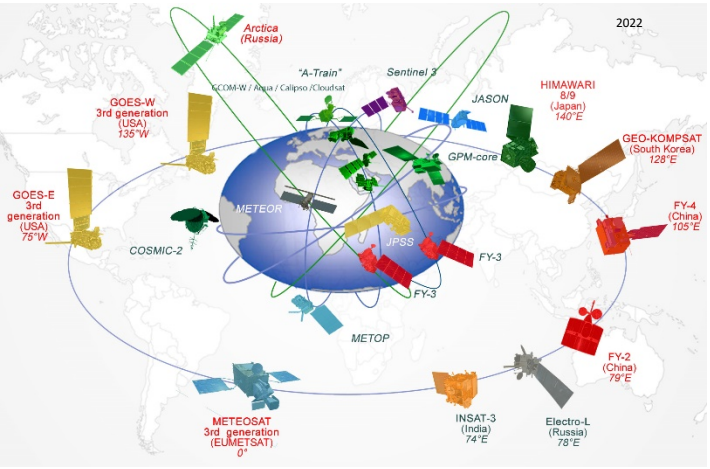


ISRO Report on Highlights and Issues in Datasets and Products

Presented to CGMS-49 WG-II Session, Agenda 2

Coordination Group for Meteorological Satellites

Executive summary

- Developed the Multi-Mission Data Reception and Processing System (MMDRPS) under MoU between ISRO and IMD (MoES), which is finally commissioned at IMD New Delhi since Jan 2021 for INSAT-3D/3DR.
- 1-D Var based physical retrieval scheme implemented for SST from INSAT-3D/3DR Imager observation to mitigate the diurnal/seasonal dependency on bias and uncertainties.
- Re-processing of Scatsat-1 data in v1.1.4 since June 20, 2019 completed (after Main chain TWTA failure) and data from Fairbanks station went into operational chain since August 2020. Anomaly observed in the on-board system of the redundant chain of Scatsat-1 since first week of March 2021. Analysis is being carried out.
- ISRO-CNES joint mission – SARAL/AltiKa post star sensor anomaly from Feb 2019 is in mis-pointing phase. Cross-over analysis carried out using Jason series of altimeter suggests that, although the bias remains more or less same, there is relatively more error in the mis-pointing phase as compared to exact repeat and geodetic phase.
- INSAT-3D/3DR Imager/Sounder radiances are monitored using GSICS procedure. Presently, inter-calibration of IR channels are in demo phase with IASI-A/B and being implemented for IASI-C and CrIS. Ray-Matching method developed for inter-calibration of Vis/SWIR channels with MODIS and is under testing.

Multi-Mission Meteorological Data Reception and Processing System (MMDRPS)

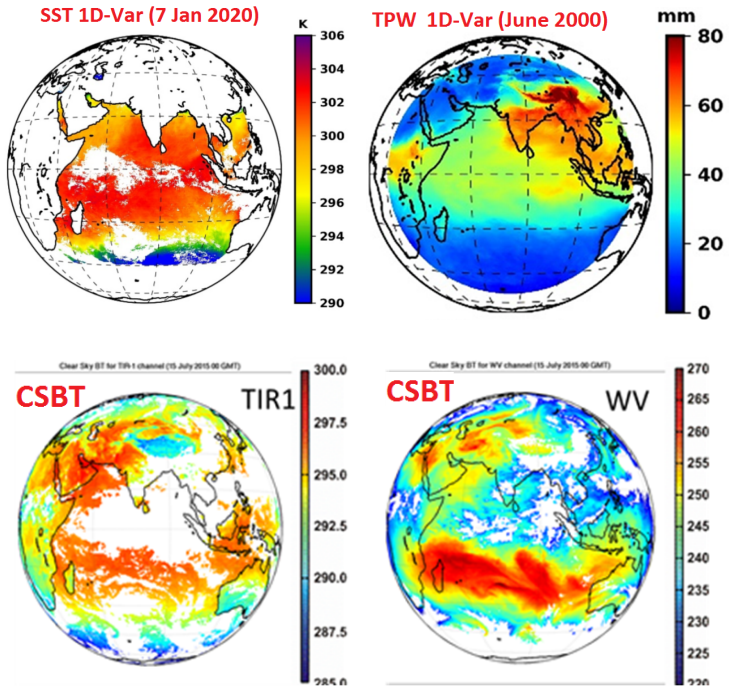
- Under **Antrix & IMD MoU**: Complete processing of INSAT-3D series of satellites, including Data Reception, Processing, Parameter Retrieval and Visualisation/ Dissemination.
- **Commissioned by IMD** on 15 Jan 2021 (IMD 146th Foundation Day)
- **ISRO developed algorithms for Geophysical Parameters.** ~25 Parameters - IMDPS system +15 Parameters added- MMDRPS.

Original list of parameters (IMDPS)	New addition : (MMDRPS)
Outgoing longwave radiation (OLR)	Clear Sky brightness Temperature (CSBT)
Rainfall using Hydro-estimator (HE)	Total Precipitable Water
Fog	Cloud Top Pressure/Temperature (CTP/CTT)
Upper Tropospheric Humidity (UTH)	Wind Vectors (Staggered mode)
Sea Surface Temperature (SST)	Net surface short wave radiation
Snow cover	
INSAT-Multispectral Rainfall (IMSRA)	
Cloud mask	
Land Surface Temperature (LST)	
Quantitative Precipitation Estimation (QPE)	
Aerosol Optical Depth	
Atmospheric Motion Vectors	
Cloud Microphysical parameters	
Evapotranspiration	
Solar Insolation over land	

INSAT-3DR Sounder Derived Products

Old (IMDPS)	New Additions (MMDRPS
Temperature Profile	Cloud Top Pressure/Temperature (CTP/CTT)
Humidity Profile	Clear Sky Brightness Temperature (CSBT)
Total Column Ozone	T-Phi gram (GUI based utility for forecasters)

Sample new products in MMDRPS



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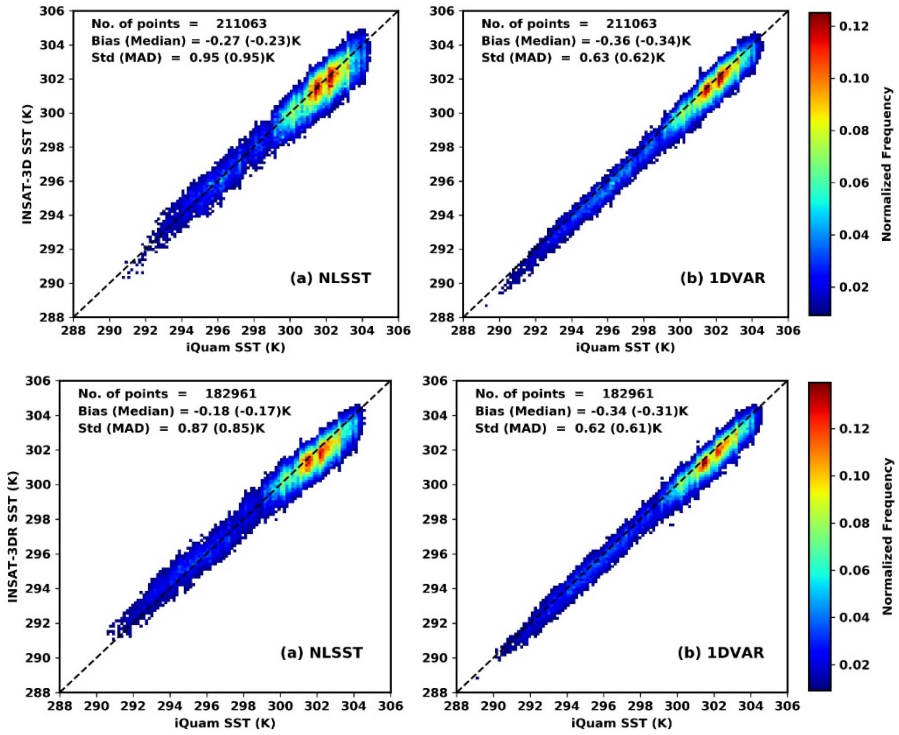
Implementation of 1D-Var based physical retrieval algorithms for SST

- Non-Linear Sea Surface Temperature (NLSST) algorithm prior to February 2021.
- Large uncertainties in SST observed due to the calibration anomalies arising during mid-night hours as well as satellite eclipse periods.
- To mitigate these diurnal/seasonal anomalies, following major changes have been made (Feb 2021 onwards):

1. Real-time radiance bias corrections using matchup data of INSAT observations w.r.t. the simulations from closest forecast.
2. SST estimation using one-dimensional Variational technique*.
3. RMSE has reduced from ~0.9K to ~0.6K in both INSAT-3D & 3DR. Biases of ~0.3K is largely due to the bulk-skin temperature differences.



Gangwar, R. K. and Thapliyal, P. K., (2020). Variational based SST retrieval from Thermal Infrared Observations of INSAT-3D/3DR Imagers. Remote Sensing, 12, 3142; doi:10.3390/rs12193142.

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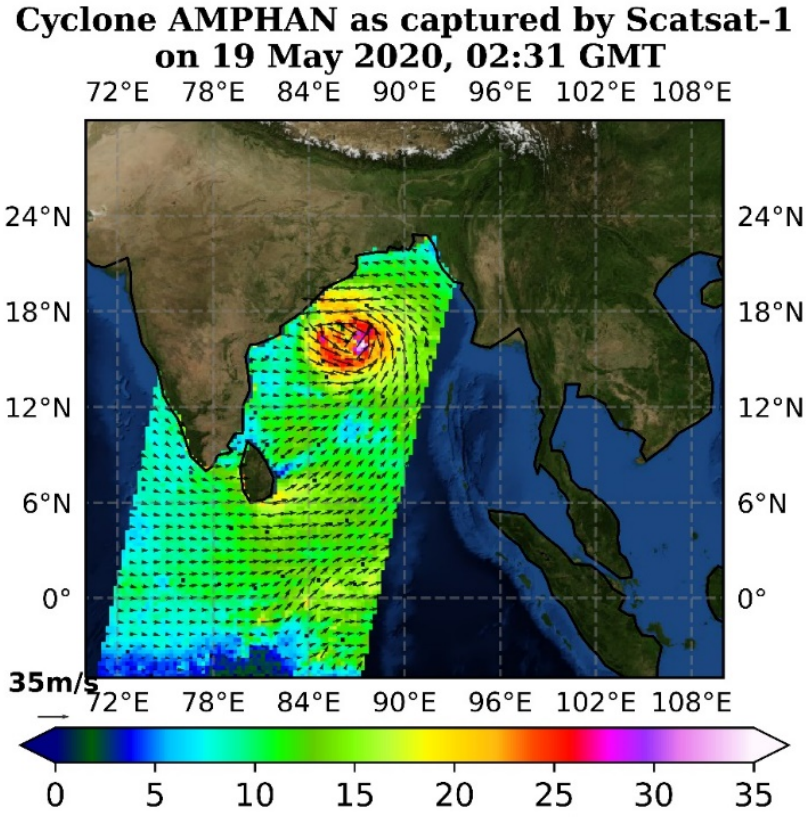
SCATSAT-1 Status

- Data products from redundant chain of Scatsat-1 operational since December 17, 2019 (version 1.1.4).
- Re-processing of data in v1.1.4 since June 20, 2019 (i.e., after Main chain TWTA failure).
- Scatsat-1 dumps at Fairbanks station went into operational chain since August 2020.
- Anomaly observed in the on-board system of the redundant chain of Scatsat-1 since first week of March 2021. Analysis are being carried out.



SARAL/AltiKa: ISRO-CNES Joint Altimeter Mission

(An assessment of Sea level Anomaly for various phases of operations)

SARAL/AltiKa : Launched Feb, 2013 (First Ka-band Space-borne Altimeter). 7-years of operation and still going strong!

Important component of operational oceanography
Ocean State Forecasting models (Wave & Circulation)

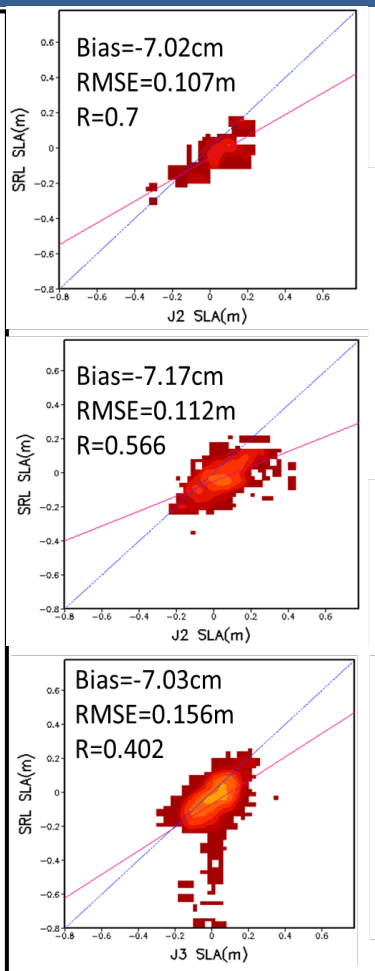
Three phases of operations:

- Exact Repeat Mode (ERM) – Mar,13 – Jul,16
- Geodetic Mode (GM)- Jul, 16-Jan,19
- Star Sensor anomaly phase (large mis-pointing) Feb, 19 onwards

Cross-over analysis of AltiKa SLA carried out using Jason series of satellites. Bias remains practically the same for all the phases but there RMSE is more in mis-pointing phase (0.16 m) than ERM (0.10 m) and GM (0.11) phase.

During mis-pointing phase, it is recommended to use data with off_nadir_angle <0.09 deg^2 (SALP-RP-P2-EA-22250-CLS146)

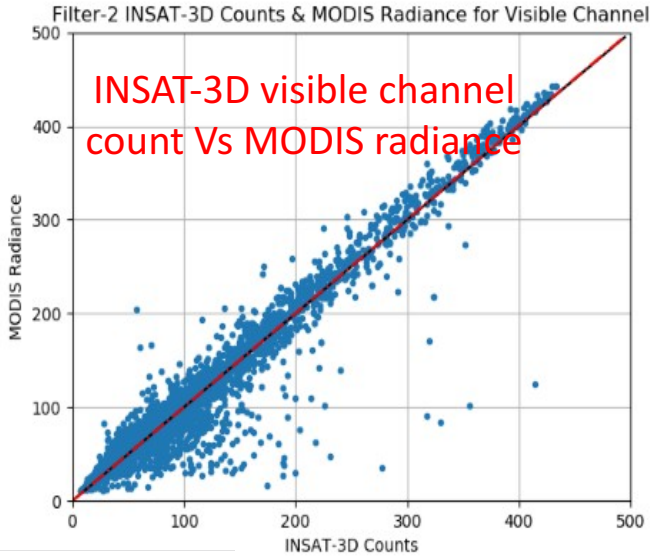
- Significant Wave Height (SWH) data still being used in operational wave forecasting models.
- Post star sensor anomaly, SLA data good for ocean mesoscale studies.

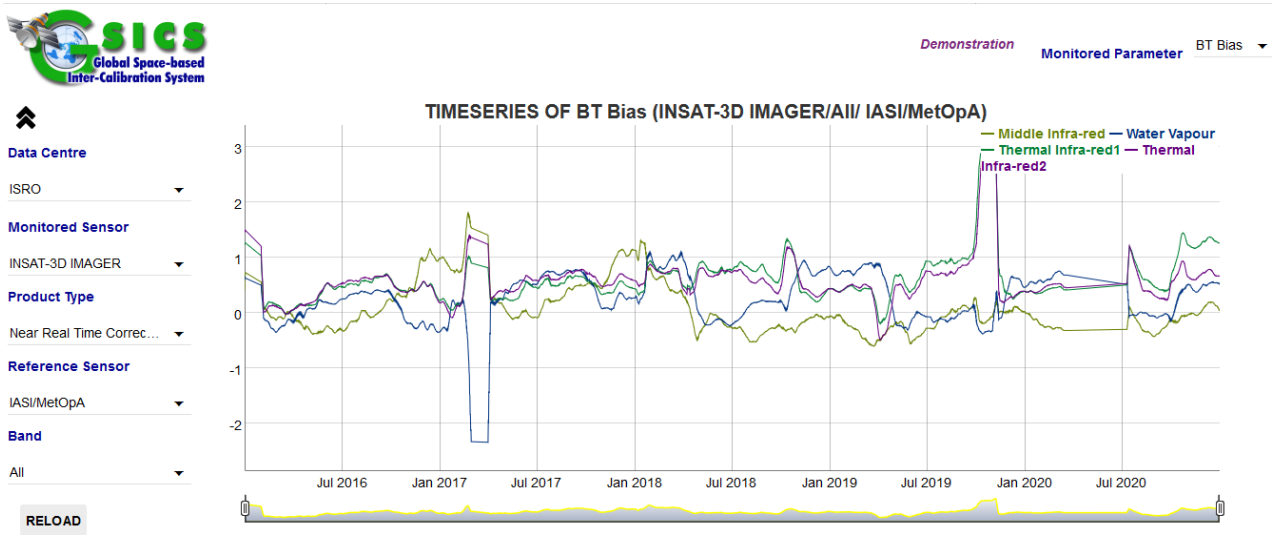


Scatter plot of Jason vs SARAL/AltiKa Sea Level Anomaly for the various phases of operations

ISRO's GSICS Activities, Action & Achievements Summary

- INSAT-3D/3DR Imager GSICS coefficients in demo phase
- Ray-matching method developed for inter-calibration of INSAT-3D/3DR Visible and SWIR channels using MODIS data.
- GEO-GEO inter-calibration initiated using MSG-SEVIRI (IODC coverage)
- A procedure is established to inter-calibrate INSAT-3D/3DR Imager IR channels using CrIS data.





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Thanks

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