

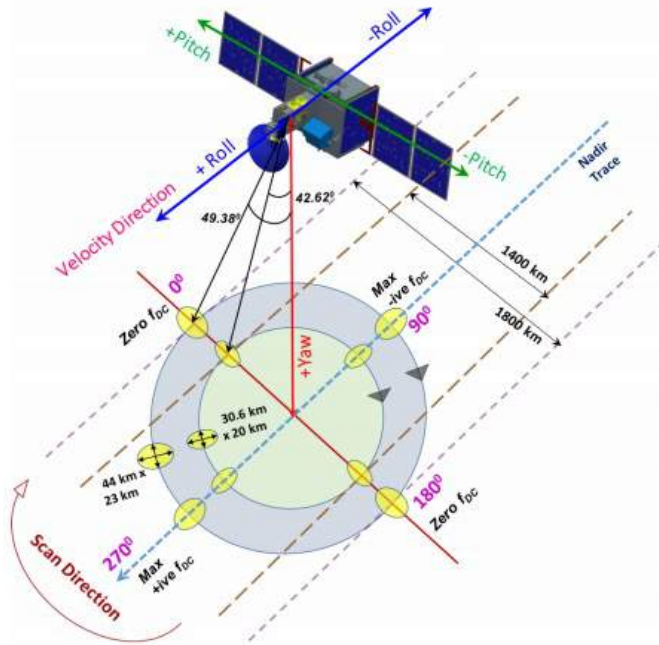
Ocean surface vector winds from the ISRO's latest scatterometer on-board Earth Observation Satellite (EOS) - 06

INTERNATIONAL OCEAN VECTOR WIND SCIENCE TEAM (IOVWST) MEETING - 2024

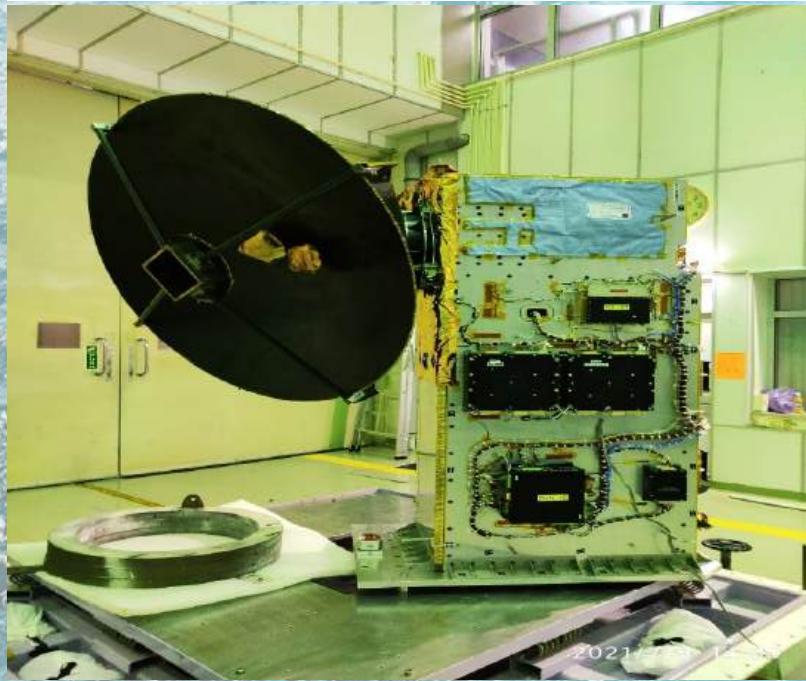
Abhisek Chakraborty, Pradeep Kumar Thapliyal, Devang M Mankad, Prantik Chakraborty, Rashmi Sharma and Raj Kumar

Space Applications Centre, Indian Space Research Organisation
Ahmedabad, India

Observation geometry



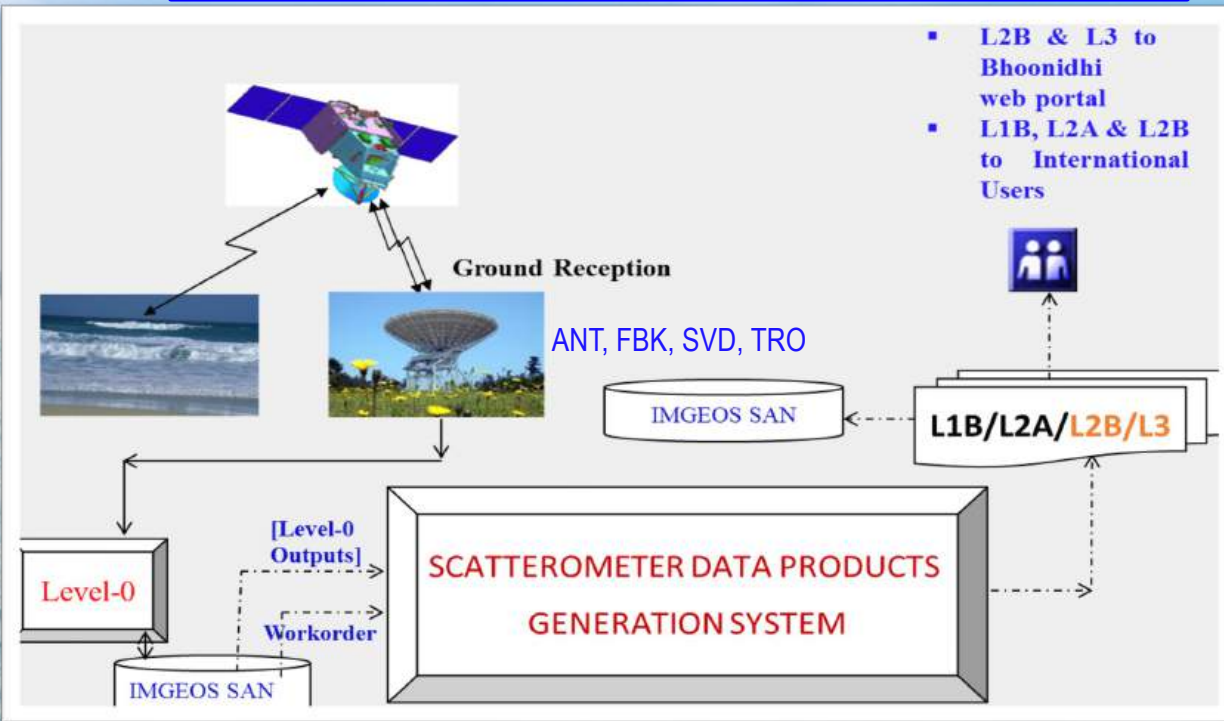
Payload integration at lab



Mission Specifications

Spacecraft Altitude	734-767 km
Inclination	98°
Orbit	Polar, Sun Synchronous
Yaw rotation over an orbit	±4°
Frequency	13.5156 GHz
Polarization	HH for Inner and VV for Outer beams
Swath	1400 km (both beams available) 1400-1800 km (only outer beam available)
Wind Speed Range	3-30 m/s
Wind Direction Range	0° to 360°
Wind Speed Accuracy	~1.6 m/s rms or 10% whichever is higher (for 25 km products) ~1.8 m/s rms or 10% whichever is higher (for 12.5 km products)
Wind Direction Accuracy	20° rms
Wind Vector Cell (grid) Size	25 km square & 12.5 km square grid
Noise equivalent Sigma-naught	-36 dB (Outer beam, HH) -39 dB (Inner beam, HH)

Overview of Data Products Generation System



EOS-06 SCAT : Data products

Category	Parameter	Resolution (km)	Format	Availability
L1B	Scan mode σ°	-	HDF5	NRSC
L2A	Swath grid σ°	12.5, 25	HDF5	NRSC
L2B	Swath grid Winds	12.5, 25	HDF5	NRSC
L3S	σ° (Daily Global gridded)	12.5, 25	HDF5	NRSC
L3W	Winds (Daily Global gridded)	12.5, 25	HDF5	NRSC
L3IC	Global Ice cover	12.5, 25	Geotiff	NRSC
L4AW	Analyzed winds	25	Netcdf	MOSDAC
L4INDIA, FULLGLOBE, NPOLAR, SPOLAR	σ° , γ° , BT	2	Geotiff	MOSDAC

EOS-06 SCAT : Products Timeline

Product Version 1.0.0 : Launch: 26/11/2022

- TWTA switched ON 03/12/2022: Redundant chain
- L2B: All SCATSAT-1 Algorithms & SCATSAT-1 (v1.1.3) GMF are being used
- Main chain activated on 06/12/2022

Product Version 1.0.1 : 08/02/2023 (Afternoon)

- Updated count to power conversion coefficients
- Modelled OAT values in the L1B
- Updated wind speed bias and rain flag in the L2B
- HR-mode acquisitions during 01-10 March 2023

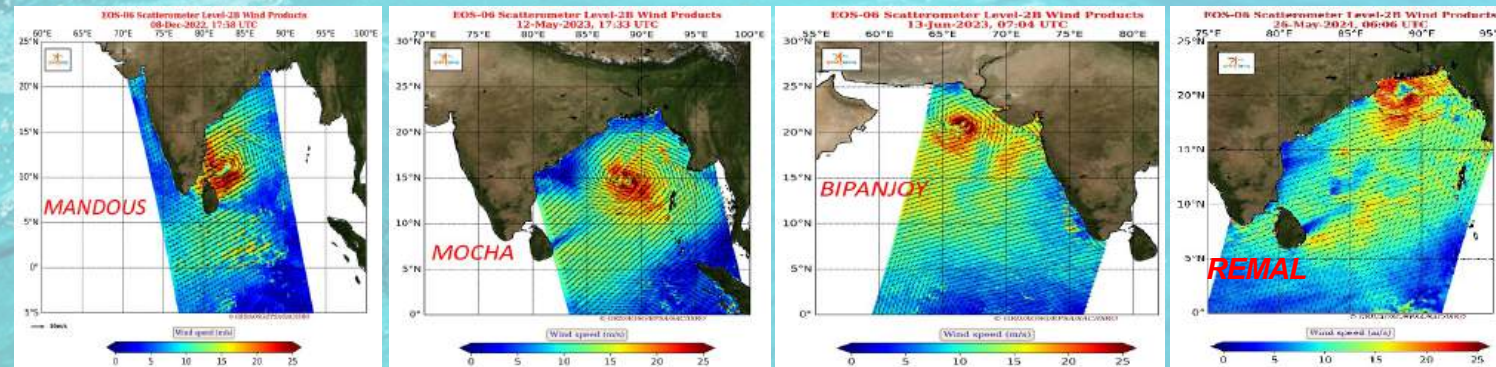
Product Version 1.0.2 : 24/05/2023 (Afternoon)

- Improvement in peak finding /slice balance

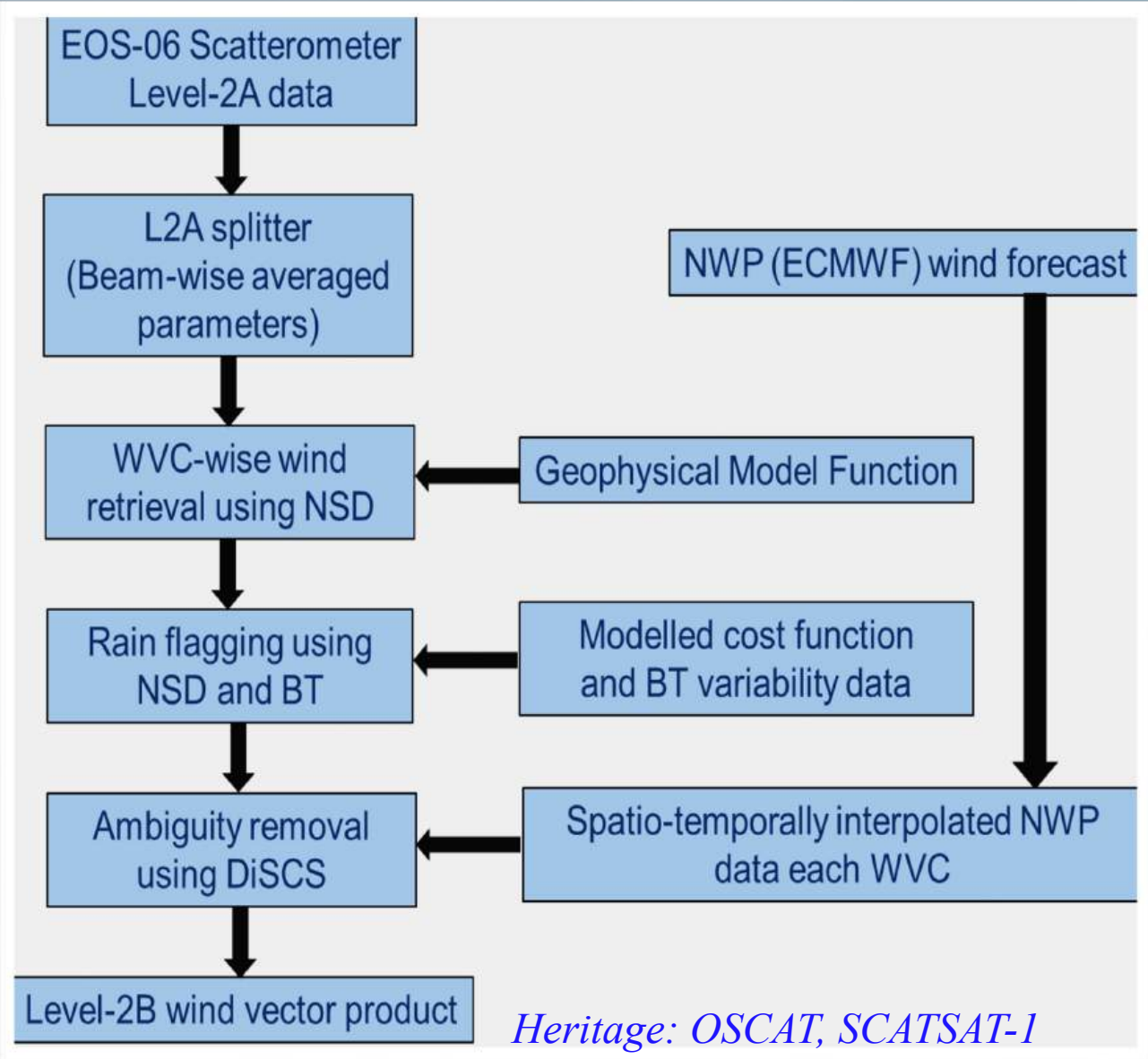
Product Version 1.0.3 : 29/05/2024 (Afternoon)

- EOS-06 SCAT specific GMF

Winds over tropical cyclones as captured by EOS-06 Scatterometer

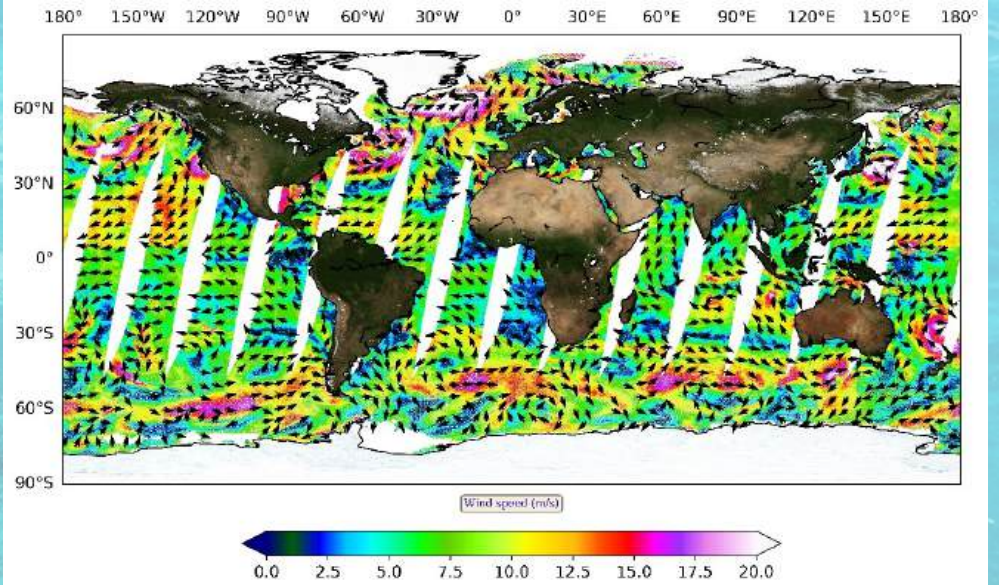
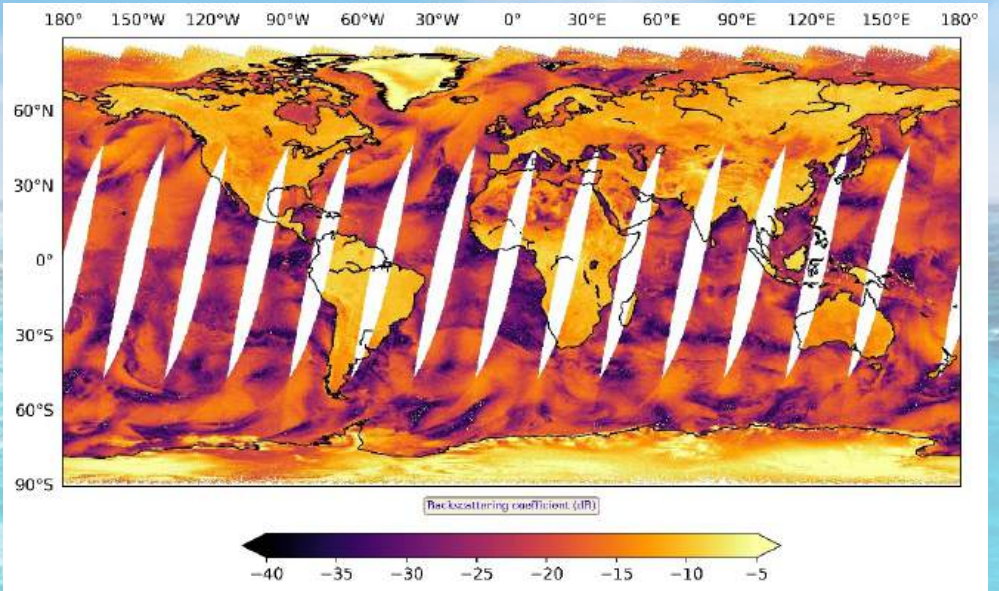


EOS-06 SCAT : Flowchart for Level-2B wind products

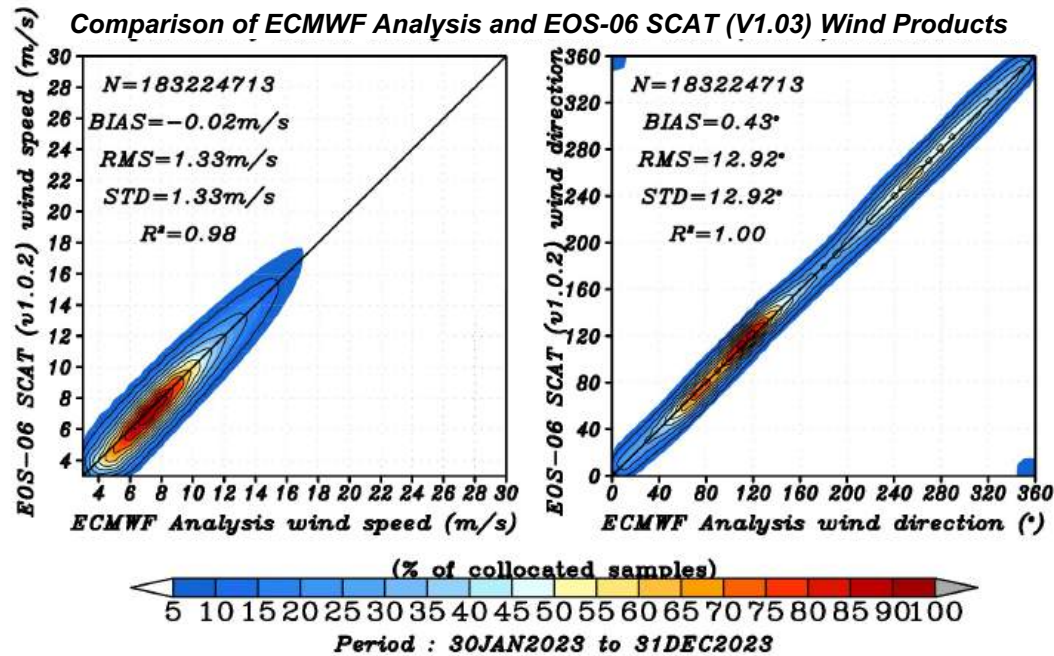


Heritage: OSCAT, SCATSAT-1

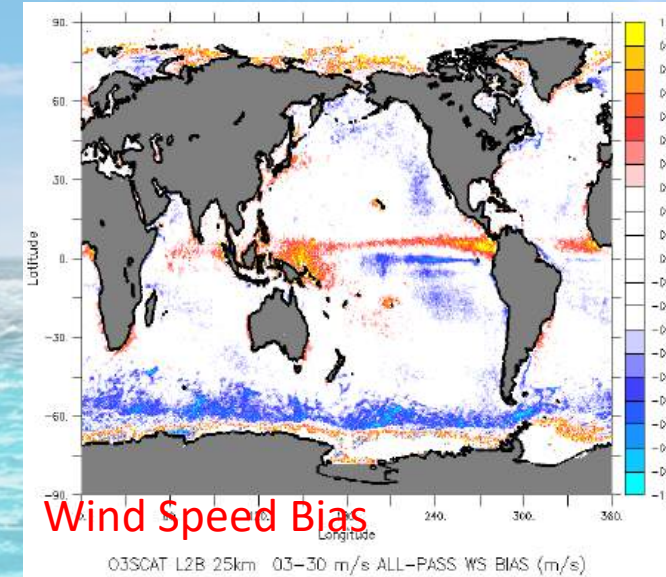
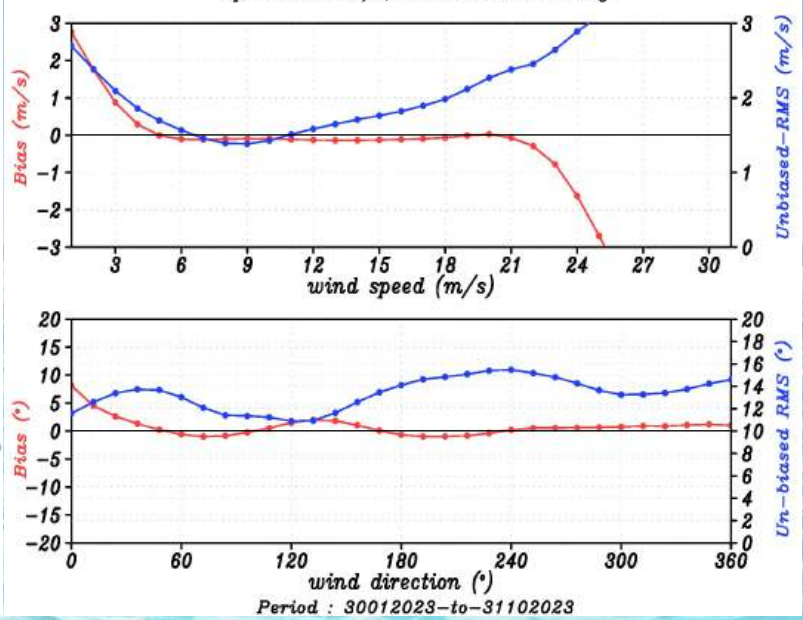
Level-2A (backscattering coefficient) and Level-2B (ocean surface vectors winds) products for all descending passed on 11th February 2023



Comparison of ECMWF Analysis and EOS-06 SCAT (V1.03) Wind Products



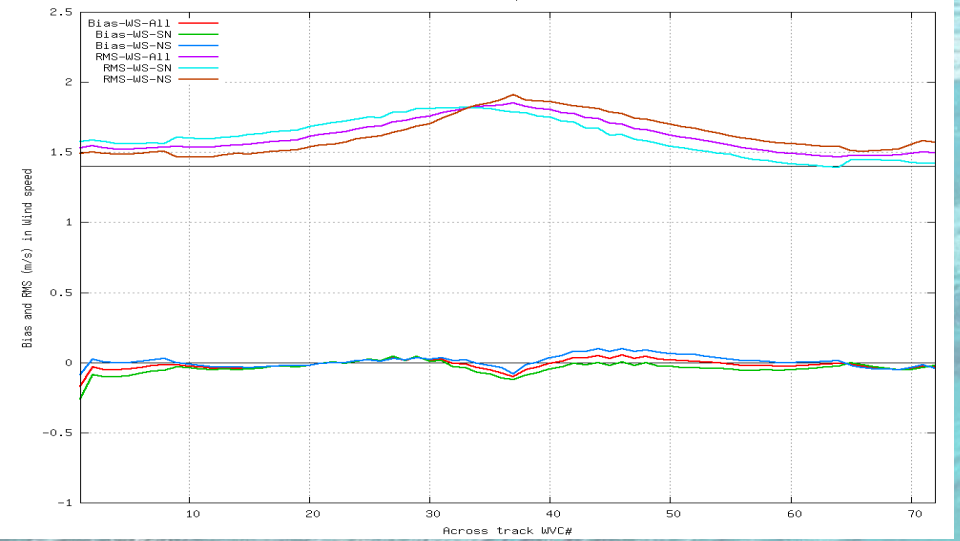
Bin wise comparison (EOS-06 SCAT/ECMWF) for all passes over global oceans
Speed Bin=1m/s; Direction Bin=10 deg



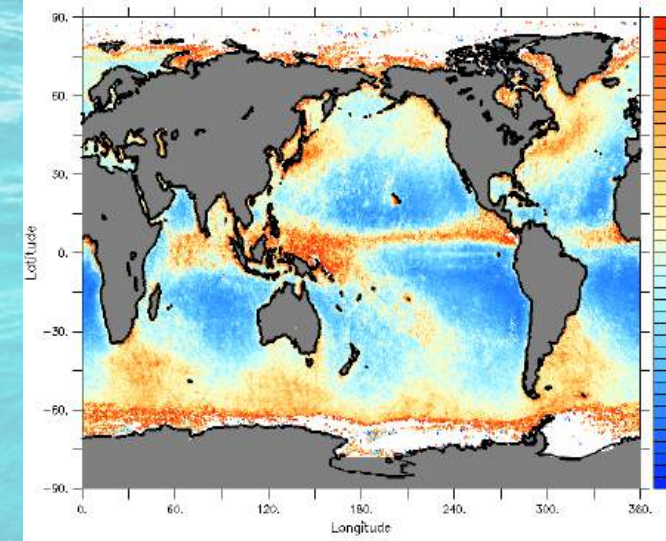
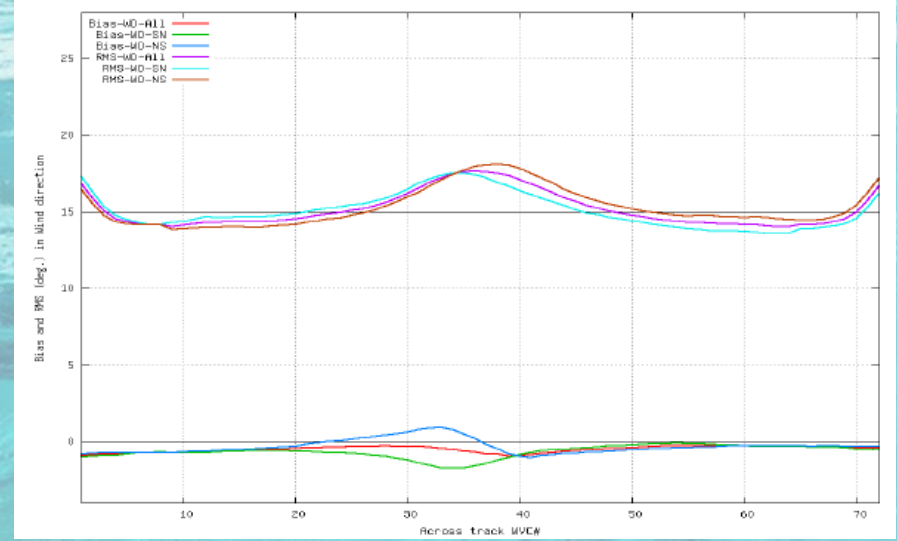
Wind Speed Bias

O3SCAT L2B 25km 03-30 m/s ALL-PASS WS BIAS (m/s)

Cell-wise Bias and RMS in Wind Speed for 30Jan2023 - 31Dec2023



Cell-wise Bias and RMS in Wind Direction for 30Jan2023 - 31Dec2023



Wind Speed RMSD

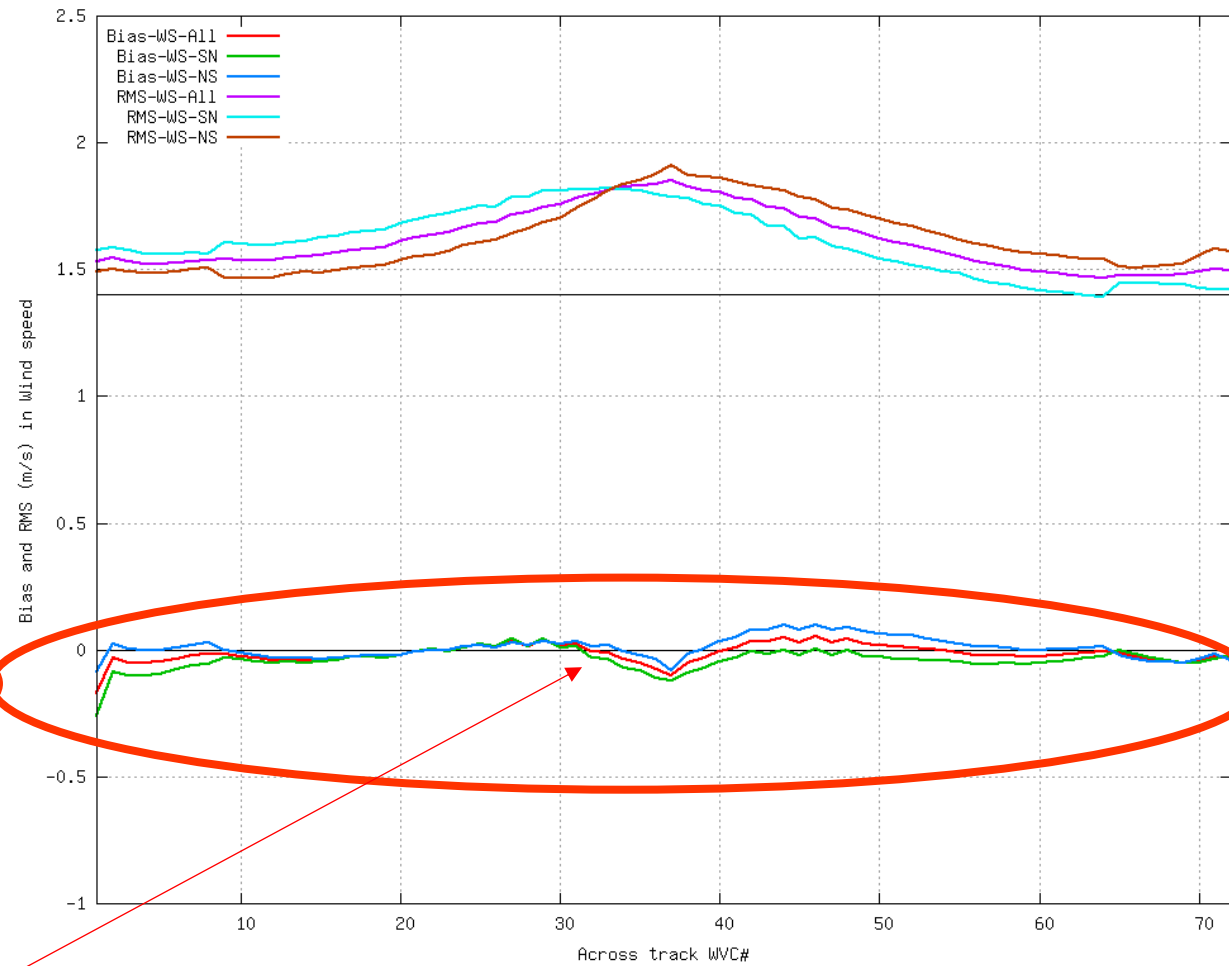
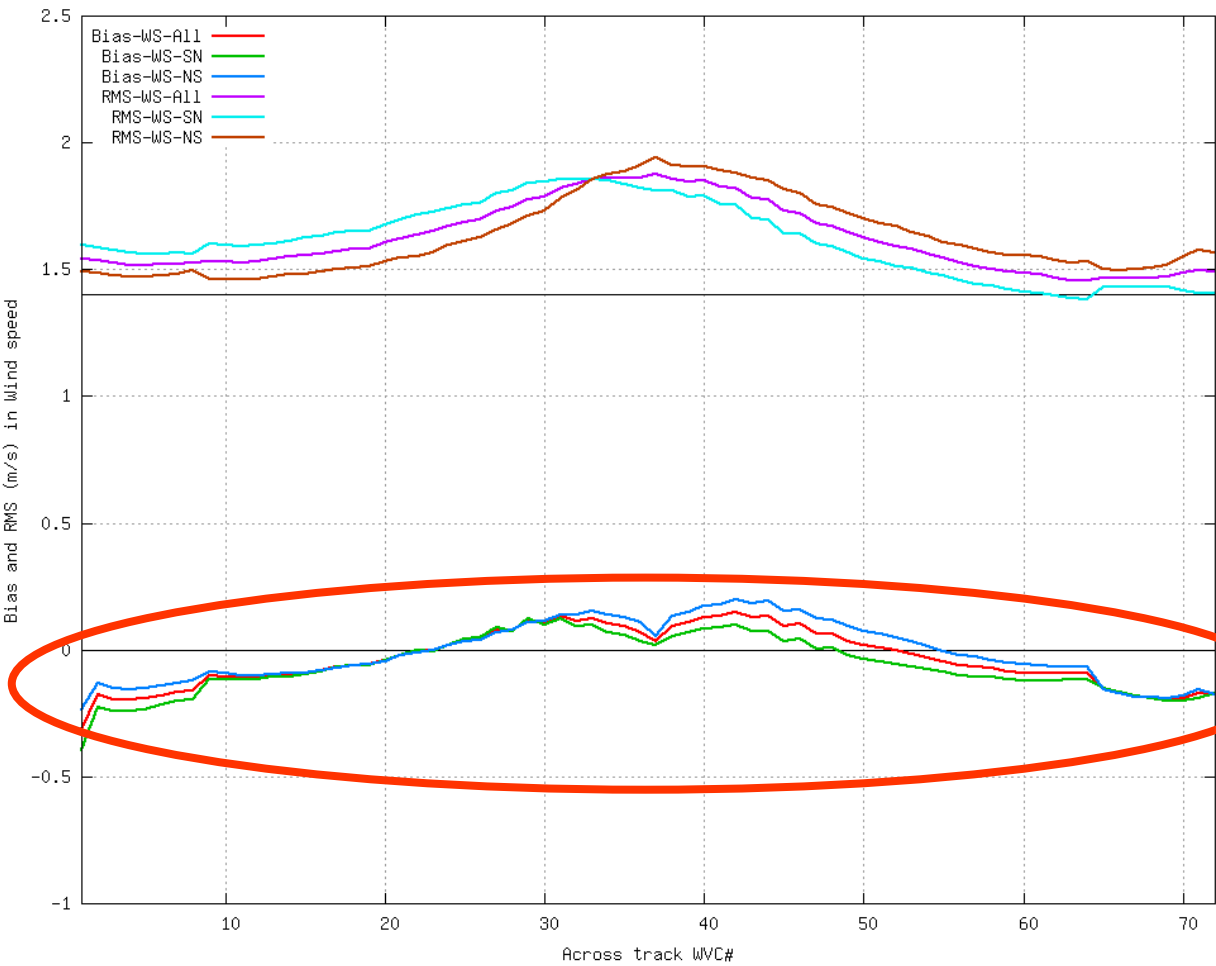
O3SCAT L2B 25km 03-30 m/s ALL-PASS WS RMSD (m/s)

V1.0.2 (SCATSAT-1 GMF)

V1.0.3 (EOS-06 GMF)

Cell-wise Bias and RMS in Wind Speed for 30Jan2023 - 31Dec2023

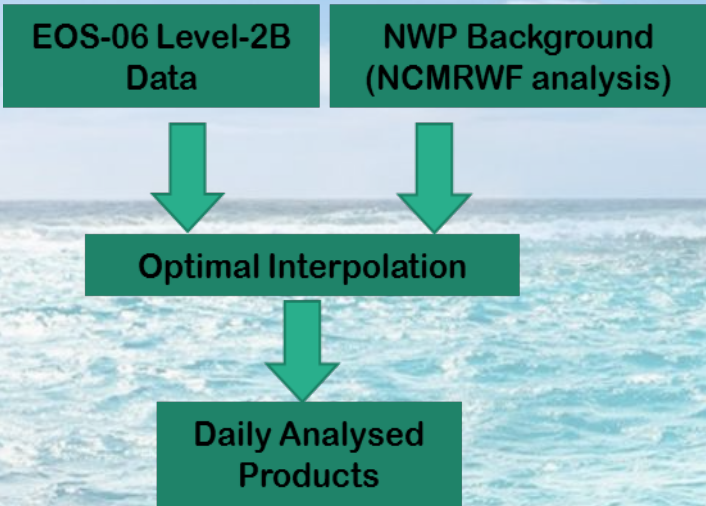
Cell-wise Bias and RMS in Wind Speed for 30Jan2023 - 31Dec2023



Range ~ ±0.1 m/s

EOS-06 SCAT Level-4 Value Added Products (www.mosdac.gov.in)

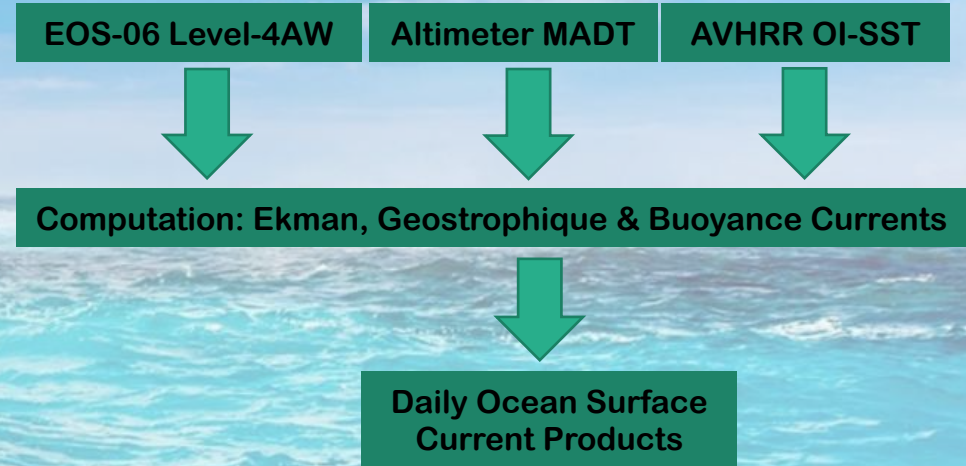
EOS-06 SCAT L4AW : Algorithm flowchart



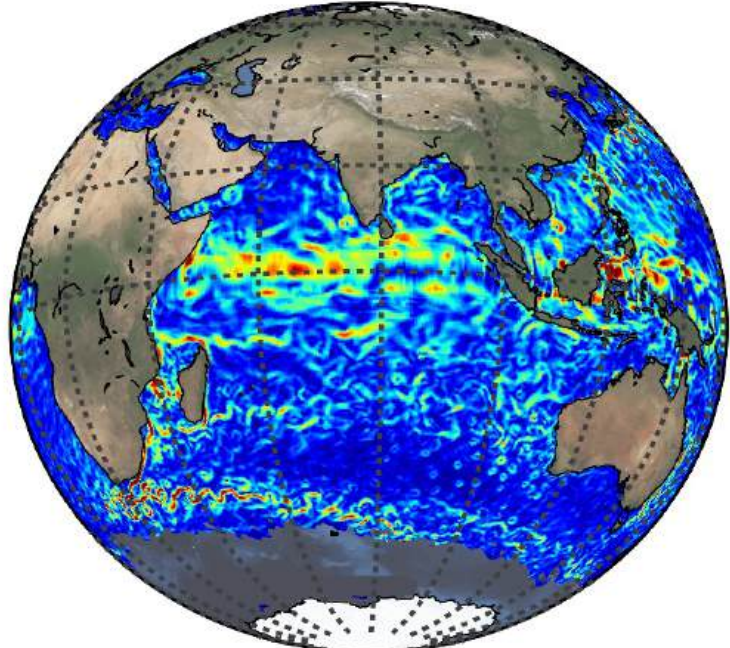
Analyzed Wind Products

Sr. No.	Parameter	Unit
1.	Uobs (observed zonal wind speed)	m/s
2.	U (analyzed zonal wind speed)	m/s
3.	Uestd (analysis error standard deviation in zonal wind speed)	m/s
4.	Vobs (observed meridional wind speed)	m/s
5.	V (analyzed meridional wind speed)	m/s
6.	Vestd (analysis error standard deviation in meridional wind speed)	m/s
7.	Taux (analyzed zonal wind stress)	Pa
8.	Tauy (analyzed meridional wind stress)	Pa
9.	Divg (analyzed wind divergence)	Sec ⁻¹
10.	Curl (analyzed wind stress curl)	Pa/m
10.	Qlh (analyzed latent heat flux)	W/m ²
12.	Qsh (analyzed sensible heat flux)	W/m ²
13.	NS (number of samples per day)	Number

Algorithm flowchart for Ocean Surface Current Products



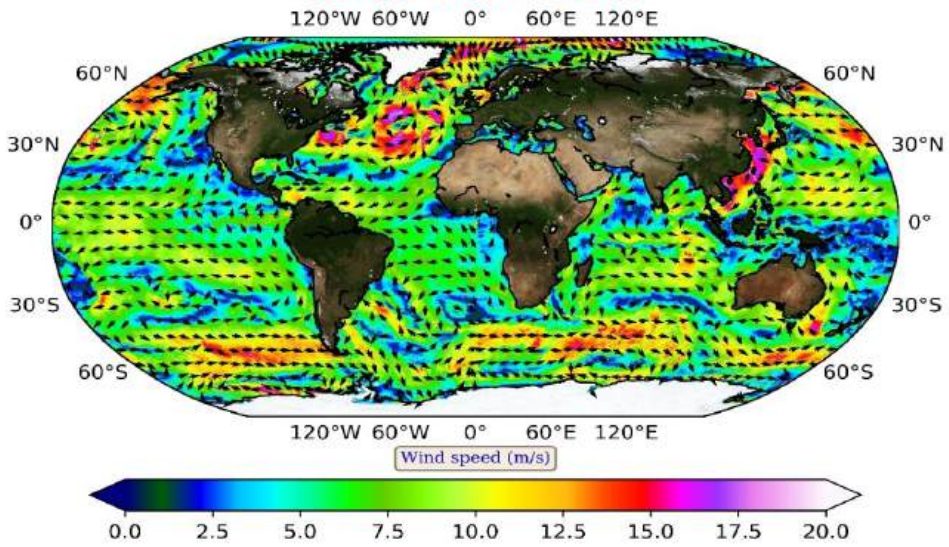
Sea Surface Currents on 15 Feb., 2023



Product Fromat: NetCDF4
 Spatial Resolution: 0.25°x0.25°
 Temporal Resolution: Daily

EOS-06 scatterometer Level-4AW Analyzed Wind

Date: 2022-12-17



Product Fromat: NetCDF4
 Spatial Resolution: 0.25°x0.25°
 Temporal Resolution: Daily

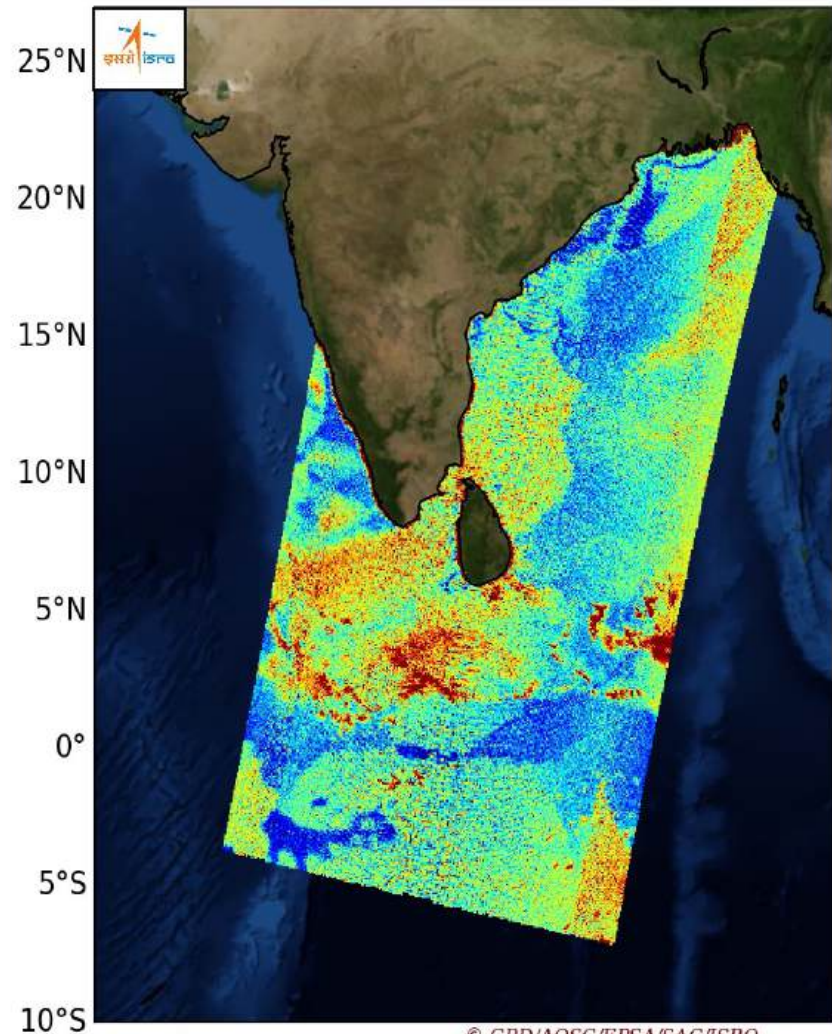
Science Product : Daily global ocean surface currents

Level-4AW: Daily global analysed winds

EOS-06 Scatterometer winds (HR-mode @ 5km)

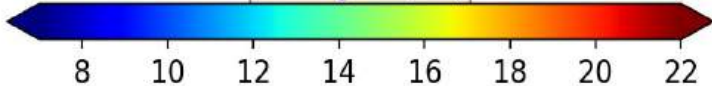
Date: 02-March-2023, 07:06 UTC

65°E 70°E 75°E 80°E 85°E 90°E 95°E



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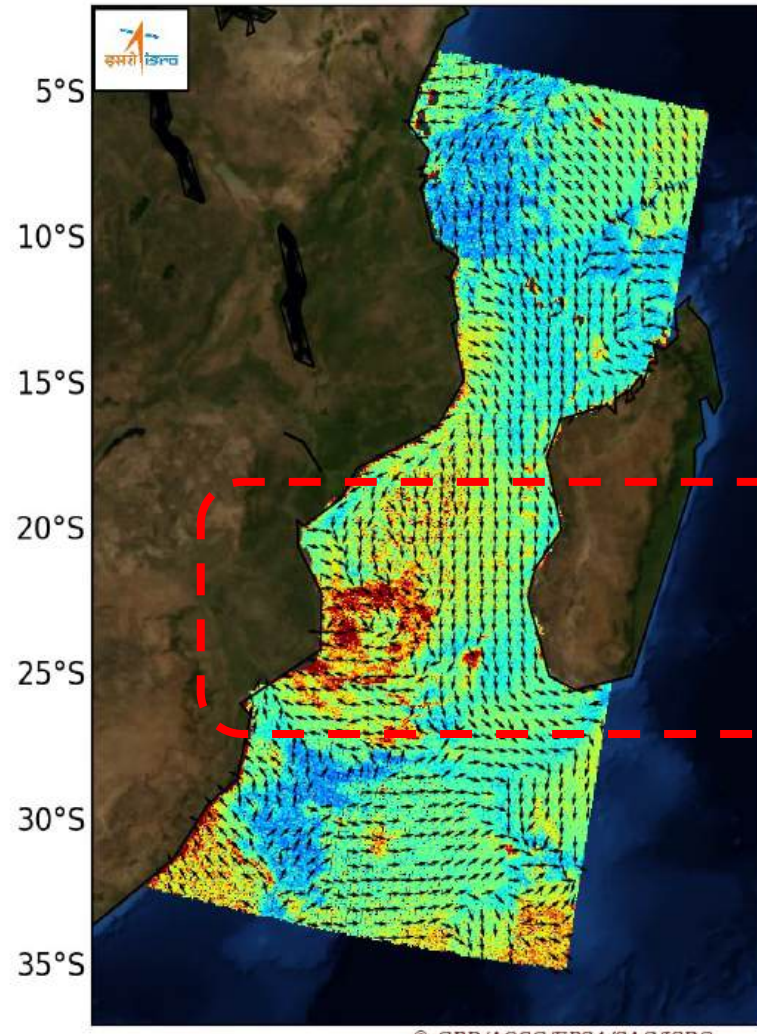
Wind speed (m/s)



EOS-06 Scatterometer winds (HR-mode @ 5km)

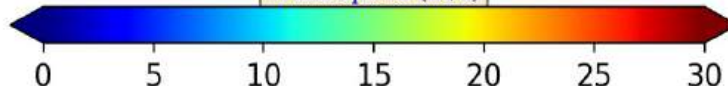
Date: 01-March-2023, 09:42 UTC

30°E 35°E 40°E 45°E 50°E



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Wind speed (m/s)

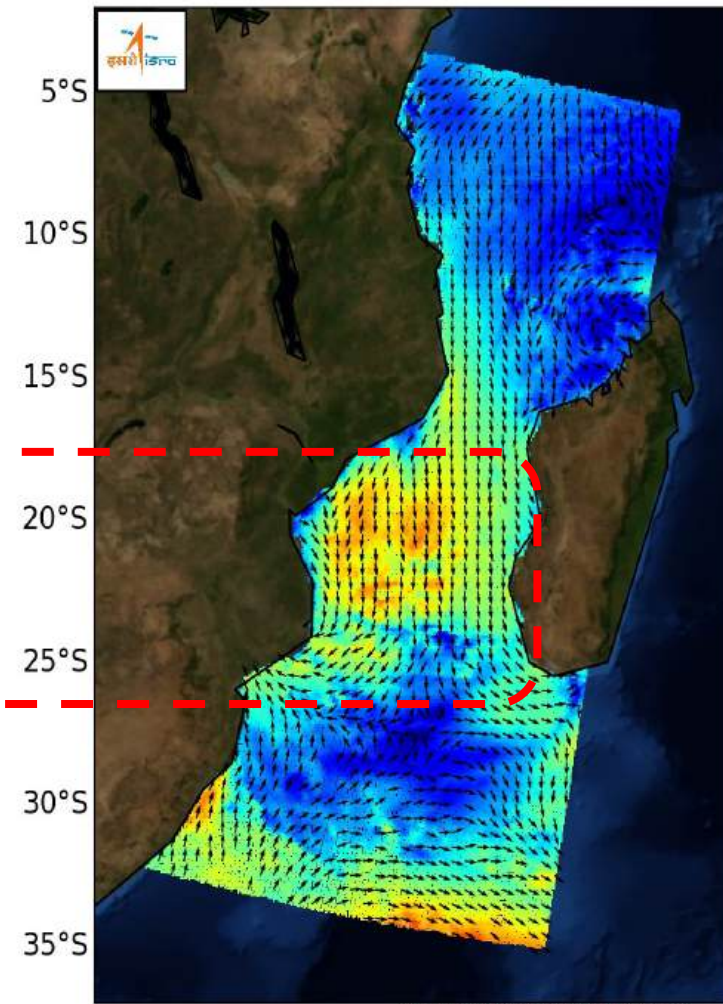


ECMWF Forecast winds

(interpolated on scat swath)

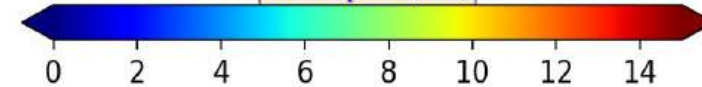
Date: 01-March-2023, 09:00 UTC

30°E 35°E 40°E 45°E 50°E

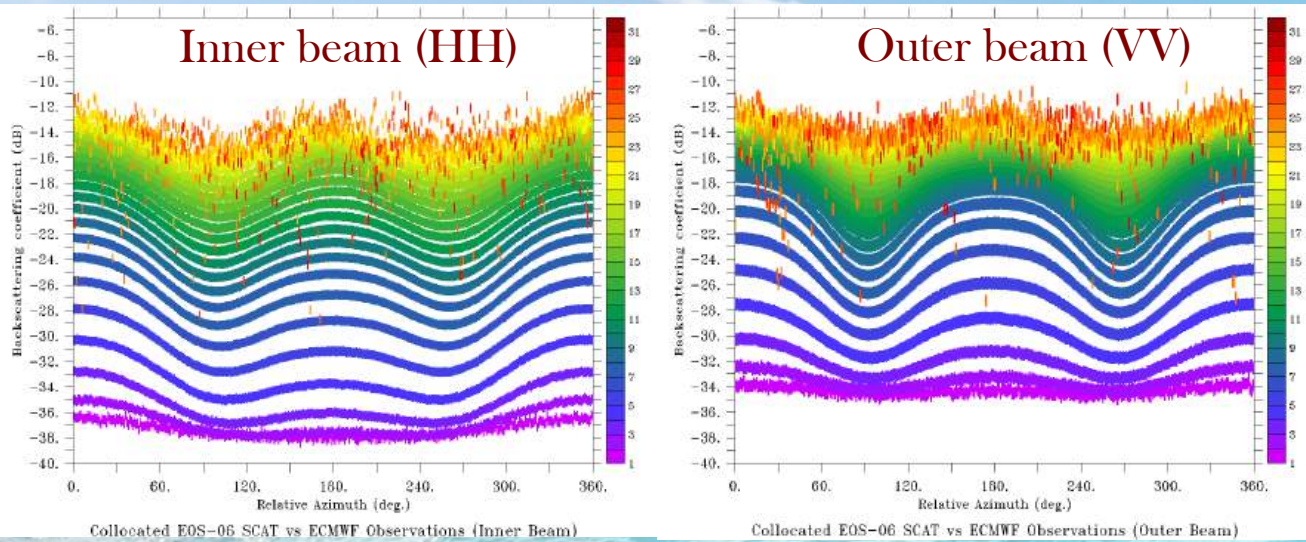


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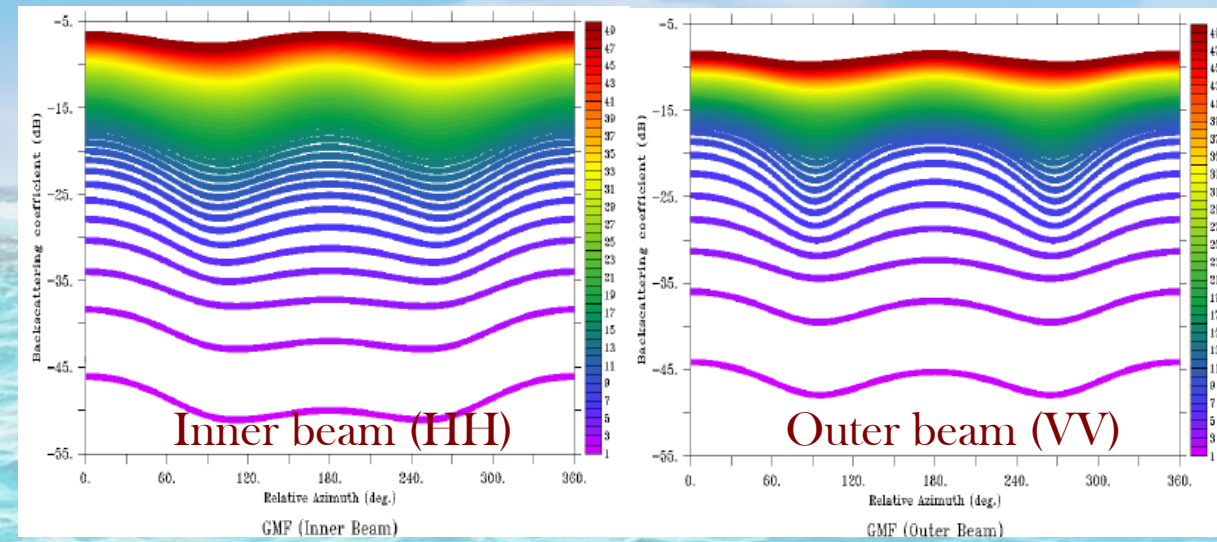
Wind speed (m/s)



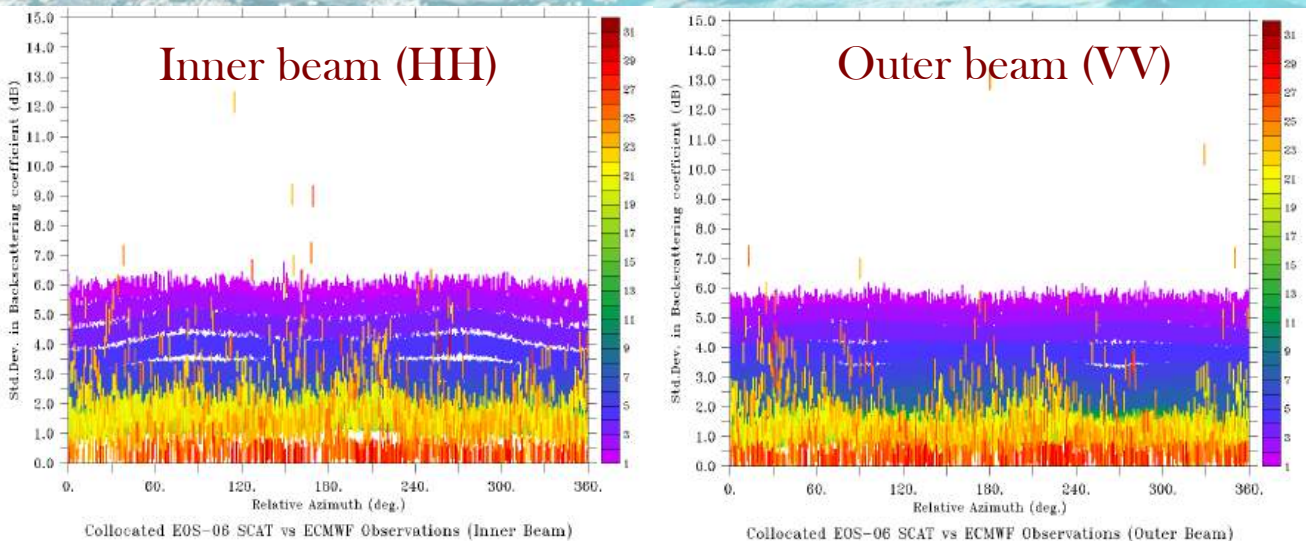
Observed backscattering



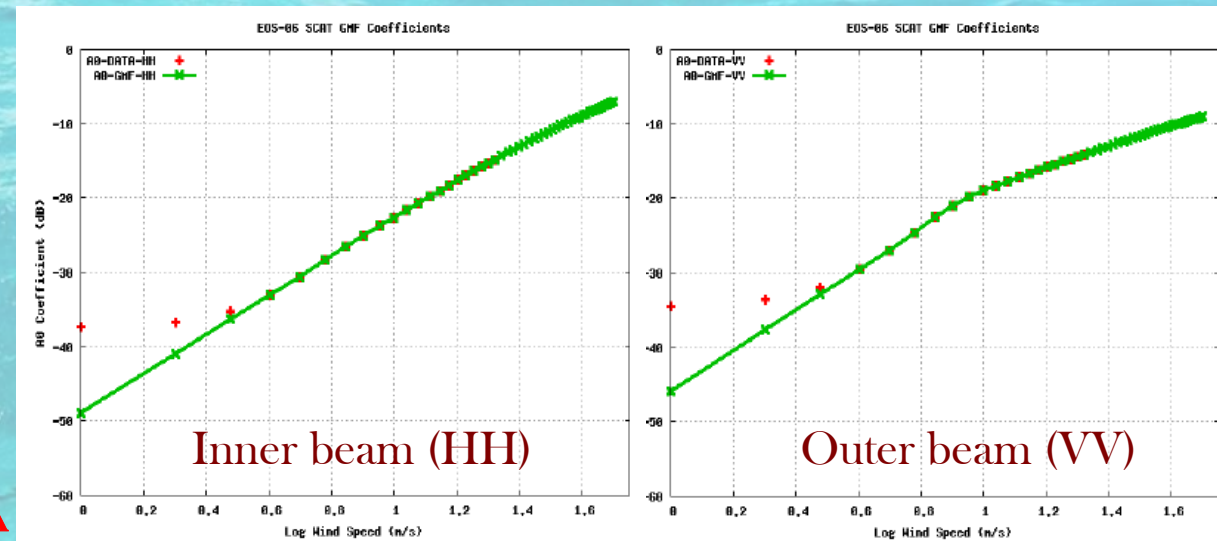
GMF fitted backscattering



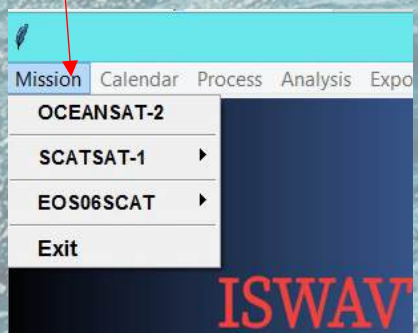
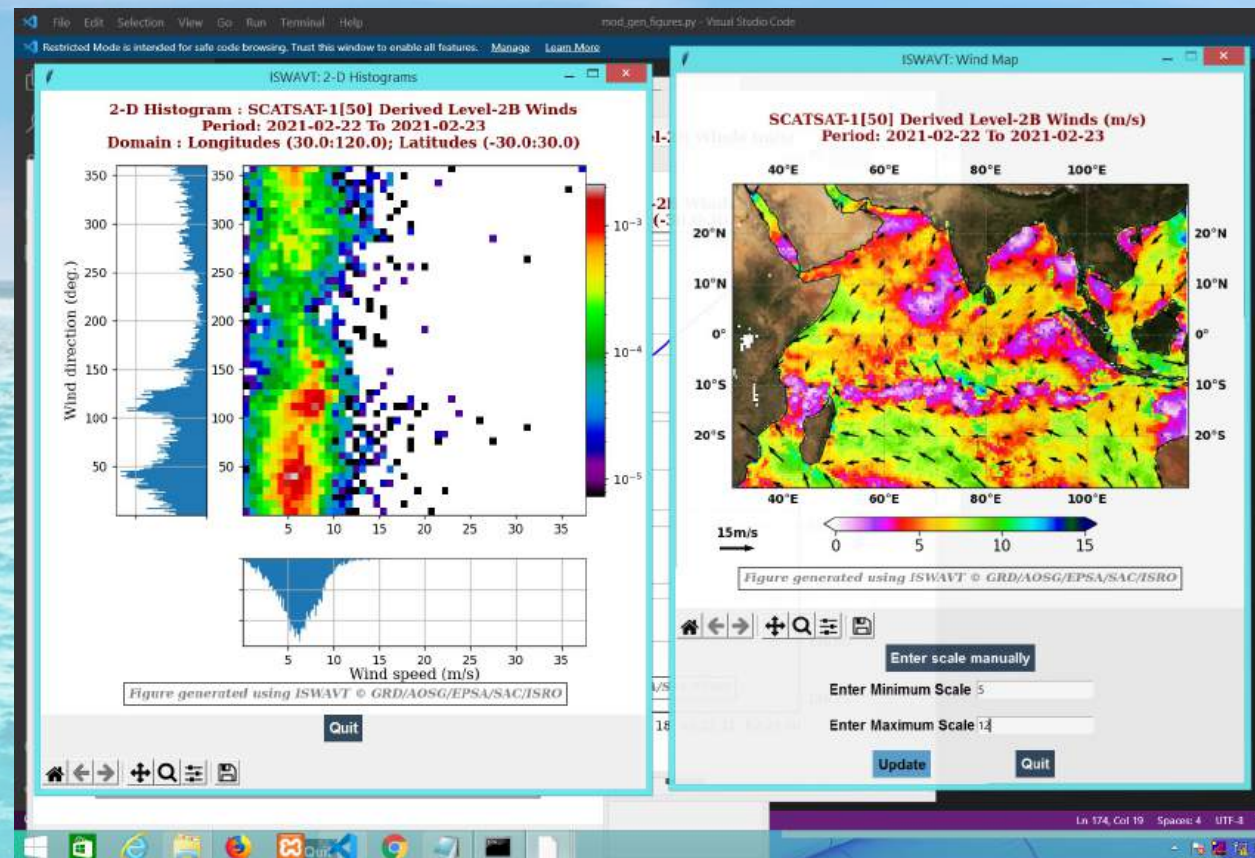
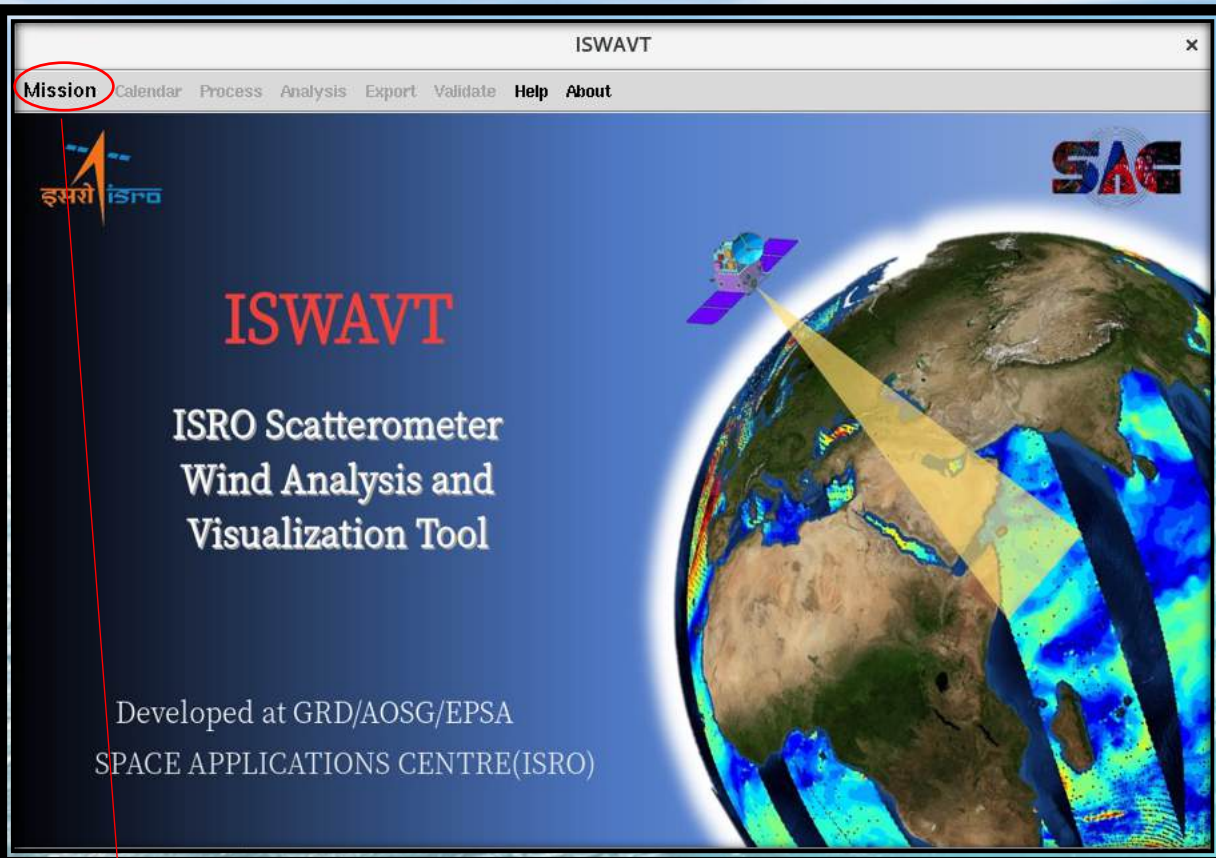
Standard deviation of observed backscattering



GMF fitted A0 coefficient



ISRO Scatterometer Wind Analysis Tool (ISWAVT)



Features:

- RoI selection
- HDF5 Export to CSV/Ascii
- Visualize single/multi-date data
- Analysis: Time-series, histograms, wind rose

The beta version can be obtained from MOSDAC by sending a mail to admin@mosdac.gov.in

- A *multi-dimensional histogram* based algorithm is being developed for improved rain flagging

Conclusions

- **ISRO has launched its third scatterometer mission on-board EOS-06**
- **The performance of the payload is normal**
- **The experimental high-resolution mode has been tested successfully**
- **During In Orbit Testing (IOT) phase, both main and redundant chain operations were executed successfully**
- **Operational products are being generated at IMGEOs and are being disseminated from Bhoonidhi web portal**
- **Value added (Level-4) products are being generated and disseminated from MOSDAC**
- **Product quality is normal and meets the mission specifications successfully**

! Thanks for your attention !