



# **Using Indian EO data for resource conservation & sustainable development planning**

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# Outline

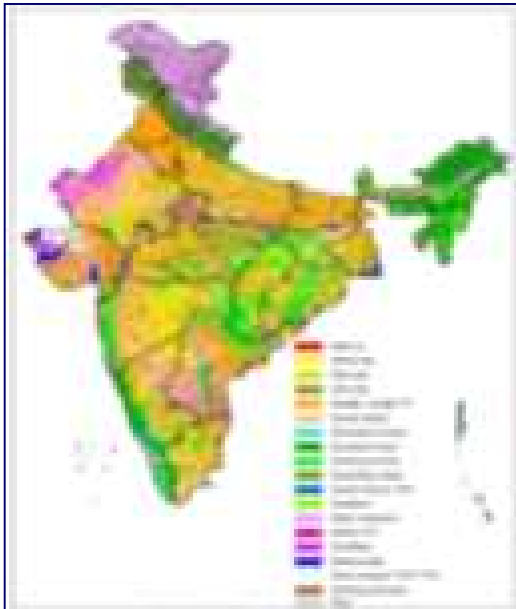
- Sustainable Development : **India Facts**
- Indian EO Satellites & Applications
- Challenges & National e- Governance Program
- EO Applications for Sustainable Development (SD)
  - *Monitoring & Info systems for Natural Resource Mnagement*
  - *Achieving sustainable resource use (Decentralised planning)*
  - *Environment Protection*
  - *SD with Disaster Risk Reduction*
  - *Urban & Infrastructure Planning*



# India

- Geographic Area : 328.8 MHa
- Population : 1256 Million (est 2014) ; [29%, 0-14 Years]
- Urbanization : 31.7 % (2012)
- Food Production : 280 Million t
- Forest Cover : 70 Mha

***CHALLENGE : Diversity, Scale, Resource Conservation, Inequality***



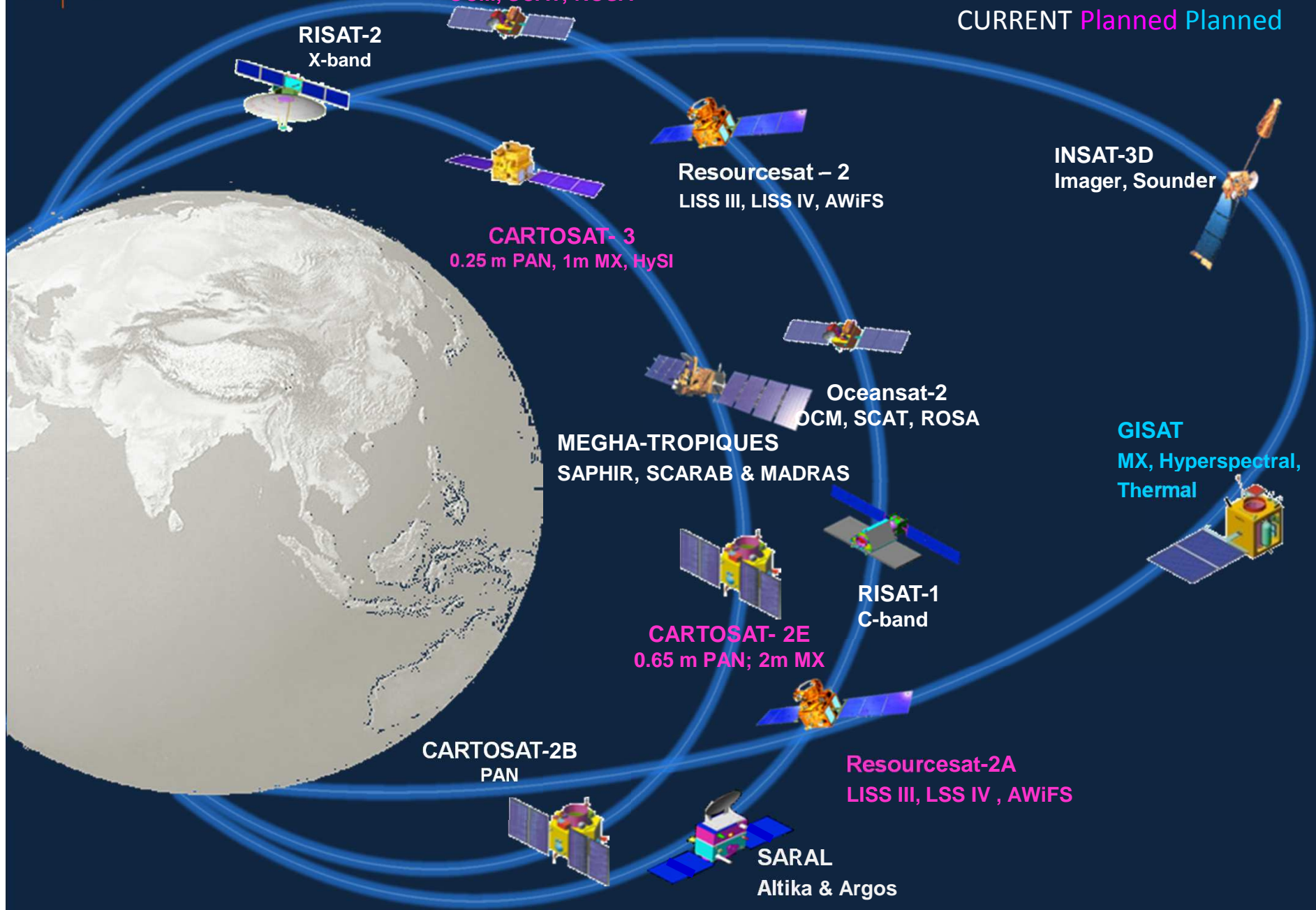
## Natural Resource Census

- Periodic Inventory of Natural Resources under NR Census Programme:  
*Land use/ Land Cover, Soil, Geomorphology, Wetland, Land degradation, Snow & Glaciers, Vegetation*



# Indian EO Missions

CURRENT Planned Planned



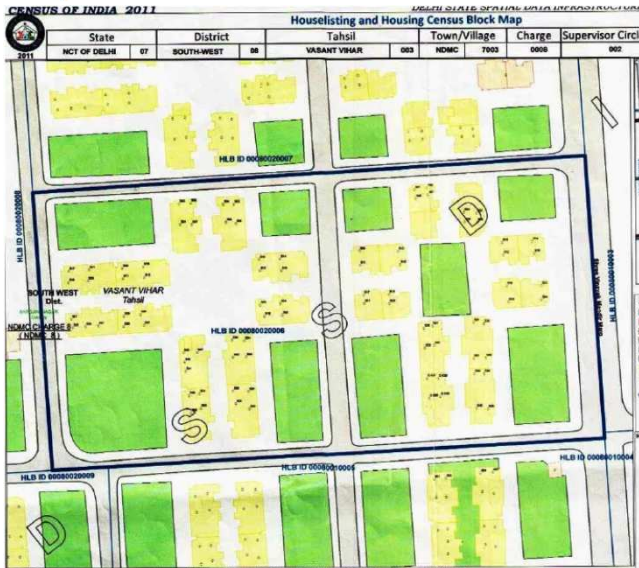


# Challenge of counting 1.2 billion

- Census 2011 of India, 15<sup>th</sup> since 1872 adopted ICT, space observations & geomatics
- Challenge
  - *Counting billion plus with a household questionnaire > 50 parameters*
- Approach
  - *House & Household enumeration (2010)*
  - *Census Enumeration (Feb 2011)*
- Use of Geomatics in Pre-Census Phase
  - *Ensure pre-labelling of seamless/ without overlap all houses in the country*

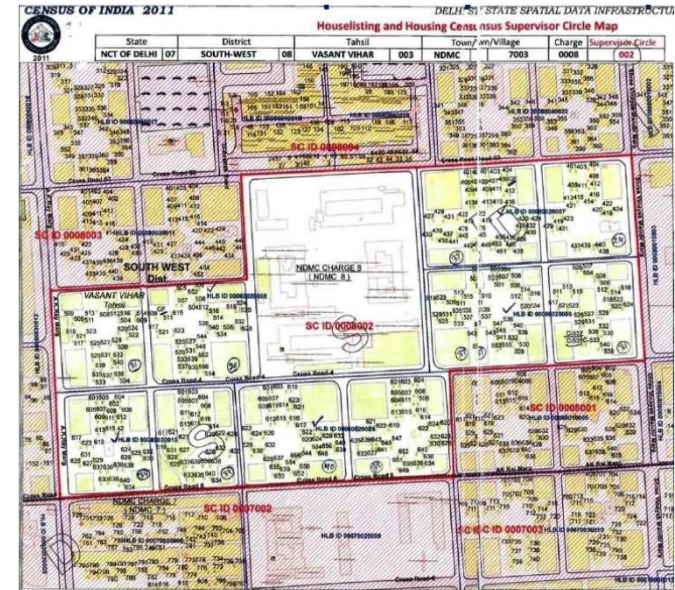


# Example of Maps for Census

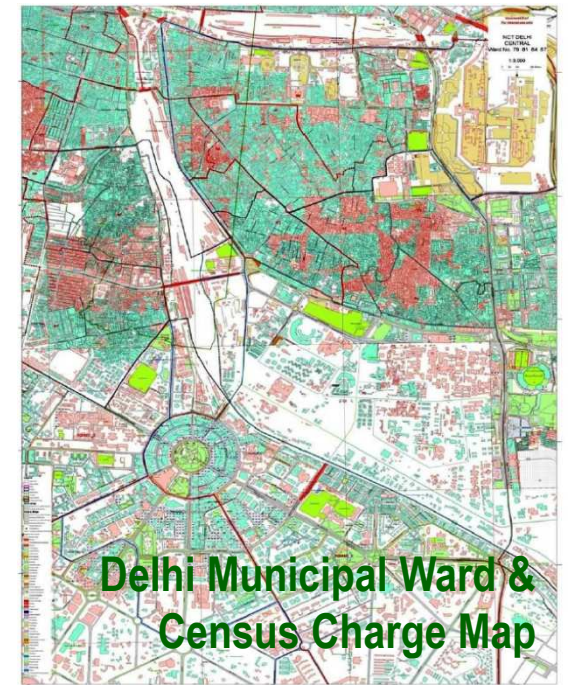


Enumeration Block (EB)  
indicating location and each house/building

Supervisory Circle  
comprises six contiguous EB



Census Charge Map





# Local Interventions for sustainability

- Soil & water conservation at local scale is most critical component for building sustainability
- Major Government Policies & Schemes support it monetarily
  - *Integrated Watershed Development Program*
  - *National Watershed Development & Reconstruction Program*
  - *National Rural Employment Gaurantee*
- EO data are used for **planning**, **implementation** and **monitoring** phase of these programs
- EO data extensively used and lessons learnt have led to new EO application program
  - *Space Information Support for Decentralised Planning*

## CARTOSAT-1 +IRS LISS-IV MERGED DATA with CADASTRAL OVERLAY



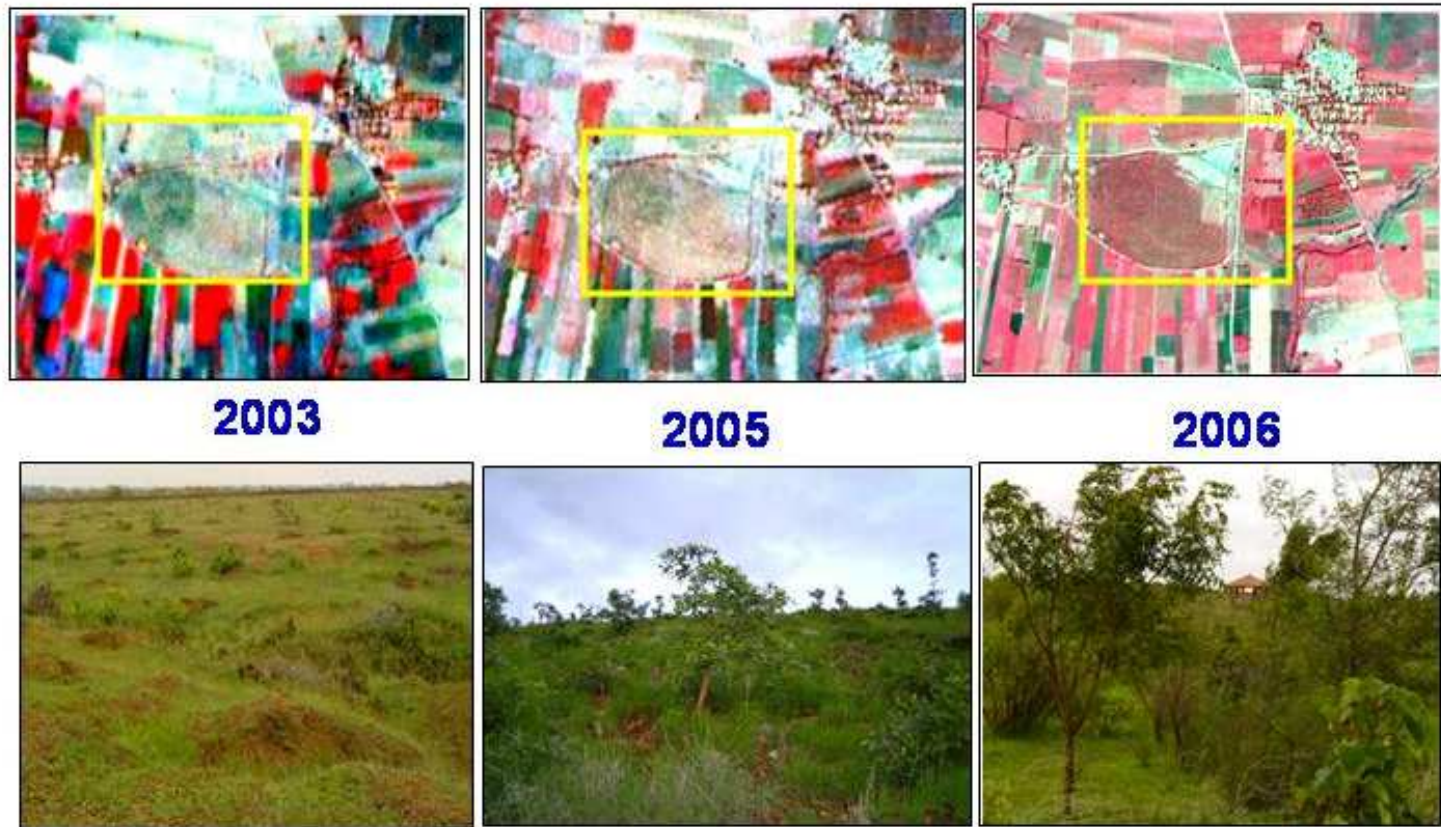
**NABARD Supported Holistic Watershed Development Programme (NHWDP) for  
Six Districts of Vidarbha, Maharashtra**  
**Capacity building for PIAs + NGOs for enhanced Resources mapping on 1:10K**





# Watershed Development: Monitoring, Evaluation

- Sujala – 738 watersheds treated (500,000 ha)
- World Bank funds US \$ 127 million
- Monitoring & Evaluation by Antrix/ ISRO

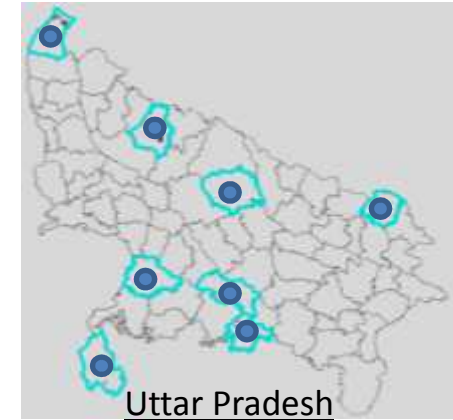


*Field & LISS-IV monitoring of afforestation; Itagi SWS, Karnataka*

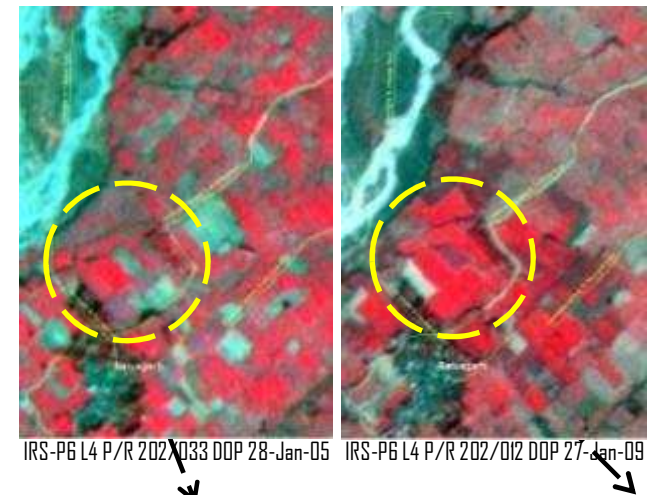


# NWDPRA Watershed Monitoring

- 45 micro-watersheds spread across 8 districts of UP
- Area of watersheds ~ 500 ha
- Change detection study using IRS-P6 LISS-4 temporal data
  - Baseline data preparation (2005-06)
  - Con-current Treatment Monitoring (2008-12)
- Development of MIS/ GIS  
Monitoring Indicators



#	Indicators	Data source	Information Content
1	Natural resources	Temporal LISS-4 & field observations	Cropland, Crop type, Plantation, Sustainability, Drainage line treatment
2	Ecological improvement	-do-	Soil & Water Conservation measures, Wastelands, Pastures, Stabilized slopes, Treated gullies , etc.
3	Technical indicators	Field, satellite & ancillary sources	Water table rise, Flood moderation, Erosional/ runoff characteristics, etc.
4	Institutional building and community organization	Ancillary sources	No. of farmers trained, % of population willingly adopted conservation practices, etc.
5	Economic and social	Ancillary sources	Change in household income , Change in living standard , alternate employment opportunities, etc.
6	Essential service	Ancillary sources	Literacy rate, no. of schools, no. of houses with electricity, fuel wood availability, etc.



## Field Observations



Check dam for in-situ moisture conservation



Bunds erected along field boundary



Rows of Eucalyptus trees



3-tier agricultural practices



# Space Information Support for Decentralised Planning (SIS-DP)

- Decentralised planning is enshrined in Indian Constitution
  - *73<sup>rd</sup> Amendment (Panchayat Raj Institutions-PRI); 74<sup>th</sup> Amendment (Urban Local Bodies-ULB)*
- SIS-DP aims to provide access to EO data, derived inputs and technology support PRI & ULB for meeting planning needs
- Required image data base, thematic maps and web geo tools and access are being made available for 1:10,000 scale for field-scale applications

# Satellite Image Highlighting Erosion along high slopes



erosion

erosion

Indian Remote Sensing Satellites  
Indian Space Research Organisation  
Department of Space, Government of India

Hoshiarpur Dist, Punjab State

IRS Cartosat-1 (2.5m)  
IRS Resourcesat-1 LISS IV (5.8m)





Terrace cropping system on plateau slopes, South Urmodi Dam, Parali, Maharashtra



# High Resolution Satellite Data Showing Cultivation in Sand dune areas in Bhiwani Dist, Haryana State



Sand dunes

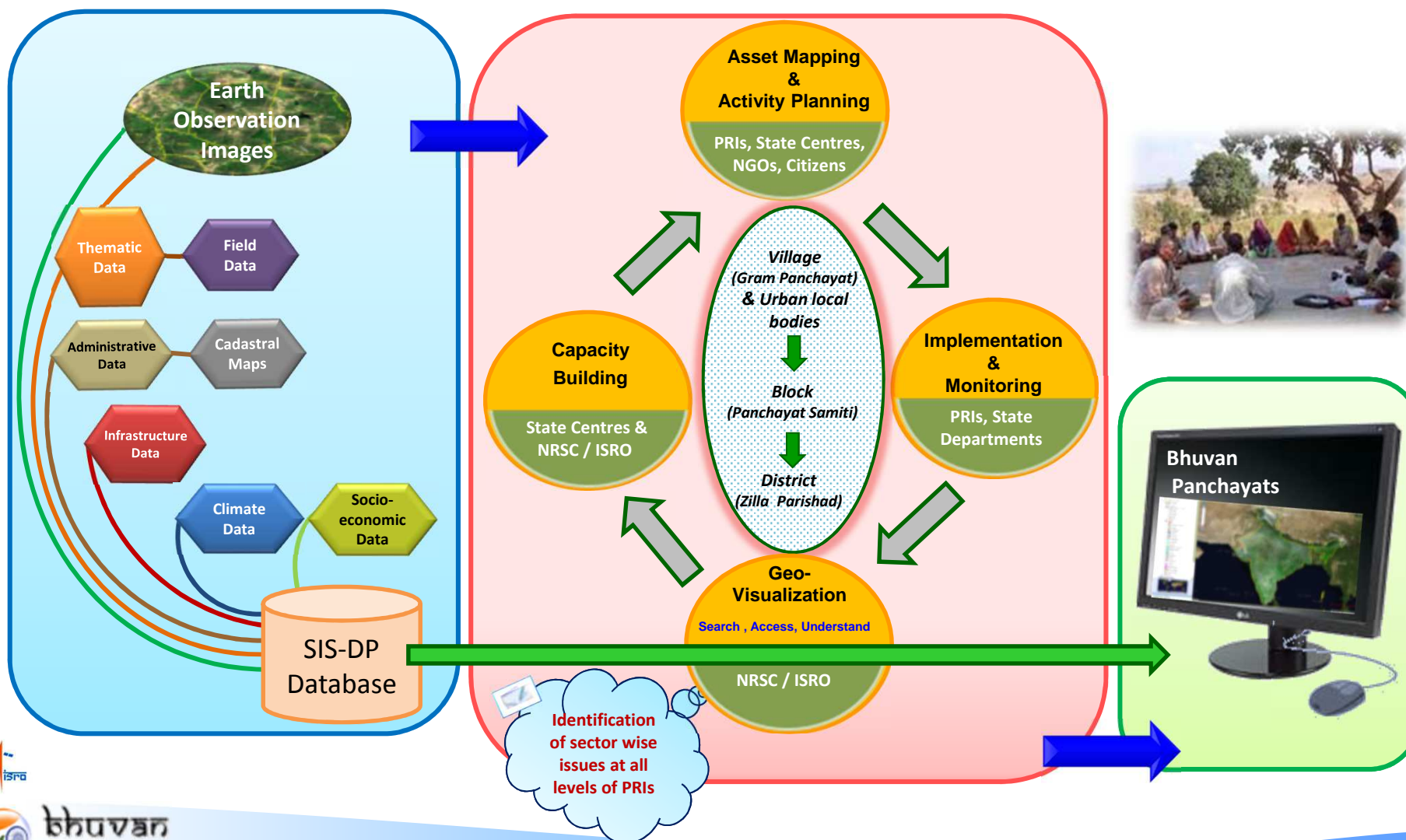
Tosham

# SIS-DP Conceptual Framework

**1. Database Generation and Organization**  
*Spatial & non spatial data*  
*NRSC & States Centres / partners*

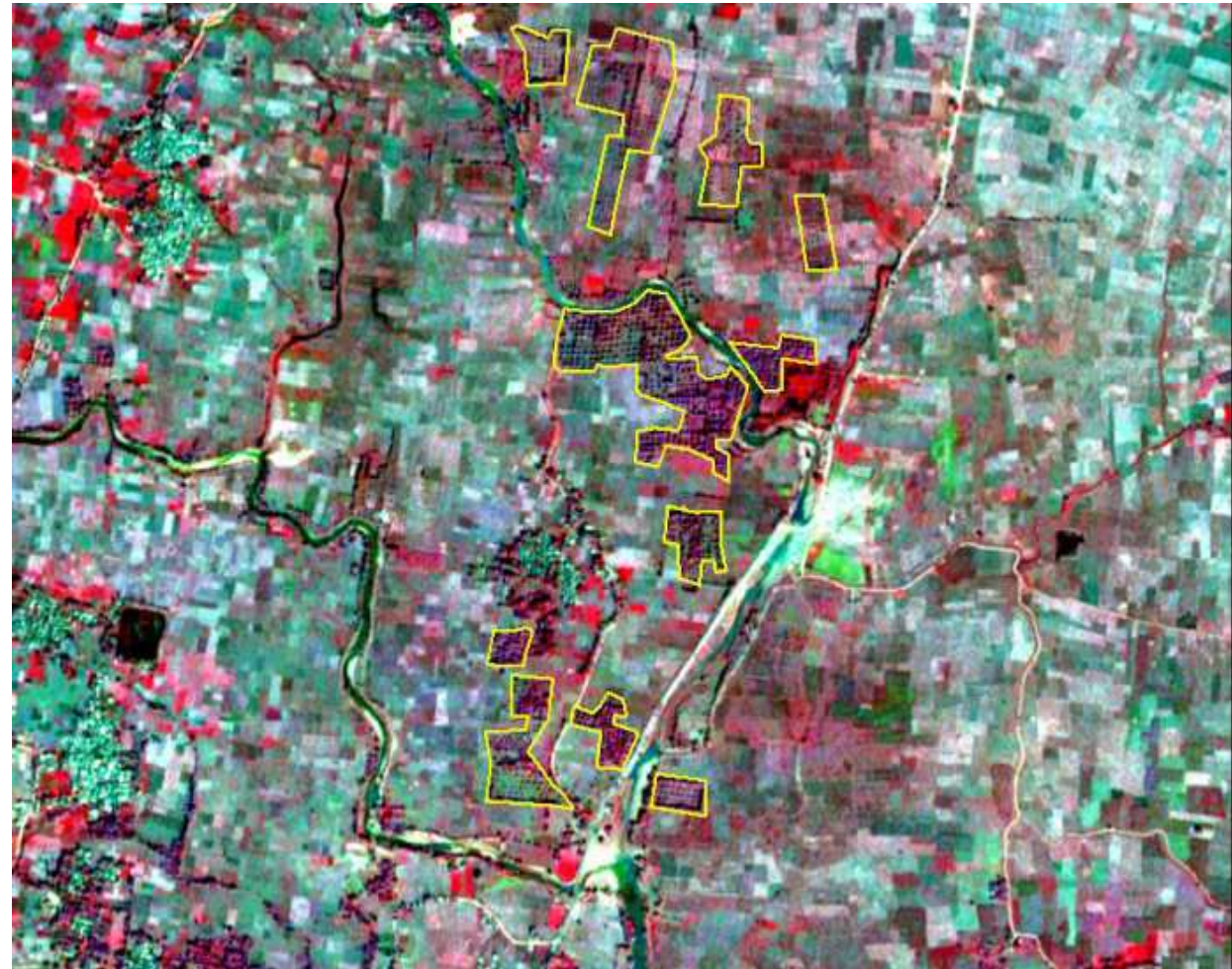
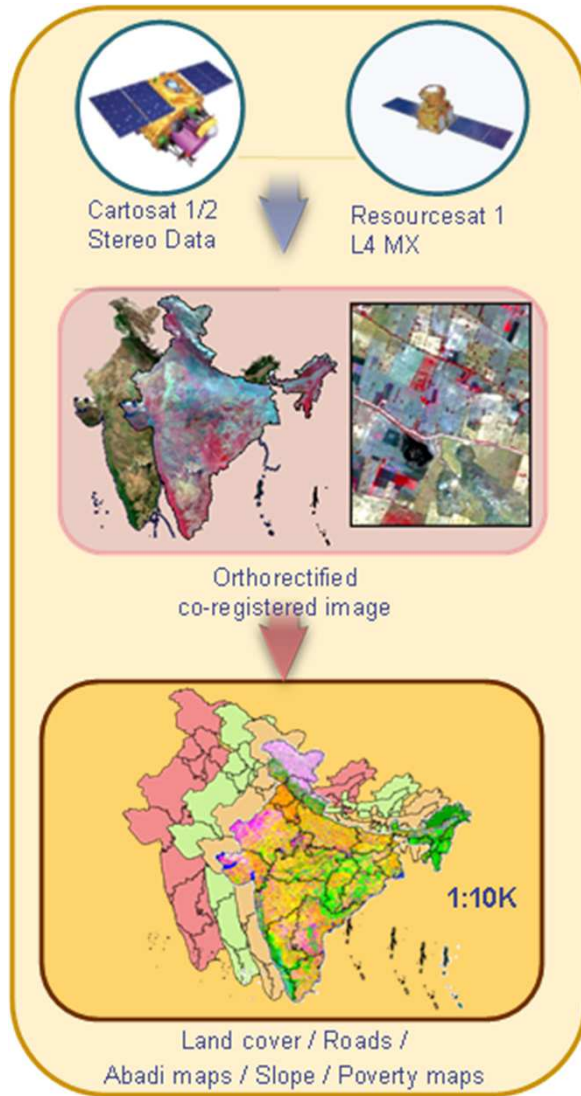
**2. Enabling Environment for PRI's**  
*Web Based System for PRI's – Four modules*  
*NRSC / ISRO*

**3. Outreach**  
*PRI's & Citizens*  
*NRSC & States Centres /partners*





# Space-based Information Support for Decentralized Planning

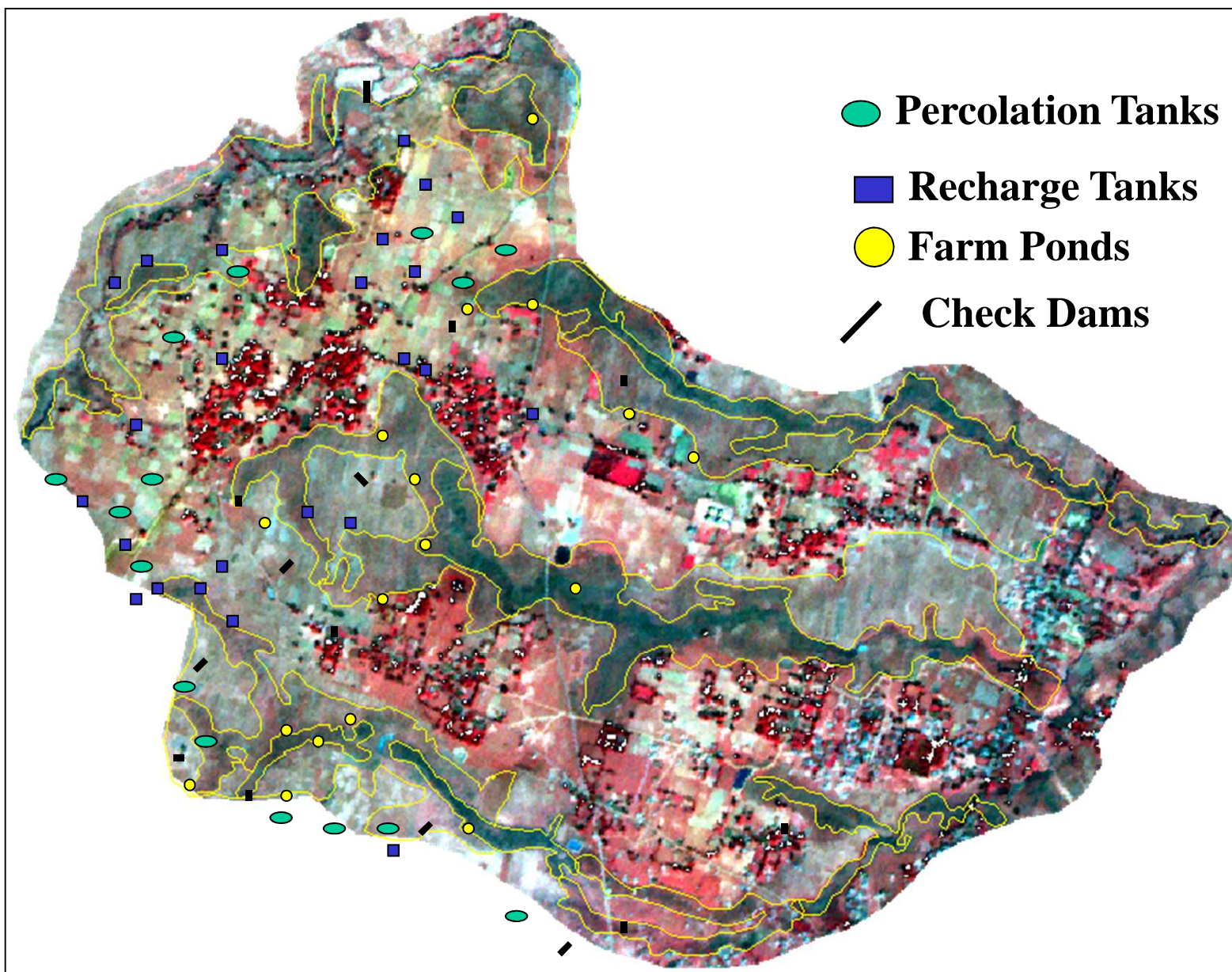


**Agricultural plantations: Meerut**

**Space-based Information Support for Decentralised Planning**



# VILLAGE LEVEL WATER RESOURCES PLAN



Bamandiha Village, Lohardagga Block & District, Jharkhand state



# Environment Protection

- **National scale Landscape-level biodiversity map**
- **Monitoring of National Parks & Sanctuaries**
- **Eco-sensitive area zonation**
- **Coastal Regulation Zones**
- **Environmental Clearance & EIA**



# Development Planning with Disaster Risk Reduction

- India is highly prone to various disasters
- EO program supports all phases of Disaster Management
- RECENT EXAMPLES
  - *Preparatory Phase*
    - Flood Hazard Zonation
  - *Early Warning Phase*
    - Cyclone Prediction (Phailin case study)
  - *Early Response & Relief*
    - Flood inundation mapping

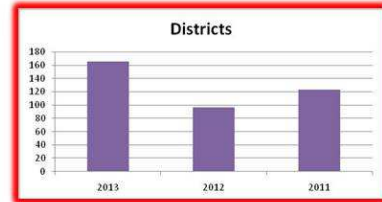
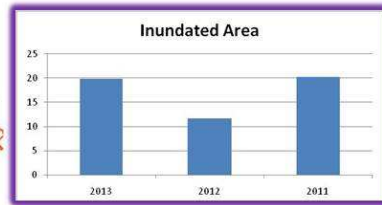
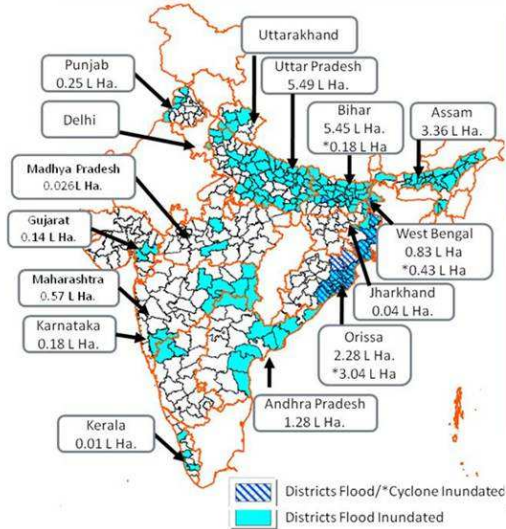


# EO Role in Flood Management



## Flood Inundation Mapping - 2013 npsc

15 States - 19.91 L ha. - 165 Districts - 144 Maps

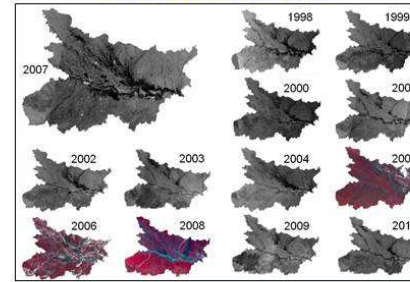


Users:  
 - Ministry of Home Affairs  
 - State Relief Commissioners



## Bihar Flood Hazard Atlas

13 Years (1998-2010)  
128 satellite datasets



### Broad Methodology

- Generation of flood layers from satellite data
- Preparation of annual flood layers (13 years)
- Integration and classification of flood layers of various flood hazard categories

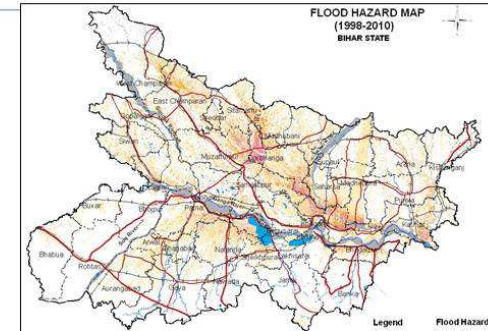
### Information Provided

- A Flood Hazard Atlas showing
  - District-wise Flood Hazard Area,
  - List of villages in high & very high flood hazard categories,
  - Flood hazard index for all districts

### Flood Hazard Index

$$\sum (\text{Hazard Category (Hw)} \times \text{Hazard Area (Aw)} \times \text{Intra Annual Variations (IAVw)})$$

Hw = Weightage for Hazard Category  
 Aw = Weightage for % Hazard Area  
 IAVw = Weightage for intra annual variation

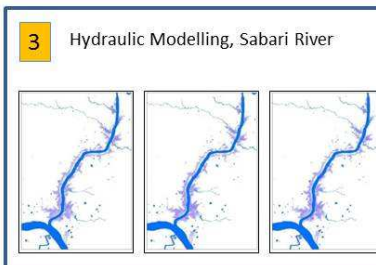
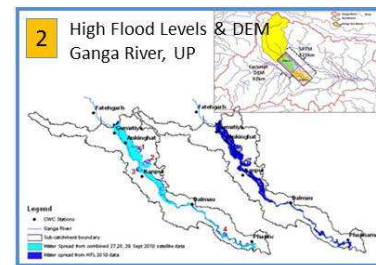
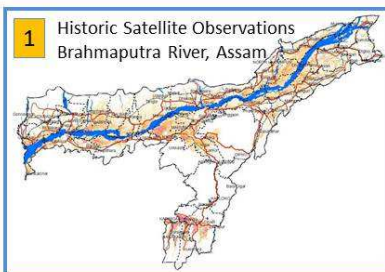


## Flood Prone Area Assessment

### Methods of Assessment

1. Historic Satellite Observations
2. Integration of Flood Level with DEMs
3. Hydraulic Modelling

DSC is in the process of bringing out the flood inundated area of the country based on satellite data of 2003-2012, as a first step towards flood prone area assessment





# Phailin Cyclone, 2013

- Bay of Bengal prone to many cyclones
- Previous super cyclone 05B occurred in Orissa in 1999, causing 10,000 deaths
- Phailin caused 21 deaths, most intensively forecasted & managed cyclone with 1.2 million evacuation. (13 million affected)



# Phailin : INSAT-3D & Oceansat

## Early Cyclogenesis Detection

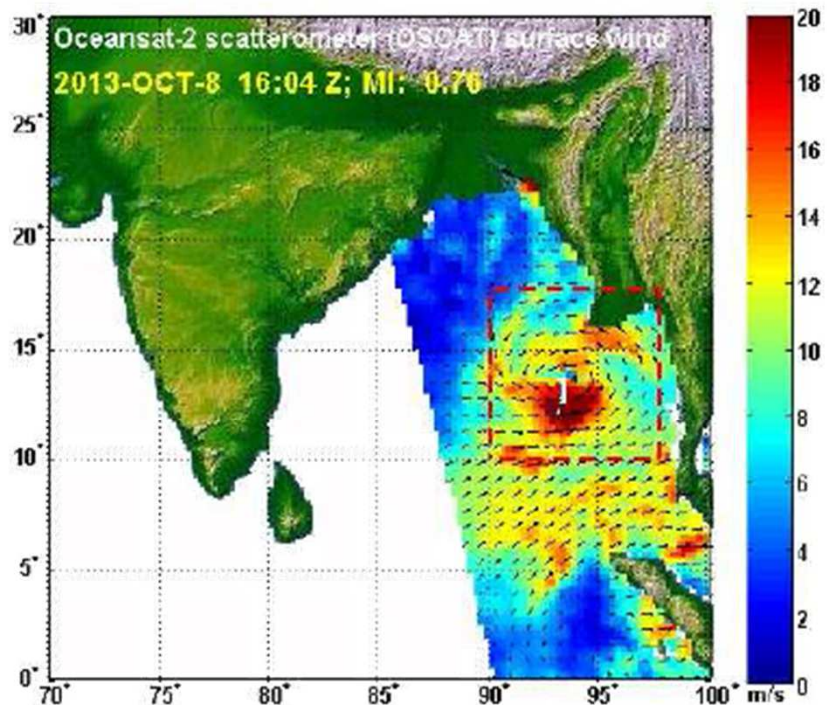
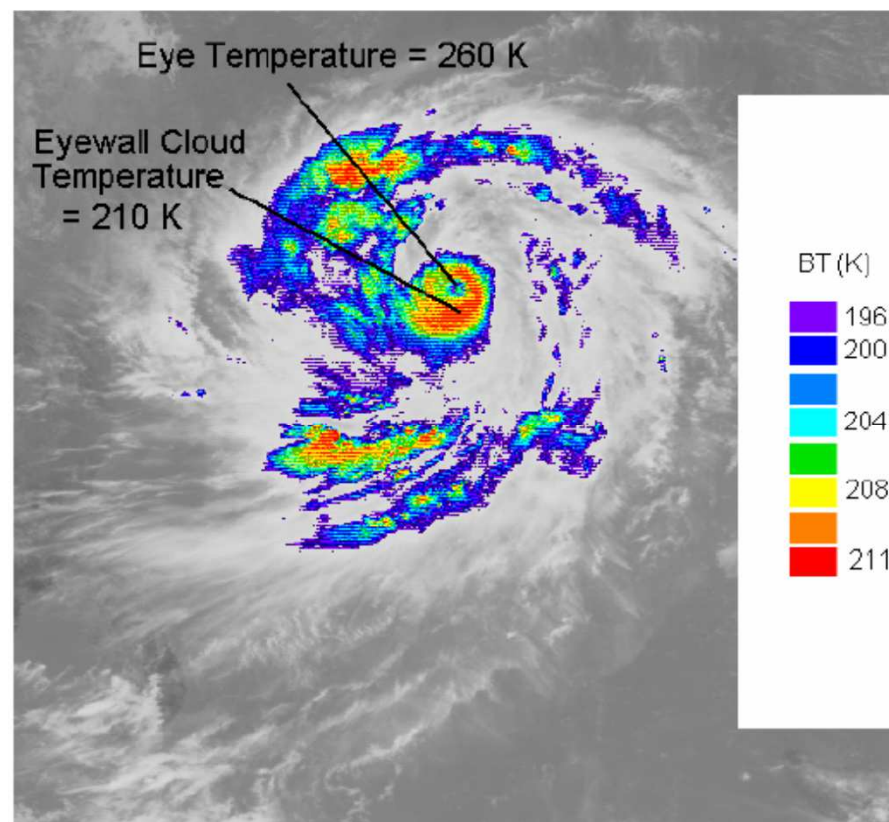


Fig. 2 : Patterns of OSCAT winds on 8<sup>th</sup> October 2013 indicating a strong possibility of cyclogenesis.

### INSAT-3D TIR-1 Channel Image of Cyclone PHAILIN.

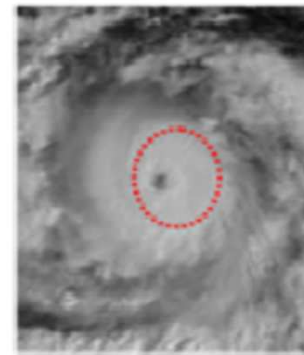
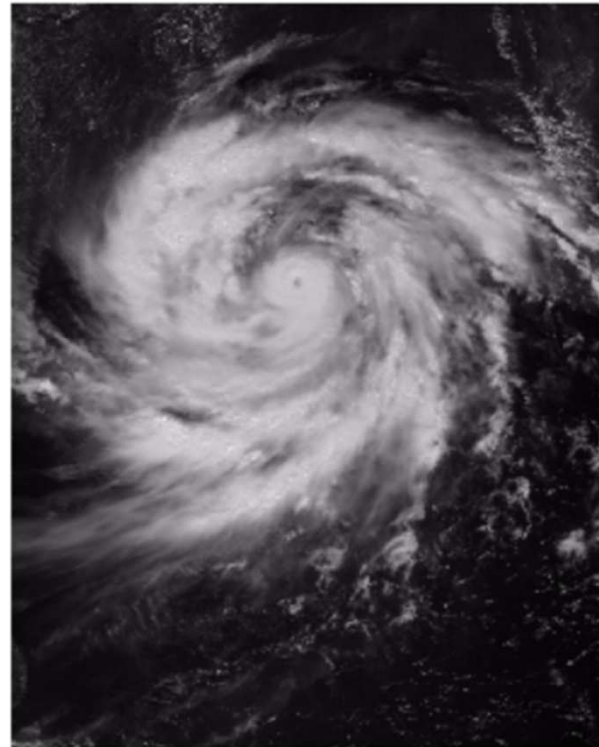
Brightness temperature gradients in the central dense overcast (CDO) region is useful for estimation of cyclone intensity.

## Improved Cyclone Characterization





# Phailin – INSAT-3D, Kalpana Comparison

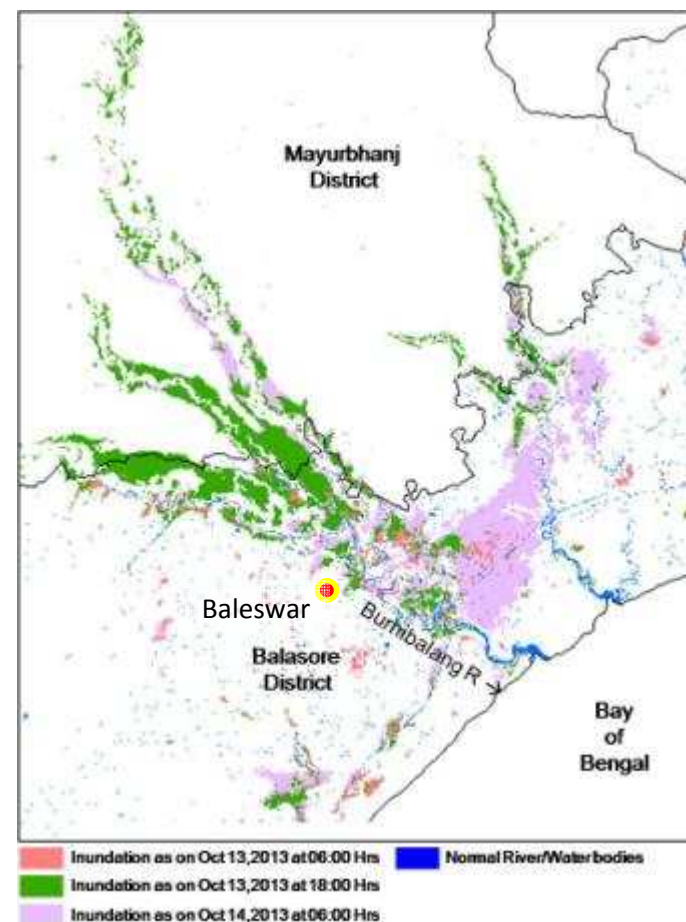
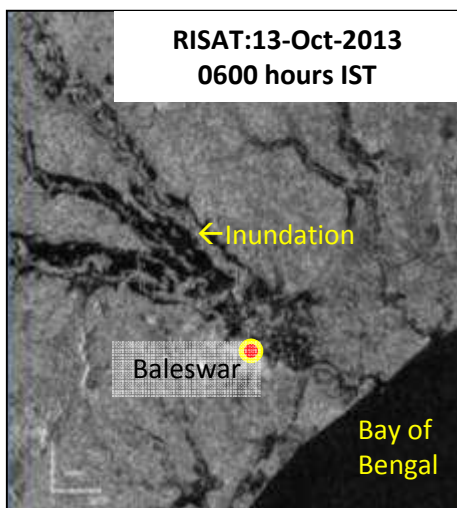
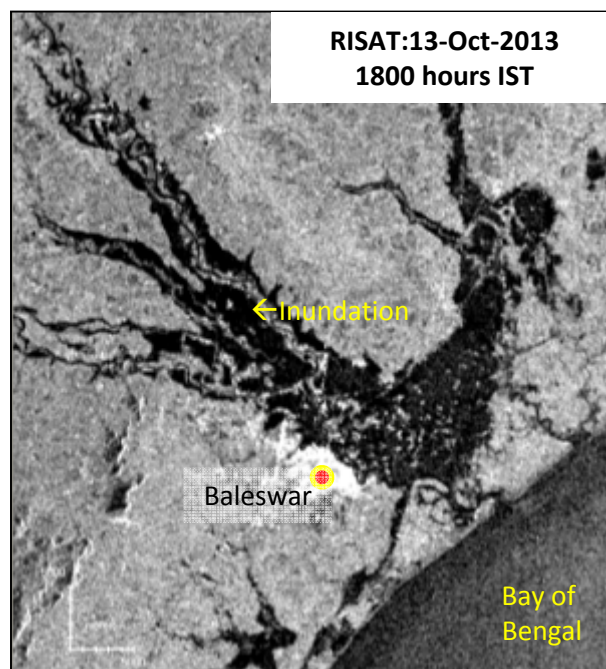
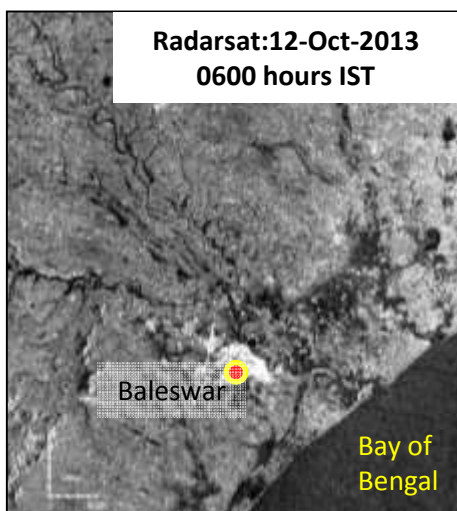


Coverage of cyclone Phailin by visible channels of (a) Kalpana and (b) INSAT-3D satellites on 11-Oct-0600Z. Higher resolution INSAT-3D images were useful in determination of key structural parameters such as radius of maximum wind ( $R_{max}$ )

# 12-hourly Monitoring with RISAT-1

## Baleswar, Odisha

- Severely affected districts like Balasore, were monitored on 12-hrly basis during peak floods and changes in inundated areas / village can be seen







# Urban Sustainability

- Urban Master Plans (UMP)
  - *Preparation, Mid-plan review of UMP*
    - National Urban Information System (NUIS)
    - National Capital Region (NCR) Mid-term review
- Monitoring Urban Environment
  - *Sprawl, green cover, lakes/wetlands*
- High resolution EO & photogrammetry for Urban Infrastructure
  - *Mapping squatter habitations, basic amenities provisions*

.ca 8000 Urban Areas/  
Towns & Cities  
> 75% have not Master plans



# BHUVAN-NUIS : Master Plans

- NUIS Spatial Database (1:10,000 scale) made available on BHUVAN for multiple applications
  - Citizens : Visualization , Feedback
  - Urban Planning Bodies : (National & State) : Status query, Approval of Plans
  - Local Planning Body – Add layers, Upload, Edit layers, Propose Plan layers
- Open Source Plugin at Client End : Only Internet Needed

Feedback

Status

Projects-Urban:NUIS

Welcome Je\_Jabalpur Logout

Town Jabalpur

Point Layers

- NUIS Towns
- Census 2011(1 lakhs+)
- Bhuvan Satellite Imagery Service

HIDE LAYER STATUS

NUIS LAYERS

- Base Layers
  - State/District/Village
  - Municipal
  - Road Central Line
- Urban Land Use
  - Builtup Urban
  - Agriculture
  - Builtup Rural
  - Drainage
  - Road/Rail/Bridges
  - Transportation
  - Wastelands
  - Rail
  - Canal
- Town Specific Data
  - Cadastral Map
  - Master Plan

Activate: Swipe Deactivate: Swipe

Contact us | Terms

Layer Name	Availability Status
State/District/Village	APPROVED
Municipal	APPROVED
Road Central Line	APPROVED
Builtup Urban	APPROVED
Agriculture	APPROVED
Builtup Rural	APPROVED
Drainage	APPROVED
Road/Rail/Bridges	APPROVED
Transportation	APPROVED
Wastelands	APPROVED
Rail	APPROVED

Feedback

FEEDBACK FORM

From: bhuvan@isro.gov.in

Subject: Upload of data

Detail: This is regarding uploading of the data

To: Mail For Town Planner

Mail Address Associated Region

Enter Image Content: 28318

Submit Reset



***Thank You***

<http://bhuvan.nrsc.gov.in>  
<http://www.india-wris.gov.in>  
<http://www.nrsc.gov.in>  
<http://www.isro.gov.in>