49th Session of
UN-COPUOS
(7-16 June 2006)

Agenda Item 12:
Space and Water

Use of Space-based Systems for Water Resources Management In India

Presentation by
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Indian Delegation

A Vision (1963)- shared and sustained; realized and enriched

The Drivers for Space-based Remote Sensing Applications in India

- Disaster Management
- Weather Prediction
- Water Security
- Food Security
- Energy Security
- Environment Security
- Smart Governance
- Sustainable Development

2% of World's geographical area
4% of World's Water Resources
17% of World's population

Poor predictability of Monsoons

Water Resources Management- The National Imperatives

4000 billion cubic metres of rainfall annually, however, only 12% of it is presently being utilized.

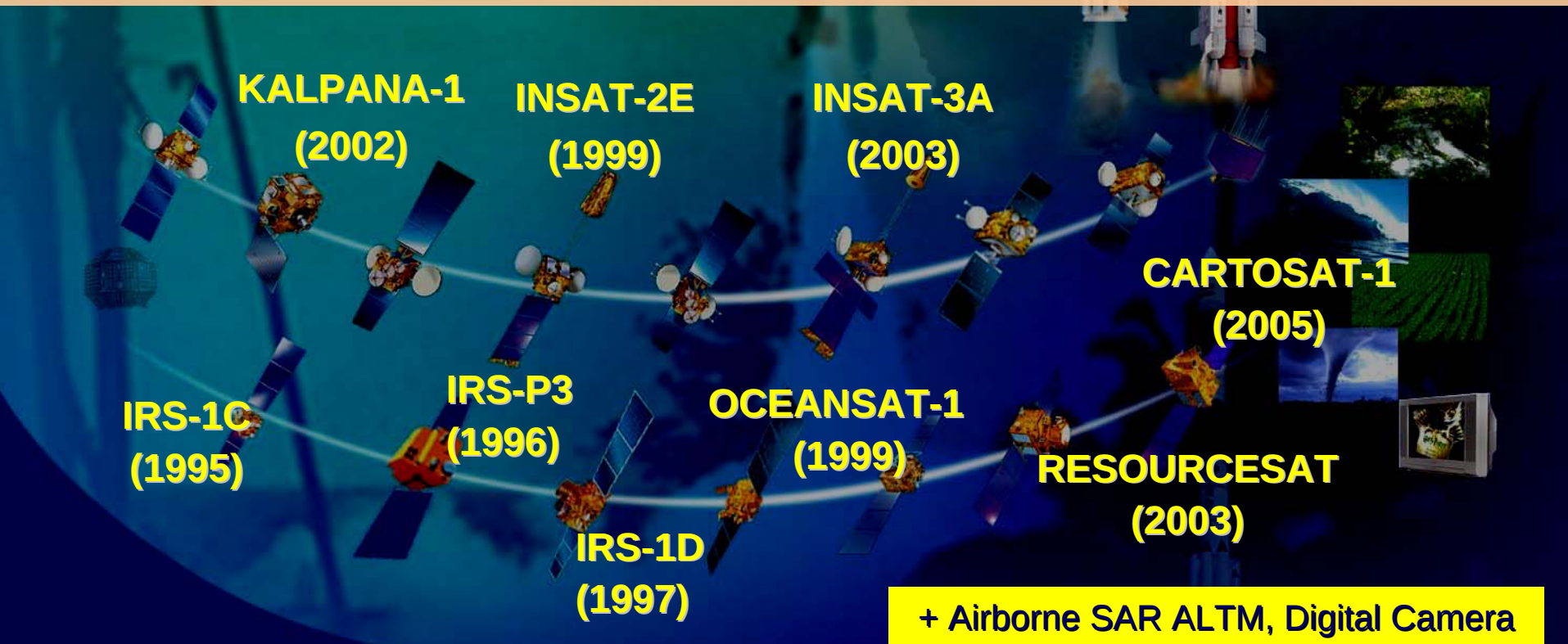
Declining per-capita availability of water *(5200 cubic metres in 1951 to nearly 1700 cubic metres now)* leading to a water stress condition.

Predominantly Rain-fed Agriculture,
Degraded Lands (57%),
Low Irrigation Efficiency (~ 35%)

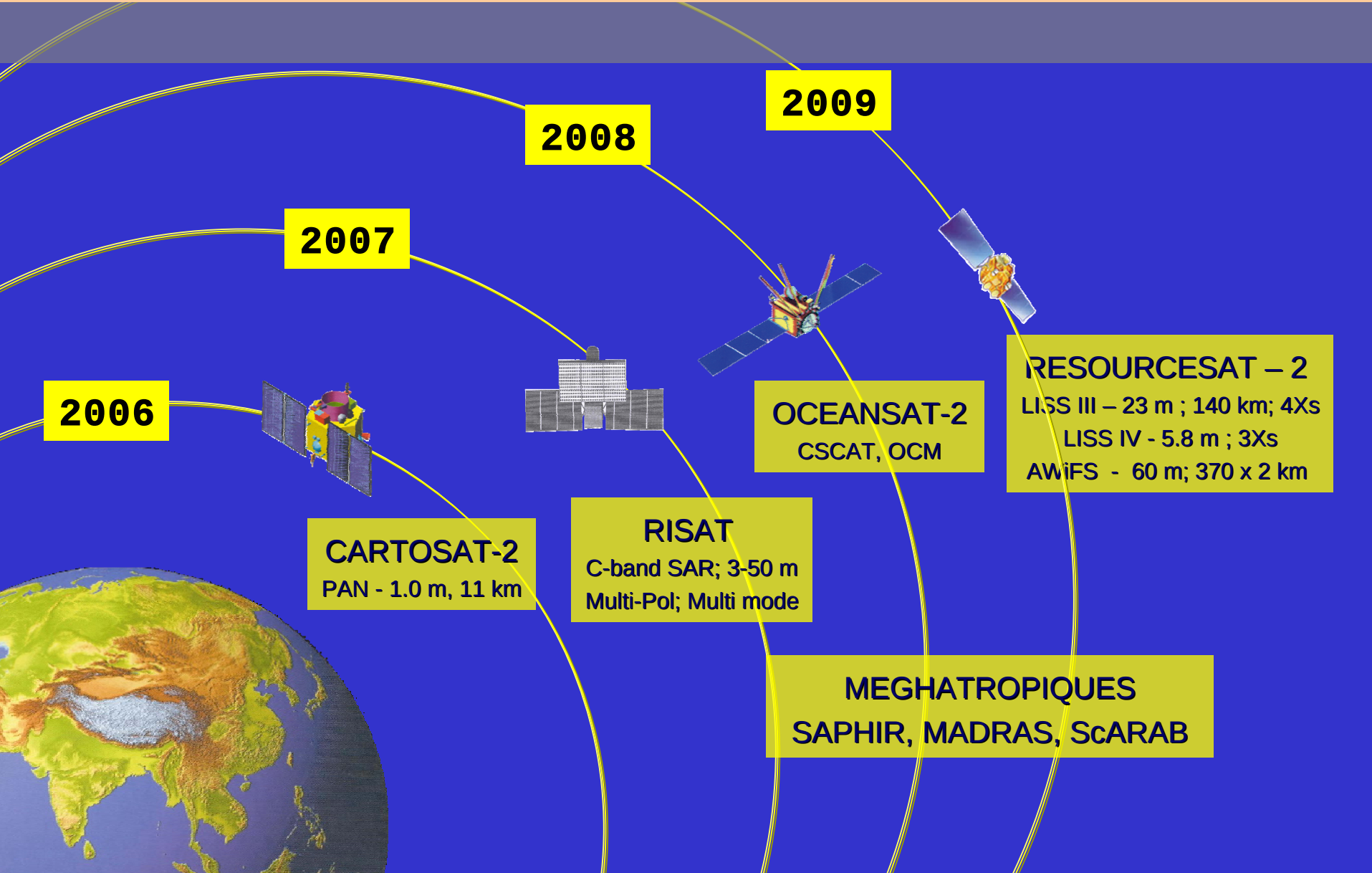
Over-exploitation of Ground Water in several areas

A Constellation of state-of-the-art EO Satellites

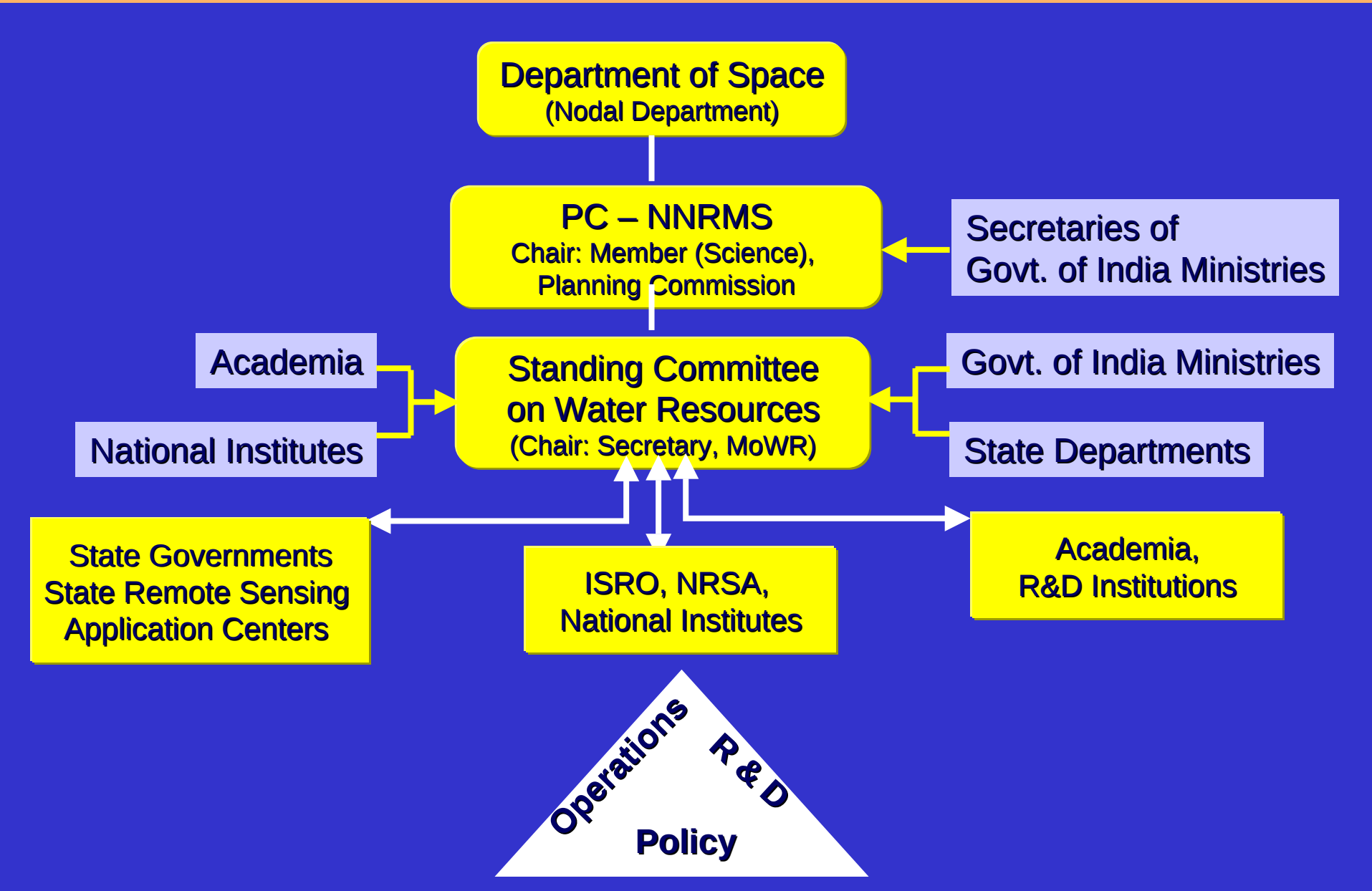
Imaging	with Spatial Resolution of 1 km to 1 metre
Providing	Repetitivity of 22 Days to every 30 minutes
Receiving	Data in India and several Ground Stations abroad
Enabling	Mapping from 1:1 Million scale to Cadastral Level

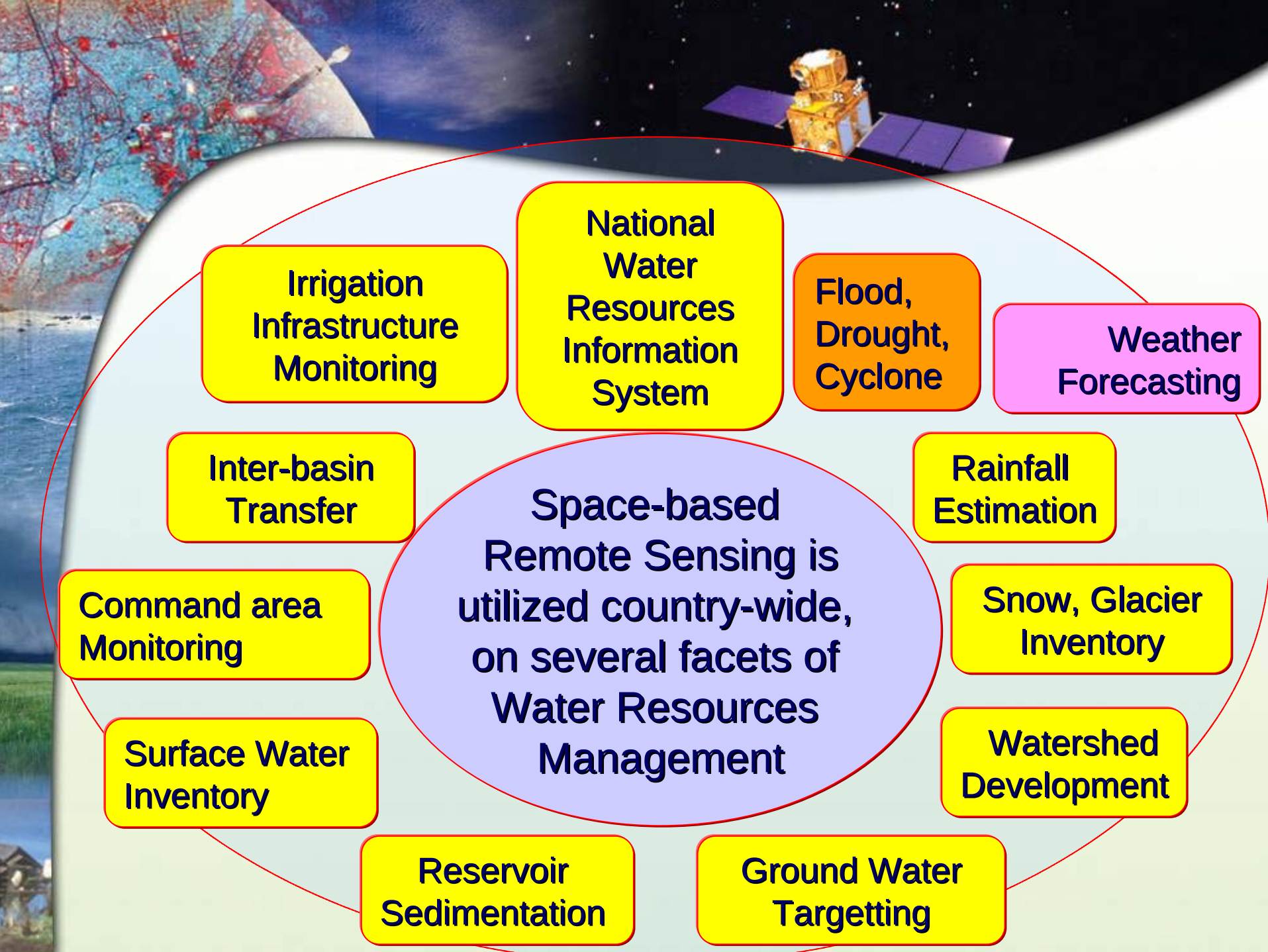


Ensured and Sustained
Thematic Satellite missions for the near future

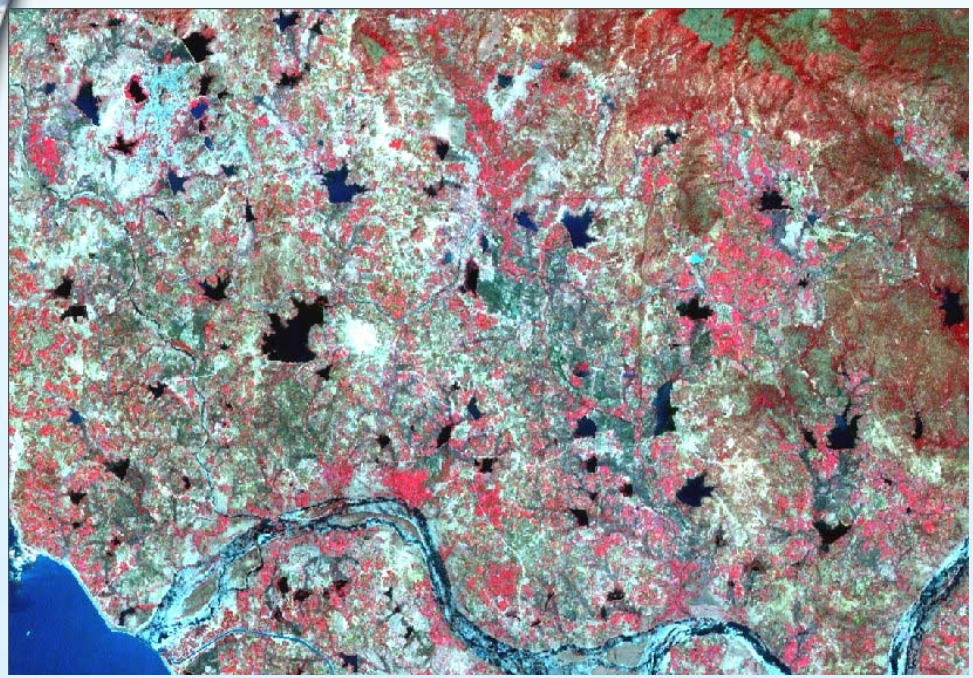


National Natural Resources Management System- A Unique Institutional Arrangement




National Water Resources Information System
Irrigation Infrastructure Monitoring
Flood, Drought, Cyclone
Weather Forecasting
Inter-basin Transfer
Rainfall Estimation
Space-based Remote Sensing is utilized country-wide, on several facets of Water Resources Management
Command area Monitoring
Snow, Glacier Inventory
Surface Water Inventory
Watershed Development
Reservoir Sedimentation
Ground Water Targetting

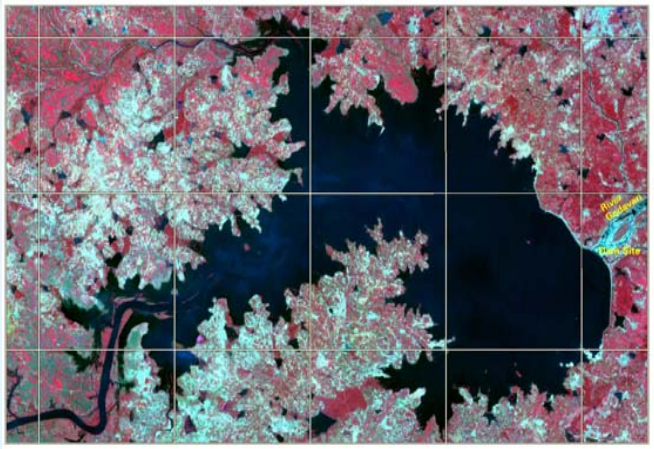
Surface Water Inventory

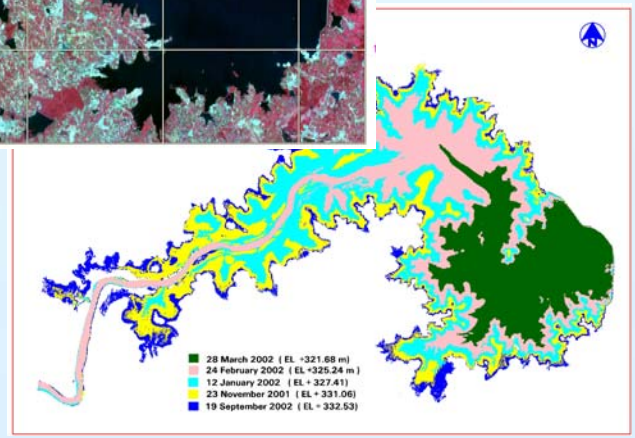


- About 500,000 water bodies/tanks used for irrigation
- Storage capacity coming down due to Silting etc.
- Area under tank irrigation 4.78 Million ha in 1962-63; 3.07 Million ha in 1985-86

A National Project for “Repair, Renovation and Restoration of Water Bodies” launched where space-based remote sensing provides significant inputs

Reservoir Sedimentation

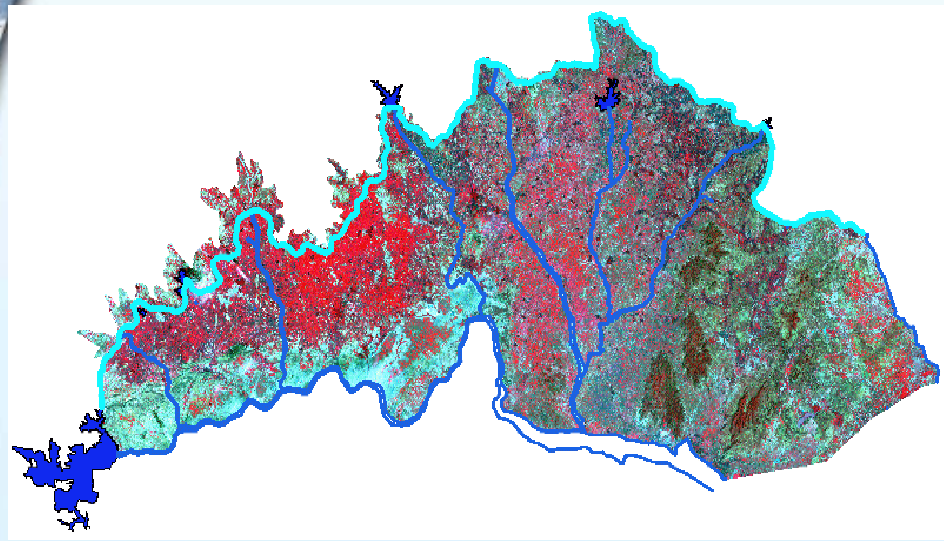




- Annual Sedimentation rate more than 1.5 to 3 times more than designated rate
- Use of Satellite data to estimate reduction in the “Live Storage Region” whereas conventional hydrographic surveys used for the “Dead Storage Region”

A National action plan for Sedimentation Assessment of 124 Reservoirs is being implemented during 10th Plan (2002-2007) under the NNRMS Standing Committee on Water Resources

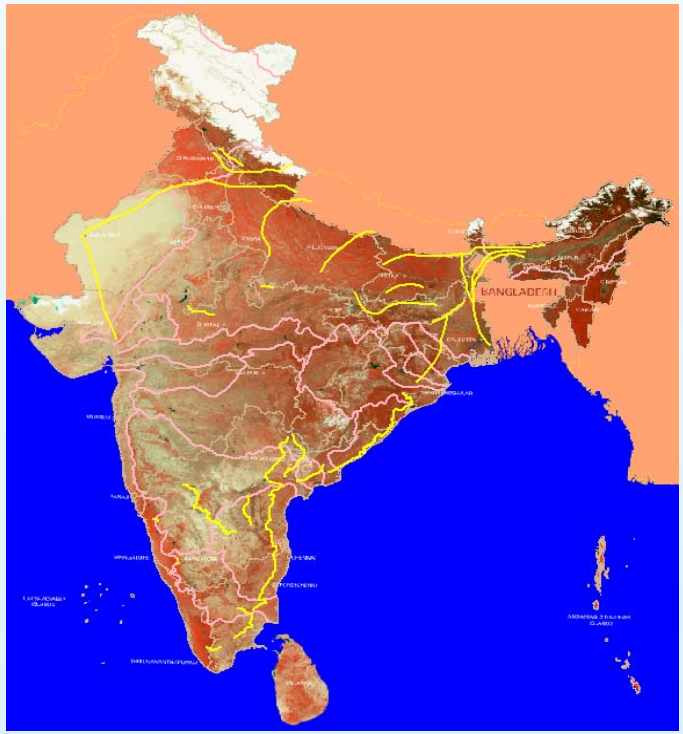
Command Area Monitoring



- Irrigation potential created to the tune of 100 Mha. But Water use efficiency (~ 35%) needs to be improved (to 50%)
- Periodic performance evaluation of Command Areas being done using Remote Sensing data

- Centrally sponsored Command Area Development Project and National Water Management Project ongoing;
- National Water Resources Information System initiated under the NNRMS Standing Committee on Water Resources

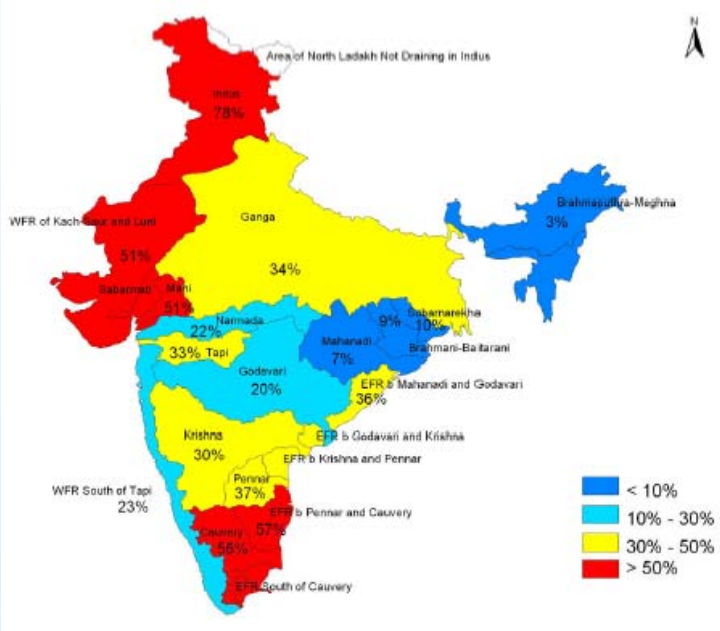
Inter-basin Transfer



- 12 major river basins and 46 medium river basins with ultimate irrigation potential of 140 Mha
- Episodic deficits and excesses; floods and droughts in several parts
- Feasibility studies underway on interlinking of river basins

- Space remote sensing inputs used Feasibility studies – Topographical Surveys, Hydrological Surveys, Geo-technical / Geological, Environmental & Ecological Command Area Surveys, Base line information, Water balance studies, Run-off estimation in un-gauged basins

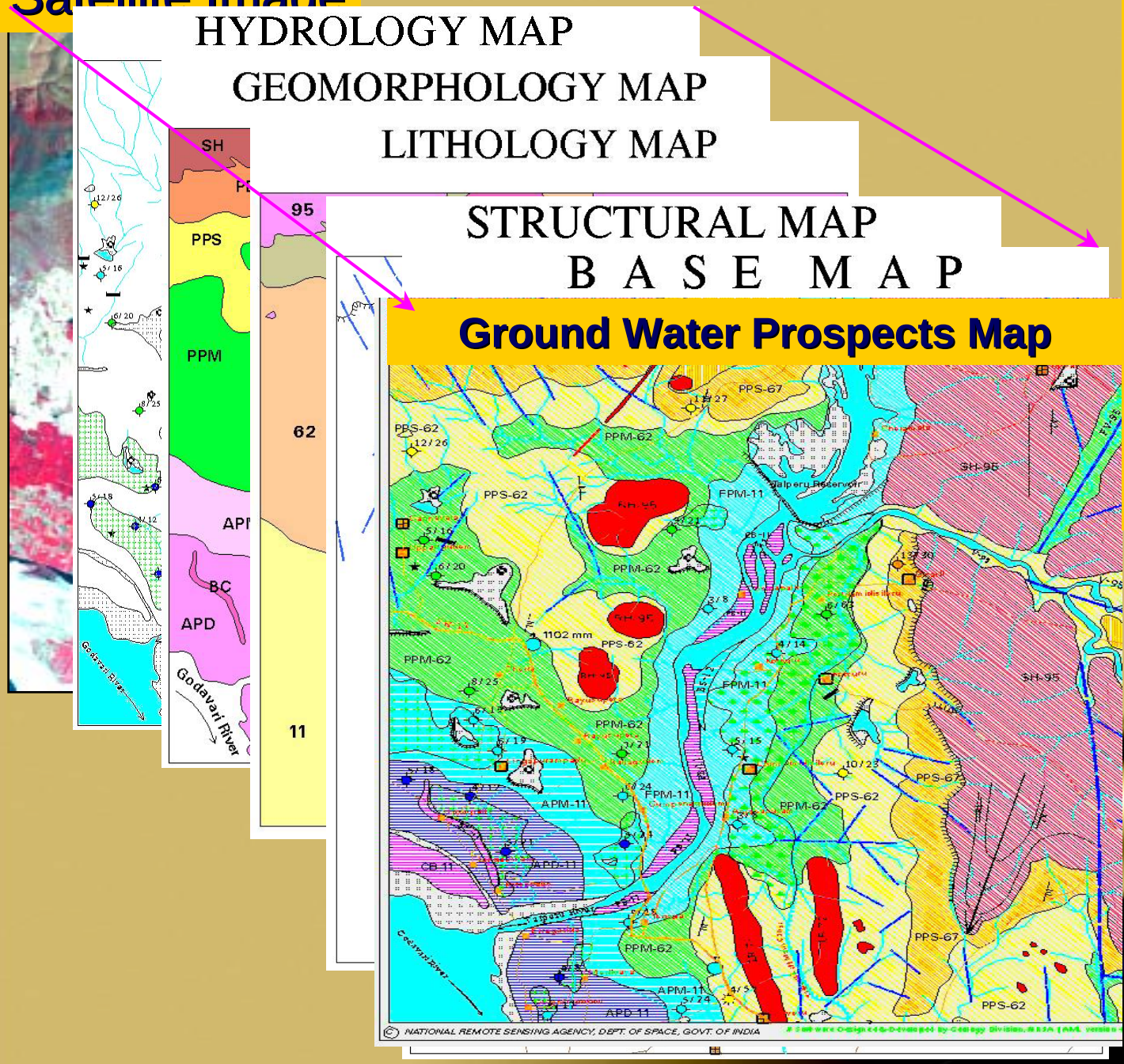
Ground Water Targeting



- Ground Water constitutes 55% of irrigation water requirement, 50% of urban water supplies and 85% of domestic use in rural areas
- Problems in access to Drinking water: Urban (15%); Rural (21%)
- Exploitation more than 50% in several areas (Red Colour)

- Space-based remote sensing being used fruitfully to prepare ground water prospects map under a national Mission-Rajiv Gandhi Drinking Water Mission

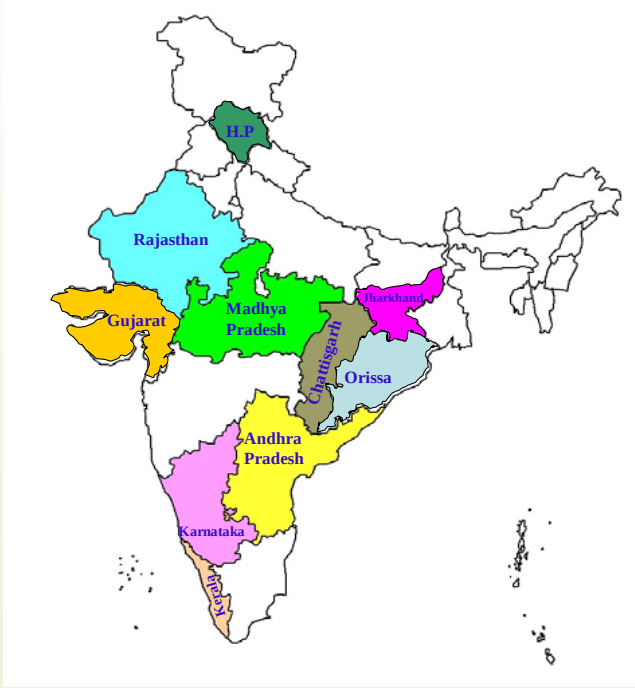
Satellite Image



The Map contains information on:

- Hydrogeomorphological unit
- Geological Sequence / Rock type
- Depth to water table &no. of wells observed
- Recharge conditions
- Aquifer material
- Types of suitable wells
- Depth range of wells
- Yield range of wells
- Homogeneity of the aquifer
- Water Quality
- Recharge structures

National Drinking Water Mission Implementation



So far 2,20,000 wells have been drilled with 90-95 % success rate and 7500 recharge structures have been planned/ implemented by the line depts in the respective States

Rajiv Gandhi National Drinking Water Mission Project

Feedback on the usage of Ground Water Prospects Maps prepared under RGNDWM Project and supplied by NRSA

Name of the State: Andhra Pradesh,RWS,PRED

Number of maps received so far: 244

Feedback: up to 02/05/2005

SN	Name of the District	No. of Wells		No. of recharge structures		Remarks
		Drilled	Successful	Planned	Implemented	
1	Chittoor	647	602	63	63	
2	Kadapa	940	874	34	34	
3	East Godavari	843	784			
4	Guntur	347	323			
5	Karimnagar	1867	1736	37	37	
6	Khammam	1464	1362			
7	Krishna	903	840	11	11	
8	Medak	2409	2240			
9	Nalgonda	2030	1888	93	93	
10	Nellore	3622	3368	8	8	
11	Nizamabad	689	641			
12	Prakasham	6882	6400	26	26	
13	Srikakulam	1256	1168			
14	Visakhapatnam	3389	3152			
15	Vizianagaram	2367	2201	6	6	
16	Warangal	3207	2983	155	155	
17	West Godavari	265	246	7	7	
	Total	**33127**	**30808**	**440**	**440**	

For Chief Engineer,RWS,Hyd.

National Drinking Water Mission
The Impact

The Last Mile

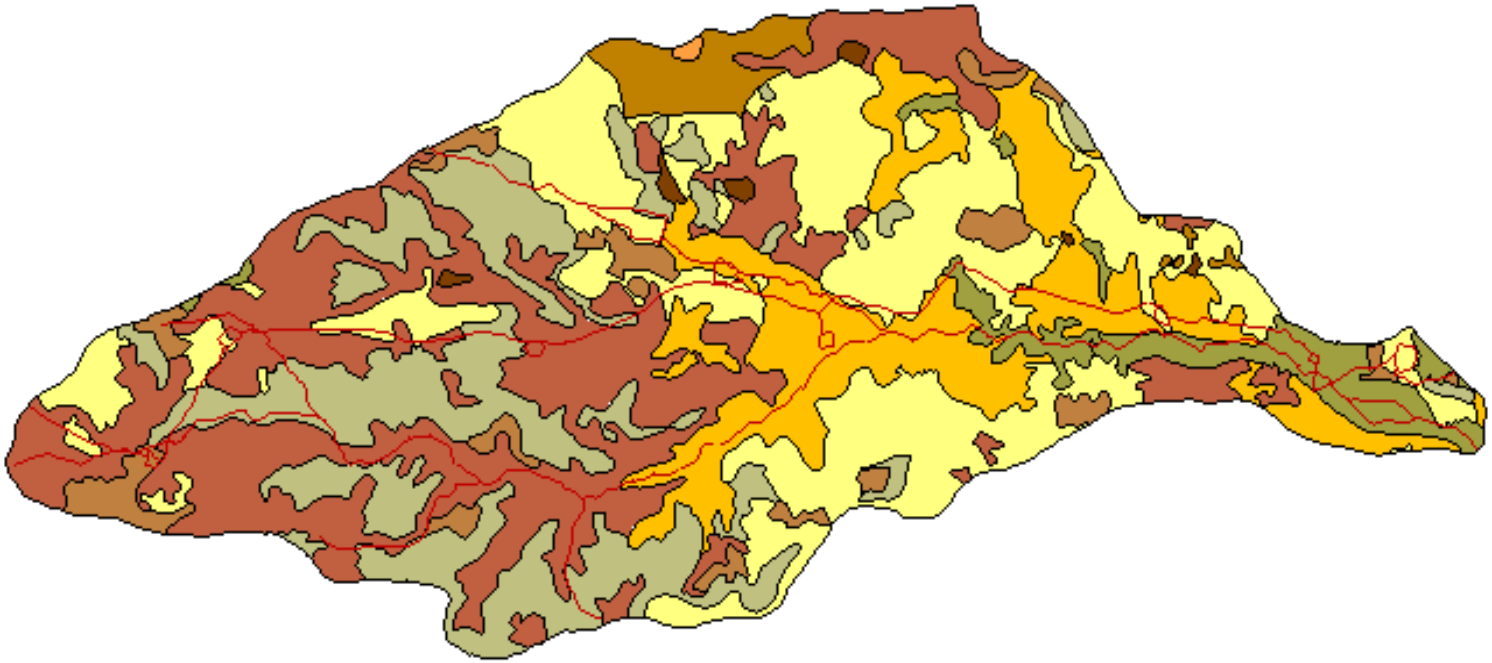
Before

After

Watershed Development

- Judicious management and conservation of soil and water resources on Watershed basis is a prerequisite for sustaining productivity
- Space-based Remote Sensing played a significant role to prepare Integrated data base on current land use, geomorphology geology, soils, forest cover, socio-economic information required for:
  - Characterisation and Prioritisation of watersheds to be take up for treatment *(for decision makers)*
  - Generation of action plans locating water harvesting structures, conservation measures, alternate land use *(through a participatory process at local community level)*
  - Monitoring of the changes and impact

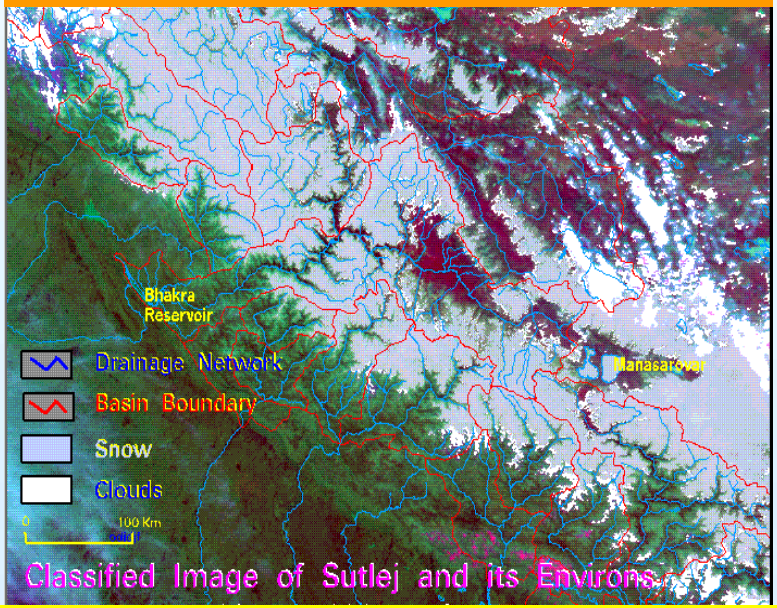
Watershed Development



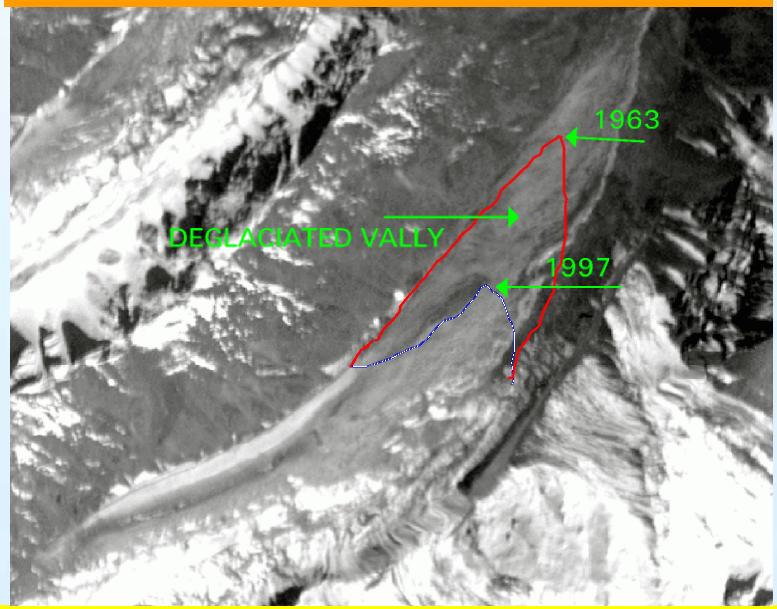
- Integrated Mission for Sustainable Development (1992-2000) covered 84 Mha from 25 States [on 1:50,000 Scale using Satellite Data]
- Land Treatment Plans for rainfed rice, oilseeds, pulses and cotton
- Integrated resources System for Desertic Areas in 7 States

Snow and Glacier Inventory

Snow studies in Sutlej Basin (NOAA Data)



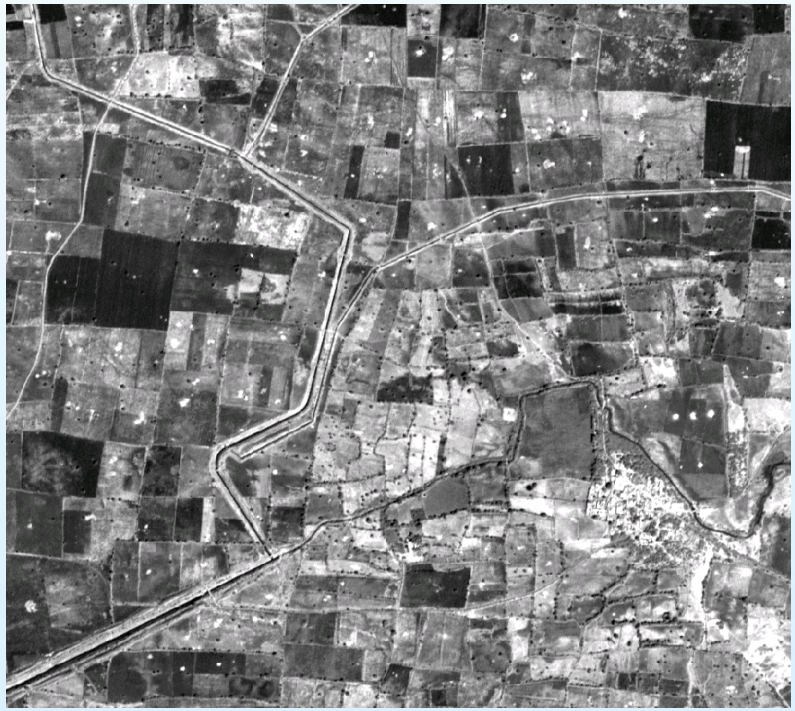
Glacier Retreat monitoring using IRS PAN stereo data



- Seasonal (April-June) Snow melt run-off forecast (< 10% error, 1st week April) at Bhakra Dam in Sutlej basin, being enlarged for other basins.

- Himalayan Glacier Inventory (>2400 nos.), mass balance & retreat by RS

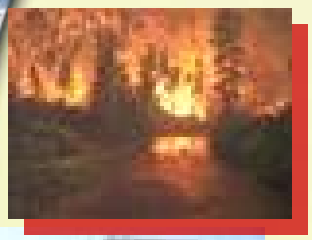
Irrigation Infrastructure Monitoring



- Mapping of Canal network, Cross drainage and other irrigation infrastructure using High resolution Satellite data
- Assessment of Irrigation Potential created vis-à-vis planned

Nation-wide monitoring of all ongoing projects using Cartosat data underway, under Accelerated Irrigation Benefits Programme of then Government of India

Disaster Management



NDEM

2005

Tsunami

Forest Fire Monitoring

DSC

2000

Landslide Hazard Zonation

Cyclones-Inundation and Damage asssessment

1995

1990

Earthquake Damage Assessment

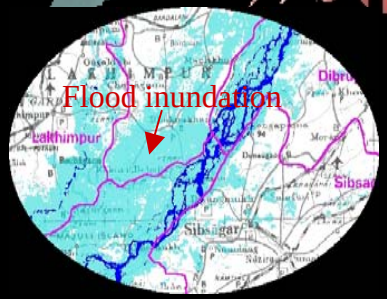
Flood Inundation Mapping and Damage Assessment

1985

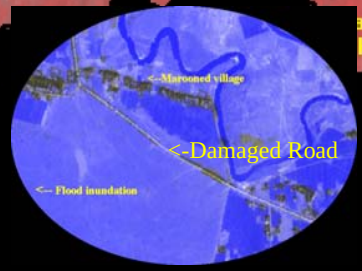
National Agricultural Drought Assessment and Monitoring

Flood Disaster Management – Space inputs

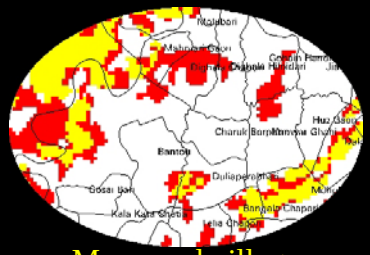
Historic flood of river Brahmaputra



Flood map



Assessment of damages



Marooned villages

Villages under inundation during 29 Jun-02 Aug, 199

Receded inundation in Villages by 02 Aug 1999

• Flood hazard zones

Information derived from Space

- **Flood inundation map**
- **Flood damage assessment**
- **River Configuration & Flood control works**
- **Bank Erosion**
- **Flood Hazard Zones**

River Configuration
Bank Erosion & eroded bund

Utilisation of information

- **Organising Relief operations**
- **Planning Flood Control Works**
- **Identification of chronic Flood prone areas**
- **Strengthening of existing Flood Control Works**
- **Flood plain zoning**

RS & GIS Capacity Building

Period	Students/ Year
1971-1980	77
1981-1990	149
1991-2000	187
> 2001	248
Total Trained: 5860 *	

* (Mar 2006)

2002 — M.Tech (AU)
M.Sc., (ITC)

2001 — International Technology & Economic cooperation (MEA)

1995

1994 — NNRMS Faculty Training

1983 — Renamed as IIRS

1976 — Indian Photo Interpretation Institute Under NRSA

1966 — Indian Photo Interpretation Institute Under Survey of India / ITC Aided

Thank you for kind attention