ISRO Updates since CGMS-53 and Report on the Medium to Long-term Future Plans on Earth Observation

Presented to CGMS-54 plenary session, agenda item [3]
CGMS-54-ISRO-WP-04

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Coordination Group for Meteorological Satellites

Executive Summary

- **INSAT-3DR** (launch: Sep-2016) at 74E and **INSAT-3DS** (launch: Feb-2024) at 82E operational in GEO
- **EOS-06** (Oceansat-3), launched in Nov 2022 operational with Ku-band Scatterometer, and 13-band Ocean Color Monitor (OCM-3). Data available to Global Users through GTS and ISRO web-portal
- Joint NASA-ISRO **NISAR** (L & S band SAR) launched in Jun 2025. Spacecraft commissioning and calibration completed by Dec-2025. Payloads currently in Science Cal/Val phase
- **Oceansat-3A** with OCM-3, Ku-band Scatterometer, Sea Surface Temperature Monitor (SSTM), and Millimeter-wave Atmospheric Temperature & Humidity Sounder (MATHS) will be launched this year
- ISRO-CNES joint mission SARAL/AltiKa functioning in mis-pointing mode; mission extension beyond June 2026 will be discussed with CNES considering the health of the satellite
- Under **GSICS**, inter-calibration of INSAT-3DS observations carried out: IR channels, w.r.t. MetOp-IASI and VIS/SWIR channels using Ray-matching method, w.r.t. MODIS
- Work on MoES proposal for INSAT-4th Generation satellite in advance stage with instrument specifications for Advanced Imager, Lightning Imager and Hyperspectral IR Sounder finalized

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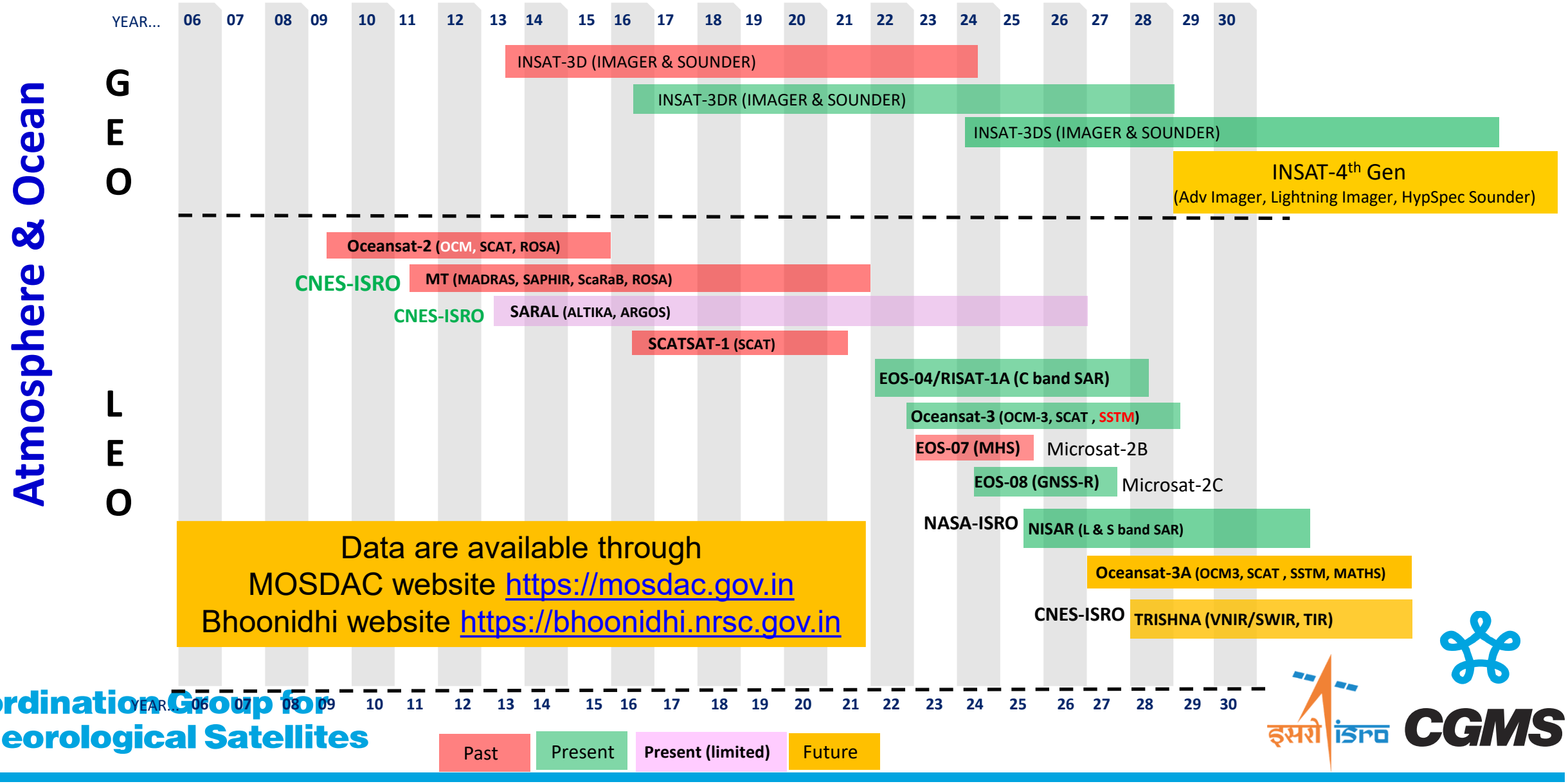
Overview - ISRO Satellite Systems



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EOS-06/Oceansat-3 (OCM & SCAT) – Products & Dissemination

- Scatterometer winds utilized for Cyclogenesis and Track & Intensity prediction as well as NWP model assimilation by Global users (Data available through GTS-BUFR)
- EOS-06 Ocean Colour Monitor is catering to Potential Fishing Zone (PFZ) advisories
- Chl-a derived using OCM3 Fluorescence triplet bands over coastal region have shown reasonable dynamical variabilities

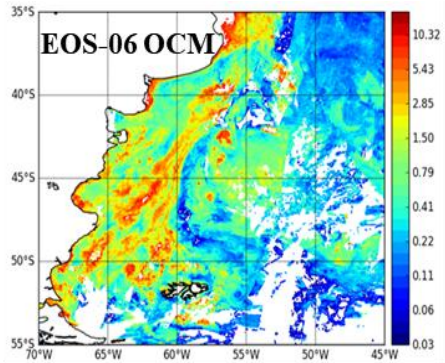
Operational Products (Bhoonidhi)

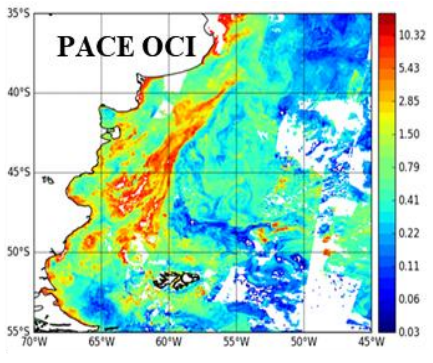
1. Ocean Biophysical Products:
   - Chlorophyll-a Concentration
   - Remote Sensing Reflectance (R_{rs})
   - Aerosol Optical Depth
   - Total Suspended Matter
   - Diffuse Attenuation Coefficient
2. Land Biophysical Products:
   - NDVI
   - Vegetation Fraction
3. Sea Surface Wind Vector
4. Global Sea Ice Extent

Value-added Products are available through MOSDAC

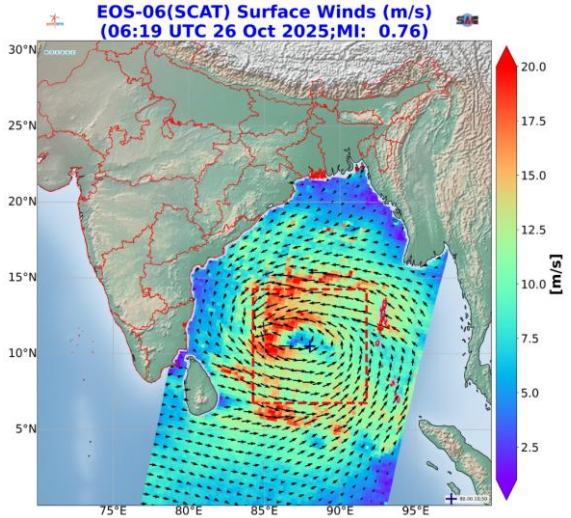
Several new Products added this year

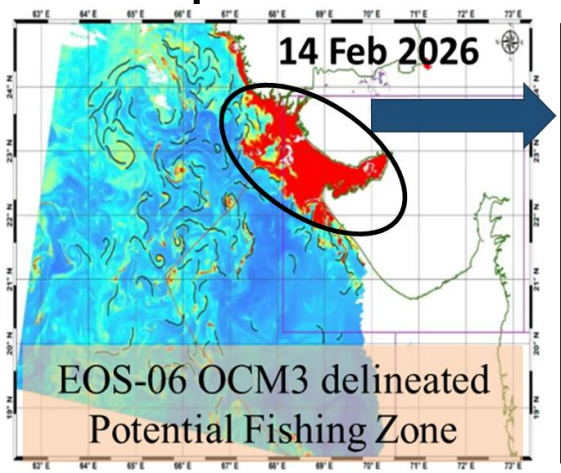
Normalized Fluorescence Line Height (nFLH) has shown importance in deriving Chl-a in Coastal waters

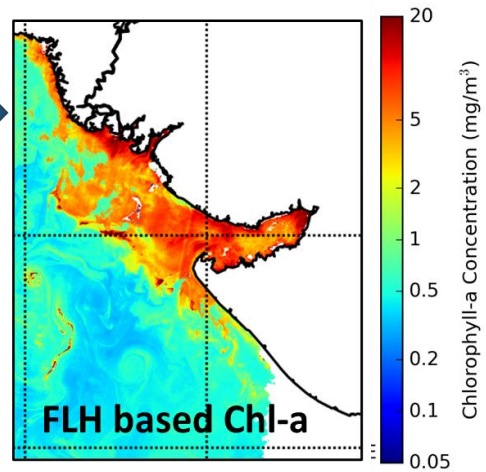




South Atlantic Ocean Blooms from Ocean Color Sensors (8-15 Nov 2024)







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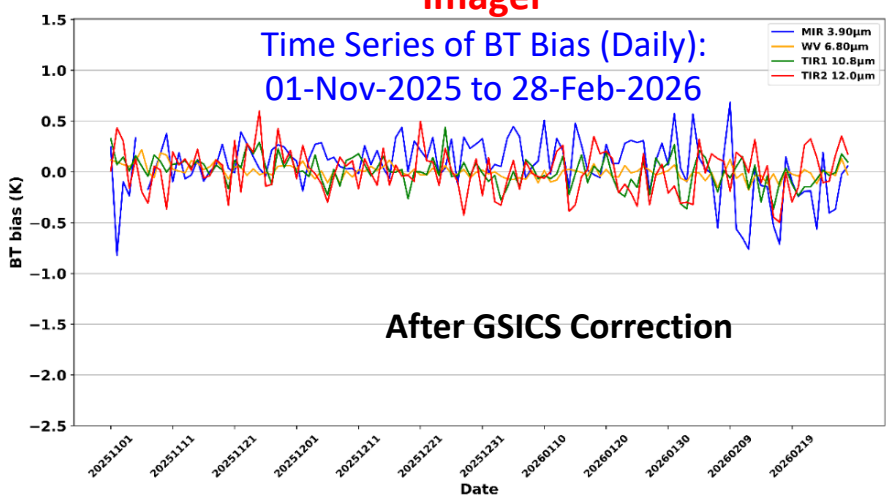
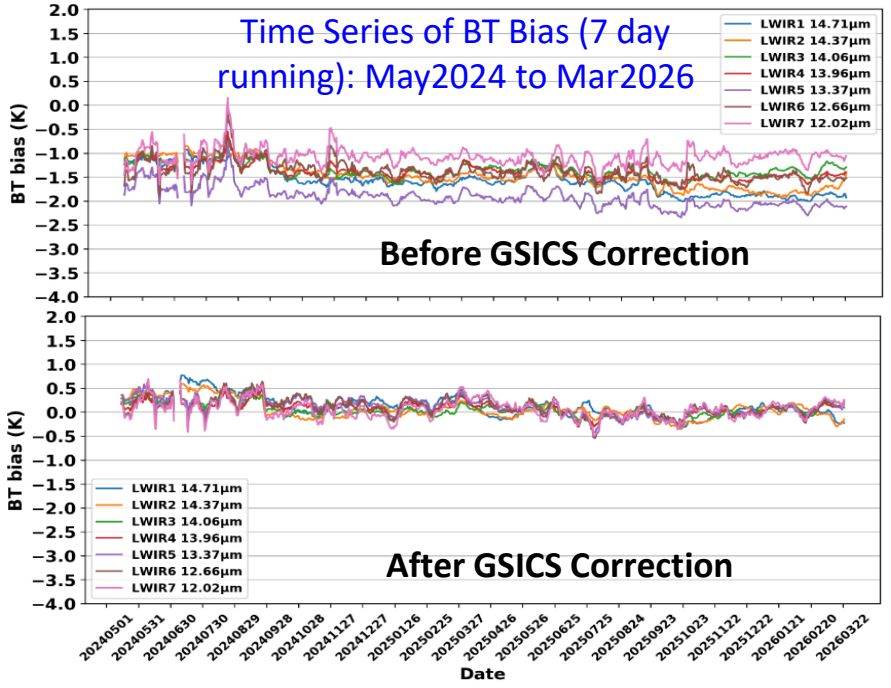
INSAT-3DS

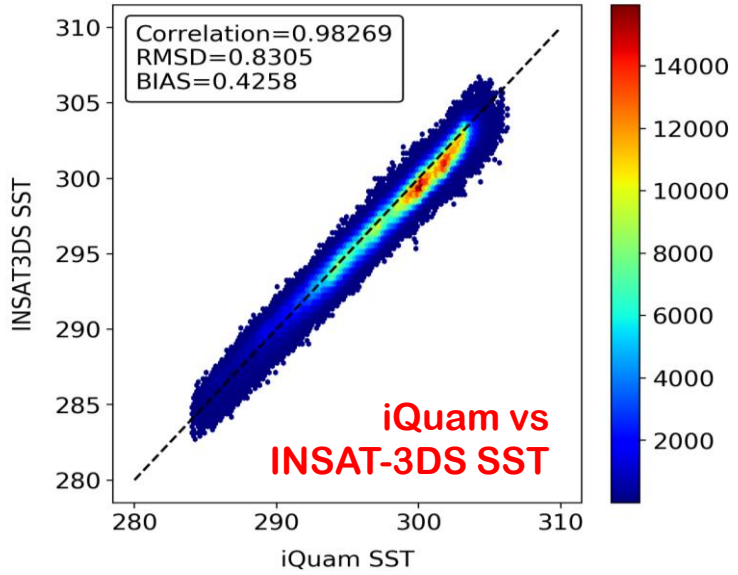
- Launched on 17-Feb-2024
- 6-Ch Imager and 18-Ch Sounder
- Design improvements to mitigate the issues related to the BBCAL/ Mid-night sun, w.r.t. its predecessors INSAT-3D/3DR
- After GSICS correction - Biases in the L1B products are significantly smaller and stable for both Imager and Sounder
- Efforts to make INSAT-3DS SST product in GHRSST compliance format **(BoM, Australia)**
- Full Disk AMV under evaluation

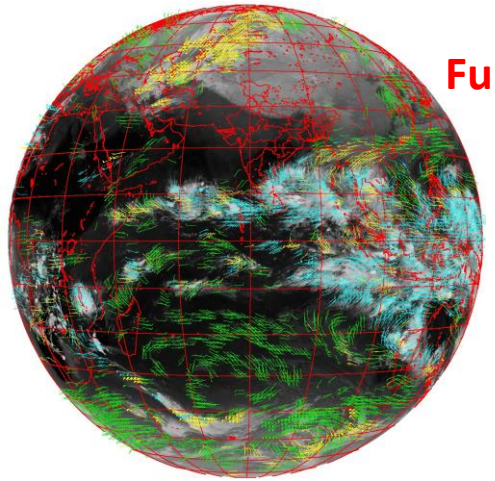
Imager



Sounder







Full Disk AMV

14Dec2024
1200UTC

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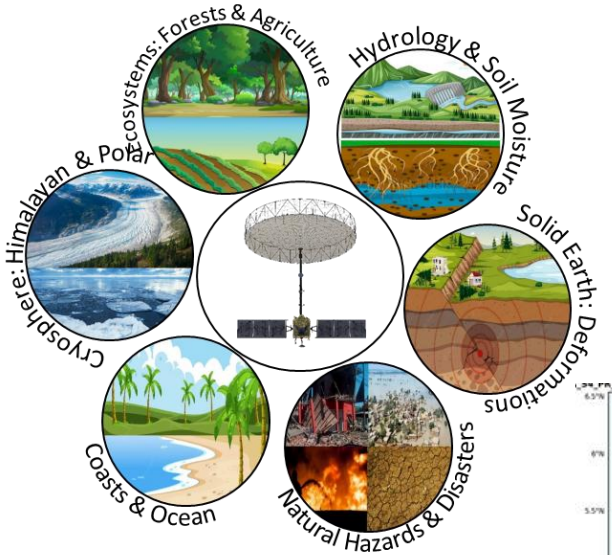
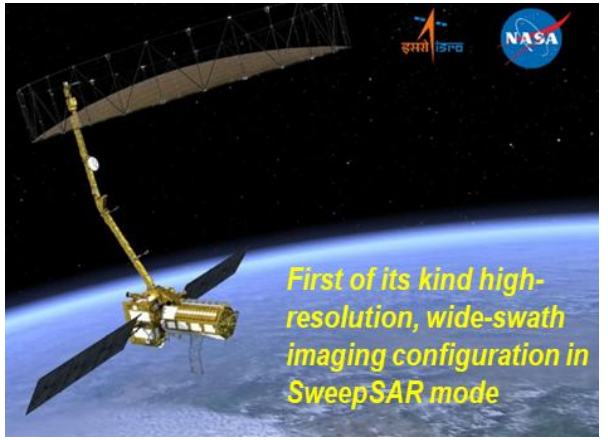
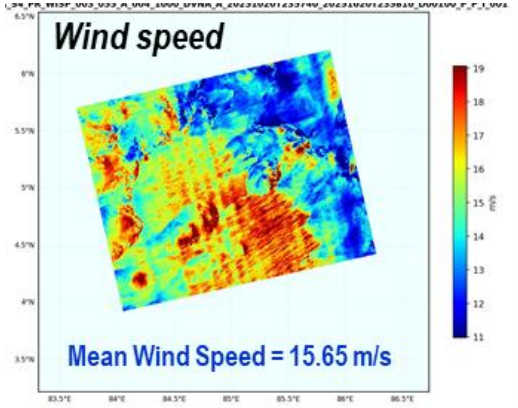
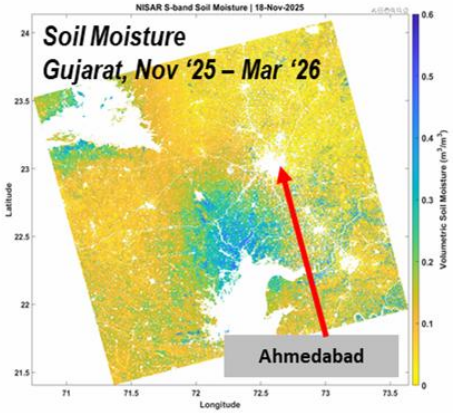
NASA-ISRO Synthetic Aperture Radar (NISAR) Mission

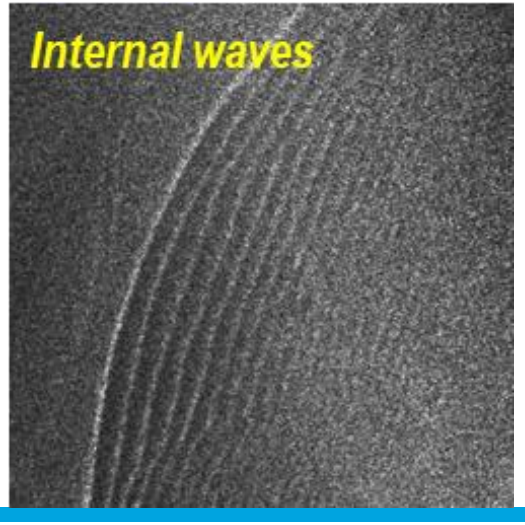
- NISAR (launched 30 July, 2025) comprises S-band SAR developed at SAC-ISRO and L-band SAR from JPL-NASA.
- Aims to study dynamics of Ecosystems, Solid-earth, Cryosphere, Hydrology and Oceans to understand underlying processes.
- Spacecraft commissioning & calibration completed by Dec-2025. **Payloads, currently, are in Science Cal/Val phase.**
- S-SAR sample data-products slated for release in June-2026. **Release of operational products (Level-2) planned in Aug-2026, from Bhoonidhi portal of ISRO.** (https://bhoonidhi.nrsc.gov.in)
- Participation of Non-governmental entities in developing downstream applications











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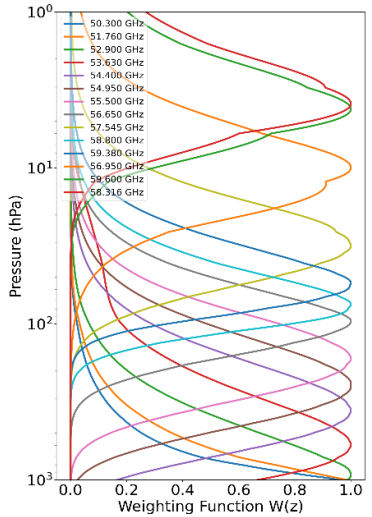
FUTURE INDIAN SATELLITES

Oceansat-3A (2026)

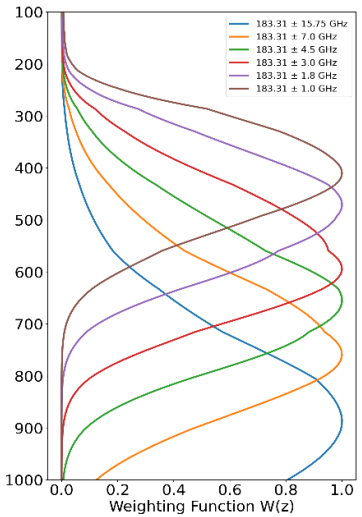
- Continuity to Ocean Color & Ocean Surface Wind Vector observations
- Combined with Oceansat-3, enhanced revisit for Met and Ocean appl
- ARGOS in Oceansat-3 is replaced by Millimeter-wave Atmospheric Temperature and Humidity Sounder (MATHS)
  - 20-Channel cross-track scanning Radiometer (50-60GHz and 183.31± 16.25GHz)
  - Spatial resolution of 25 km and 15 km, for O_2 and H_2O bands, respectively
- Payload integration in advanced stage

Oceansat-3A
(OCM3, SCAT, SSTM, MATHS)

Ocean Color & Wind vector – Continuity + SST



O_2-Band weighting Function



H_2O-Band weighting Function

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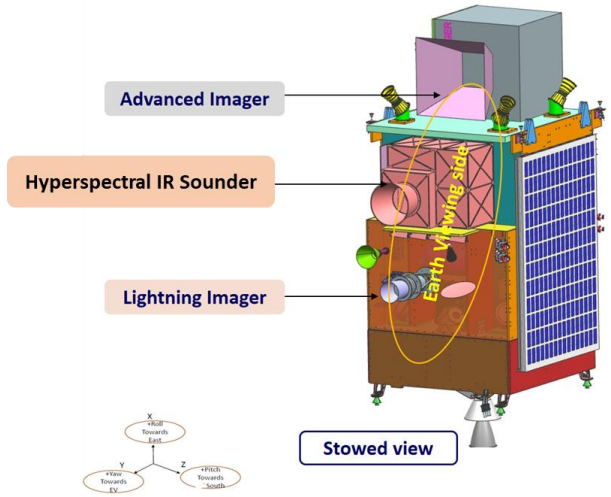
GEO: INSAT-4th Generation Satellite

a) Advanced Imager
- 18 Bands from 0.5 – 13.5 µm with Spatial Resolution 500m for VIS/SWIR and 1-2 km for IR
- Faster Scanning for Nowcasting applications

b) Lightning Mapper

c) Hyperspectral Infrared Sounder

- **Preliminary Design Configuration & Instruments Specification finalized**
- **Payload development initiated**

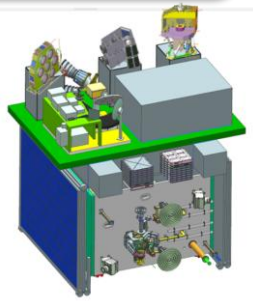


Readiness for G20 mission

A **Joint Global Mission** to provide Satellite based products for better understanding of challenges associated with **Environment and Climate**.

Addressing Major Global Issues

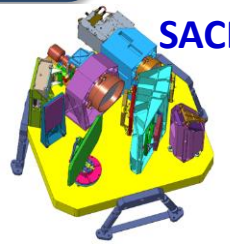
- Air Pollution
- Green House Gases
- Forest Fire
- Climate Change



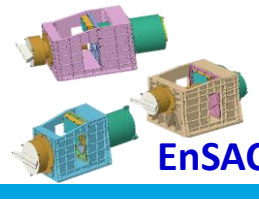
Four Payloads from ISRO-India
Multiple Payloads from G20 Nations

- Polarization Sensor - Cloud & Aerosol (PolSAC)
- GHG monitoring system (EnSAC)
- Active Forest Fire detection sensor (SACFF)
- Hyper Spectral MATHS (Hy-MATHS)

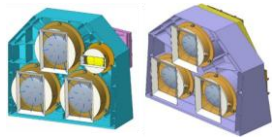
✓ **System configuration finalised**



SACFF



EnSAC



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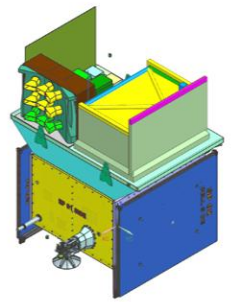
Status of ISRO-CNES TRISHNA Mission

High Resolution TIR / VIS-SWIR

- ❑ Global Coverage (Land + Coastal)
- ❑ 11 bands (VSWIR: 7, TIR: 4 bands)
- ❑ Overpass Time: 12:30 LT Equator



A. Primary design drivers

- Ecosystem Stress and Water Use
- Coastal, Shore and Inland Waters

B. Secondary design drivers

- Urban Heat Island, Solid Earth, Cryosphere, Atmosphere

*** ATBD for L1/L2 Products finalised**

*** Payload Development in progress**

Next Phase

- Algorithm Prototyping/ Software Implementation
- Cal-Val Execution
- Utilization Programme

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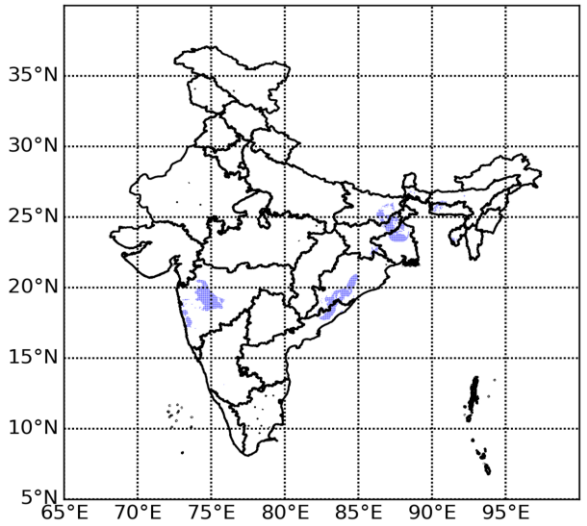
AI/ML Based Initiatives at ISRO for Retrieval and Applications

Development of Nowcasting algorithms

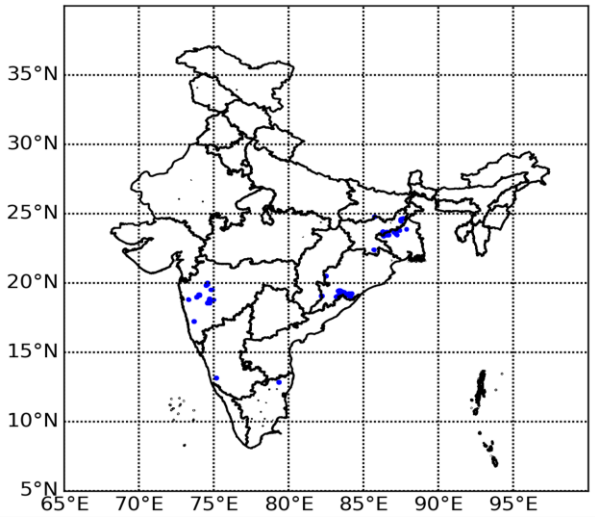
Lightning Nowcast: Developed an AI/ML based technique to provide Lightning alerts 90 minutes in advance by integrating MSG-SEVIRI, NWP Model Forecast and Surface Observations.

Assessment of the Experimental Lightning alerts is undergoing with IMD/MoES

Lightning alerts issued at 1030 UTC, 22-May 2026 valid for next 90 min



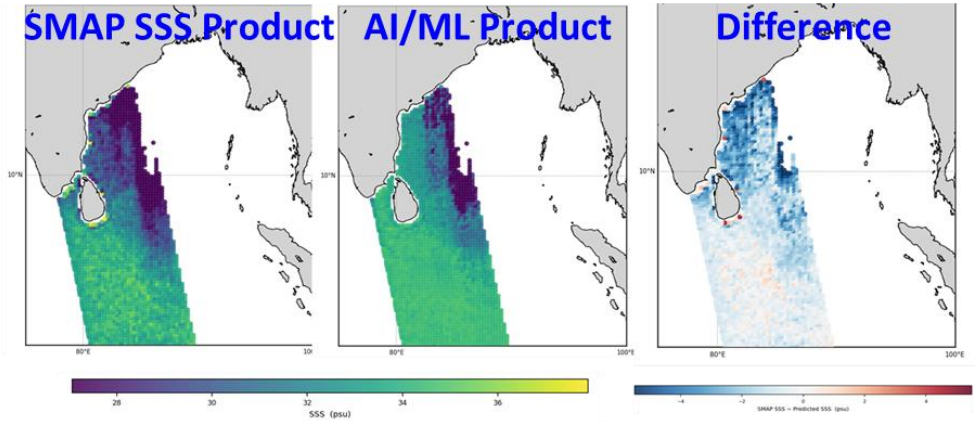
Observing Lightning events at 1200 UTC, 22-May-2026

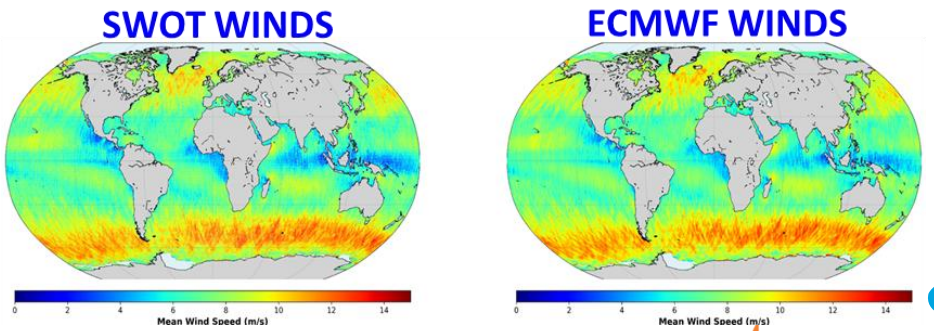


ISRO-Eumetsat Collaboration

Development of New Retrieval Algorithms

- **Wind Speed** from Surface Water and Ocean Topography (SWOT)
- **Sea Surface Salinity** from Soil Moisture Active Passive (SMAP)





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Demand Driven Space Policy: National Meet 2025 (NM2.0)

'Leveraging Space technology & Applications for Viksit Bharat 2047'

Proposed Missions for Ocean and Atmospheric Applications

Highlights

- **Meetings with:**
  - **63** Central Ministries/ Depts
  - **36** States / UTs
  - **300+** one-to-one meetings
  - **08** Regional State meets
- **One** Industry Session deliberations

NM2.0 Outcome

User requirements synthesised in space infrastructure requirements

Operational missions (Suggested by MoES)

- Oceansat-4 Series
- INSAT-4th Generation
- Numerical Weather Prediction (NWP) missions
- Millimetre-wave Sounder + Scatterometer missions
- Nadir Altimeter missions
- Atmospheric Chemistry missions

Technology Demonstration (Suggested by MoES)

- Aerosol-Cloud-Precipitation missions
- L-Band Active/Passive Microwave mission
- Wide Swath Altimeter mission
- Geo-MATHS mission
- Wind Profiler (Doppler Wind Lidar) mission

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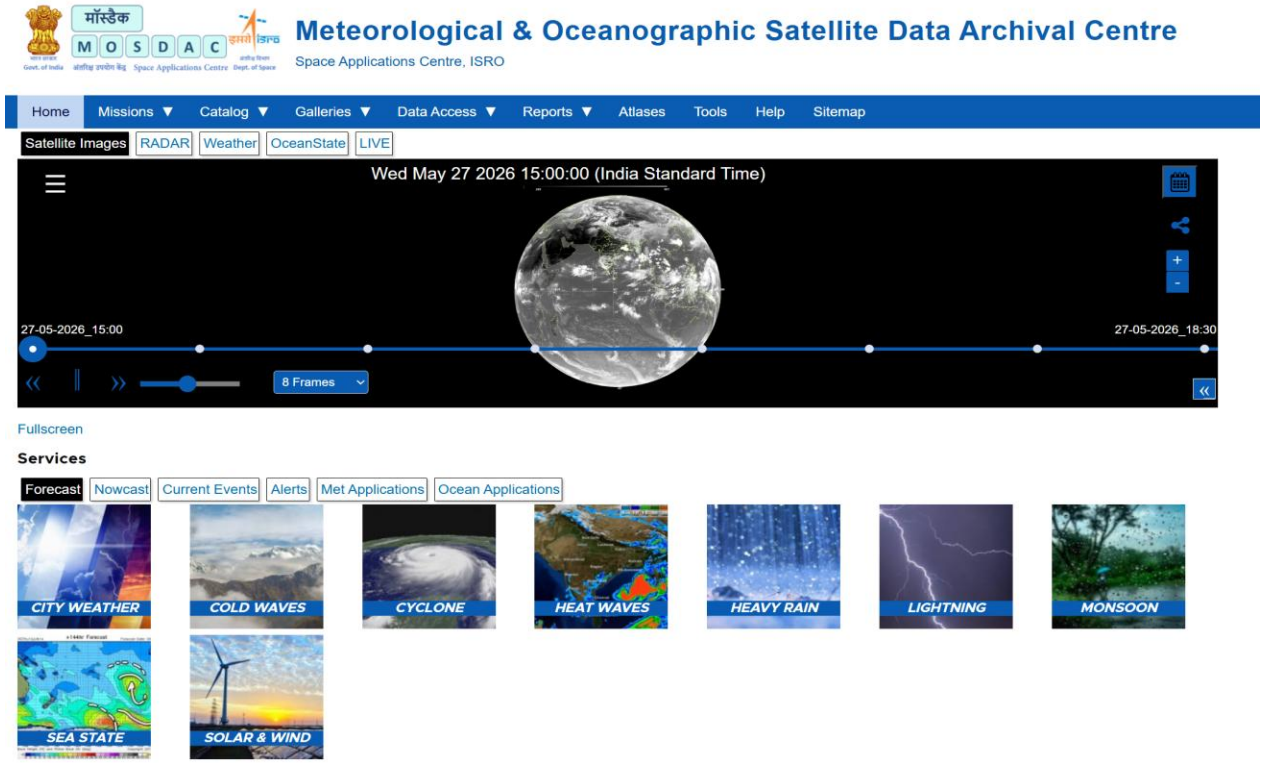
Indian Satellite Data available through ISRO Web Portals:

https://mosdac.gov.in/



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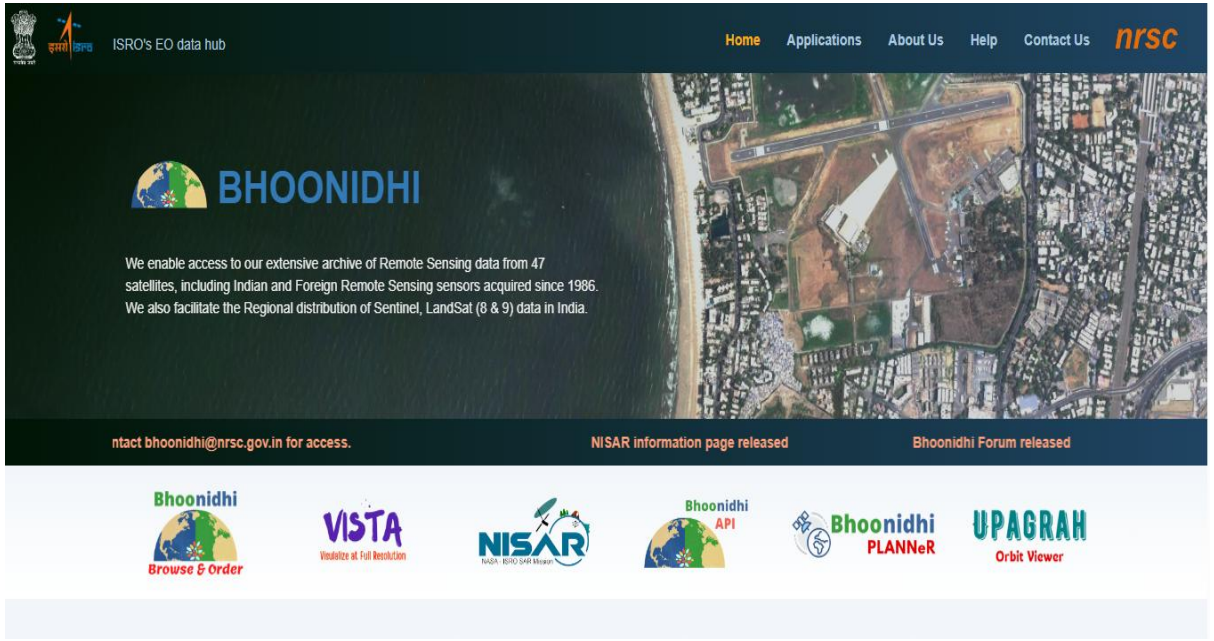

Thank you

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