed in any organisational maps, portal follows a well defined standard symbology for all thematic web maps.

Major themes Available in NNRMS

It includes data sets from projects under NRR which includes, Natural Resources Census (NRC), Natural Resources Information System (NRIS), Wastelands, Wetland, Snow cover Monitoring and apart from various projects being executed by various ISRO/ DOS Centres.

About NNRMS WMS (web map service) services

Implementation of services called WMS (web map service) is as per OGC (open Geospatial consortium) and is available from NNRMS portal. Users of NNRMS can avail these facilities with the use of WMS supporting software. WMS ser-

vices will provide accessibility of the maps at users desktop without ordering it; the layers can be used as if they are lying on their data server. Further, these layers can also be overlaid with other datasets available with the user. Detail document is available on NNRMS portal. This document describes the details usage of WMS service through commonly used enterprise and open source software.

Recent development

Recently "Automated snow cover data processing" s/w tool has been developed, which brings voluminous data of "Monitoring of Himalayan snow and glaciers" project which is Snow and glacier studies, A joint project of Ministry of Environment, Forests and Climate Change (MoEFCC) & Department of Space (DOS), Govt. of India and Project carried out at SAC. Due to this automated tool today snow cover data available from 2010 – 2013. The peculiarity of this data is that it is available dekad wise for all nine months especially from Oct- June. 2013-14 data will also be made available shortly.

Also, Glacier Lakes, Glacier Morphology, Glacier SNOUT, Glacier Datasheet of UTTARAKHAND state under this project is also available for users.

Data ordering and user agency

We have users from all sectors and used our data for various projects. The users of NNRMS registered through NNRMS portal can access all metadata and maps along with WMS services, where the data ordering is made available to authenticated users especially from Government organizations and research institutes.

Table 1: Thematic Layers

Theme	Scale
WETLAND	1: 250,000 1:50,000
WASTLAND MAPPING	1:50,000
LAND USE/LAND COVER	1:250,000 1:50,000
DESERTIFICATION	1:500000
SNOW COVER MAPPING	1:250000
GLACIER INVENTORY	1:50,000

Conclusion

NNRMS portal is the most comprehensive with diverse themes and areas on natural resources of the country. NNRMS provides the information as well though it shall have its own spatial data sets. However the process of metadata and WMS service makes it more resourceful to research community. Today NNRMS has voluminous number of users which users like Central Government, Educational Institutes, Industry, NGO, Private/ Public Enterprise, Research Organisation, Research Institute, State Govt, Students etc. NNRMS is serving data within the spatial NSDI metadata data standards in the form of services and hence which became model for various organisation to serve individual data repository through various portals.●

ISG Membership

MEMBERSHIP GUIDELINES

Subscription for Life Membership is also accepted in two equal installments payable within duration of three months, if so desired by the applicant. In such a case, please specify that payment will be in installments and also the probable date for the second installment (within three months of the first installment).

A Member of the Society should countersign application of membership as proposer.

Subscription in DD or Cheque should be made out in the name of 'Indian Society of Geomatics' and payable at Ahmedabad.

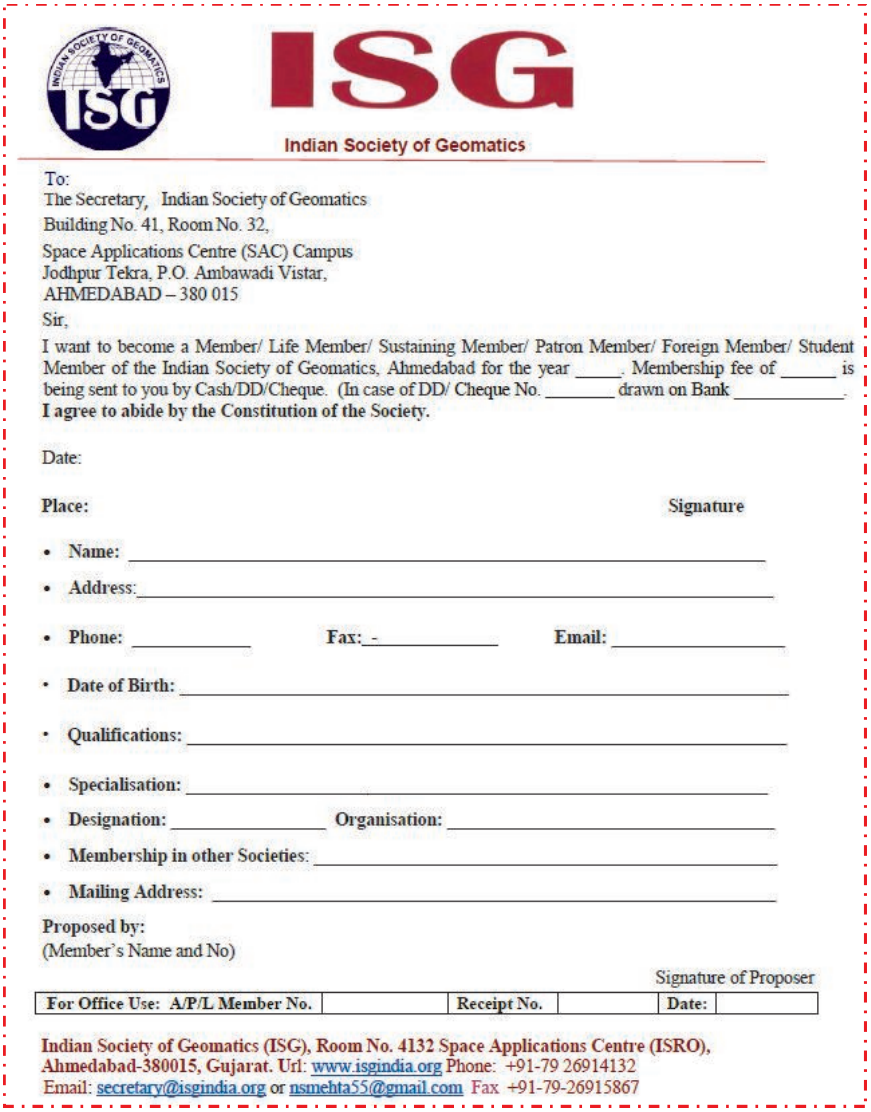
Direct deposit in ISG A/Cs must include bank fee Rs. 25/- for cash payment.

Financial year of the Society is from April 1 to March 31.

For further details, contact Secretary, Indian Society of Geomatics.

ISG has chapters already established at the following places. Ahmedabad, Ajmer, Bhagalpur, Bhopal, Chennai, Dehradun, Delhi, Hyderabad, Mangalore, Mumbai, Mysore, Pune, Tiruchirappalli, Srinagar, Vadodara and Visakhapatnam. Applicants for membership have the option to contact Secretary/Chairman of the local chapter for enrolment. Details can be found at the website of the Society: www.isgindia.org.

Journal of the Society will be sent to Life Members by softcopy only.



ISG

Indian Society of Geomatics

To:
The Secretary, Indian Society of Geomatics
Building No. 41, Room No. 32,
Space Applications Centre (SAC) Campus
Jodhpur Tekra, P.O. Ambawadi Vistar,
AHMEDABAD – 380 015

Sir,

I want to become a Member/ Life Member/ Sustaining Member/ Patron Member/ Foreign Member/ Student Member of the Indian Society of Geomatics, Ahmedabad for the year _____. Membership fee of _____ is being sent to you by Cash/DD/Cheque. (In case of DD/ Cheque No. _____ drawn on Bank _____.
I agree to abide by the Constitution of the Society.

Date:

Place: **Signature**

- **Name:** _____
- **Address:** _____
- **Phone:** _____ **Fax:** _____ **Email:** _____
- **Date of Birth:** _____
- **Qualifications:** _____
- **Specialisation:** _____
- **Designation:** _____ **Organisation:** _____
- **Membership in other Societies:** _____
- **Mailing Address:** _____

Proposed by:
(Member's Name and No)

Signature of Proposer

For Office Use: A/P/L Member No.		Receipt No.		Date:	

Indian Society of Geomatics (ISG), Room No. 4132 Space Applications Centre (ISRO), Ahmedabad-380015, Gujarat. Url: www.isgindia.org Phone: +91-79 26914132
Email: secretary@isgindia.org or nsmehta55@gmail.com Fax +91-79-26915867

S. No.	Membership Category	Membership fees		Annual Subscription INR (Indian)
		INR (Indian)	US $ (Foreign)	
1.	Annual Member	10.00	---	300.00
2.	Life Member			
	A) Admitted below 45 years of age	2500.00	250.00	
	b) Admitted after 45 years of age	2000.00	200.00	
3.	Sustaining Member	---	---	2000.00
4.	Patron Member	50000.00	3000.00	---
5.	Student Member	10.00	---	100.00

NISAR Science & Applications Workshop

Anup Das, Space Applications Centre, ISRO, Ahmedabad; Email: anup@sac.isro.gov.in

NASA-ISRO Synthetic Aperture Radar (NISAR) is a collaborative Mission jointly by ISRO and JPL/NASA (USA) to be launched in 2020. The Mission consists of dual L- and S-band polarimetric SAR with a 12-day interferometric orbit that will provide systematic global coverage over all the landmass including cryosphere with high resolution and wider swath data.

In this connection, annual workshops have been planned by ISRO and NASA to reach out the applications science community and various end-user communities for larger involvement and better utilization of NISAR data. The first workshop on NISAR Science was organised during 17-18 November, 2014 at Space Applications Centre (SAC), ISRO, Ahmedabad following a similar workshop on 'Applications' organized by NASA at Reston, Virginia during 28-29 October 2014 for the US community. The first science workshop that invited new ideas on SAR applications from Indian users witnessed participation of over 380 persons representing 88 institutions in India. In that workshop, few new applications of SAR were discussed and incorporated in the NISAR science plan.

The second workshop on NISAR Science was organised at SAC (ISRO), Ahmedabad during November 19-20, 2015. The workshop themed as "reaching out to the users' community" focused on involving more institutions and users in NISAR science and applications. The workshop invited various Government Departments, Ministries and PSUs, who are already using or planning to use SAR data to support their management or decision making needs, to share their experiences and discuss their requirements of SAR data from future missions, in the workshop. The workshop also invited representatives from Academic & Research Institutions, involved in development of SAR based applications, calibration/ validation of SAR data, software / tool development for SAR data processing and analysis to showcase their application studies related to themes identified for the workshop. Earlier, the second NISAR Applications workshop was organized in USA by NASA-JPL during 13-15 October 2015.

There was an overwhelming response from the Indian user community for this workshop. There were about 360 persons representing 124 institutions from 69 cities in India participated in this workshop. Representatives from 12 ministries and 04 PSUs also participated in the workshop to share their applications requirements and expectations from NISAR mission. A delegation from USA comprising 16 scientists participated in the workshop.

The workshop succeeded in bringing in more number of institutions and SAR data users to NISAR mission and possible applications of NISAR Data. The program of the workshop was organised as multiple plenary sessions, parallel breakout sessions on different application themes and poster session. The major applications themes were: Ecosystem processes; Geoscience and natural

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hazards; Cryosphere; Coastal, Ocean and Atmosphere applications; Calibration / Validation of SAR data. There were 32 invited presentations and 98 contributory presentations made at the plenary, break-out and poster sessions in the workshop.

Dr. Gerald Bowden

The response from ministries and other government agencies to participate in the workshop was overwhelming and many couldn't participate in the workshop due to delay in their nominations. Many of the registered participants from the southern states couldn't attend the workshop due to heavy rainfall in Chennai and other places just before the workshop, resulting in cancellation of flights/trains.

Shri. C. M. Kumar, Member, NITI Aayog

The workshop witnessed huge number of registrations from students/ research scholars who wanted training on SAR data analysis for various applications during the workshop. Such registrations were turned down for this workshop and it was proposed to organize separate training workshops for students on SAR data analysis under NISAR outreach program, in near future.

Group-snap of Participants at NISAR Science and Applications Workshop