



Committee on Earth Observation Satellites

Earth Observation Programme of ISRO

Dr. P. G. Diwakar

Director

Earth Observation Applications &
Disaster Management Support Programme, ISRO

Indian Space Research Organisation

CEOS WGCapD-8 Annual Meeting

Agenda Item 2

Working Group on

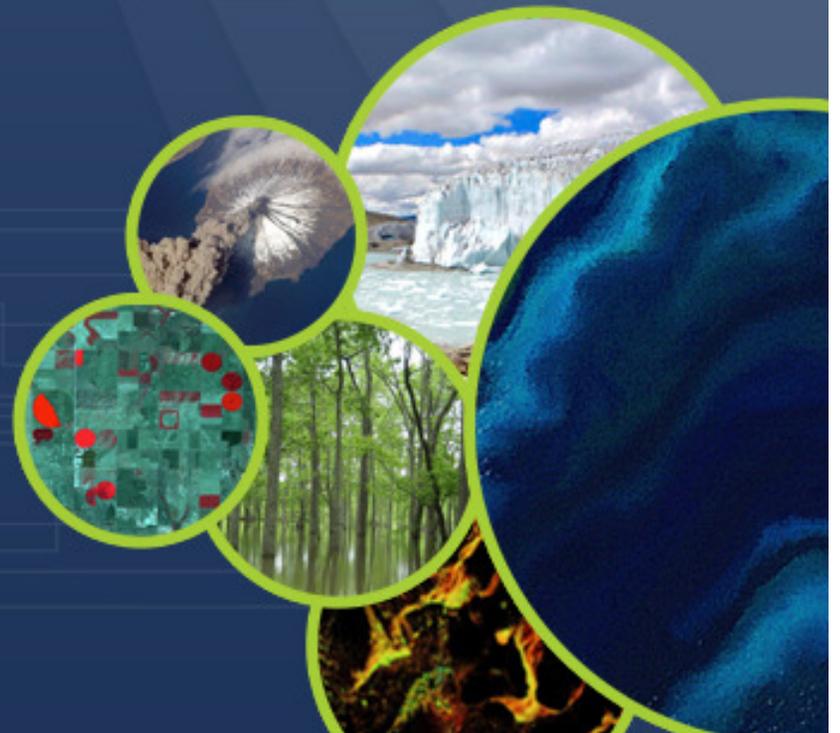
Capacity Building & Data Democracy

Indian Institute of Remote Sensing

Indian Space Research Organisation

Dehradun, India

March 06th – 08th, 2019





- **Ensuring Data Continuity for Operational & Emerging Applications**
- **Periodic inventory of natural resources to enable SDI**
- **Advanced models to meet evolving needs of stakeholders.**
- **Information systems with decision tools & citizen centric services.**
- **Maximize outreach of space applications**

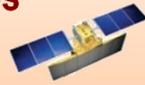
GOALS

Space Segment



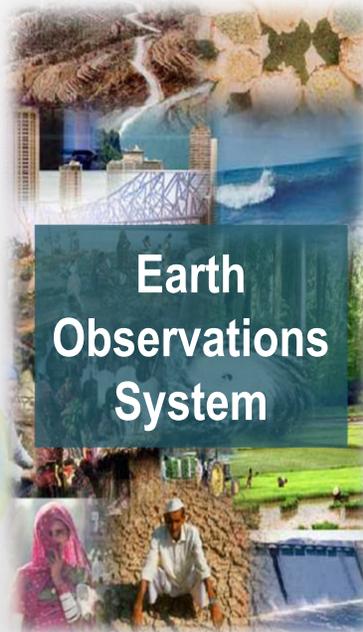
Constellation of Satellites

- Land & Water
- Cartography
- Ocean, Weather & Climate



Institutional Linkages

- Ministries / Departments
- State Remote Sensing Centres
- Industry & Academia
- International Cooperation



Earth Observations System

Ground Segment

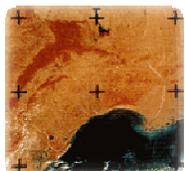
- Data Acquisition & Processing
- Data Products Generation
- In-situ Observation Network
- Information Dissemination

Space Applications

- National Imperatives & SE develop.
- NR Management & Disaster Mgmt.
- Land-Ocean-Atm. Interactions
- Enabling Geospatial data & Applns.



Frame Imaging (1979)



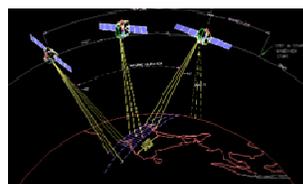
Bhaskara-1/2 (1979/ 81)
1 Km Resln.

Push Broom, 2 Tier Imaging (1988)



IRS 1A/1B (1988/ 91)
36/72 m,
7bits, 22 days

Step-and-Stare Imaging (2001)



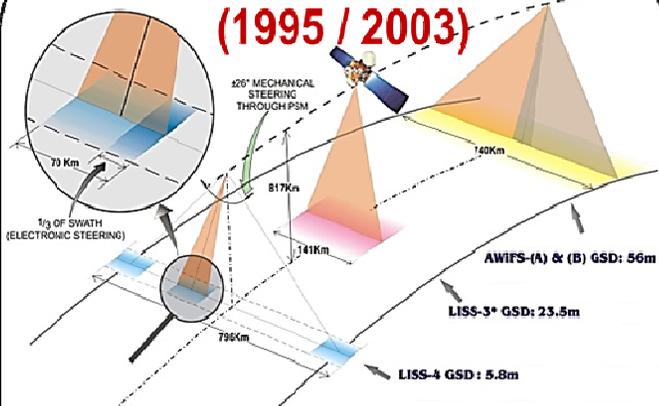
TES (2001)
~1 m, 10 bits

1 Km **Spatial Resolution** → 0.6 m

24 D **Templ. Resolution** → 2.5 D

7Bits **Spectrl. Resolution** → 14Bits

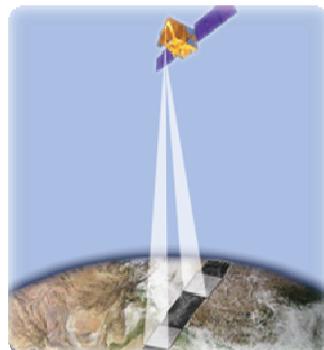
Push Broom, 3 Tier Imaging (1995 / 2003)



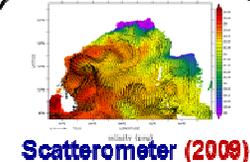
IRS IC/ID (1995/ 1997), 6-188 m,
7 bits, 5 / 24 days

Resourcesat 1/2/2A (2003/ 11/ 16), 6-56 m,
7-14 bits, 5 / 24 days

Stereo Imaging (2005)



Cartosat 1 (2005), 2.5 m, 10 bits,



Scatterometer (2009)

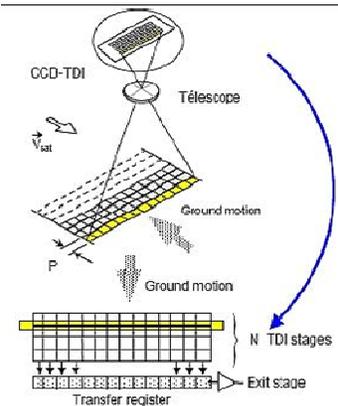


SAR Imaging (2012)



Altimeter (2013)

TDI Imaging (2016)



Cartosat 2 Series (2016)
0.6 m, 11 bits



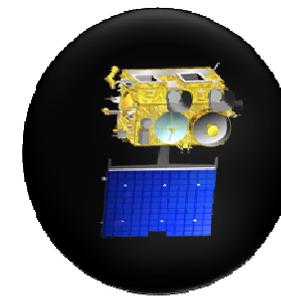
EVOLUTION OF METEOROLOGICAL OBSERVATION CAPABILITIES



2 to 3 bands

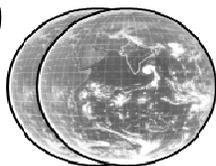


3 to 6 bands



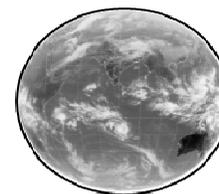
INSAT 1 Series (1983)
2 Bands

Vis: 2.0 km; TIR: 8 km
4 images per day



INSAT 2 Series (1990)
3 Bands

Vis: 2 km; WV: 8 km; TIR: 8 km
4 images per day

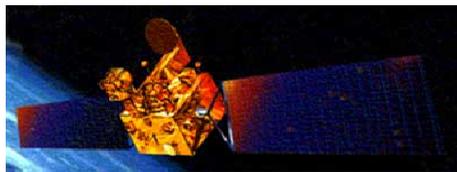


INSAT 3 Series (2013)
6 Bands

Vis & SWIR: 1 km; MWIR: 4 km;
WV: 8 km; TIR(2): 4 km
19 Channel Sounder
48 images per day

OCEAN OBSERVATION SATELLITES

Oceansat-1



OCM 8 spectral bands and
MSMR (6.6, 10.65, 18.0 and 21
GHz) (H and V polarizations)

Oceansat-2



OCM 8 spectral bands
Ku-Band Pencil beam Scatterometer
ROSA



Space and Ground Assets



11 Earth Observation Satellites in Orbit

Land & Water Resources, Cartography

RESOURCESAT-2/2A



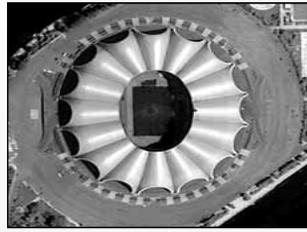
56 / 23 / 5.8 Meters

CARTOSAT- 1



2.5 Meter - Stereo

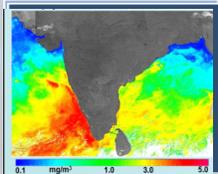
CARTOSAT-2S



Sub- meter

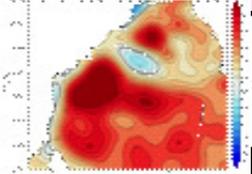
Oceanography

OCEANSAT-2



Ocean Color
360 m / 2 days

SARAL



Ocean Altimetry
Ka BAND ALTIMETER

Insitu Observations

DWR



Flux Tower



AWS

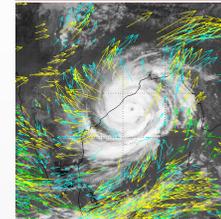


AMS



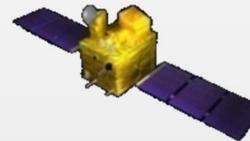
Weather & Climate

INSAT-3D & 3DR



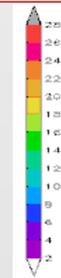
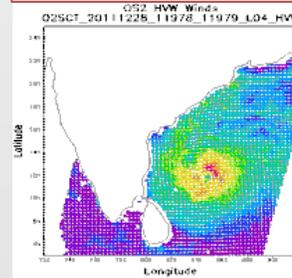
6 Bands IMAGER
19 Channel Sounder
48 images per day
Imager - 1 / 4 km

MEGHA-TROPIQUES



Radiation Budget
Atm. Profiles
Radio Occultation

SCATSAT-1



Wind Vector
Ku BAND
SCATTEROMETER



Sustain ----- Strengthen ----- Advance ----- Enrich



National Database and Institutionalisation



National level Geospatial database & usage

Rural Development

Wastelands, Land use & Land Cover, Ground Water, Rural Roads.....

Urban Development

NUIS, AMRUT, Infrastructure Devt.

Land Resources

Watershed Development, National Landuse, Land Degradation Status

Disaster Management:

Floods, Cyclone, Landslides, Forest fire, Earth Quake, Drought.....

National level Institutionalisation

Agriculture

Mahalanobis National Crop Forecast Center, MoA&FW

Water

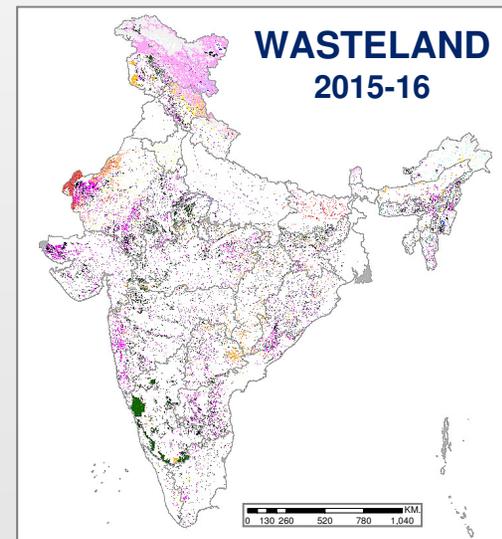
India Water Resources Info. System; MoWR, RD &GR

Forest

State of Forests in India: Biennial reports; MOEF& CC

Ocean

PFZ, Ocean State forecast, Tsunami, warning and many more: INCOIS/MoES

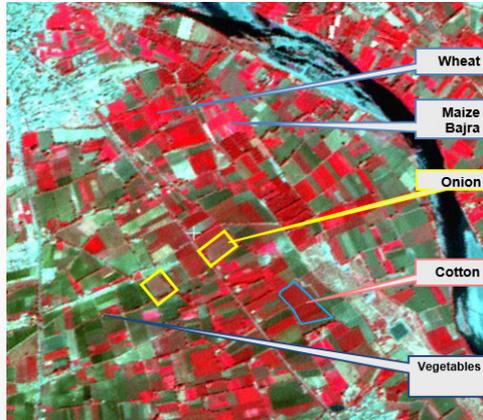




Agriculture Applications



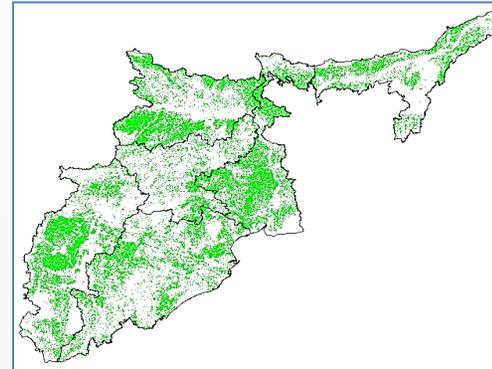
Crop Production Forecast- 8 Crops & Rabi Pulses



Food-grain availability & policy decisions on procurement & stock management.

Pre-harvest Production Estimation Rice, Wheat, Mustard, Sugarcane, Cotton, Sorghum, Jute, Pulses

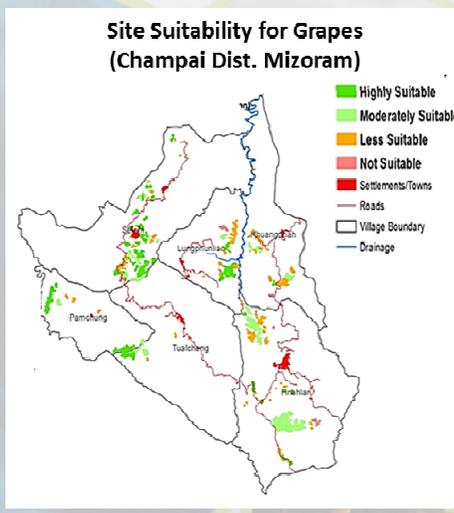
National Food Security Mission



Kharif rice, in Eastern India

Mapping **post-kharif rice fallow land** which are potential areas for cultivation of pulses and oilseeds in rabi season

Horticulture Development

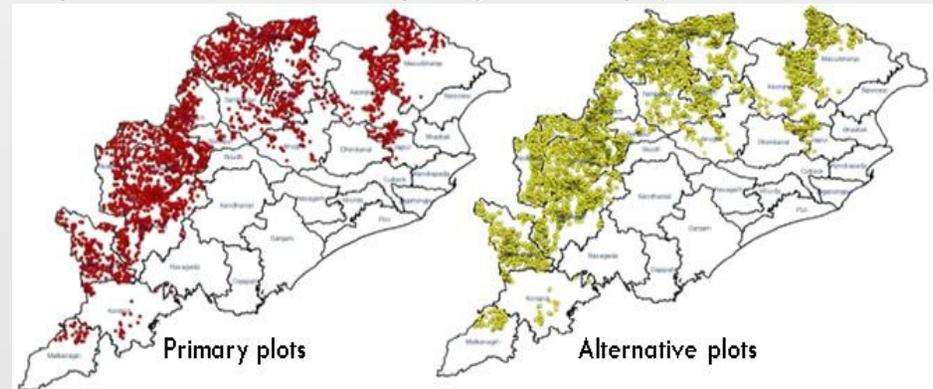


Potato, Onion, Tomato, Chili, Mango, Banana & Citrus

Areas for rejuvenation of Orchards, Site suitability for expansion Post-harvest infrastructure planning

Inputs for National Crop Insurance Programme

Optimisation of sampling for crop yield estimation



Locations for autumn paddy yield measurement



Ground Water Prospects & Sustainability



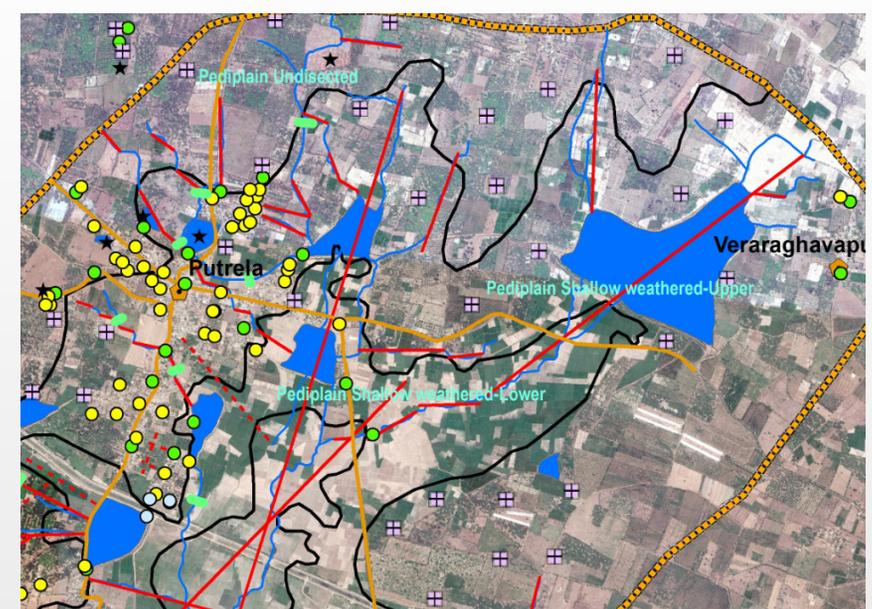
National Ground Water Prospects Information System: Bhuvan Bhujal – Yield, Depth and Recharge Locations



COLOUR	YIELD RANGE OF WELLS	DEPTH RANGE OF WELLS		
		SHALLOW < 30 M	MODERATE 30 – 80 M	DEEP > 80 M
[Purple]	> 800 LPM	[Purple]	[Purple]	[Purple]
[Blue]	400 – 800 LPM	[Blue]	[Blue]	[Blue]
[Green]	200 – 400 LPM	[Green]	[Green]	[Green]
[Yellow]	100 – 200 LPM	[Yellow]	[Yellow]	[Yellow]
[Orange]	50 – 100 LPM	[Orange]	[Orange]	[Orange]
[Red]	30 – 50 LPM	[Red]	[Red]	[Red]
[Pink]	20 – 30 LPM	[Pink]	[Pink]	[Pink]
[Light Pink]	10 – 20 LPM	[Light Pink]	[Light Pink]	[Light Pink]
[Red]	Prospects limited to valley portions only	[Red]	[Red]	[Red]
Run off zones / high relief areas				

Village Level Ground Water Prospecting

Prospective locations for ground geophysical survey for siting wells and locations for recharge structures



Legend

- [Green line] Check Dam (Suggested)
- [Star] Recharge Pit (Suggested)
- [House icon] Habitations
- [Cross icon] Farm Pond (Suggested)
- [Orange line] Roads
- [Red line] Lineament
- [Dotted red line] Inferred lineament
- [Blue line] Drainage
- [Blue area] Waterbody
- [Green circle] Bore well
- [Yellow circle] Hand pump
- [White circle] Open well
- [Dashed orange line] Putrela village boundary

0 0.75 1.5 3
Kilometers



Irrigation Infrastructure and Surface Water Management

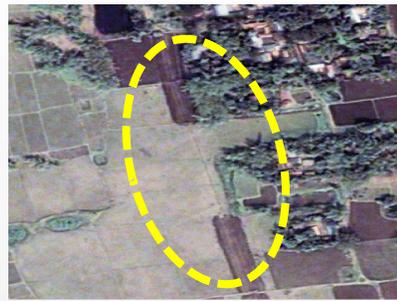


Monitoring Irrigation Infrastructure & Irrigation Potential

Bhuvan based tool for online monitoring, executed in 103 Irrigation projects in 20 states



Canal under construction



Gaps in Canal construction

National Hydrology Project

Hydro-Informatics

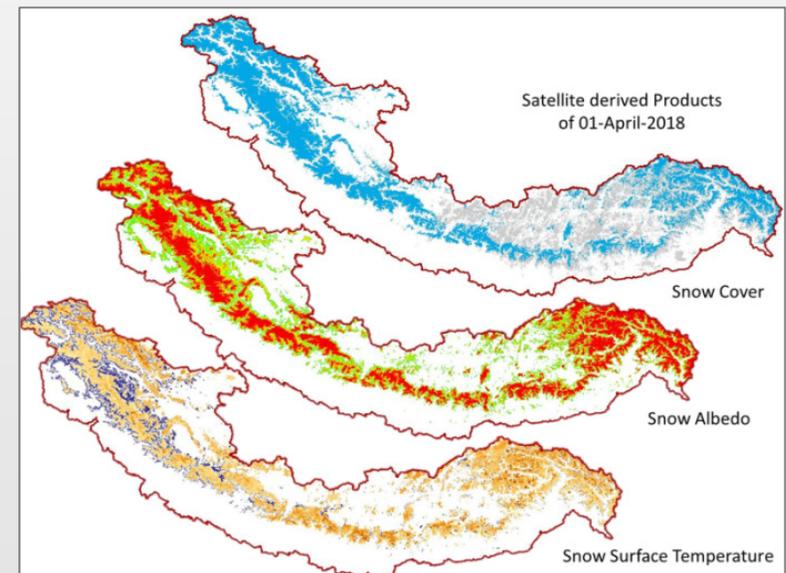
- Snow melt, Soil Moisture, Evapotranspiration, Surface Runoff, Reservoir Inflows, Hydrological Drought

- Development of Spatial Flood Early Warning
- GLOF Modelling for high risk lakes
- Real-time DSS for Irrigation Water Management

National Water Body Information System

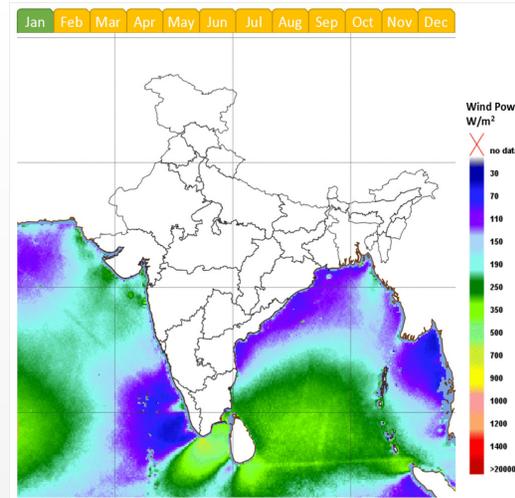


Fortnightly surface waterspread, for Reservoir management, inland fisheries, hydrological drought assessment sedimentation survey etc

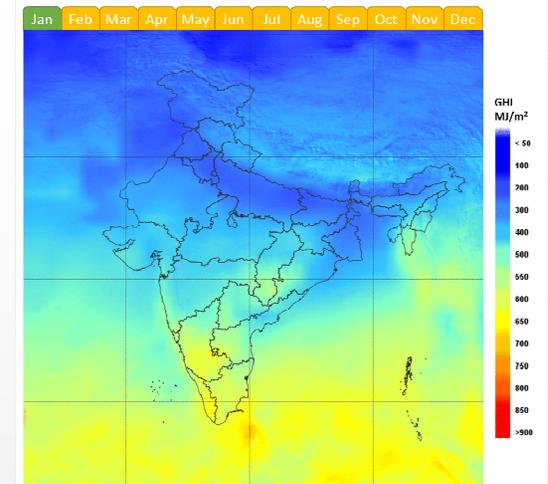




- Atlases of solar, offshore wind & wave energy potential
- 72-Hour solar power forecast developed 6 Hrly interval
- Roof-top SE potential
- MobileApp for assessing location-specific Solar & Wind Energy potential

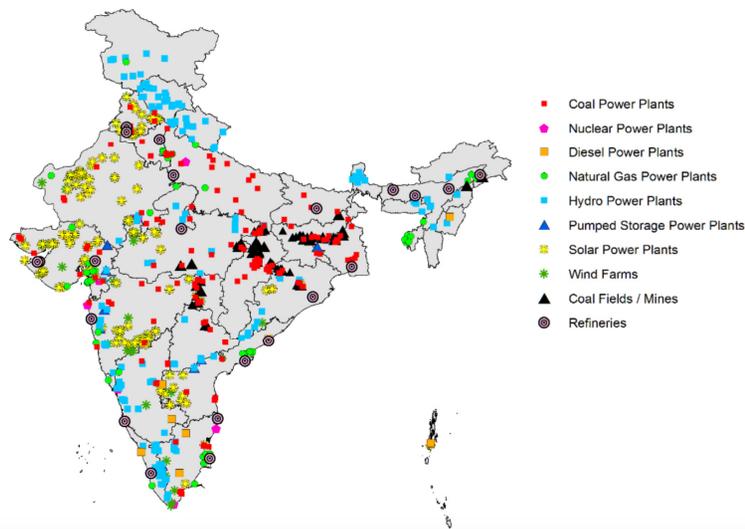


Wind Energy potential
(using Scatterometer data)



Solar Insolation (using VHR data of INSAT-3D/3DR)

Energy Map of India



Energy Management Information System - Inter-Ministry Geoportal



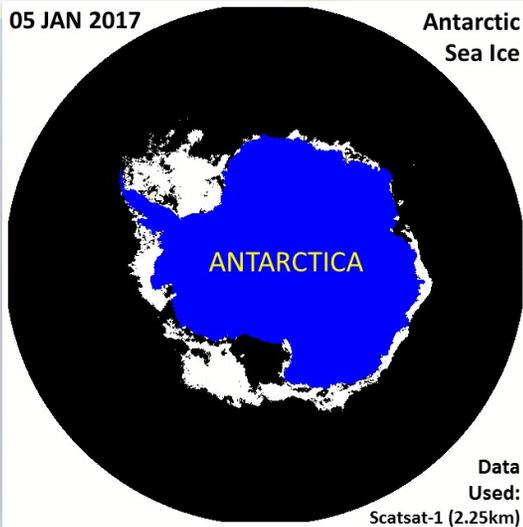
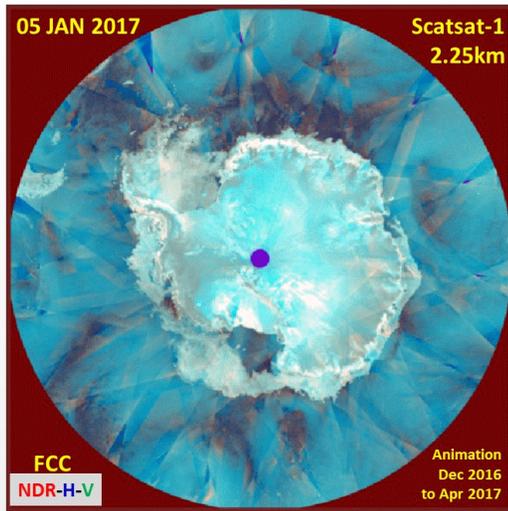
“Solar Calculator” Android App – Location based Solar energy information & forecast



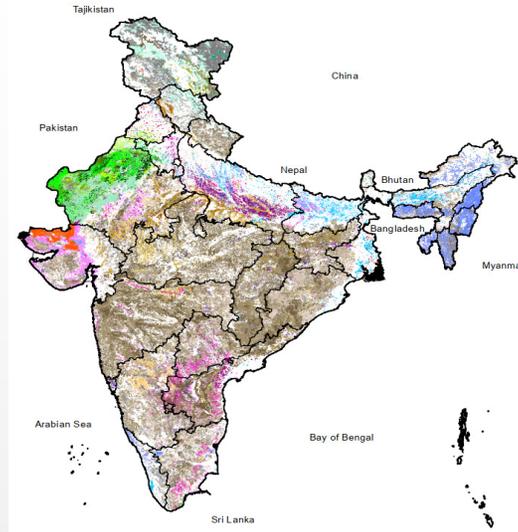
Monitoring Environment



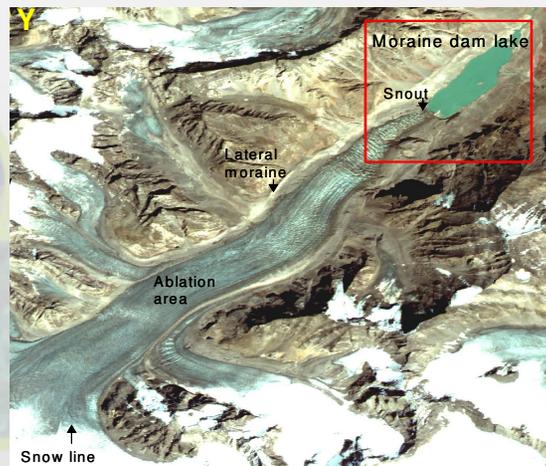
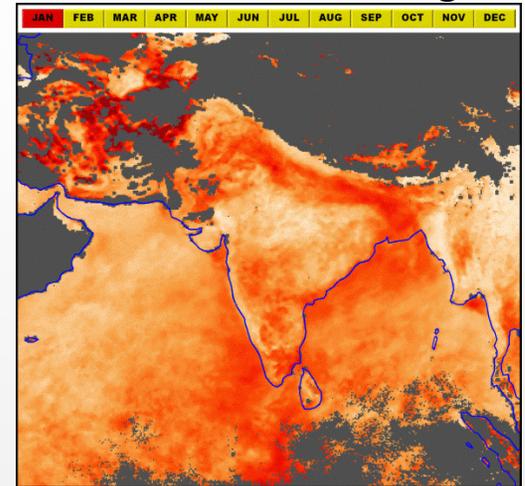
Antarctic Sea Ice Dynamics



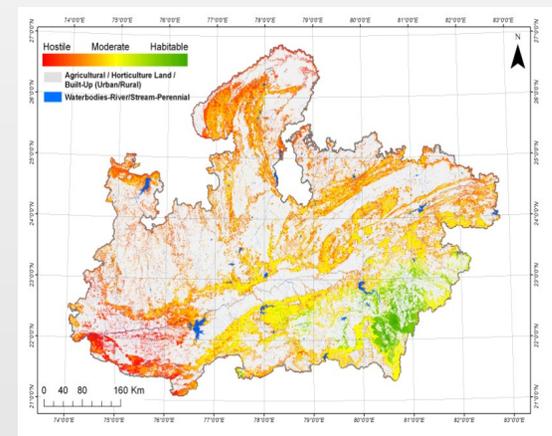
Land Degradation Status



Air quality monitoring and model based forecasting



Monitoring of Glaciers



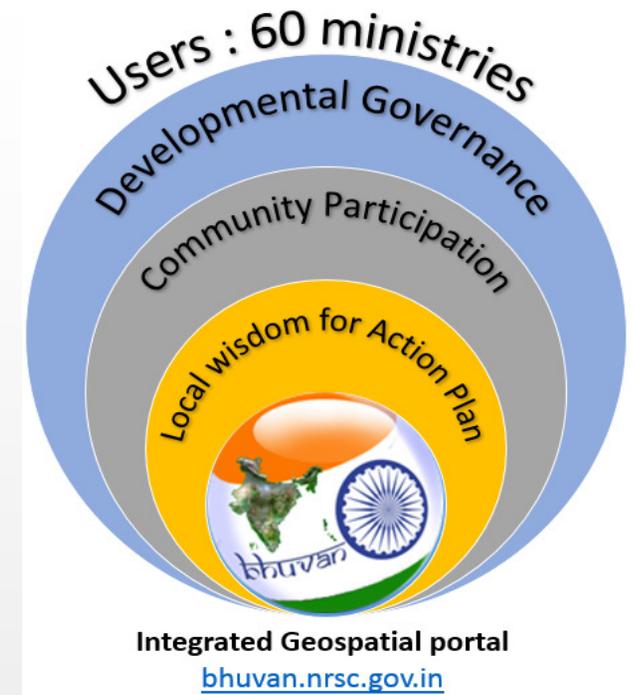
Input for wildlife conservation



Space based inputs for National Programmes on Governance and Development, enabling Planning, Monitoring & Evaluation and Decision Support

▪ Support to Flagship Programmes

- ❖ Soil Health Card Scheme (**SHC**)
 - ❖ **PMFBY** : Improved Crop Insurance Services
 - ❖ **PMGSY** : Better Utilization of Irrigation Potential
 - ❖ **AMRUT** : Citizen friendly sustainable cities
 - ❖ Swatch Bharat & Ganga Rejuvenation
 - **National Mission for Clean Ganga**
 - ❖ Monitoring of Public Benefit & Rural Development Schemes (**MGNREGA, PMAY, IWMP,**)
 - ❖ De-centralized Planning: **Participatory planning**
- **Institutionalization / Internalization** (20 Implemented)





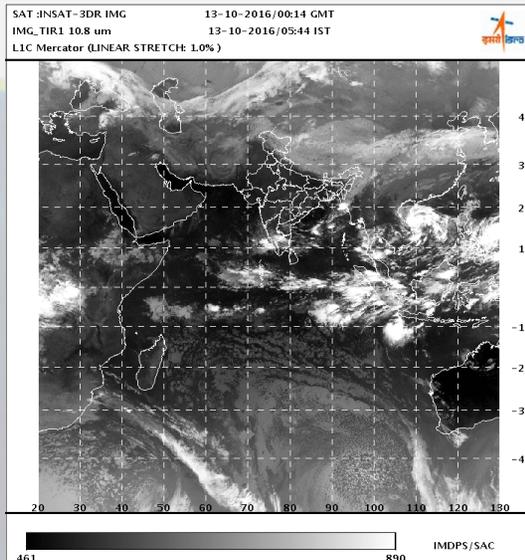
Geoportals



M O S D A C

Indian Storehouse for Space based Weather and Ocean Data

- Multi Mission Met. and Ocean Satellite Data Repository
- In situ Data, Weather and Ocean State Forecast
- Met and Ocean Applications, Research and Training



<https://www.mosdac.gov.in>

Bhuvan

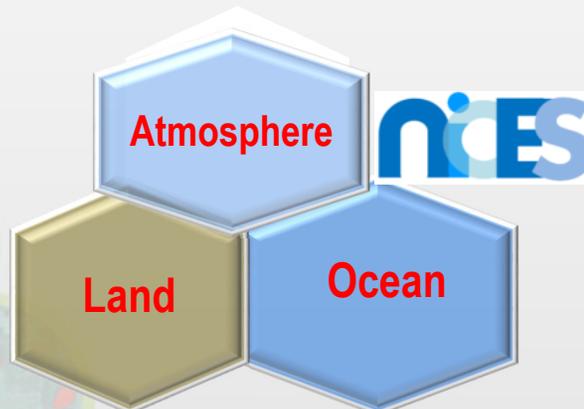


Visualisation, Free Download, Web and Mobile Applications, Maps & OGC Services, Crowd Sourcing

<https://www.bhuvan.nrsc.gov.in>



> 1.5 lakh users, 20 Nodes, Yearly Updation of Images



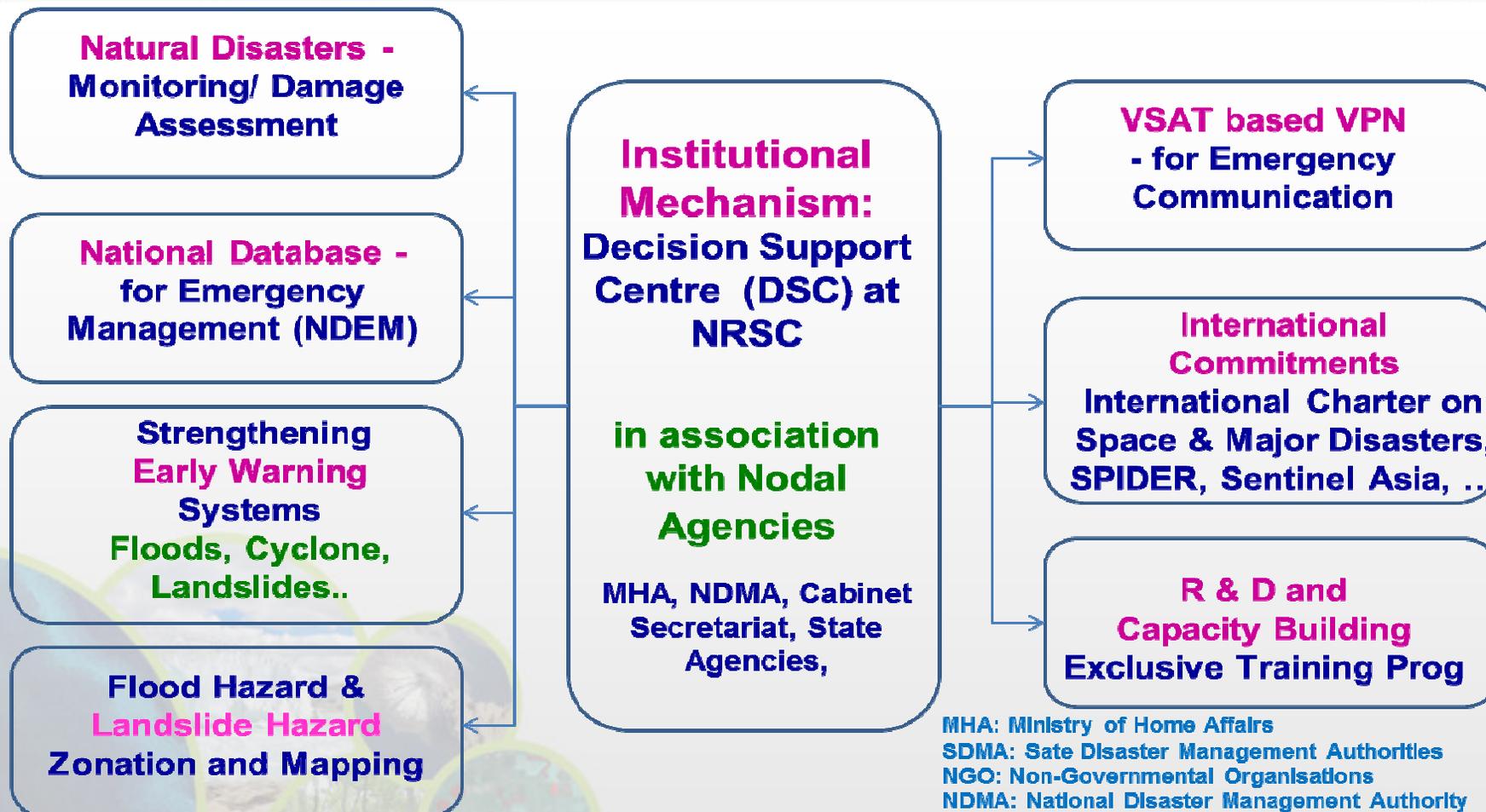
Climate / Environment Database & Inf. System

<https://www.bhuvan.nrsc.gov.in/nices>



Platform for Research & Training to Academia

<https://vedas.sac.gov.in/vedas>



Floods



- Flood Inundation Maps
- Damage Assessment
- Hazard Zonation
- Bank Erosion Studies

Cyclone



- Inundation Maps
- Recession Maps
- Damage Assessment

Earthquake



- Damage Assessment

Landslide

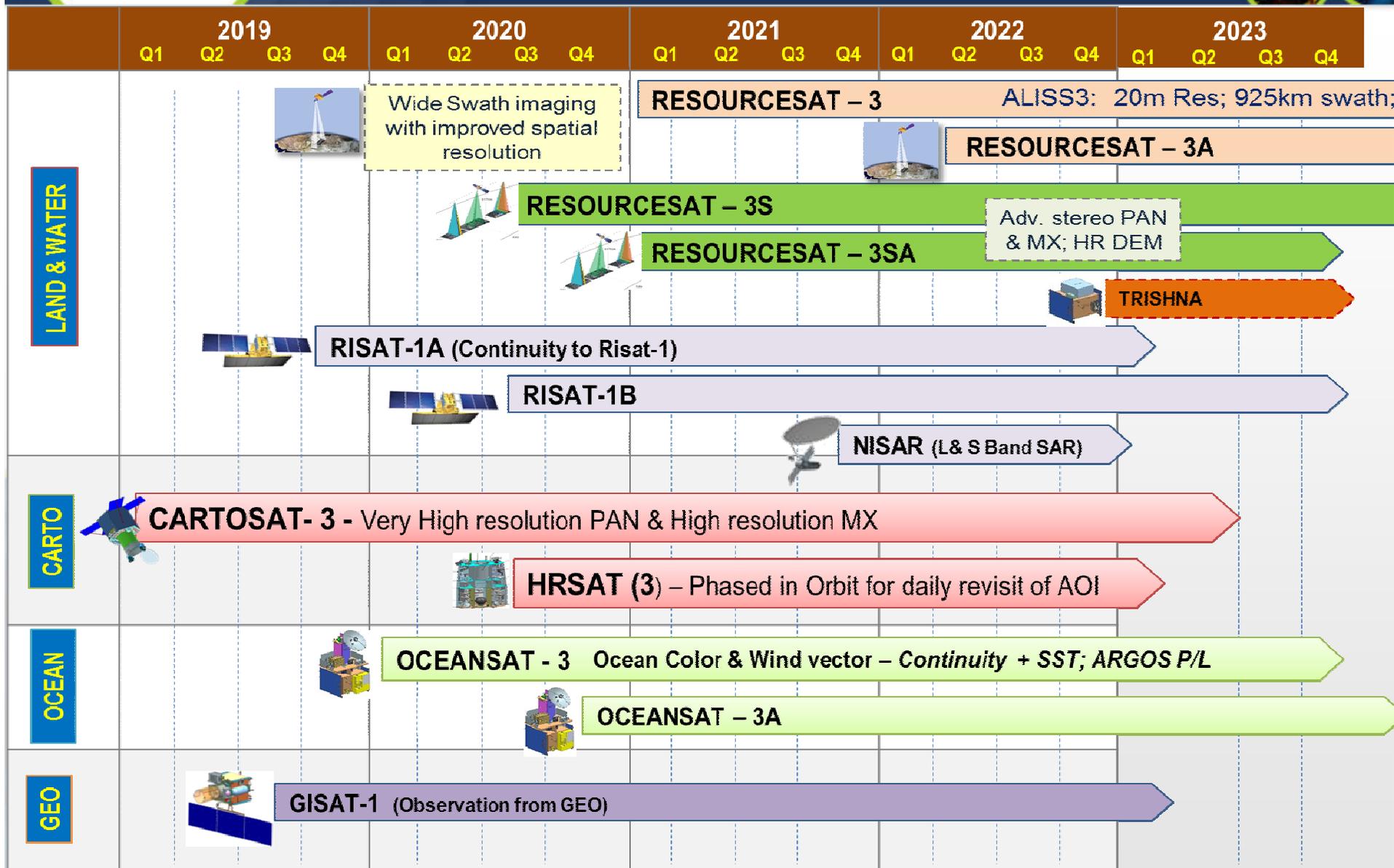


- Damage Assessment
- Hazard zonation

Forest Fire



- Active Fire Detection
- Damage Assessment



CEOS



Thank You

