



Recent Initiatives on Earth Observation Applications in India

16 March 2026

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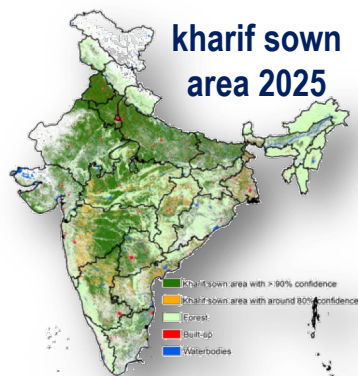
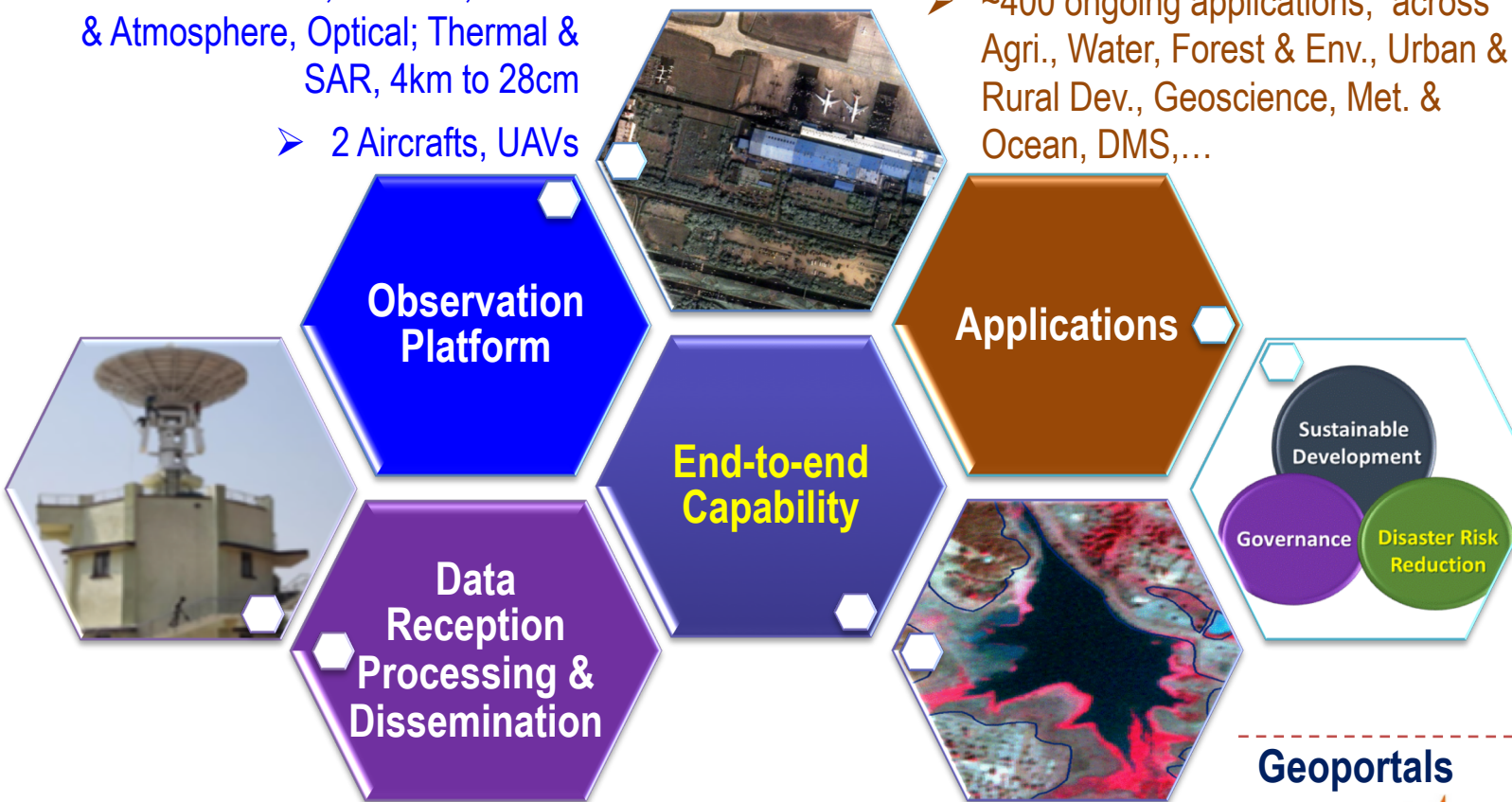
Overview of Indian Earth Observation Programme



Enabling National development, improving quality of life, building resilient society and facilitating enhanced understanding of Earth System

Demand-driven Programme

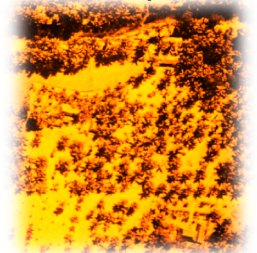
- ~50 EO Satellites, for Land, Ocean & Atmosphere, Optical; Thermal & SAR, 4km to 28cm
 - 2 Aircrafts, UAVs
- ~400 ongoing applications, across Agri., Water, Forest & Env., Urban & Rural Dev., Geoscience, Met. & Ocean, DMS,...



Automated generation of information products



Visual interpretation



Aerial survey of Coconut Root Wilt Disease using Color Infrared Film 1970

- ISRO GSs - 27 Missions, 90 Passes / Day
- ~30L Data product downloads/year

Internalization/ Institutionalization

> 20 Min./ Dept.



Geoportals



Visualisation of Earth Observation Data and Archival System



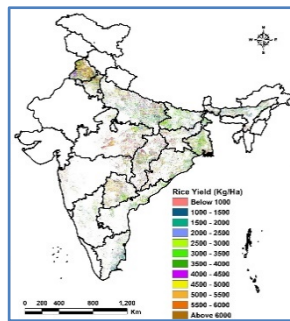
Agriculture, Water and Cryosphere Applications

Agriculture & Horticulture

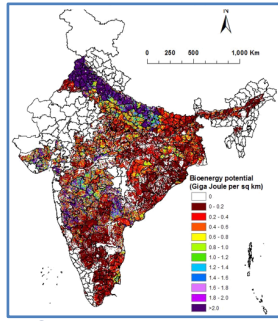
- Area, inventory and yield estimation of major field & horticulture crops – Scalable yield models
- AI-based Automated crop mapping using SAR data
- Digital agriculture solutions- KrishiDSS
- Crop insurance- yield models for Paddy & Wheat
- Crop surveillance—health, stress, damage, drought
- Agromet-based advisories to farmers

Water & Cryosphere

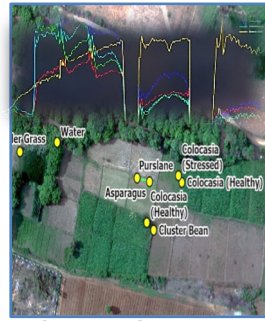
- National Hydrological Modelling System, Hydrological Unit Model & Evaporative Flux Monitoring
- Snow & Glacier Inventory & runoff forecast, Waterbody Information System & Irrigation DSS
- Isotope Hydrology
- Reservoir Storage & River Discharge: Swath Altimetry
- Polar Ice sheet dynamics: Altimeter & Scatterometer
- Ground Water- Dynamic gravity based TWS change



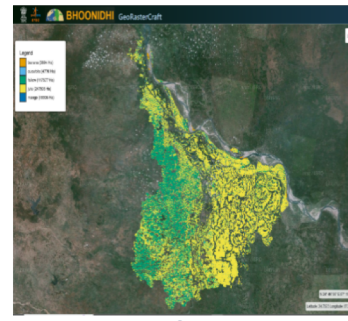
Rice Yield



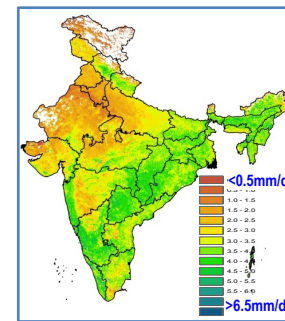
Crop Residue Bioenergy



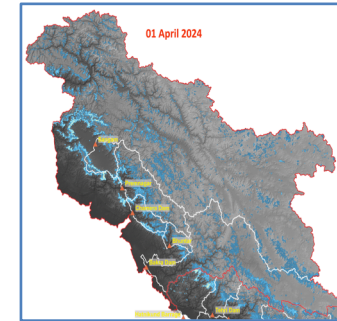
Crop Stress-UAV HyX Data



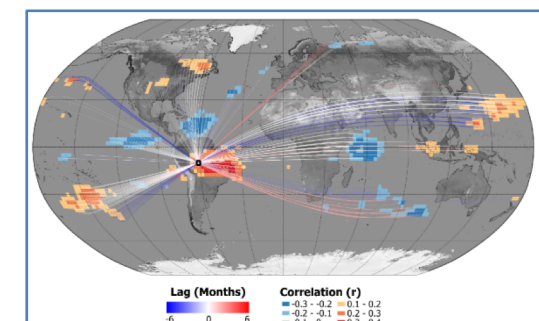
Auto Crop Classifier



Sat. data-derived AET



Spatial snowmelt runoff

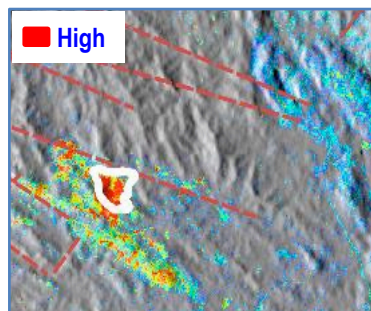
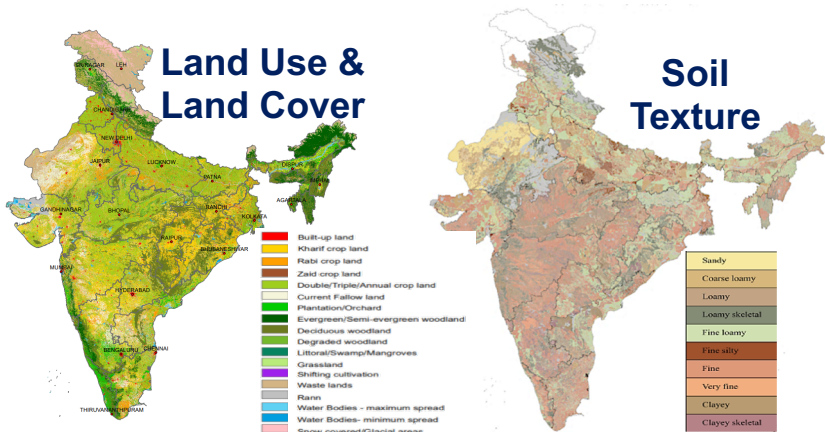
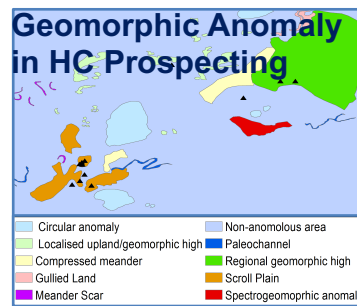
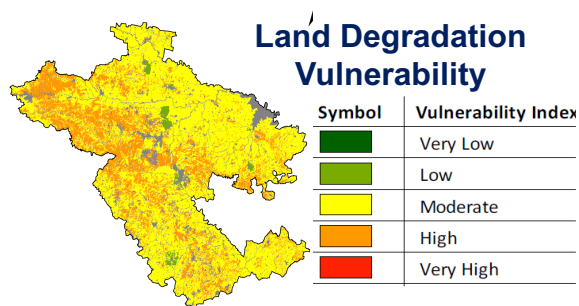


Isotope ratio Vs ET-P

Land, Geoscience and Bio-resource Applications

Land & Geoscience

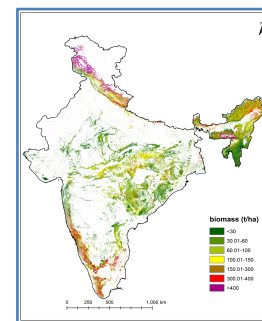
- National Annual Land Use & Land Cover (56m grid)
- Soil Resources Information (1:50K Scale)
- Soil Erosion - Fallout Radionuclides (FRNs) 137Cs
- Desertification, Land Degradation Status & Vulnerability mapping
- EO data for exploration of Hydrocarbon, REE, Gold



REE prospect- Ambaji (Gujarat)

Bio-resources

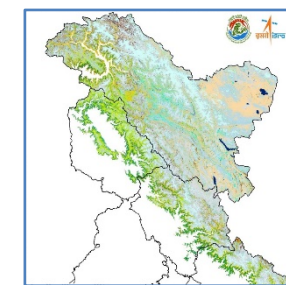
- Forest biomass- using ground, airborne & space inputs
- Dynamics of coral reef, mangroves
- Biodiversity Characterisation community level
- Dynamic Habitat Indices & ecosystem productivity
- Forest management- afforestation planning
- Upscaling of ecosystem fluxes using RS & process-based models – Forest & Agriculture



Forest Biomass



Monitoring mangroves



Himalayan Alpine Biodiversity

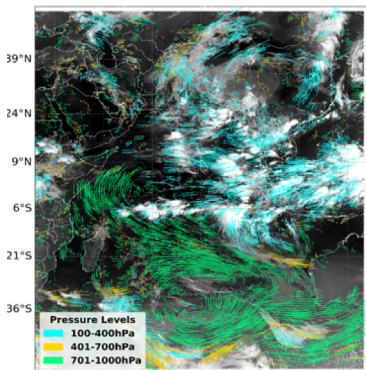


Afforestation planning

Ocean, Atmosphere and Climate Applications

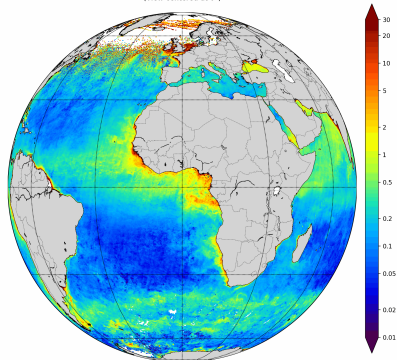
- 70 GP Products & 13 ECVs under NICES Programme, GHG estimation for UNFCCC report update
- 41 Operational products from INSAT-3DR & 3DS & 17 products from 13-Channel OCM3
- MSG-SEVIRI & INSAT-3DS for Extreme weather nowcasting
- Simultaneous MW based H&T sounding for improved NWP modelling- for Oceansat-3A
- DL framework & INSAT data for segmenting RF bearing thunder clouds & Chl-a as an early indicator for ElNino onset
- Safe Navigation- Very High Resolution Relocatable Flexible Grid Modeling System
- SWOT sea level anomaly for high resolution studies- 2-D map of sea level
- Methodology to detect Marine Debris & Oil Spill from high resolution satellite data
- Ocean Mean Temperature for Numerical Simulation of TC Track prediction
- Towards realizing NextGen MetSat, High Resolution Thermal Mission & G20 Satellite

INSAT 3DR - AMV - TIR1 IMG - 15 JUL 2025 0015UTC

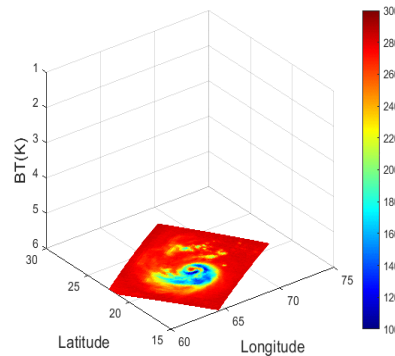


INSAT-3DS AMV

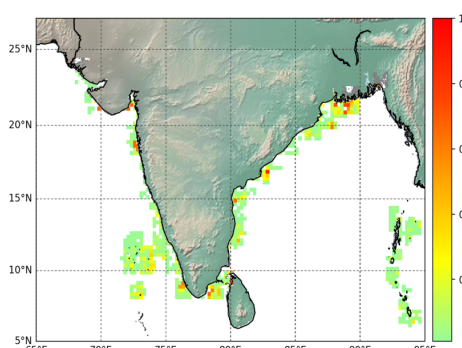
Global Chl-A Concentration
2023-01-01T00:00:00Z to 2023-01-31T23:59:59Z
(Data from: EOS-06_OCM3_L3n_MO_Chla_4km_01Jan2023_20250716_023611.nc)
(View centered at 0°)



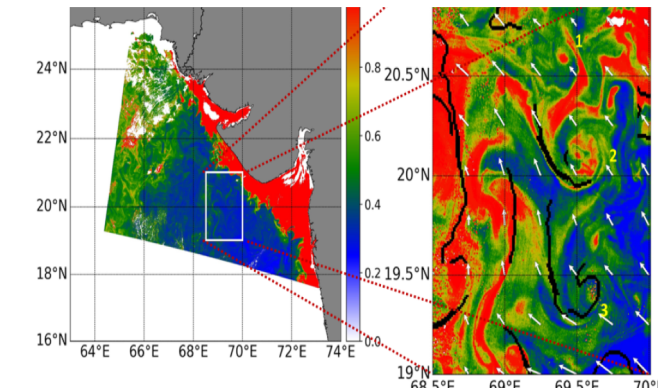
OCM3 Global Chl-A



Cyclone monitoring by MHS



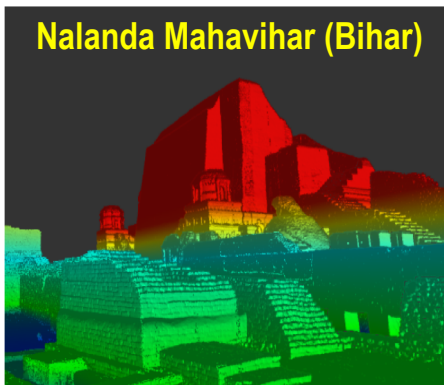
Floating Marine Debris Density



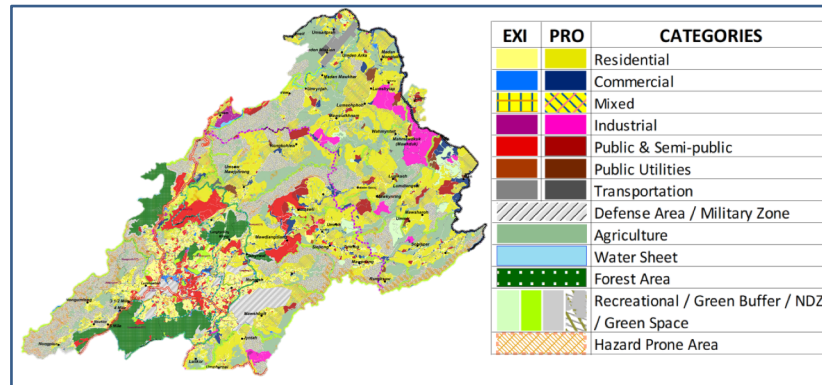
SWOT sea level anomaly

Urban & Rural Development and geo-Governance Applications

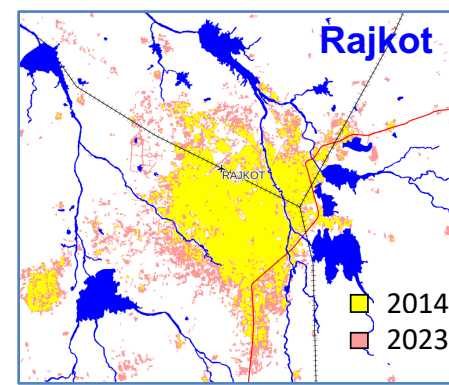
- Urban Micro-climate Modeling- UAV & VHR data for Urban Canopy Parameters, AI based built-up area
- Large Scale Geospatial data & Mobile application for Urban Master Plan – Urban Rejuvenation
- Urban Water Body Information System (UWaIS) for Rejuvenation & Conservation of Urban Waterbody
- Risk Informed GIS based Master plan preparation & Greenfield Township planning
- 3D Digital Documentation of Heritage sites
- Rural development Action plan for Village Clusters, to leverage collective strength
- Decision Support for Watershed Development planning
- Large scale Geospatial database & tools for decentralized planning
- **Continued support for Governance- Housing, Rural Employment, Urban Rejuvenation, Rural connectivity, Crop Insurance, Taxation, Citizen Unique Identification,**



3D Point Cloud- UNESCO Heritage Site



Urban Master Plan- Proposed Land Use 2041 (Shillong City)



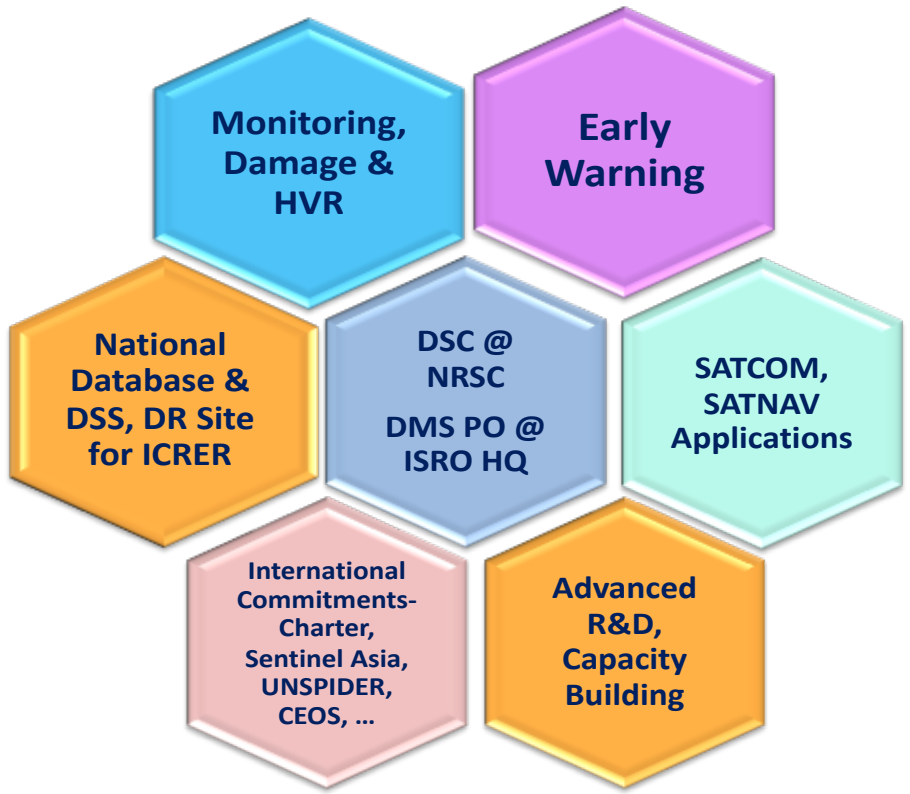
Built-up area-Decadal increment



Monitoring progress of Housing Scheme

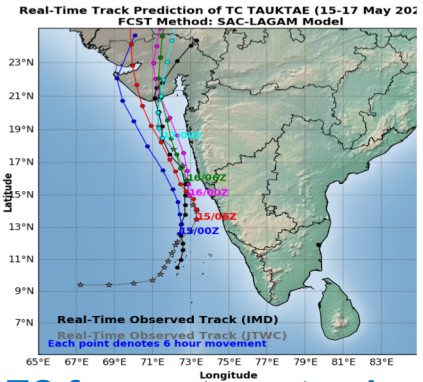
Disaster Management Support Programme

Enable space-based inputs for effective disaster management by respective nodal departments/ ministries

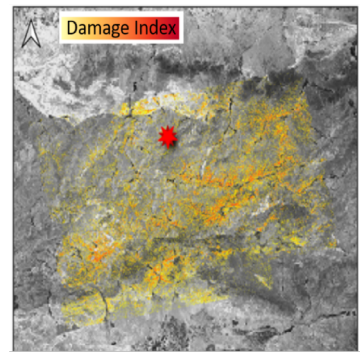


Flood, Cyclone, Forest fire, Landslide, Earthquake, Lightning, GLOF

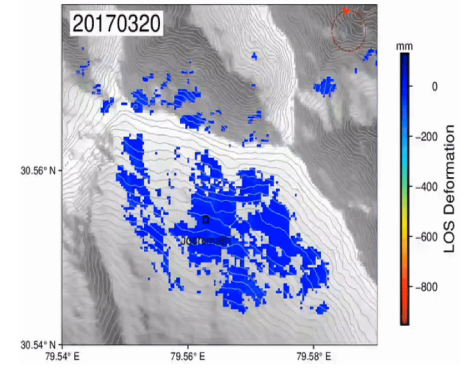
Liaison with Central & State Disaster Management Stakeholders



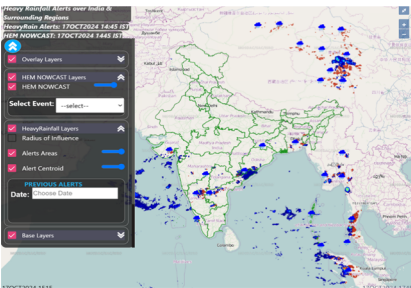
TC forecast: customized Hurricane-WRF model



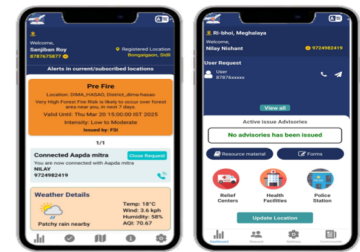
EQ Damage using Coherence loss



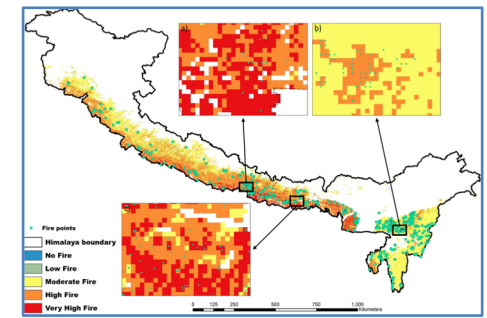
InSAR for Slope Deformation Estimate



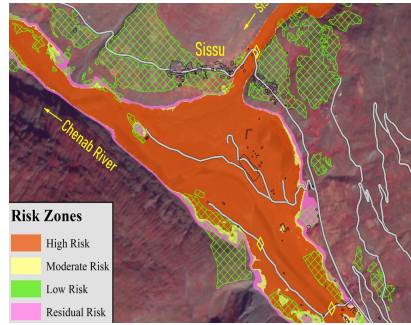
Extreme Weather Nowcasting



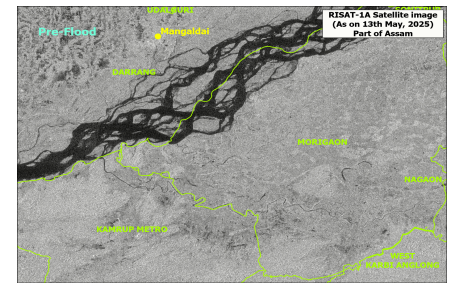
SMART AXOM-Geofencing based Disaster Alerts



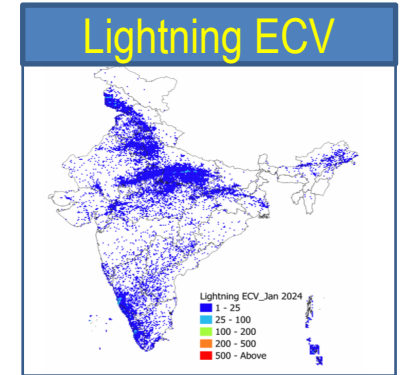
Forest Fire Weather model for the Himalaya



GLOF Risk Modelling

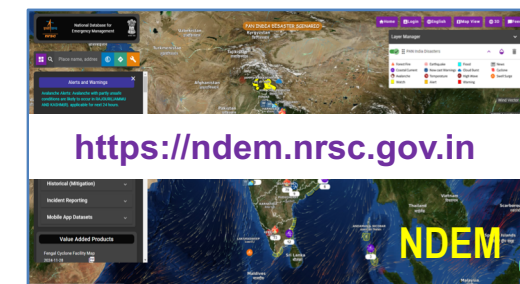


SAR data for Flood Monitoring



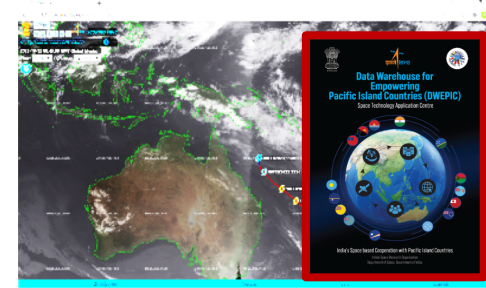
Dissemination of EO Data & Services- Geoportals of ISRO

- **BHOONIDHI:** Satellite Data dissemination portal. 49 missions' data, 6.5PB storage, ~70K Users.
- **BHUVAN:** g-Governance, visualization & dissemination of Geospatial information. 1.2PB storage, 25M+ hits/day, 150+ data layers, 270+ Applications, 12 APIs, 230M+ POI
- **MOSDAC:** ISRO's Met & Ocean data products & services' archival & dissemination: 4 PB storage , 13,000 users , 4 lakh products per month. APIs, Jupiter based Interactive Computing,..
- **VEDAS:** Interactive analytics on Raster & vector data. 1PB storage, RiDAM, GES, API, WebUI, AI/ML Models
- **NeSDR:** Regional repository of data & tools for decision support by Government users. 1400+ layers, ~25 services
- **NICES:** Dissemination of climate & environment data. 13 ECVs, 70 GP Products, > 5000 GB Data
- **NDEM:** National Database & DSS tools for Emergency Management. 40+ services, 120TB storage.

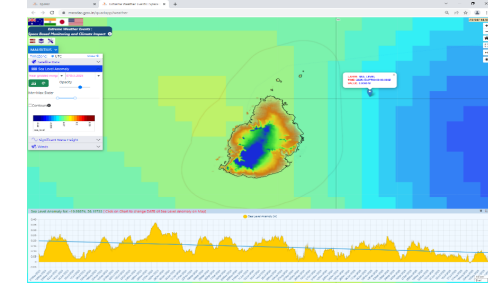


Engagements under International Cooperation

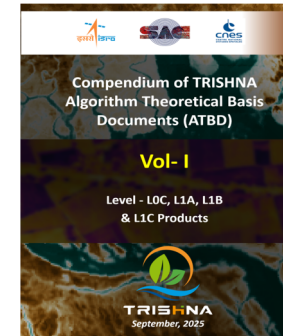
- **QUAD Space Working Group:** Extreme weather & study of climate impact on sustainable development – Mauritius
- **FIPIIC:** Bhuvan – DWEPIC portal for developmental planning, disaster management, and climate change studies
- **INDIA-OMAN Space Platform** for Geospatial applications
- **Joint Missions & Science Applications- TRISHNA (CNES), G20 Satellite** (proposals from 6 countries)
- **International Charter Space & Major Disasters-** Member Agency since inception. Held Lead Role 6 times
- Active in **CEOS, GEO, CGMS, BRICS, BIMSTEC, UN ESCAP, IORA, ..**
- **Training & Capacity building under CSSTE-AP, ITEC, ASEAN,.....**
- **APRSAF: SAFE** (Rice Monitoring, CH4 flux in Rice fields), **Sentinel Asia** (ISRO is a Co-chair of SA-SC)



Extreme Weather Monitoring & DWEPIC for FIPIIC



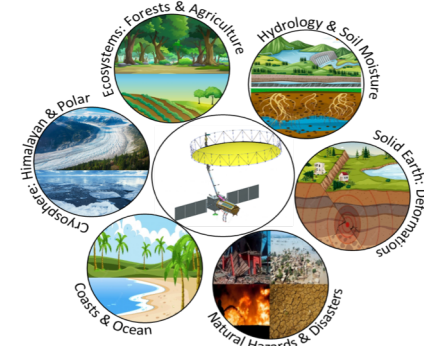
Space based Monitoring over Mauritius (QUAD)



ATBDs for Science Products- TRISHNA



BHUVAN Geoportal for OMAN

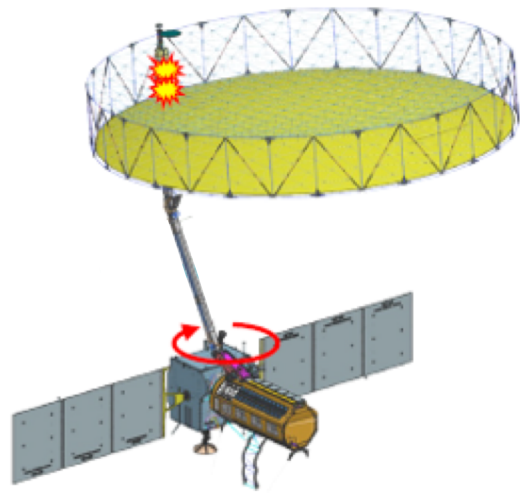


Science Products from NISAR

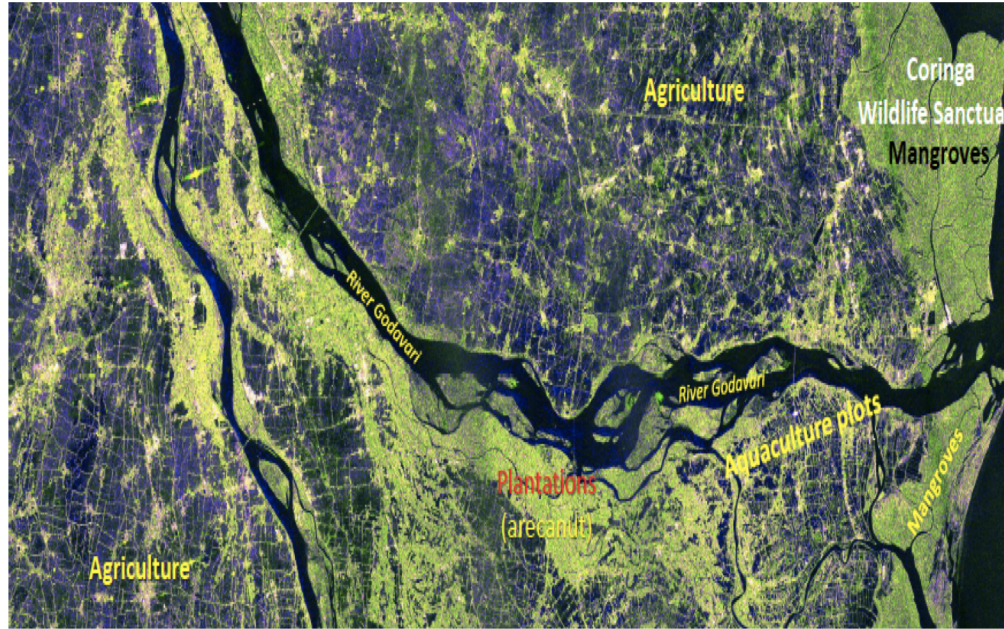


CH4 flux in paddy fields

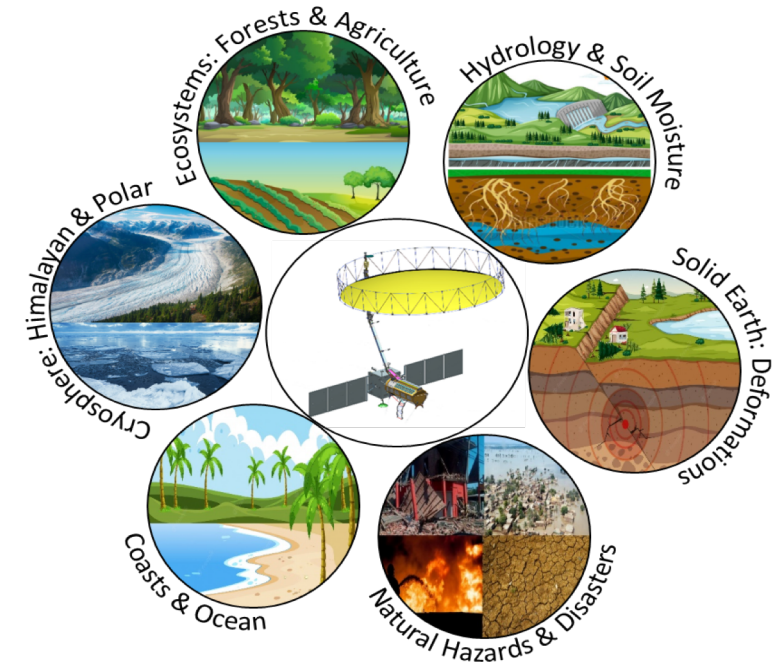
NASA-ISRO SAR MISSION



NISAR Deployed Configuration



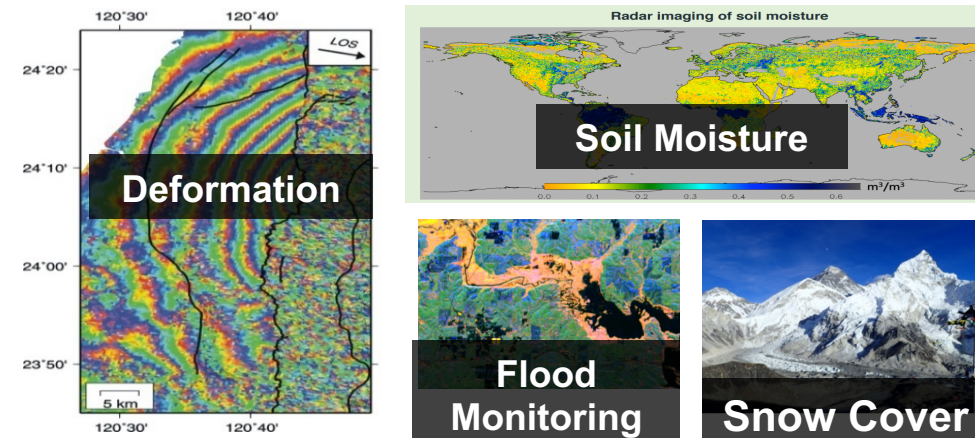
S- Band SAR Payload Image



Forest cover, Crop Area, Biomass, glacier velocity, dry-wet snow, palaeo channel, mapping, coastal bathymetry....

- **NASA:** L- Band SAR & dia. 12 m deployable Unfurlable Antenna
- **ISRO:** S- Band SAR, S/C mainframe & Launch by GSLV-F16
- Unique Sweep SAR feature enabling higher resolution radar imaging with high swath

Science Calibration phase is progressing



Upcoming Earth Observation Missions (1)

Oceansat-3A

Orbit	Sun synchronous ; 720 km ; ECT: 12:00 Hrs
P/L	OCM-3 (13 bands: 402 to 1020 nm) : 360 m OSCAT-3 (Ku Band - 13.51 GHz) SSTM-1 (2 Bands: 11 & 12 μm) : 1080 m
Swath	1400 x 1400 km

SSTM specifications

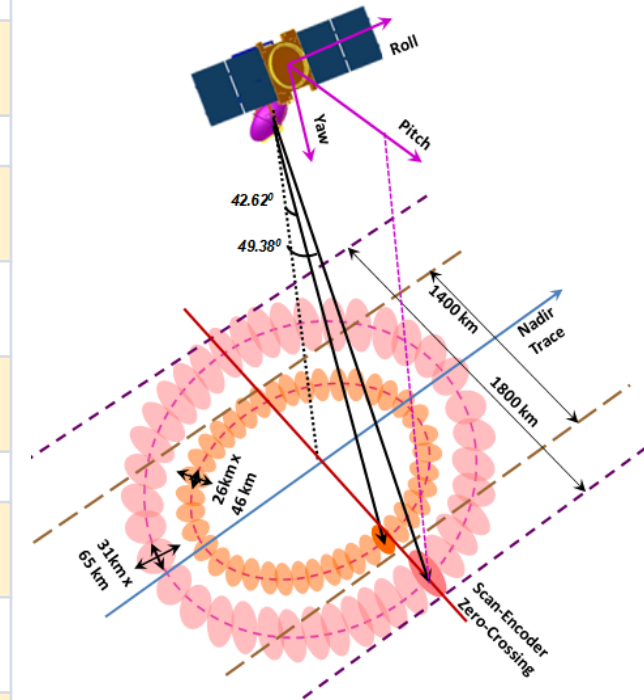
S. No.	Parameter	Design Goal
1	IGFOV at nadir (m)	< 1080 m
2	Spectral bands (μm)	10.75 - 11.25 11.75 - 12.25
3	Band Width (μm)	0.5
4	Swath (km)	1440
6	NEdT @ 300K	< 150mK
7	Saturation temperature (K)	> 340

OCM-3 Band description and their applications

Band#	CWL (nm)	Primary Application
B1	412	Differentiate yellow substance & chlorophyll
B2	443	Chlorophyll absorption maximum; low chlorophyll
B3	490	Moderate chlorophyll
B4	510	High chlorophyll; Total Suspended Matter (TSM)
B5	555	Reference baseline for Chlorophyll
B6 *	566	Phycoerythrin absorption , Trichodesmium bloom
B7	620	Turbidity in coastal Case 2 waters, Phycocyanin absorption
B8*	670	Baseline for fluorescence line height (FLH), chl secondary absorption
B9 *	681	Chlorophyll fluorescence
B10 *	710	Baseline for FLH, vegetation - chlorophyll fluorescence; atmospheric Correction
B11	780	Atmospheric correction; avoids O2 absorption Band
B12	870	Atmospheric correction; good assessment of spectral scattering
B13 *	1010	Atmospheric correction in turbid waters, aerosol – white foam discrimination

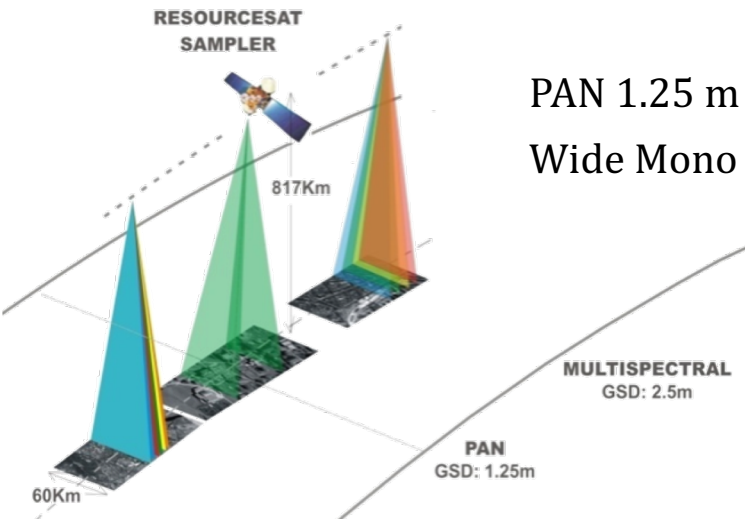
Ku band Scatterometer (13.515 GHz) ;

Orbits / day: 14 ½ ;
Repeat cycle: 2 days



RESOURCESAT 3S/3SA

RESOURCESAT SAMPLER



PAN 1.25 m Stereo

Wide Mono with 106 Swath

Sensor	GSD	Swath	Revisit
PAN	1.25 m	60 km	Revisit of 4 Days
MX	2.5 m	60 km	
Orbit: 633 km ; ECT: 10:30 Hrs			

3m DEM with < 5m accuracy, inputs for planning, execution, monitoring of water resources projects, HR mapping/monitoring, DMS, bathymetry of Glacial lakes/ costal lines, ...

TRISHNA

(Thermal infraRed Imaging Satellite for High-resolution Natural resource Assessment)

VNIR-SWIR

- Bands: 4 (VNIR), 2 (SWIR), 1 (WV)
- Resolution: 57 m (Cirrus & WV; 114 m)
- Swath: 1060 km

TIR

- Bands : 4 bands
- Resolution: 57 m(Land) /1 km (Ocean)
- Swath: 1060 km

VNIR (485, 555, 670, 860, WV-910), SWIR(Cirrus-1380, 1610) TIR(8.65micr.m, 9.0, 10.6, 11.6)

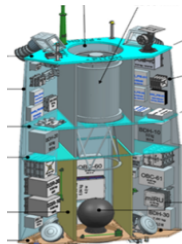
Sector

Applications

AWM	<ul style="list-style-type: none"> • Actual ET, Stress index, crop management & yield modelling, drought, LAI product, soil wetness
Coastal	<ul style="list-style-type: none"> • Coastal and inland water quality and thermal pollution monitoring, Harmful algal bloom
Hydrology	<ul style="list-style-type: none"> • Assessing irrigation needs, crop water requirements, irrigation / tanks water assessment.
Snow / Cryosphere	<ul style="list-style-type: none"> • Snow cover, inputs to Hydrological models for snow-bound regions; Avalanche forecasting, Snow-melt runoff & debris thickness estimation, Snow cover change & metamorphism, Estimating snow properties

HRSAT

Constellation of High-resolution Satellites



Sensor	GSD	Swath	Revisit
PAN	0.85 m	15 km	Daily (AOI)
MX	< 3.2 m	15 km	
LWIR	17 m	6 km	
Orbit: 660 km ; ECT: 9:30 Hrs			

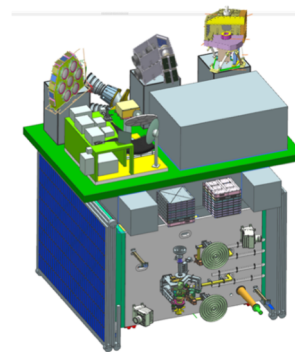
- PAN : 0.45 - 0.8 μm ,
- MX (3) : 0.52-0.59 μm ; 0.62-0.68 μm , 0.77-0.86 μm
- LWIR : 7.1-11 μm

Systematic coverage of high resolution data of the country twice a year & feasibility of daily revisit of Area of Interest

Large scale mapping, Regional/ Urban Planning, Road Alignment Planning, Infrastructure/ Asset Planning & Monitoring, Transmission line Route Alignment and Asset Management, DMS ...

G20 SAT

A satellite to be realised on a collaborative basis among G20 nations to enable space-based observations of various variables that affect environment and climate change.



Potential Observables: Air pollution, Green House Gases and Forest fires, Humidity, Precipitation, Ocean surface Vector Winds, Currents, Waves, Soil Moisture, Radiation budget

Indian payloads

- Polarization Sensor for Aerosol & Cloud Monitoring (POLSAC)
- Environmental Sensor for Atmospheric Composition (EnSAC)
- Sensor for Advanced Climate studies & Forest Fire (SACFF)
- Mm-wave Temperature & Humidity Sounder

Payloads from G20 nations are being finalised

Space Sector Reforms - Emerging Indian Private Sector

- ▶ Indian Space Policy (2023) & Revised FDI policy released
- ▶ Coarser than 5m resolution Indian EO data on free & open basis
- ▶ Financial Support - Investment Incentive Scheme, Venture Capital Fund, Technology Adoption Fund
- ▶ Significant increase in Space Start-ups - ~400
- ▶ ISRO's support to Industry - ~75 Joint proposals
- ▶ Launch Vehicle building through Industry - PSLV, SSLV Technology Transfer, LVM3 PPP
- ▶ Transfer of Technology – 100 Agreements
- ▶ Space Based EO Satellite constellation through PPP

Launch Systems

(non exhaustive list)



Ground Systems

(non exhaustive list)



Satellite Systems

(non exhaustive list)



In space solutions

(non exhaustive list)



Space Data Applications

(non exhaustive list)



Charting the Roadmap 2040: National Meet – 2025

Translating user requirements into roadmap of Applications & Missions, towards **Leveraging Space Technology Applications for Viksit Bharat 2047**

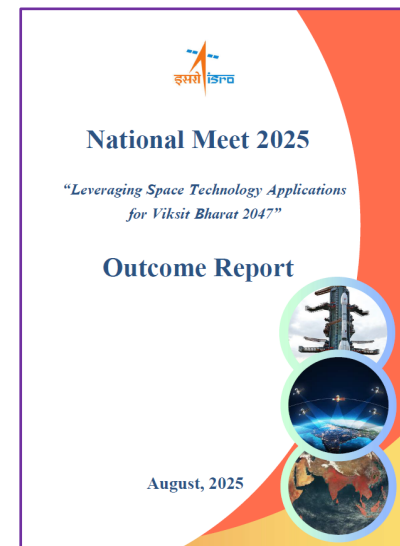
- ❑ ~300 one-to-one meetings, 08 Regional & 02 State Meets
- ❑ 91 User Requirement Documents
- ❑ Mega User Meet during 22nd and 23 August 2025, ~1,500 officials attended
- ❑ Outcome Report based on user need - Mission Roadmap 2040
- ❑ 100+ satellites proposed, ~65% in the small satellite class
- ❑ Doubling ground stations, Indian Earth Engine, On-board AI/ Edge Computing



Interaction with Ministries



Concluding Session of NM 2025



- **Demand driven regime; users project the requirements for EO infrastructure**
 - INSAT 4th generation, Scatterometer constellations, Temperature/ Humidity profilers, Radiometers etc.
- **Focus on R&D, demonstrating newer applications, capabilities of new & emerging observational systems**
 - **On-board data processing and dissemination**
 - **Platform/ Tool Independent applications**
 - **AI augmented applications**
 - **Science applications addressing real-world problems**
 - **Conceptualising prototype applications for science concepts**



**ISRO Supports strong cooperation for maximizing
Satellite Applications for Sustainable Development,
Disaster Resilience & Economic Prosperity**

THANK YOU...