

# **India's Earth Observation Applications on National Development and Governance**

**Presentation to the 65<sup>th</sup> Session of UNCOPUOS**

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India

# Indian Space Programme

## Vision:

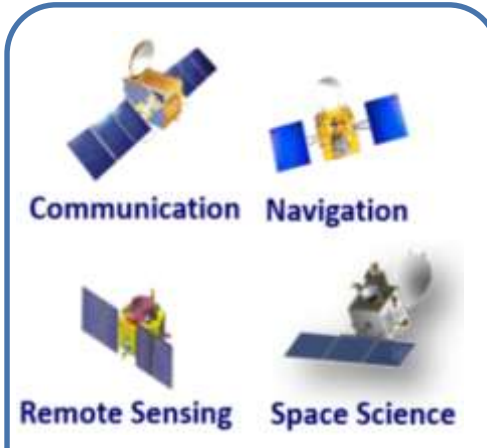
Harness space technology for national development, while pursuing space science research and planetary exploration

*...we should be second to none in the applications of advanced technologies to the real problems of Man and Society*

**Dr. Vikram Sarabhai**



**Space Transportation**



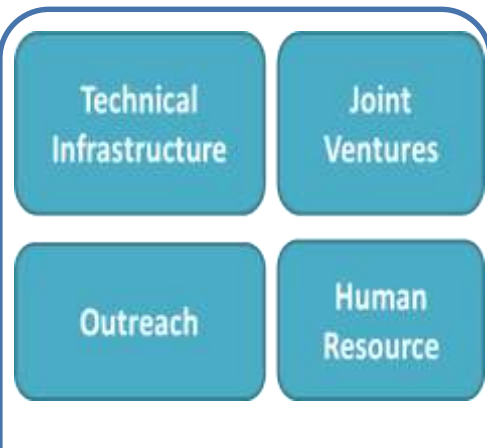
**Space Infrastructure**



**Space Applications**



**Human Space Flight**



**Capacity Building**

- 114 Spacecraft Missions, 83 Launch Missions, 13 Student Satellites, 2 Re-entry Missions and Launch of 342 Foreign Satellites
- Internalization of Space Applications in More than 20 Government Ministries/ Departments

# Indian Earth Observation Programme

Enabling National development, improving quality of life, building resilient society & better understanding of Earth System

## Programmatic Goals

EO Missions & Data Utilization Plan	<ul style="list-style-type: none"> <li>• User Demand aggregation</li> <li>• Payload Specs based on demand</li> <li>• Data usage roadmap</li> </ul>
EO Data Products & Dissemination	<ul style="list-style-type: none"> <li>• Data Processing &amp; Value Addition</li> <li>• Analytics &amp; Modeling</li> <li>• Information Systems &amp; Platforms</li> </ul>
EO Applications	<ul style="list-style-type: none"> <li>• National Imperatives / Priorities</li> <li>• Socio Economic Transformation</li> <li>• Citizen-Centric Advisories</li> </ul>
Institutional Linkages	<ul style="list-style-type: none"> <li>• Ministries / Departments</li> <li>• Industry &amp; Academia</li> <li>• International Cooperation</li> </ul>
Capacity Building	<ul style="list-style-type: none"> <li>• Generation</li> <li>• Absorption</li> <li>• Utilization</li> </ul>

**Enable Policies, Guidelines & Regulations**

## Application Domains



# Data Sources for Earth Observation Applications

## Space Segment

### RESOURCESAT & RADAR IMAGING SATELLITES

Natural Resources & Disaster Management



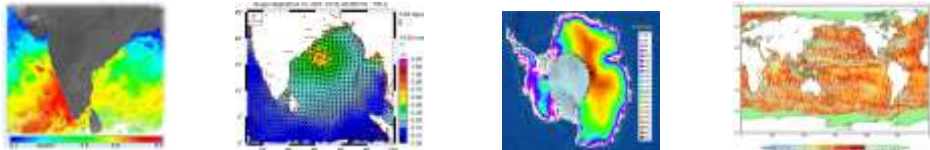
### CARTOSAT SERIES

Cartography & Large Scale Mapping



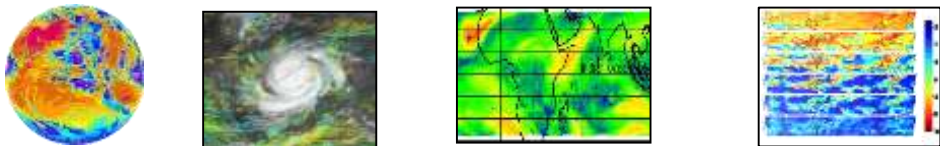
### OCEANSAT, SARAL

Ocean State Forecast ; Ocean Altimetry, Wind Vector



### INSAT 3D & 3DR

Weather Forecasting; Atm. and Climate studies



## Aerial & UAVs



- Two Beechcraft Aircraft
- Sensors / Instruments
  - LiDAR – DC ( 5cm GSD)
  - L & S band SAR
  - Hyperspectral



- Unmanned Aerial Vehicles
  - Hex Copter & Quad Copter
  - Fixed Wing UAV
  - Capacity across various Departments & industry

## Terrestrial



Automatic Weather Stations



Doppler Weather Radars



Atmospheric BL Lidars



Buoys



Floats



# Sustainable Development –Inputs for Food & Water Security

## Potential Fishing Zone (PFZ) Forecast

- Daily dissemination of PFZ forecast to > 6.75 Lakh fishermen
- Increased catch per unit effort, reduced search time & fuel savings

## Pre-harvest Crop Acreage & Production

- Multiple in-season Crop Acreage & Production Estimation (~25 crops)
- For policy decisions on procurement & stock management

## Bringing Green Revolution to Eastern India – National Food Security Mission

- Utilising post-kharif fallow lands for short duration pulses & oil seeds
- Vertical expansion of agriculture

## Surface Water Information

- Fortnightly Surface Water Spread information
- Input for Reservoir management, inland fisheries, hydrological drought..

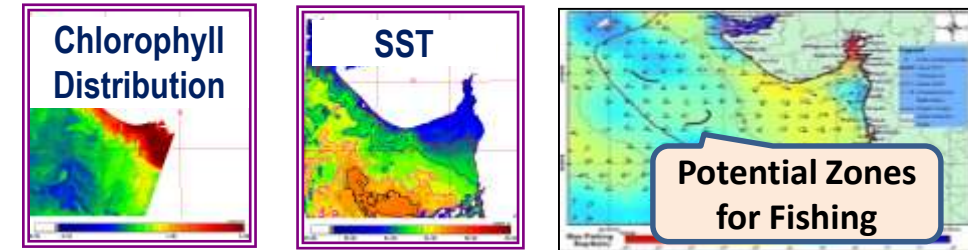
## Ground Water Prospects, Quality & Sustainability

- Ground Water Prospects Information: Yield, Depth and Recharge site
- Groundwater quality point database of 12 geo-genic elements

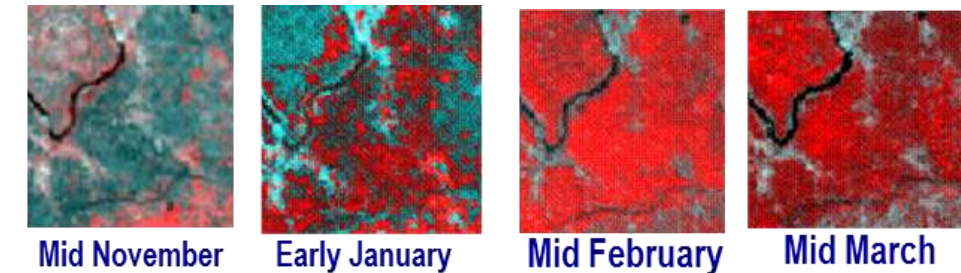
## Monitoring Irrigation Infrastructure Creation

- Identifying critical gaps in irrigation infrastructure
- Accelerating irrigation benefits & achieving targeted potential

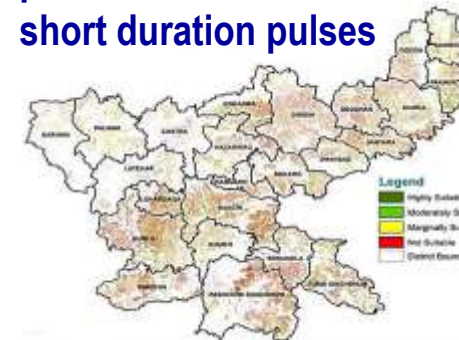
## POTENTIAL FISHING ZONE FORECAST



## CROP ACREAGE & PRODUCTION - WHEAT



## post-kharif fallow lands for short duration pulses



## National Water Body Information System



# Sustainable Development – Natural Resources & Renewable Energy

## Natural Resources Census

- Periodic assessment of Land use / Land Cover
- Biennial assessment of forest cover
- Periodic assessment of Wetlands, Snow & Glaciers, Biodiversity etc.

## Status of Land Degradation, Desertification & Wastelands

- Periodic assessment of Desertification, wastelands
- Input to UNCCD

## Developmental Planning

- Space based inputs for Decentralized planning
- Formulation of Land & Water resources' development plan

## Monitoring of Air Quality

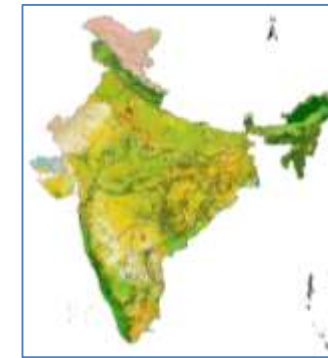
- Aerosol Optical Depth
- Model-based forecasting air quality

## Development of Renewable Energy

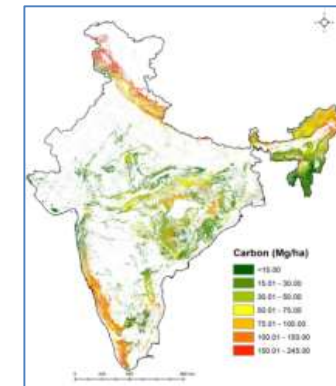
- Assessment of Solar, Offshore wind and wave energy potential

## Mineral Exploration

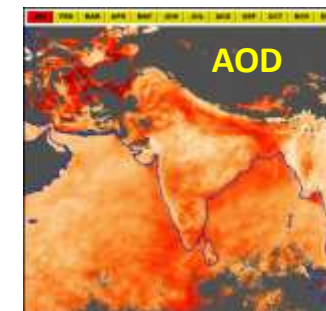
- Rock phosphate, Manganese, Iron, Hydrocarbon etc.



Land Use / Land Cover



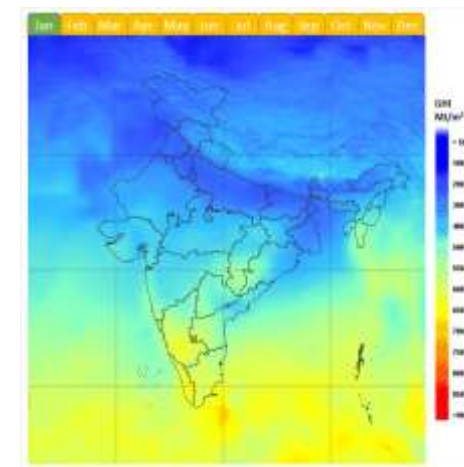
Spatial Estimate of Biomass



Air Quality Monitoring



Desertification & Land Degradation Status



Solar Power Assessment



# Space Technology Inputs for Governance

## Continuous & Demand based inputs for Planning, Monitoring & Evaluation and Decision Support

### ➤ Support to Government Programmes

- CoVID-19 – Geoportal on vaccination centres, containment zones, resources accessibility...
- Improved Crop Insurance Services – Decision Support
- Watershed management (86,000 Micro-watersheds) - Assessing the impact of interventions
- Urban transformation – Inputs for Urban Master plans towards Citizen friendly cities
- Monitoring of Public Benefit Schemes (Rural Employment; Housing; etc.) – enhancing efficiency
- De-centralized Governance - Participatory planning at grass-root level
- Connectivity to rural habitations – Rural development
- Water Resources development –for water stressed regions
- National Hydrology Project - Hydroinformatic products



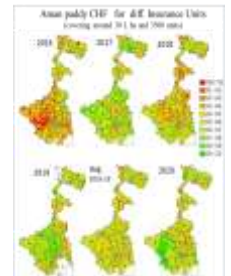
**CoVID Vaccination Centres**



**Monitoring & Evaluation of 86,000 micro-watersheds**



**Urban Geospatial Database for Master Plan**



**Crop Health in Crop Insurance**



**Geospatial hydro-products & services**



**Monitoring Rural Employment Scheme**

# Disaster Risk Reduction

## Floods



- Hazard & Forecasting
- Inundation
- Damage

## Landslide



- Hazard
- Early warning
- Damage

## Earthquake



- Pre-cursors
- Damage

## Cyclone



- Early Warning
- Monitoring
- Damage

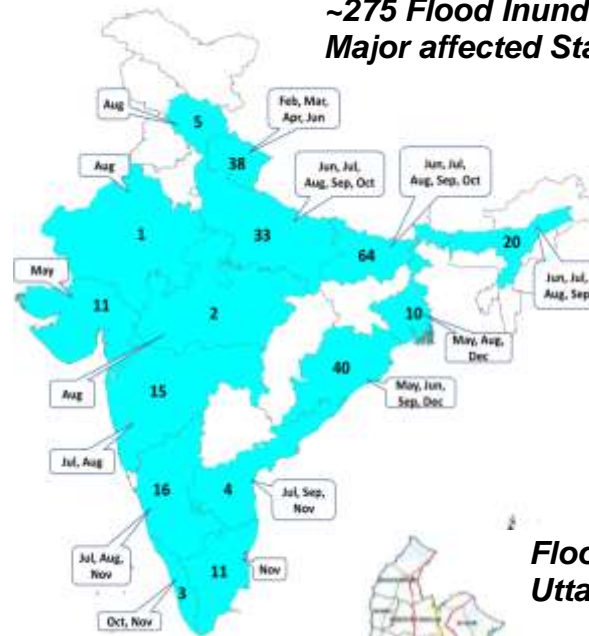
## Forest Fire



- Detection
- Impact

**National Database - for Emergency Management (NDEM)**

*~275 Flood Inundation maps for Major affected States in 2021*



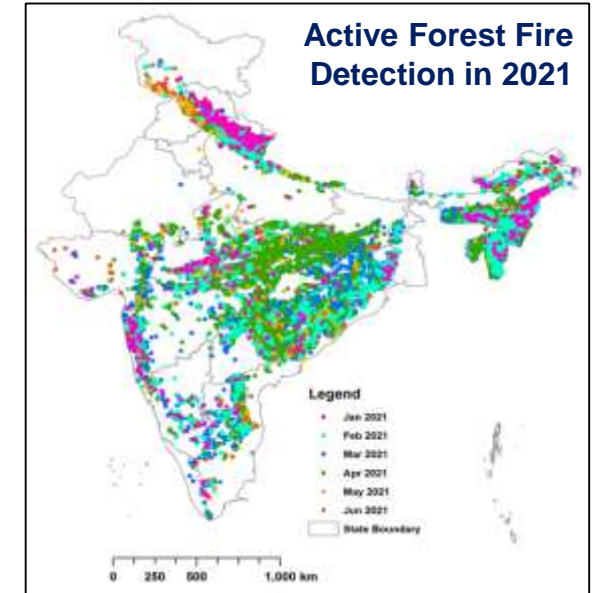
*Flood Hazard Atlas Uttar Pradesh*

### Flood Hazard Class

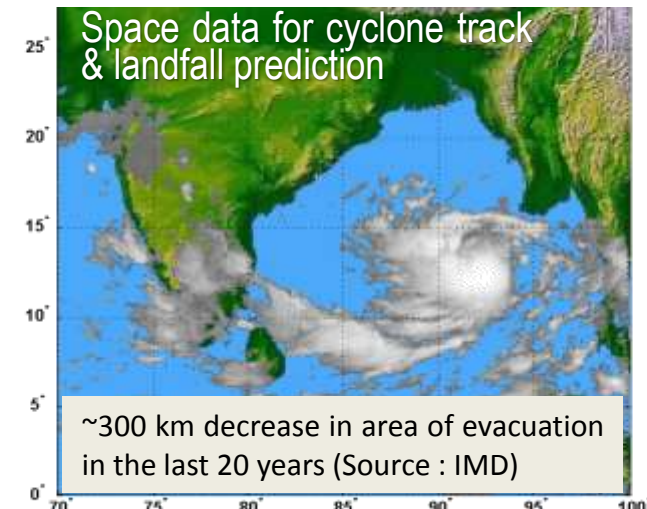
- Very Low (1-2 times)
- Low (3-5 times)
- Moderate (6-9 times)
- High (10-13 times)
- Very High (> 13 times)



**Active Forest Fire Detection in 2021**



**Cyclone Intensity, Track & Landfall Forecasting**



~300 km decrease in area of evacuation in the last 20 years (Source : IMD)

**International Cooperation- Charter on Space & Major Disasters, Sentinel Asia**



# Data & Information Dissemination

## BHUVAN

### Mobile Apps & Crowd Sourcing

~100M points

### Sharing of Open Data & Services

AWiFS, LISS III, DMSP, NICES, Natural Resources & Other Thematic Services

### Analytics & Data Science

### Geo Portals

Governance Appl.  
State & Central  
Min /Dept.

### Satellite Data Visualisation

LISS-III, LISS-IV,  
AWiFS, Cartosat-1,  
High Resl.

Hosting Earth Observation Data & Services

## M O S D A C

- Data Repository & Visualization – Met & Ocean
- In-situ & CAL-VAL data hosting & dissemination
- Forecast & Alerts - Weather & Ocean State
- Nowcast – Extreme weather events

### MOSDAC LIVE

Let's Interactively Visualise Earth



..... India strives towards maximising the use of Space Technology for the benefit of society .....

..... and in addressing various national needs on Governance and Development .....

*Thank You!*  
  
*for your kind attention*