

**Drafting Committee for the 'Asia-Pacific Plan of Action
for Space Applications for Sustainable Development
(2018-2030)**



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India

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31 May - 1 June 2018

India's Current Space Assets

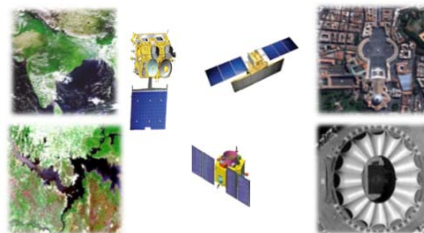
Communication Satellites

- **15 Operational** (INSAT- 4A, 4B, 4CR and GSAT- 6, 7, 8, 9 (SAS), 10, 12, 14, 15, 16, 17, 18 & 19)
- **>300 Transponders in C, Ext C & Ku bands**

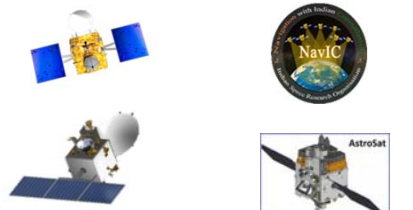


Remote sensing Satellites

- **Three in Geostationary orbit** (Kalpana-1, INSAT 3D & 3DR)
- **14 in Sun-synchronous orbit** (RESOURCESAT- 2 & 2A; CARTOSAT-1/ 2 Series (5); RISAT-2; OCEANSAT 2; MEGHA-TROPIQUES; SARAL, SCATSAT-1)



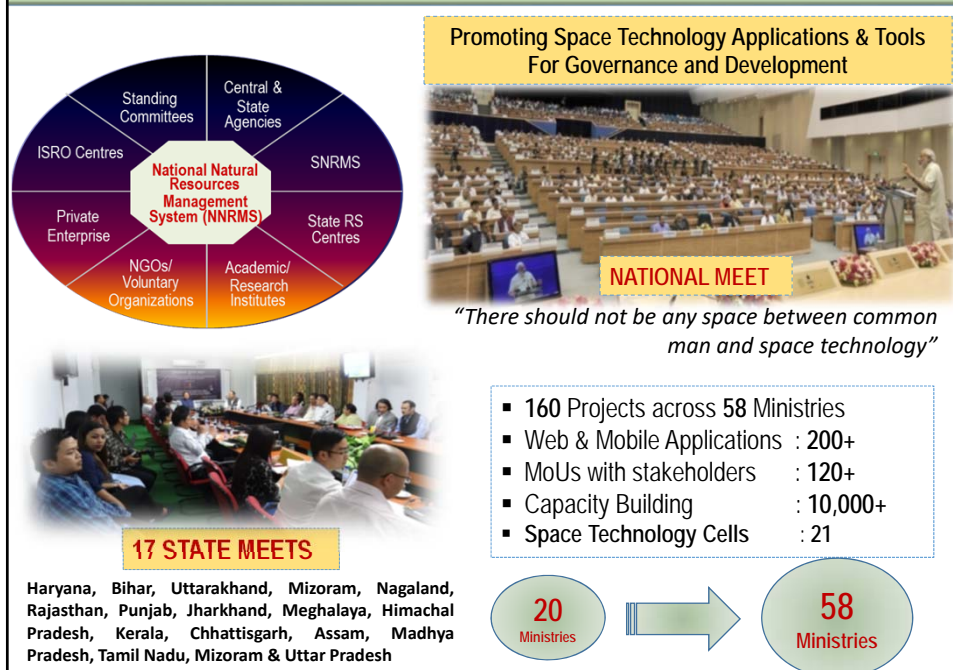
**Navigation Satellites : 7 (IRNSS 1A - IG)
& GAGAN Payloads in GSAT 8, 10 & 15**



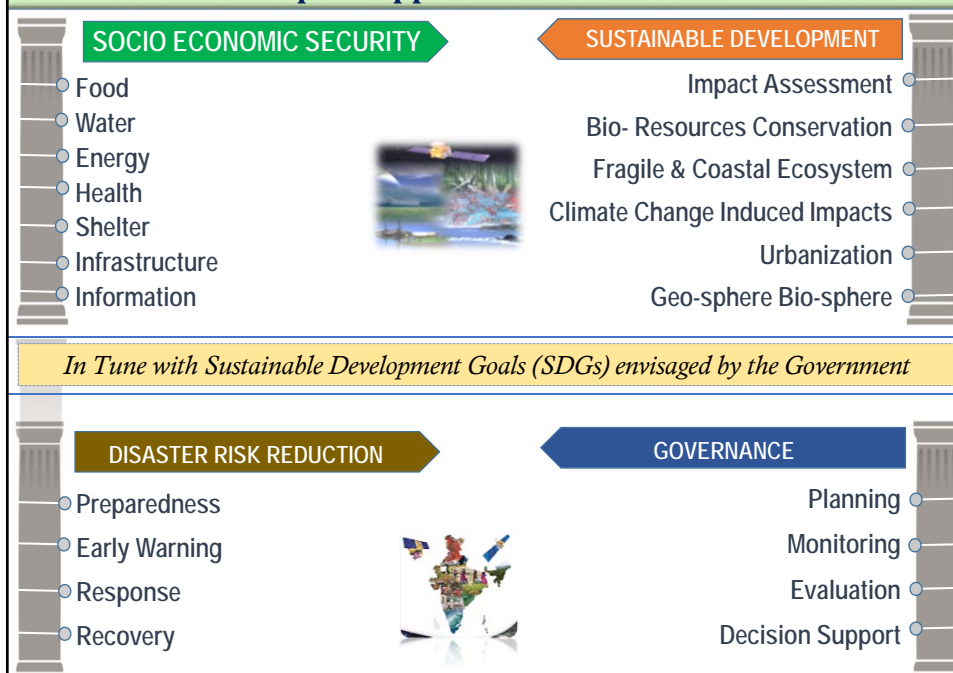
Space Science: MOM & ASTROSAT

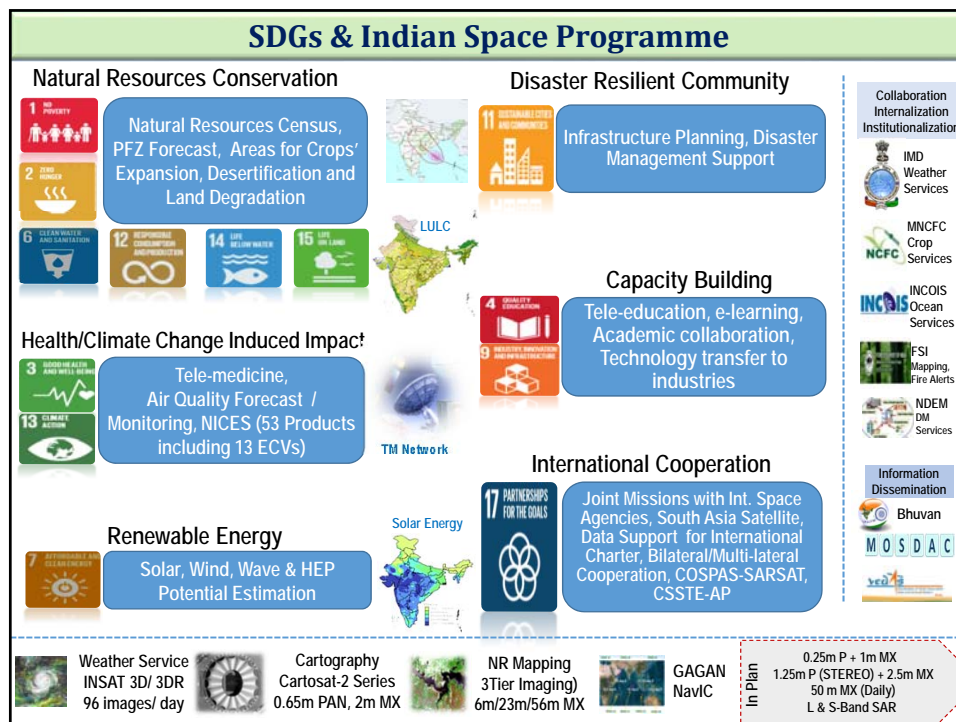


Space Applications Mechanism in India



Space Applications Verticals





Country practices in Action Area-1 (Research and Knowledge sharing)

Indian Trends in Support of SDGs

More numbers of satellites and enhanced capability

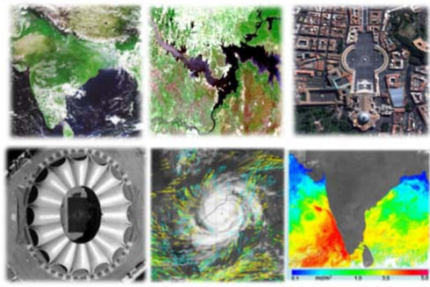
- Three tier imaging : 56 m / 23 m / 5.8 m
- Revisit Capability : 03 / 11 / 03 days
- 2.5 m Stereo imaging
- Sub-meter PAN and 1.5 m Multi-spectral
- Ocean color 360 m with 2 days revisit
- PFZ, Ocean State Forecast
- Ocean Altimetry, Surface Wind Vector
- 6 Bands Imager – 48 images per day
- 19 Channel Sounder – Atm. Profiles
- Radio Occultation – humidity profiles

Easy access to data

- Satellite data prices are reducing
- Most of the data becoming 'Open and Free'
- More data portals like Bhuvan, Mosdac, etc.

Enhanced data processing infrastructure

- Analysis Ready Data and time series data
- Better storage to archive old data, parameter retrieval, ECV inventory



Space agencies are operating or planning 322 individual EO satellite in the 2017 – 2032 period - **CEOS report**

Free downloads through Bhuvan

Product	Availability
AWIFS Ortho 56 m	2008, 2009, 2010, 2013
LISS-3 Ortho 23 m	2008-09, 2011, 2012, 2013
IMS-1/HYSI	2008-2012
Oceansat OCM GAC	2011-2015

- Free downloads coarser than 23m resolution, CartoDEM, Oceansat data, Scatsat-1 data etc. made available free and open since 2010.
- Total 10.08 lakhs products in 2017-18 itself.

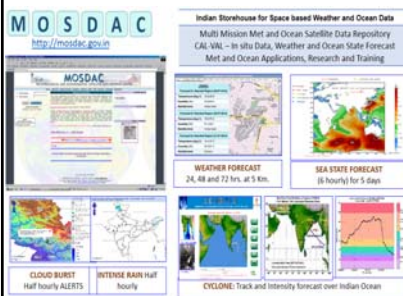
Actionable Products & Services – Web Portals

BHUVAN



- > 55,000 registered Users
- 95 Million map tiles/ month; 900 GB of data flow
- Visualization of Multi-temporal & Multi-sensor images
- Ortho-image base, Thematic & Geo-physical products
- 75+ Web applications & Citizen-centric Applications,
- Geospatial platform for Planning & Monitoring of developmental activities

MOSDAC



- Repository of Space based Weather & Ocean Data, Geo Physical Parameters
- Weather Forecast : 24, 48 and 72 hrs. at 5 Km.
- Ocean State Forecasts : (6 hourly) for 5 days
- Cyclone Track, Intensity & landfall forecast
- Alerts : High Intensity rainfall, Cloud Bursts, Heat wave;
- Large number of Registered Users and Institutional Users
- Met & Ocean Research & Training

Country practices in Action Area-2 (Capacity Building and technical support) Academia – Industry Interface – Building Capacity



Free satellite data downloads

Outsourcing

E-learning / Vocational trainings

Crowd Sourcing & Asset Mapping

Software Development – IGIS, e-SMART

Start-ups and Incubation

Outreach facility



Centralised outreach facility for Training, Outsourcing, Skill development and an Incubation.

Research Platform for Academia



Research & training to Academia by providing data, domain knowledge and infrastructure, development of newer techniques/algorithms

Country practices in Action Area-3 (Regional norms and standards / intergovernmental platform)

Data Exchange


- International Disaster Charter and Sentinel Asia for Disaster Management Support
- USGS (Landsat – 8/7; Res-2)
- EC (Sentinel series of satellites)
- BRICS Virtual RS Constellation
- Resourcesat-1/2 data reception by INPE for environmental monitoring
- Meteorological Satellites through EUMETCast
- SCATSAT-1 data to NASA, NOAA, KNMI, EUMETSAT
- CSA (RADARSAT C - SAR)

International Charter

2016	2017
• Activations: 28	• Activations: 29
• Countries: 20	• Countries: 22
• No. of scenes supplied: 133	• No. of scenes supplied: 140

Joint Missions


Megha – Tropiques, SARAL, Satellite with Thermal Infrared Sensor, ARGOS onboard Oceansat-3, Youthsat, NISAR (L & S Band SAR), GPS RO, Mission for Climate Change Studies, AVIRIS-NG, Cal/Val using Int. sites




NISAR (2020)


Joint Indo-US satellite mission for earth science studies

Sentinel Asia



Data sharing under G-to-G arrangement






MEGHA TROPQUES (2011)

Joint Indo-French mission for studying water cycle & energy exchanges of tropical convective system.




Opportunity with International Platforms/Bodies

ISRO's Contribution to CEOS

Land Surface Imaging (LSI) – **Resourcesat-2**
 Ocean Colour Radiometry (OCR) – **Oceansat-2 OCM**
 Ocean Surface Vector Wind (OSVW) – **Oceansat-2 Scatterometer**
 Precipitation (PC) – **Megha-Tropiques**
 Ocean Surface Topography (OST) – **SARAL**
 Sea Surface Temperature (SST-VC) – **INSAT 3D/3DR**



SAARC STORM: Establishment of weather observation network (AWS, DWR & GPS Radiosonde) in Bangladesh, Nepal & Bhutan for severe thunderstorm prediction

50 AWS, 4 GPS Sonda stations, 1 DWR

Lead positions


- Chair of CEOS WGCapD, ISPRS TC-V Chair, CEOS (2020), GEOSS-AP, CGMS (2018)

Contribution to GEO

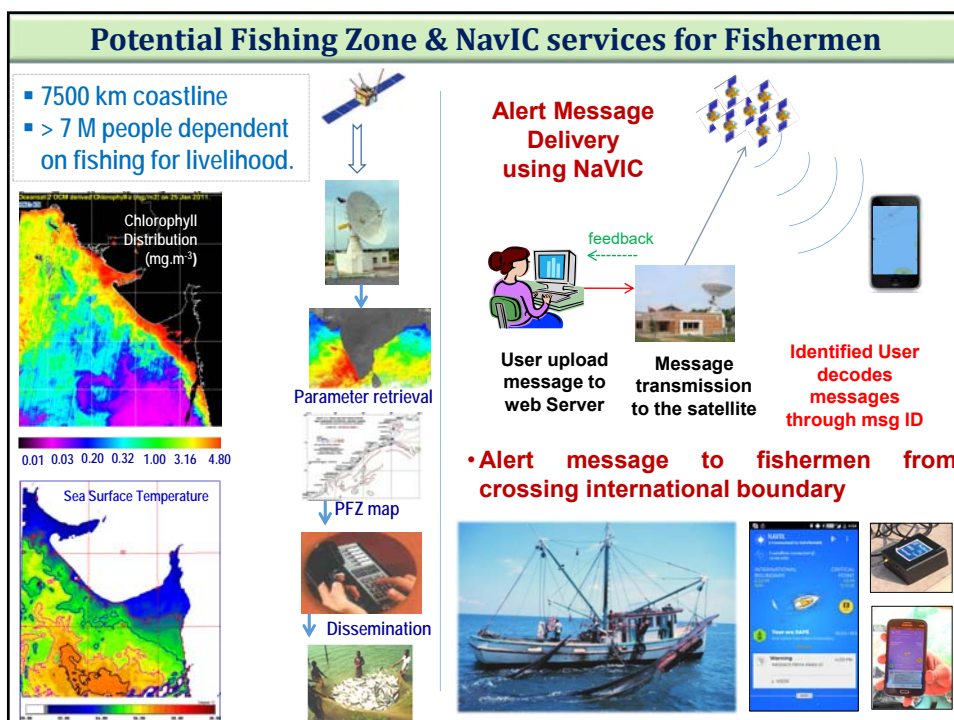
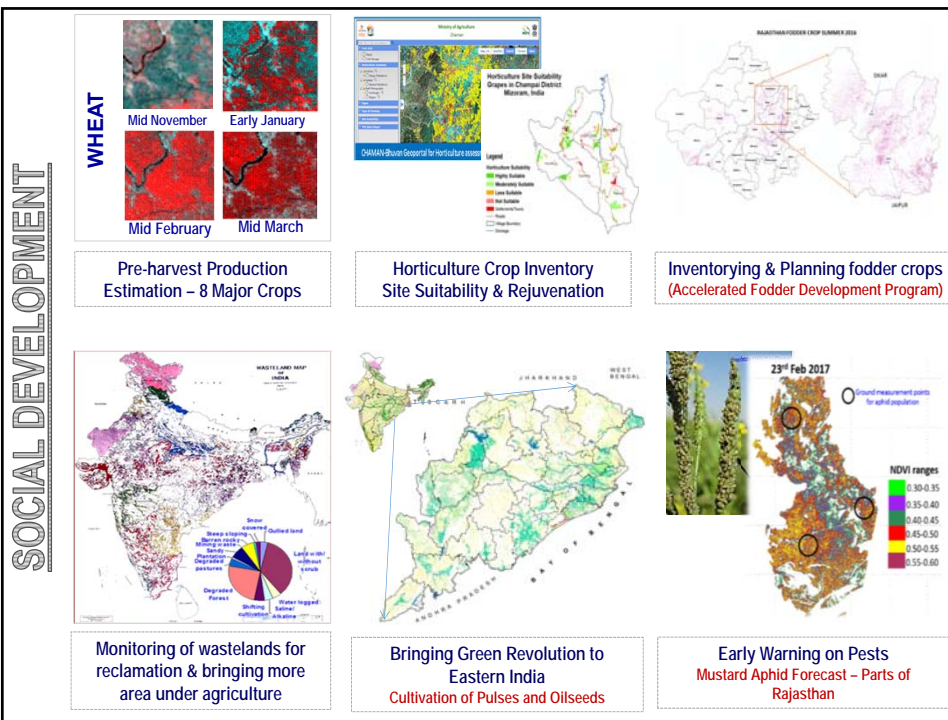
Participation in GEOSS Societal Benefit Areas (SBAs) including Global Agricultural Monitoring initiative (GEO-GLAM), Global Forest Observation Initiative and GEOSS Data CORE (Collection of Open Resources for Everyone)

Regional Cooperation

South Asia Satellite, Space Application for SAARC Countries, NR Data for ASEAN
 APRSAF, ACRS, UN-ESCAP

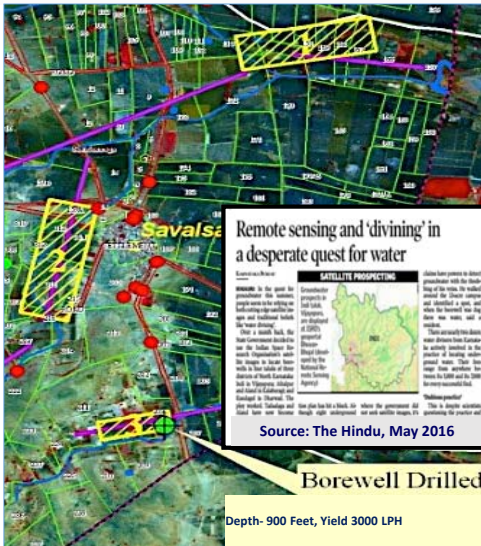


More than 1800 officials from 93 Countries are offered training by IIRS & CSSTEAP



Village Level Ground Water Prospect Mapping

During the 2016 Drought season, Village Level GW Prospects maps were generated for siting Bore wells (About 100 wells drilled @ ~85% Success rate)



8

* THE TIMES OF INDIA, CHENNAI
WEDNESDAY, MAY 10, 2017

TN hunts for water with satellite images

400 Aquifers Can Yield 90mld Via Borewells

Julie Mariappan
@timesgroup.com

Chennai: If you chance upon a team of officers going around villages with satellite imagery geophysical survey equipment and GPS, don't be perplexed. The government hydrogeologists are fanning out across the state, looking for aquifers, given the precarious water situation and the growing demand across the state.

The hydrogeologists drawn from the TWAD board began the process of remote sensing and GIS-based identification of aquifers since January after two successive

STATE'S WATER RUSH

TWAD board's satellite imagery come in handy for the search

Hydrogeologists analysed the state with satellite imagery and geo-physical survey equipment to identify water sources

> 404 aquifers were identified recently and borewells were drilled

> 138 more aquifers are found to be promising and will be linked to the existing water supply schemes in two weeks

> 50 million litres is being pumped out from these sources every day

> Infiltration wells were dug up on the river beds

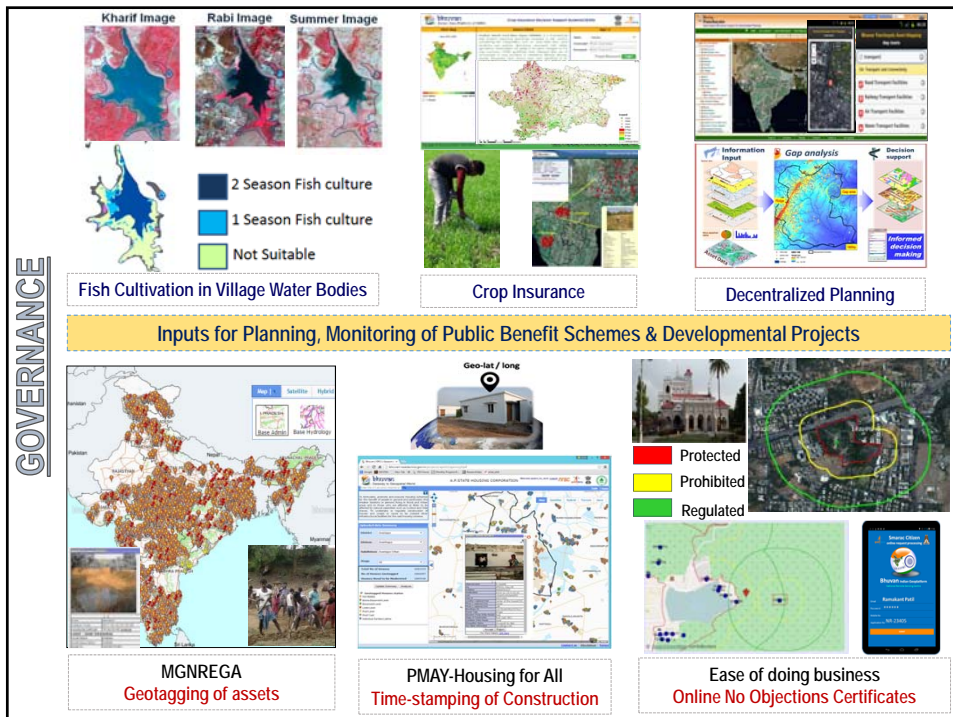
using satellite imagery and field data come in handy now. "The hydrogeologists managed to identify 404 aquifers till date and borewells were drilled, including 10 large infiltration wells dug up on the river beds to augment the supply through TWAD Board," said a senior government official. The state is predominantly covered by hard crystalline (75%) and unconsolidated, sedi-

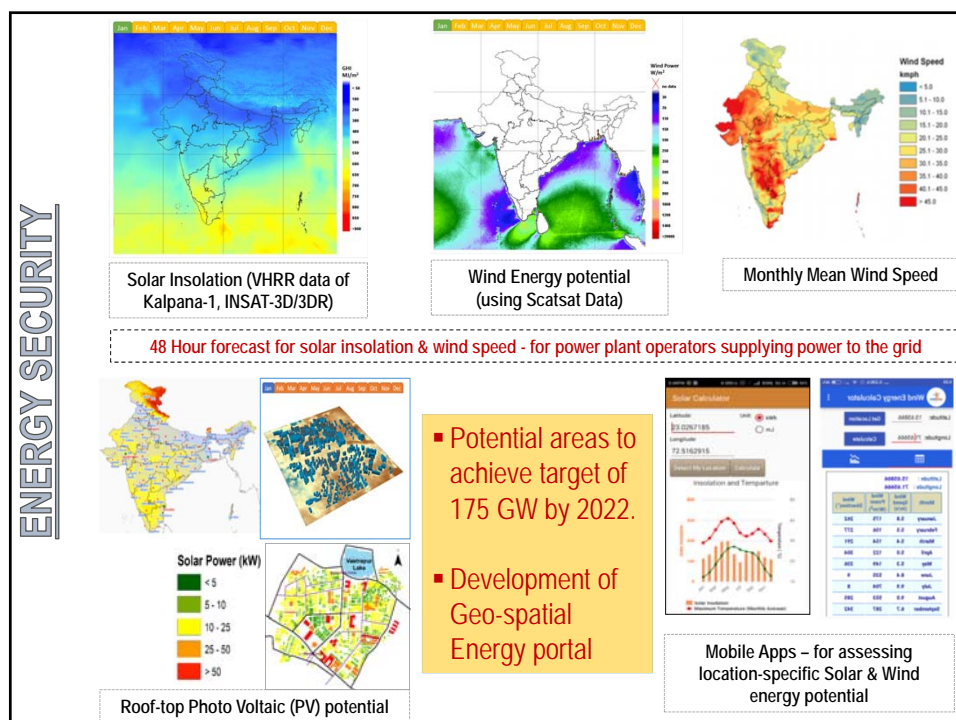
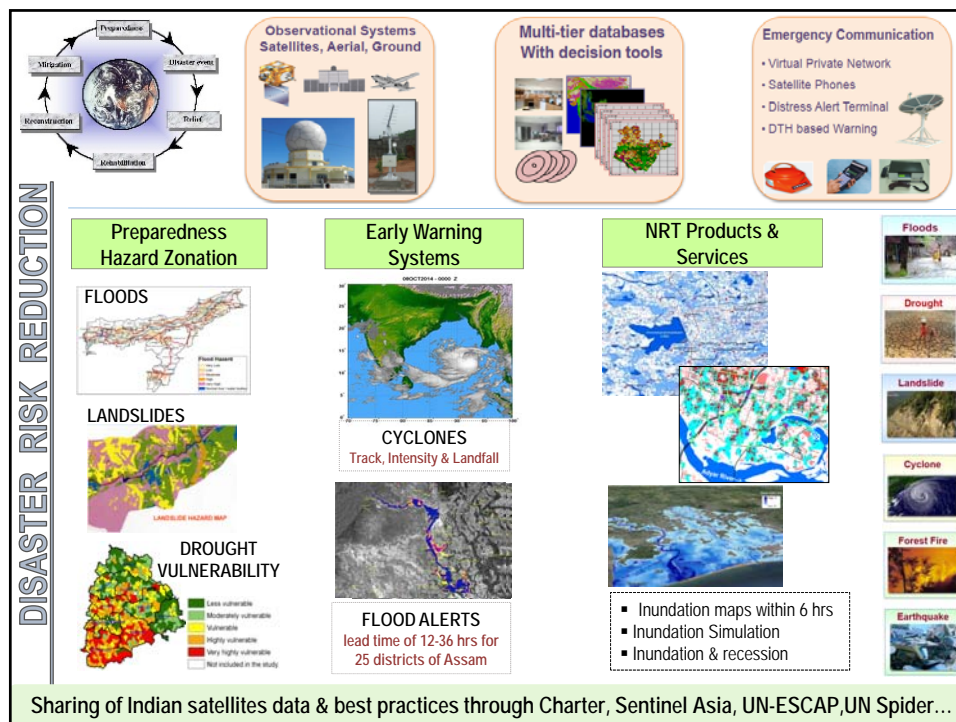
than 75% of the designated quantum of water supply schemes since March. "Given the depleting groundwater levels, new borewell sources could fail, unless sustainability is ensured. It is a stop gap measure," said another official. The water managers are hoping for a revival of good monsoon this year beginning June.

The dwindling storage in major reservoirs is a cause

538 aquifer zones were identified in these districts and bore wells were drilled to supply 120 MLD of drinking water to the drought affected villages during the drought season of 2017

Source: The Times of India, May 2017





CONNECTIVITY - ACCESS TO BASIC SERVICES



TELE-MEDICINE NETWORK

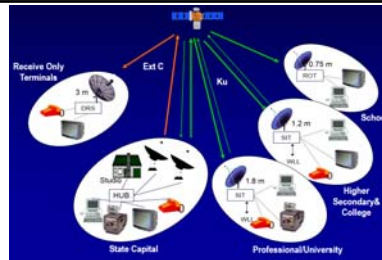
Health Care reaching to Remote / Rural Areas



CARES (Analysis of Random Epidemic Samples)



SEHAT - Geo-Tagging Health Resources & health profile data



TELE-EDUCATION NETWORK

Interactive training and skill development

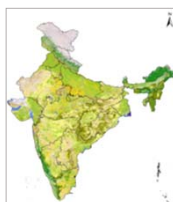
Primary/Secondary School Education
Technical/Professional Education
Distance Education, Adult Education
Teachers' Training, Vocational Training



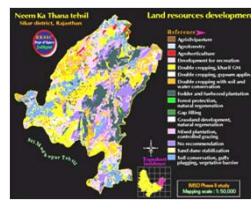
e-learning courses in Remote Sensing and Geospatial Technologies and their applications

MANAGEMENT OF NATURAL RESOURCES

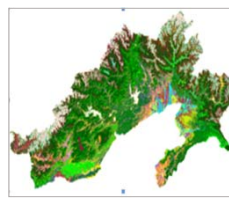
Resource Conservation...



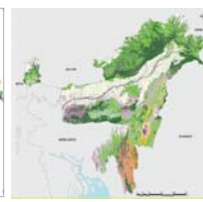
NR Census



Watershed Development
Land & Water Resources Plan



Assessment of forest Cover
Rapid Forest Mapping



Bio-diversity Charact.
Biological richness & disturbance area

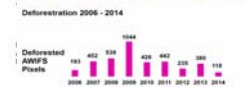
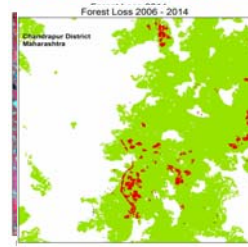
Impact Assessment

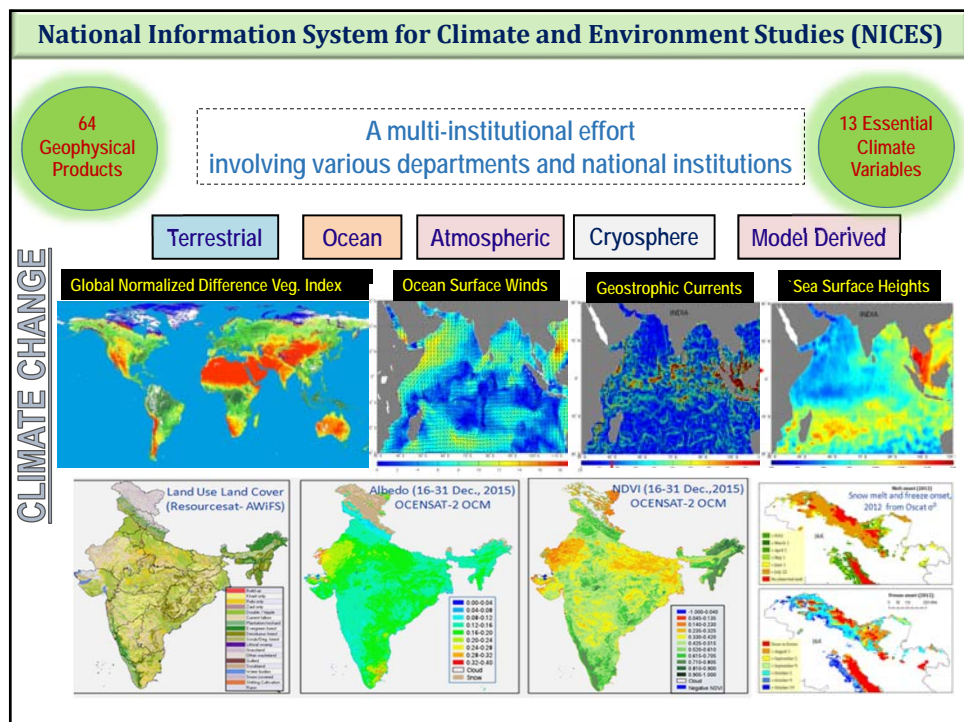
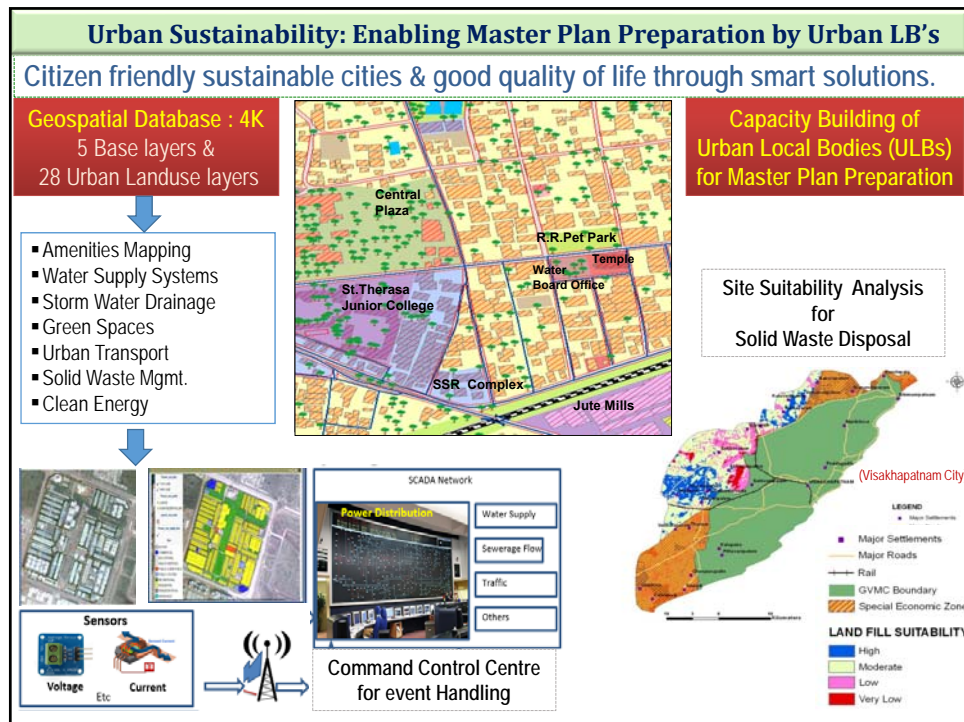


Monitoring Watershed Development
86,000 micro-watersheds



Monitoring Mining Deviations
Impact Assessment





EARTH OBSERVATION APPLICATIONS – ROAD MAP				
DOMAIN		2017 - 2020	2020-2024	2024-2030
SECURITY	FOOD	Crop Assessment – Agriculture & Horticulture Techniques for Production forecast (8 crops) Watershed Development at micro-watersheds Wasteland monitoring Improvements in PFZ advisory : Inland fisheries	Minor & mixed crops assessment, Crop intensification & diversification Techniques for Production forecast (more crops), Crop monitoring & farmer specific advisories Crop pests & diseases, crop-loss estimation & enabling crop insurance for major crops , Area-specific precision farming , Improved inputs for land & water conservation practices, Dynamic fisheries forecast & deep sea fishing	
	WATER	Water resources assessment & management Surface water mapping: Irrigation infrastructure assessment Ground Water Potential Snow melt runoff	Near real time monitoring of command areas, Surface water mapping with improved spatial & temporal scale, Improved irrigation infrastructure assessment at field level, Optimal water distribution at village level: Aquifer information system & GW budgeting Improved models for Snow melt runoff	
	ENERGY & ENVIRONMENT	Assessment of renewable energy potential & Site Suitability, Hydrocarbon, coal & atomic minerals prospecting Inventory of Landuse/ land cover, Land degradation, Snow & Glaciers, Wetlands at regular intervals Forest cover change Alert, Mangroves : Coral reefs; Coal fire monitoring, Land subsidence Generating Essential Climate Variables Health GIS	Improved assessment of renewable energy potential towards sustained energy management Advanced hyper-spectral techniques for Geological exploration Improved inventory Natural Resources (Scale, Categories) Air & water quality monitoring. Generating Climate quality products , Climate adaptation related advisories Early warning of diseases; Site suitability for medicinal plants	
	INFRA-STRUCTURE	Enabling Urban Master Plan Preparation (500 cities) Rural & urban Infrastructure Planning & Monitoring Urban growth monitoring	Enabling Master plan preparation (All towns / cities) ; 3D city modelling for Smart city development ; Infrastructure Planning & Monitoring – Rail, Road & Pipe-line	
OCEAN & METEOROLOGY		High resolution Ocean State forecasting Models for Weather forecasting < 5 km grid Improving prediction of Tropical Cyclone & extreme rainfall events	Mapping of finer scale ocean features for naval applications Improved Models for Weather forecasting : HR (1 km) prediction of surface winds, air-temp, solar radiation ; Prediction of extreme rainfall events & thunderstorms with accuracy of 1 km & time accuracy of 15 minutes, Seasonal prediction of Monsoon rainfall at 10 km resolution, Aviation and maritime transport advisories	
DISASTER	RISK REDUCTION	Hazard zonation, Damage assessment Experimental forecasting- Cyclone, Flood & rain triggered Landslides Geospatial Database for emergency management	Improved early warning models: cyclone, flood & rain triggered Landslides, Earthquake precursor analysis, real time forest fire alerts, Improvement in turn around time for information delivery Prediction models and dam break analysis, Generation of HR 3D for disaster prone areas Seamless integration of space based information Database for NDMCC Real-time prediction of Storm surges throughout Indian coastal regions Local level disaster response through community involvement	
GOVERNANCE & INFORMATION SERVICES		Asset mapping & Decentralised planning at Panchayat level Enabling Planning, Monitoring & Evaluation of developmental programmes	Update of Images and spatial database every 2 years for entire country; Improved action plan development for implementation at Panchayat level; Augmenting Bhuvan Panchayat Web Services, Development of Decision support tools	
		BHUVAN - Data visualisation & thematic services (50 nodes), MOSDAC- Weather and Oceanic services	Enriching Images , POI & Thematic data / services, Enhanced collaborative mapping & DSS Enhanced data products/ services for weather, ocean & atmosphere	

Thanks

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