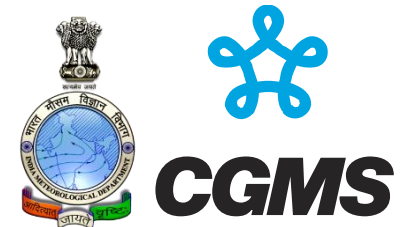


[Status and way Forward of satellite activities]

India Meteorological Department, Ministry of Earth Sciences, India



Utilization of satellite data

I. List the satellite data used by India Meteorological Department-IMD

GEO satellite data

- **INSAT-3DR/3DS:**
 - Monitoring tropical cyclones, monsoon, and severe weather events.
 - Rainfall estimation and cloud motion vector analysis.
 - Fog and snow detection.
 - Atmospheric temperature and humidity profiling.
 - Sea surface temperature monitoring
- **GOES:**
 - Atmospheric profiling, lightning detection, and severe storm monitoring.
 - Cyclone tracking
- **HIMAWARI:**
 - High-resolution monitoring of tropical cyclones in the Indian Ocean region.
 - Cloud motion vectors, sea surface temperature (SST), and fog detection.
- **METEOSAT:**
 - Monitoring precipitation, tropical cyclones, dust, fog and heatwaves.
- **Geo-KOMPSAT-2A (GK-2A):**
 - Monitoring SST, surface winds, and extreme weather events in the Asia-Pacific and Indian Ocean.



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Utilization of satellite data

LEO satellite data

Oceansat-3:

- Sea surface winds monitoring.
- Ocean state forecasting and cyclone prediction.

NOAA (15, 18, 20):

- Temperature and humidity profiles using the Advanced Microwave Sounder Unit (AMSU).

MetOp Series (A, B, C):

- Sea surface winds monitoring.
- Ocean state forecasting and cyclone prediction.

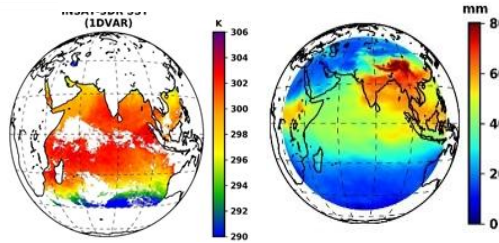
Terra/Aqua:

- Monitoring aerosols, vegetation, and land surface temperatures using MODIS.

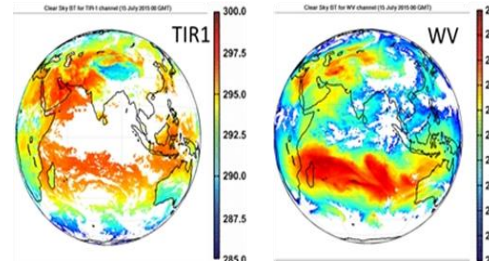
Uses of Geostationary Satellite Products

- Multi-Mission Meteorological Data Receiving and Processing System** : Complete processing of INSAT-3DR/3DS satellites, including Data Reception, Processing, Parameter Retrieval, Visualisation/Dissemination, and Validation developed by ISRO-IMD. 15 Additional parameters apart from daily operational products.

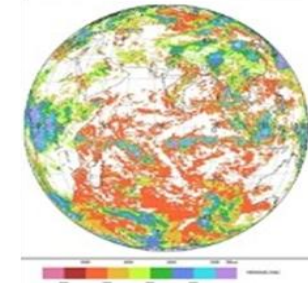
1D-VAR Algorithm for SST & TPW



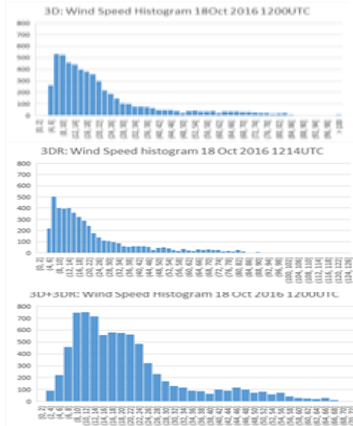
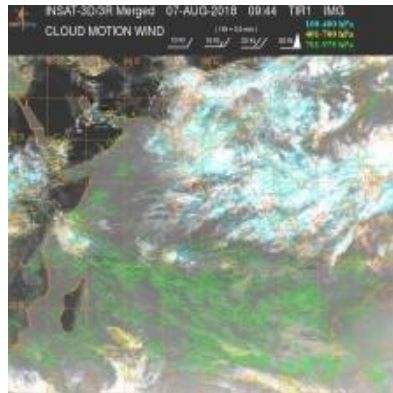
Clear sky Brightness Temperature



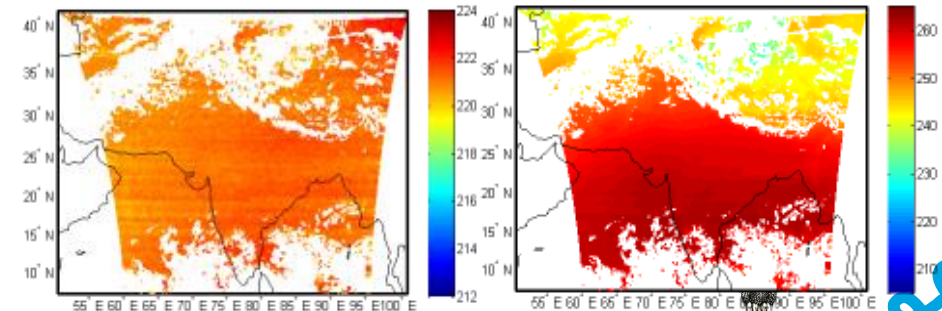
Cloud Top Pressure



INSAT-3DR/3DS Staggered Winds



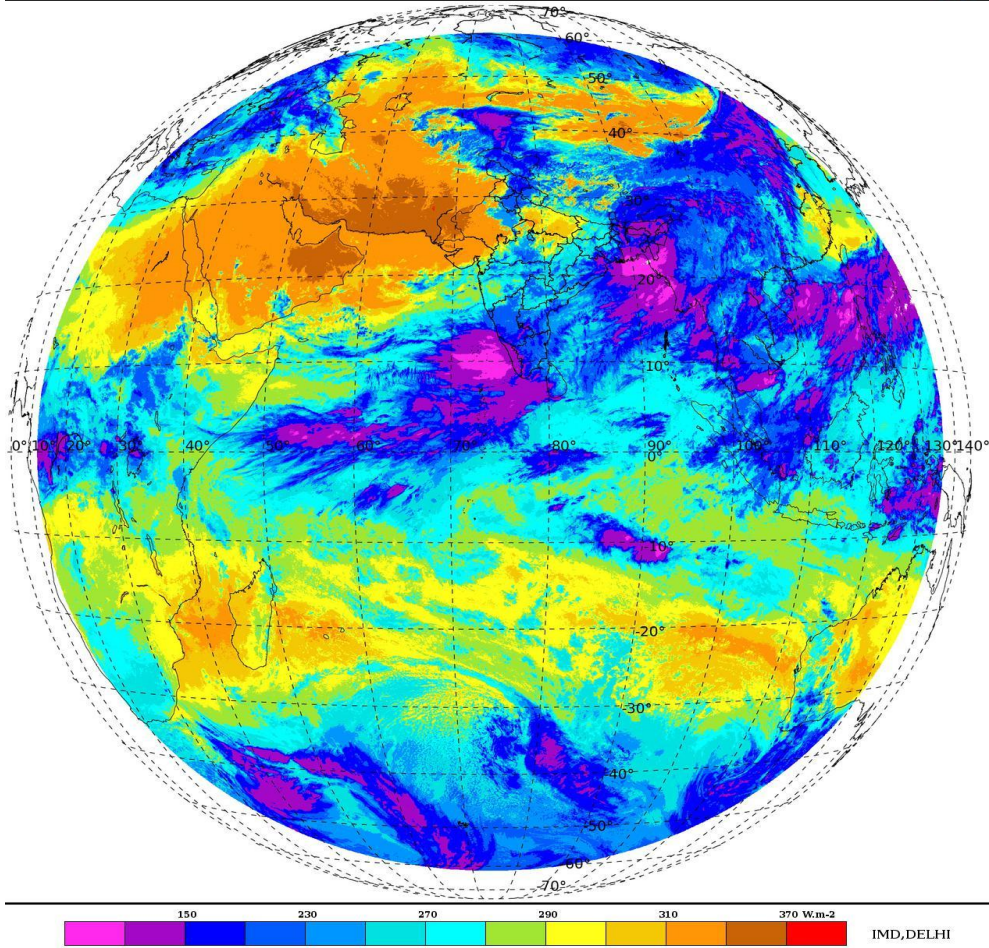
INSAT-3DR Sounder Clear Sky Brightness Temperature (CSBT)



Weather phenomena : Onset of Monsoon

SAT : INSAT-3DR IMG
 Outgoing Longwave Radiation
 L2B GEOPHYSICAL PARAMETER FULL DISK

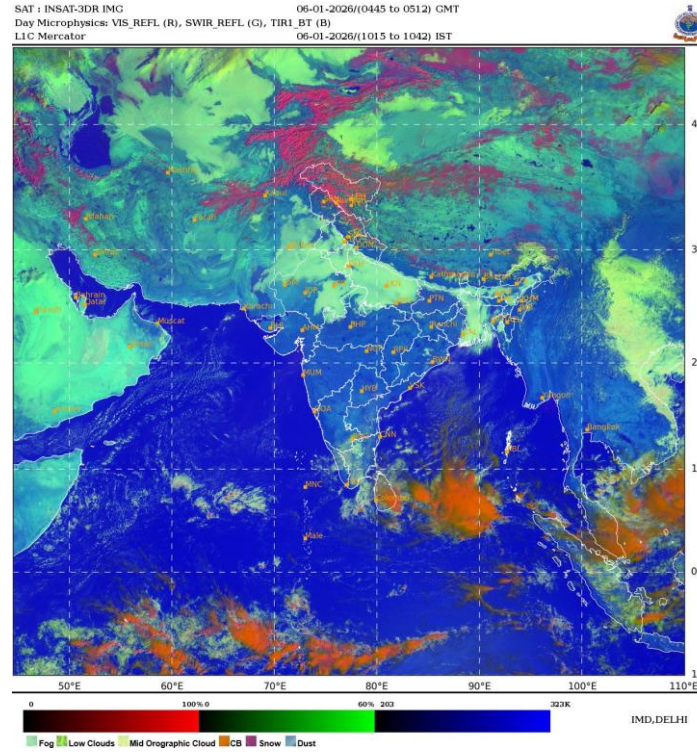
30-05-2025/(0445 to 0512) GMT
 30-05-2025/(1015 to 1042) IST



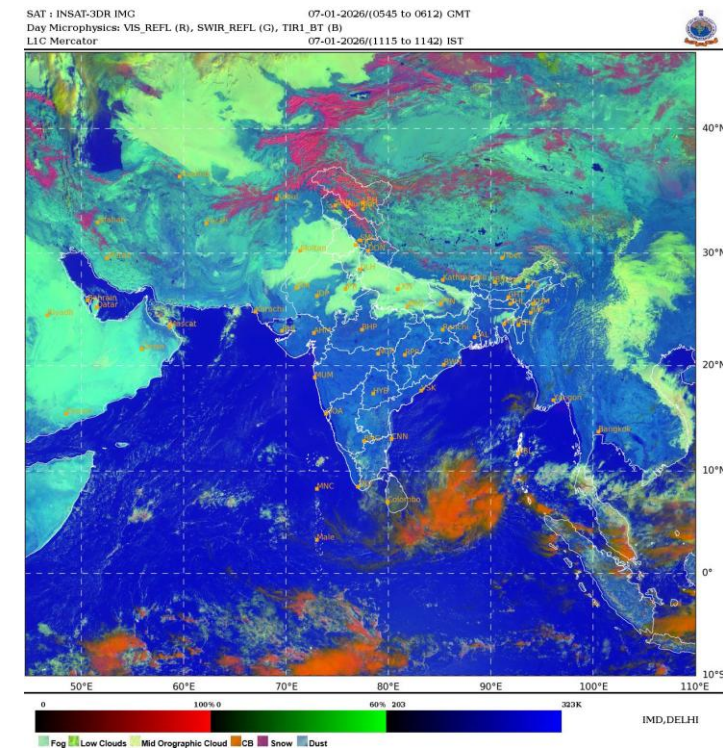
Coordination Group for Meteorological Satellites

Case Studies: FOG EVENTS, 2026

06-01-2026

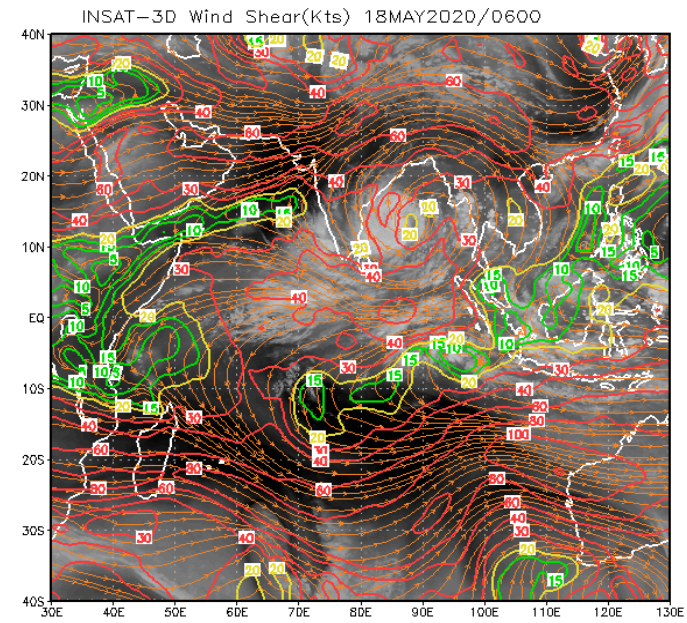
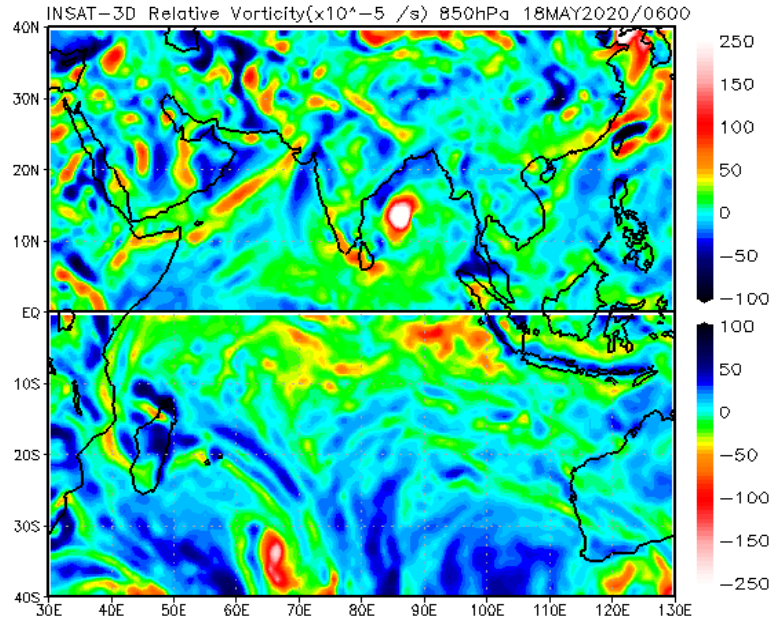


07-01-2026

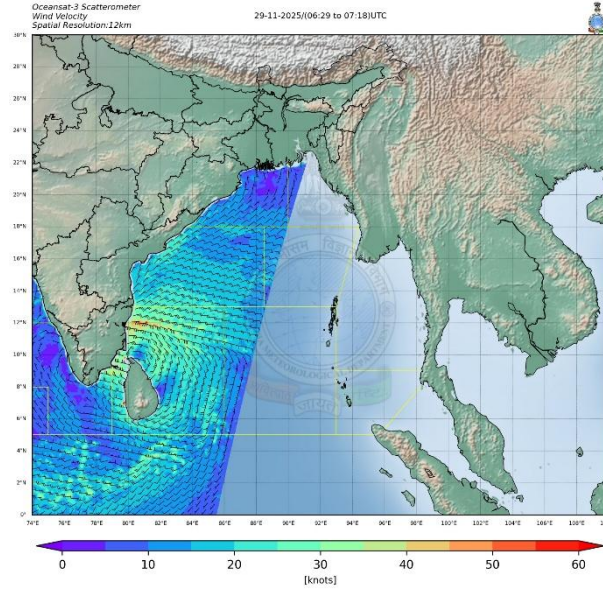
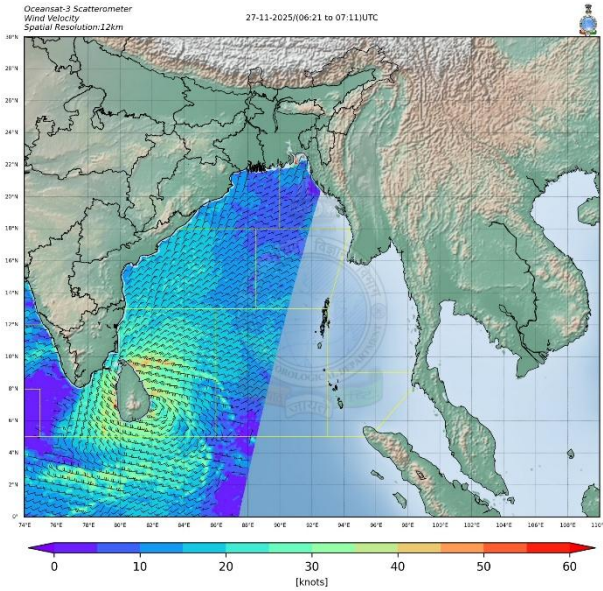


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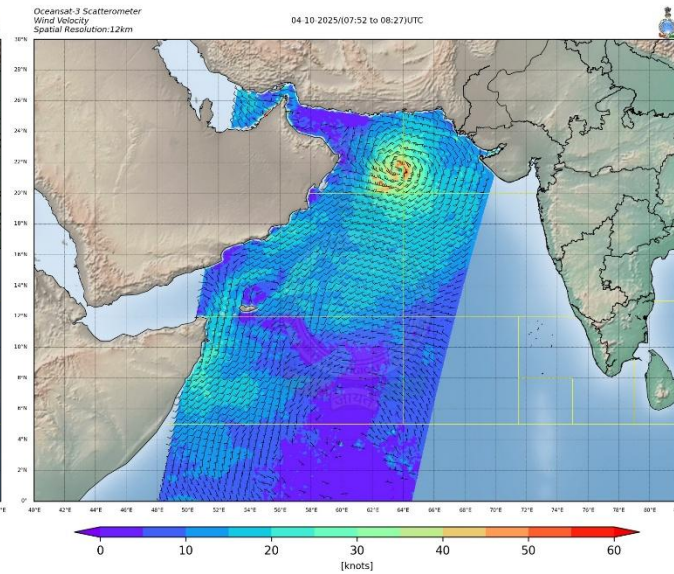
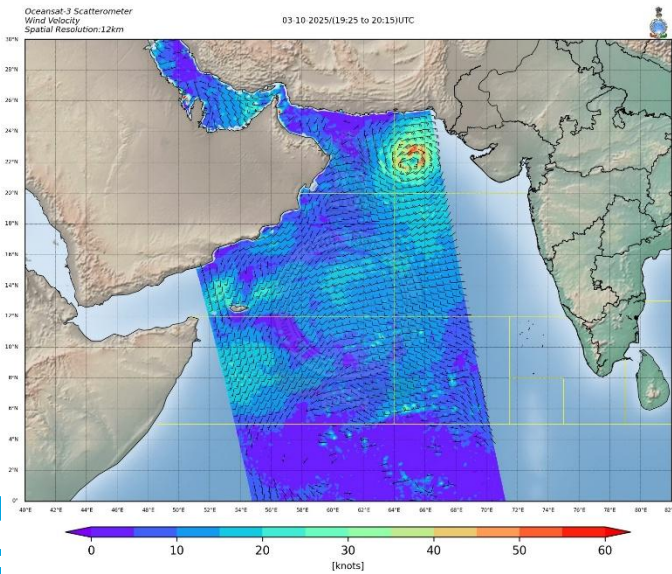
Wind Derived Products



Observations from Oceansat-3



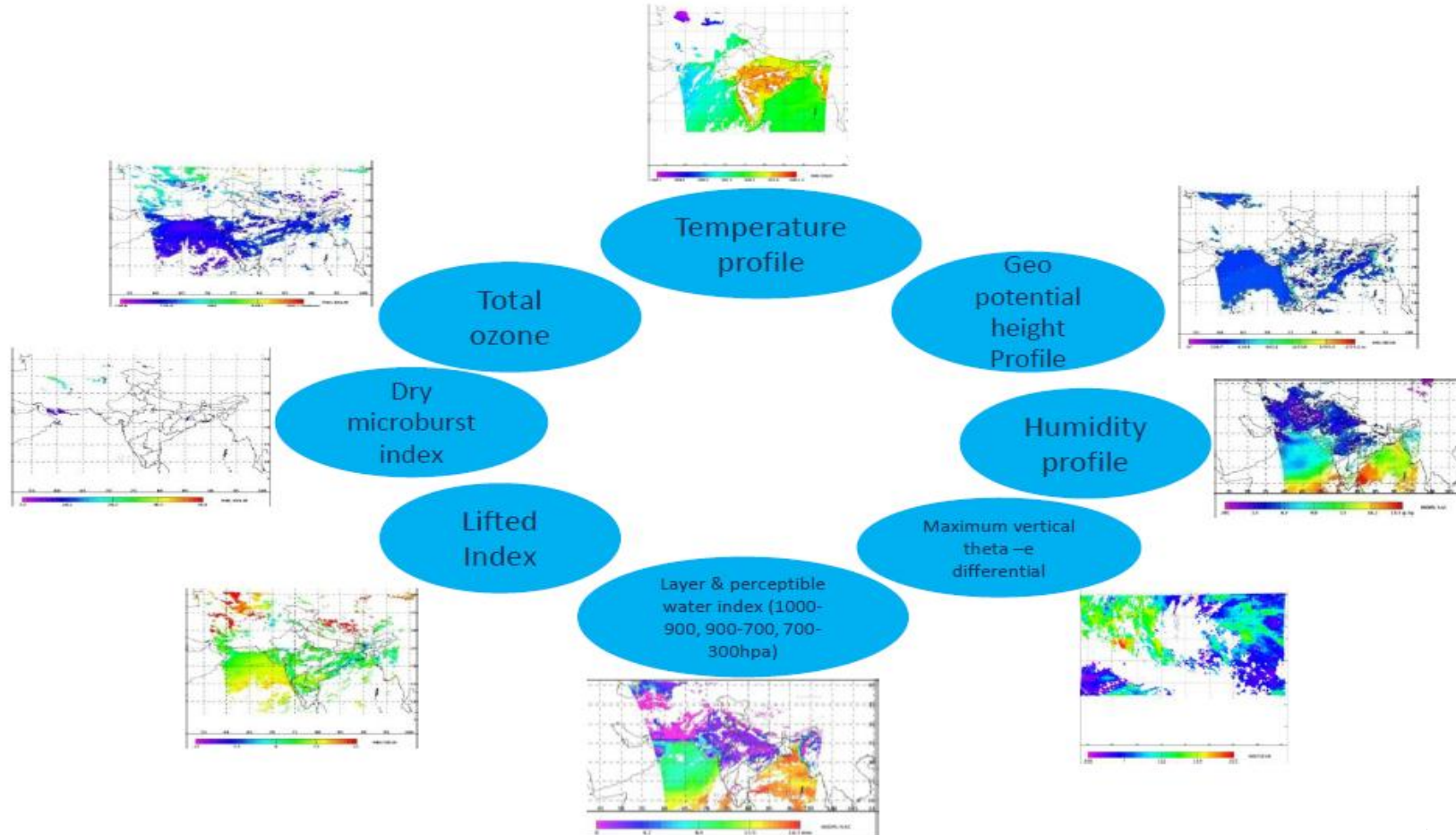
Cyclone Detwah
(27th November to 3rd December, 2025)



Cyclone Shakti
(3rd to 7th October, 2025)

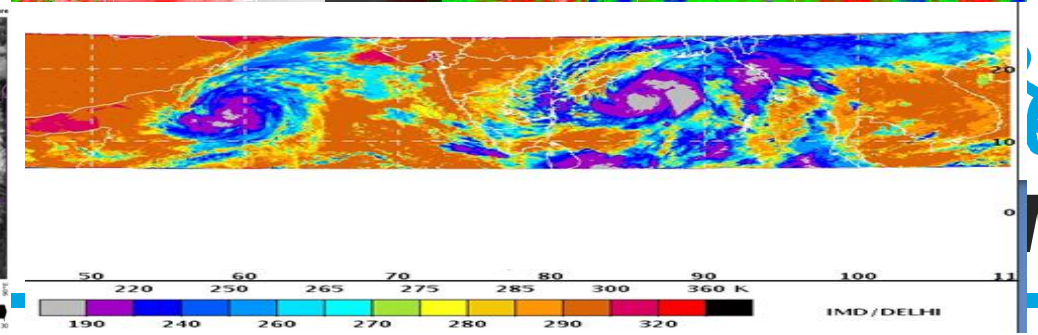
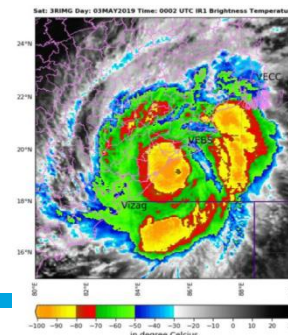
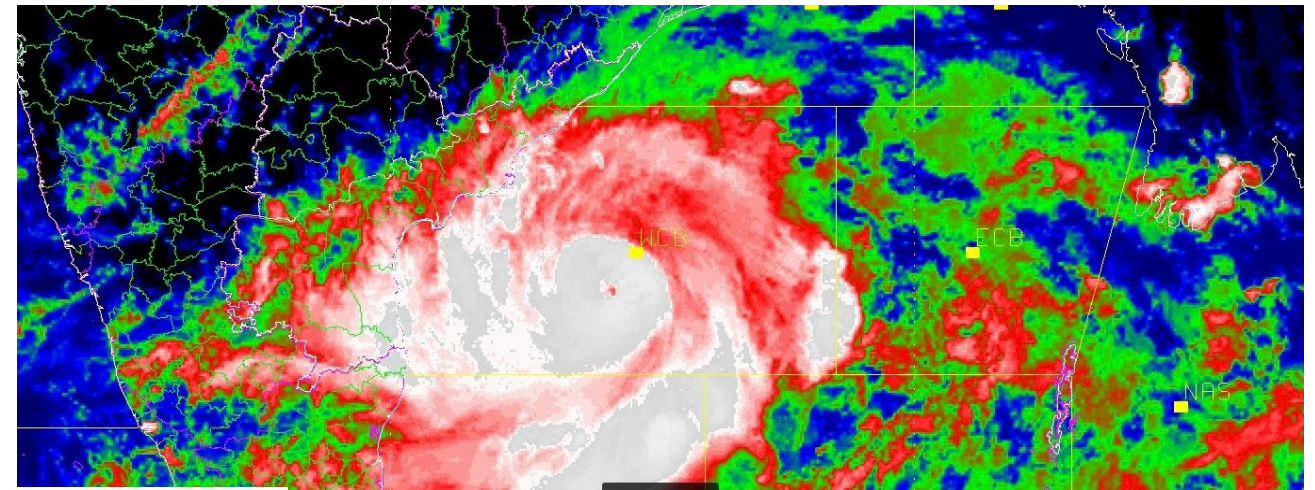
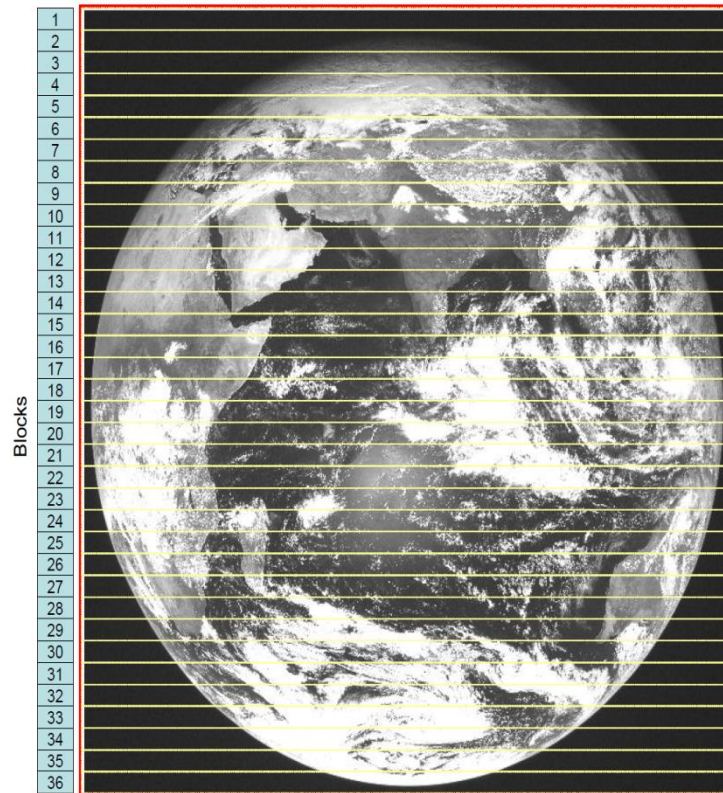
Geophysical parameters from Sounder

Allows **vertical profiling** of temperature and water vapour in cloud free areas at **40 Atmospheric levels**



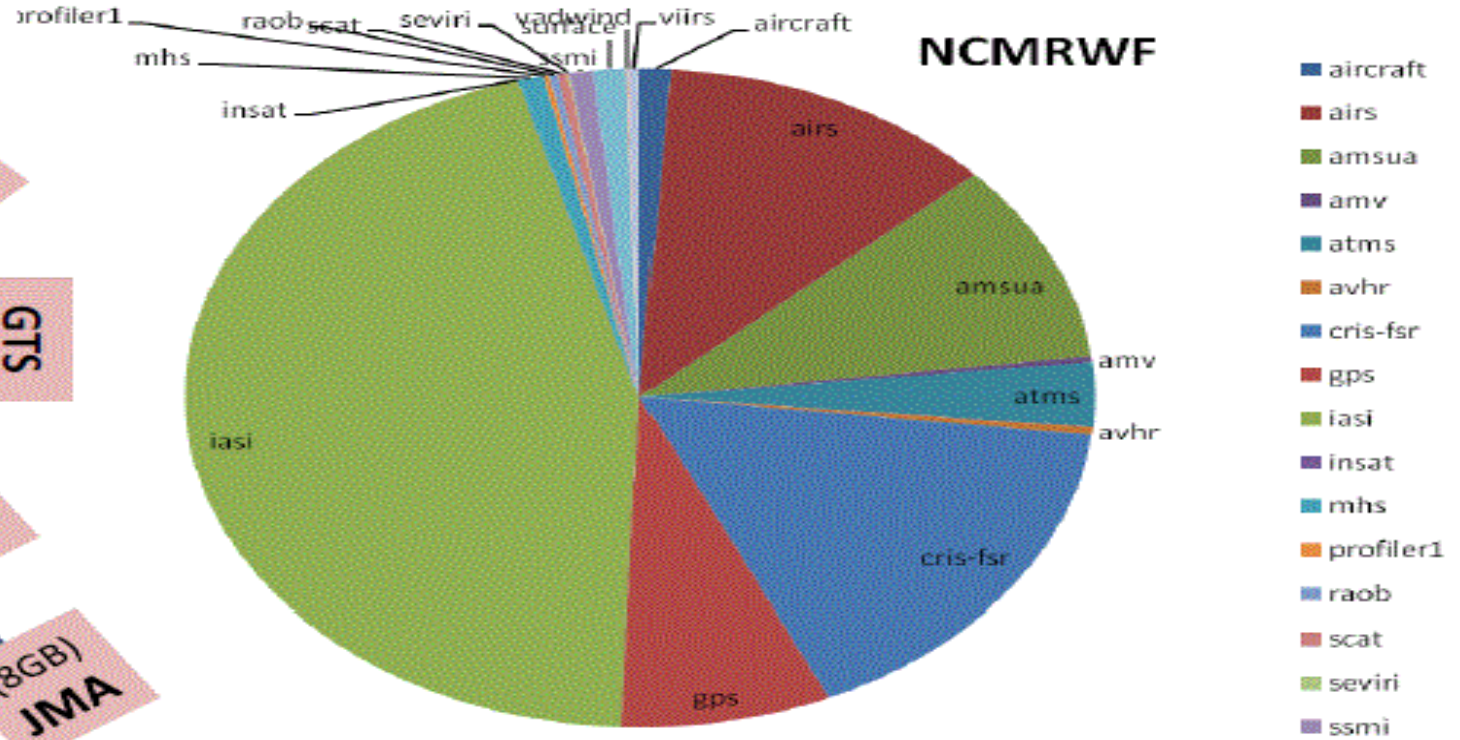
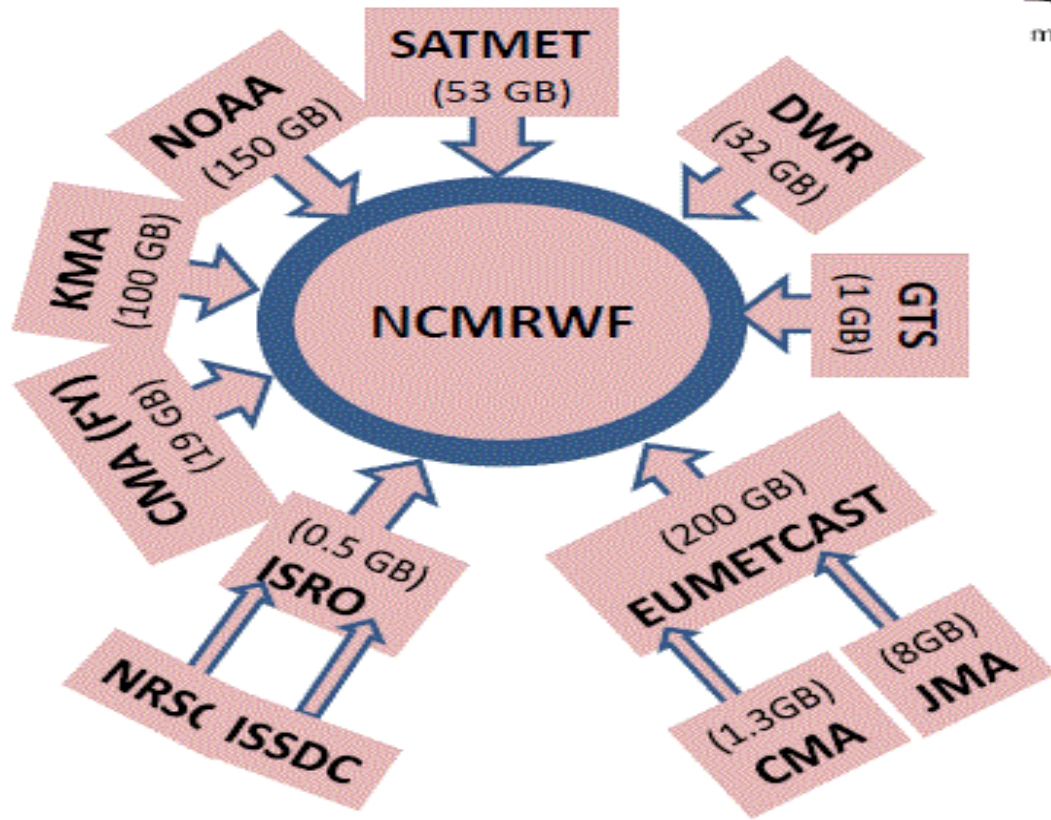
INSAT RAPID SCANS

In order to observe the severe weather conditions like Cyclone and Thunder Storms, the IMAGER instruments have been built with the flexible scanning feature named as 'Program Mode', where the number of scan lines over a given coverage region and the number of repetitions of thus selected region could be programmed for scanning, which is essential for severe weather applications like nowcasting and tropical cyclone analysis. For the utilization in weather applications, a Standard Operating Procedure (SOP) has been finalized by ISRO and IMD for conducting the Rapid scan from the INSAT-3DR Imager payload.



Data reception and assimilation in India for NWP modeling

APRARS/DBN



Satellite and Remote sensing observations
 Conventional Observations

- ~90%
 - ~10%

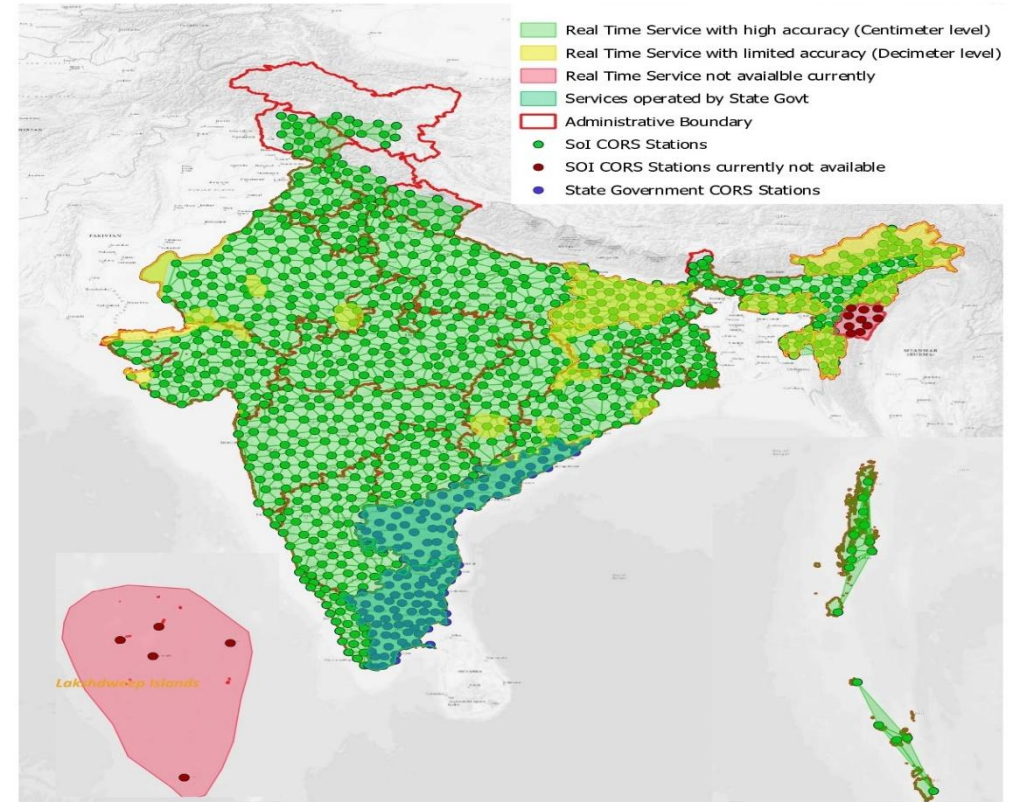
IMD Setup for GNSS and future prospects

❑ The data (IPWV) are processed daily by using the **Trimble Pivot Platform (TPP)** software and disseminated in **BUFR format** to **NCMRWF** for assimilation in **Numerical Weather Forecasting Model**.

➤ IMD is in process of signing of **MoU** with **Survey of India (SOI)** vide which IMD and SOI will share their GNSS data. Continuously Operating Reference Stations data network for IPWV derivation (100 to 900 Stations)

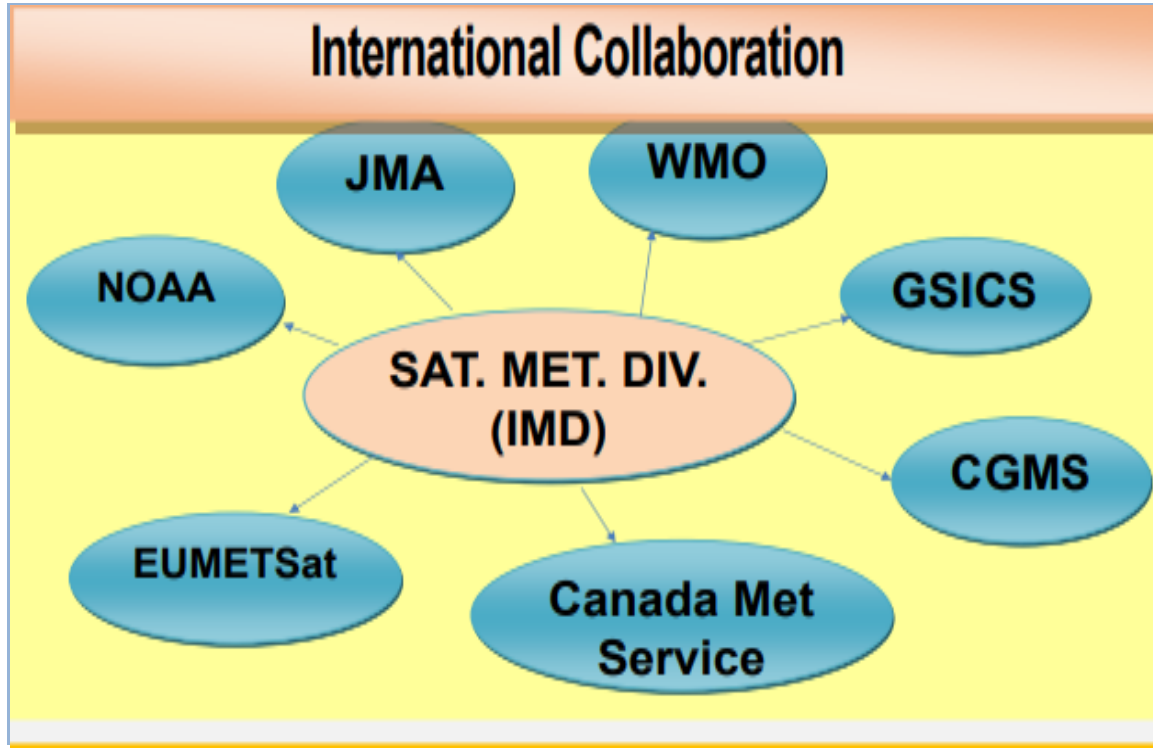
➤ Reception of **49 GNSS stations of SOI** (Trimble-20; Leica-29). Processing of IPWV data and subsequent dissemination to NCMRWF.

Real Time Positioning Services by SOI CORS Network

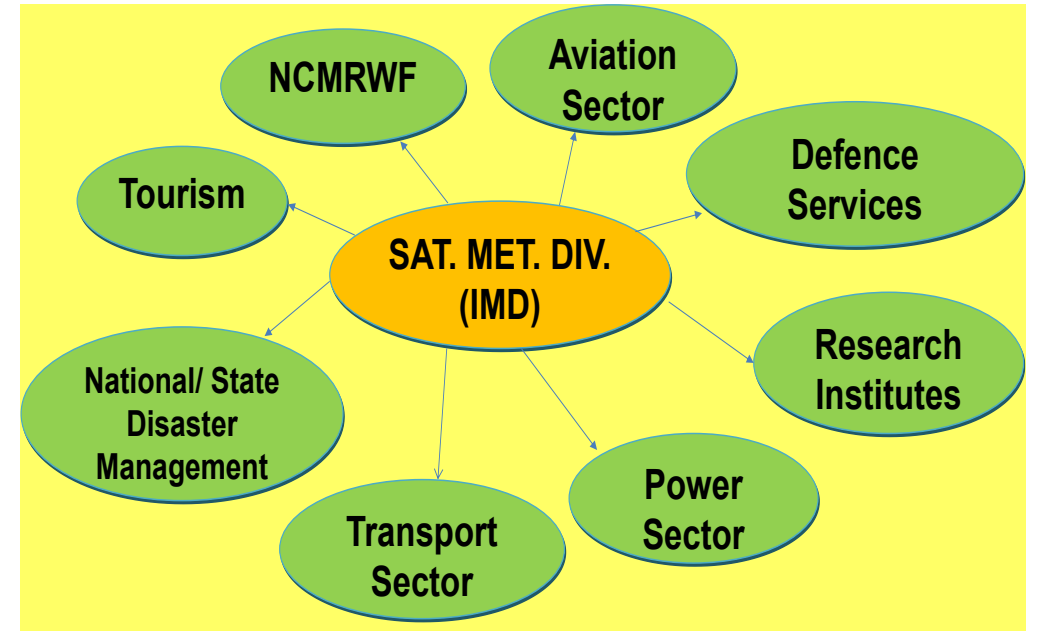


GNSS data are processed to derive IPWV using open-source platforms such as GAMIT, and are ingested into numerical models in real time to improve forecast accuracy.

INSAT Data Sharing



Stake Holders (National)



1. IMD also receives Meteosat data through EUMETCAST
2. Continued data sharing through MoUs towards EW4ALL for South Asian region
3. We acknowledge Director General, EUMETSAT for support and cooperation

FUTURE PROPOSED MISSIONS (Jointly IMD & ISRO)

GEO: INSAT-4th Generation Satellite

- a) Advanced Imager
 - 18 bands from 0.5 – 13.5 μm with spatial resolution 500m for VIS and 2 km for IR
 - Faster scanning for nowcasting applications
- b) Lightning mapper
- c) Hyperspectral Infrared Sounder (>1850 bands)

Oceansat 3A:

- ARGOS in Oceansat-3 will be replaced by Millimeter-wave Atmospheric Temperature and Humidity Sounder (MATHS) Payload
- A 20-channel cross-track scanning Radiometer operating at 50-60GHz and 183.31 ± 16.25 GHz bands
- Spatial resolution of 25 km and 15 km, for O_2 and H_2O bands, respectively.

Other LEO Missions:

- a) MW Temperature & Humidity Sounder in low-inclination orbit
- b) 6-89 GHz MW Radiometer in low-inclination orbit
- c) Dual Frequency Scatterometer, C/Ku
- d) Hyperspectral Infrared/Microwave Sounder



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Future expectations

- Improved resolution, accuracy of products
- Sampling frequency
- Quality of data
- Accessibility and availability
- Historical data for research and development
- More and Better data assimilation in NWP models
- Research on application of AI/ML with special emphasis on
 - nowcasting of severe weather and early warning
 - Preprocessing of data in models



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Thank You