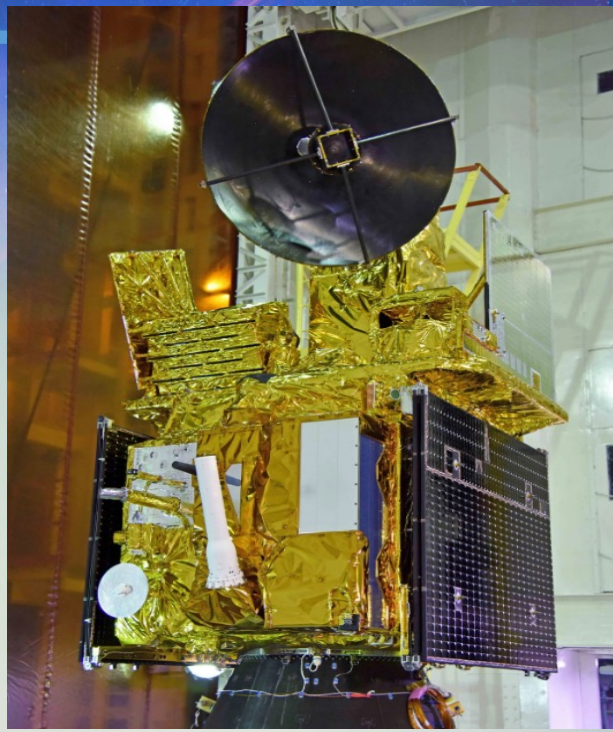
International cooperation in India's EOS-06 data utilisation

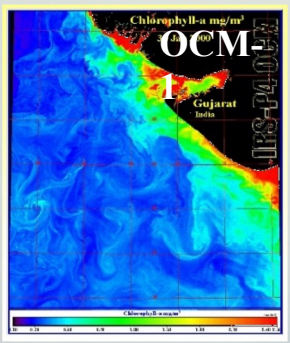
Presentation by Indian delegation
to
60th session of STSC - UNCOPUOS
Vienna, Austria

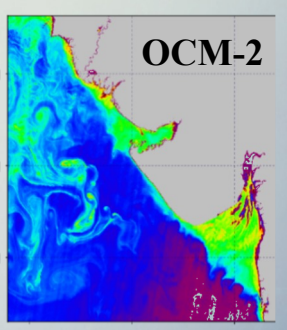
February 14, 2023

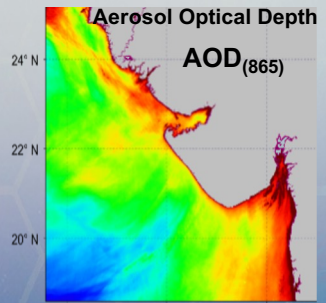
EOS 06 (Oceansat-3)

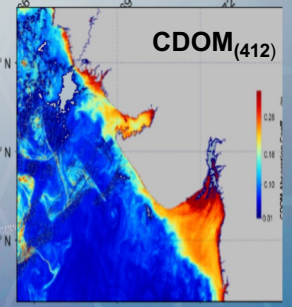
- India's 3rd generation Ocean monitoring satellite
- Carries a 13 band Ocean colour Monitor (OCM-3), Ku band Pencil Beam Sactterometer (OSCAT-3).
- OCM-3 has heritage from Oceansat-1 and 2. The 8band OCM is upgraded to 13 band OCM in 400-1100 nm range.
- Scatterometer has heritage from Oceansat-2 and SCATSAT-1. The Scatterometer is improved to provide high resolution wind vectors.
- The EOS 06 satellite was launched by PSLV C 54 mission from Satish Dhawan Space port, Sriharikota, on 26th November 2022 to a polar sun-synchronous orbit of 740km altitude



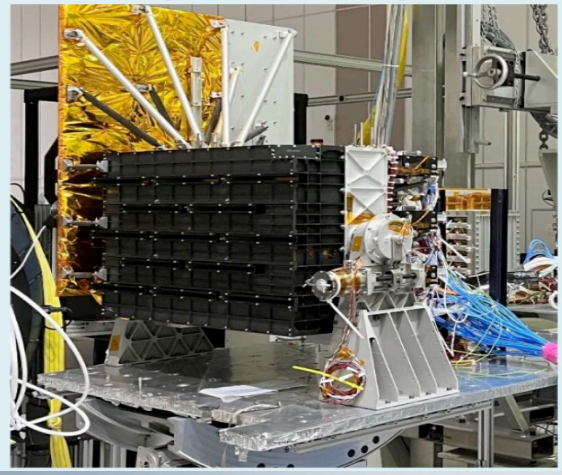




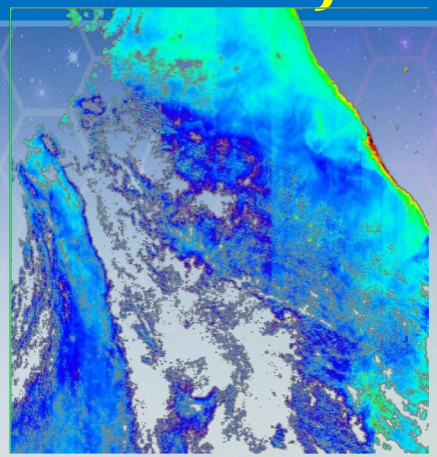




EOS-06 (Oceansat-3) Ocean Colour Monitor



Lab view of OCM-3 payload

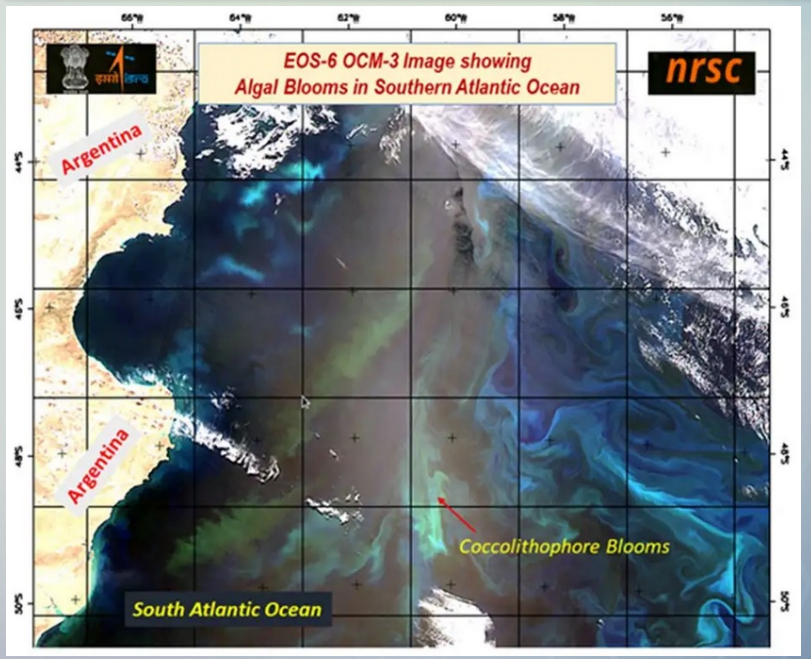


OCM3 derived Chl-a : December 16, 2022

- Narrow Bandwidth (10 nm) for most bands (2-11) or lower (9 nm) 20-30 nm (1, 12, 13) bands.
- Polar, Sun Synchronous marching orbit with ± 20° tilt , Global Mission
- Local Area Coverage at 360m and Global Area coverage at 1 Km
- Swath 1550 km.
- Global coverage in 2 days

OCM-3 Band description and their applications

Band#	Central WL (nm)	Band-width	Primary Application
B1	412	20	Differentiate yellow substance from chlorophyll
B2	443	10	Chlorophyll absorption maximum; low chlorophyll
B3	490	10	Moderate chlorophyll
B4	510	10	High chlorophyll; Total Suspended Matter (TSM)
B5	555	10	Reference baseline for Chlorophyll
B6 *	566	10	Trichodesmium bloom detection
B7	620	10	Turbidity in coastal Case 2 waters, Phycocyanin absorption
B8*	670	10	Baseline for fluorescence line height (FLH), chl secondary absorption
B9 *	681	9	Chlorophyll fluorescence
B10 *	710	10	Baseline for FLH, vegetation - chlorophyll fluorescence; atmospheric Correction
B11	780	10	Atmospheric correction; O2 absorption Band avoided
B12	870	20	Atmospheric correction; good assessment of spectral scattering
B13 *	1010	30	Atmospheric correction in turbid waters, aerosol – white foam discrimination



Present status:

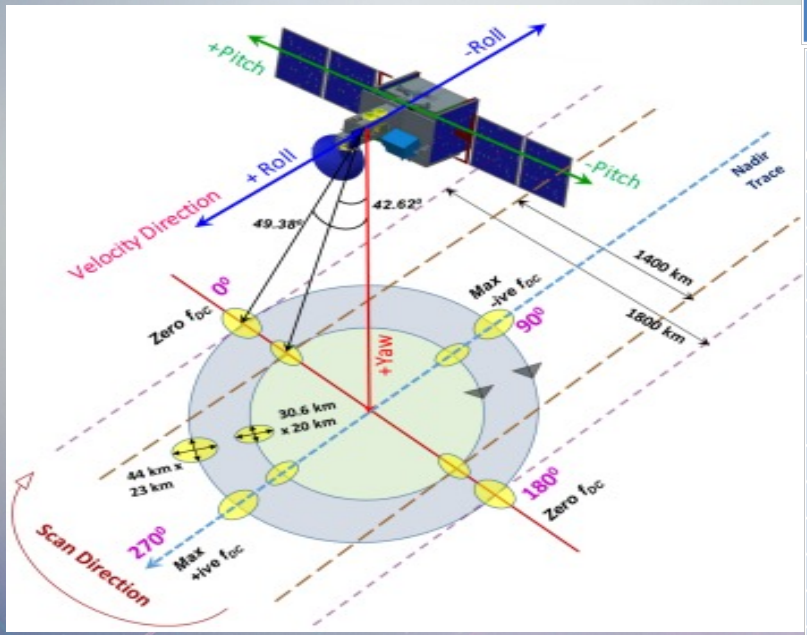
- Operational products are being generated at IMGEOS/NRSC.
- In Orbit Testing (IOT) & CAL-VAL phase is going on.

EOS-06 OCM Products Availability

Category	Parameter	Resolution	Format	Availability	To be provided
L1B	Radiance Product after Ground TDI & Geo-Tagging	**LAC (1km) /GAC (360 m)**	NetCDF-4	www.nrsc.gov.in	**Cal-Val Team**
L1C	Radiance Product Geo-referenced	**LAC/GAC**	NetCDF-4	www.nrsc.gov.in	**All**
L2C	Geo-physical Parameters Georeferenced • Chlorophyll-a • Aerosol Optical Depth • Diffused Attenuation Coefficient(Kd-490) • Total Suspended Matter • Remote Sensing Reflectance of first 10 Bands (412 to 710 nm) • Enhanced Vegetation Index • Normalized Difference Vegetation Index • Vegetation Fraction	**LAC/GAC**	NetCDF-4	www.nrsc.gov.in	**All**

EOS-06 (Oceansat-3) Scatterometer

Lab view of SCAT-3 payload



Scanning geometry of SCAT-3

Table: Mission Specifications

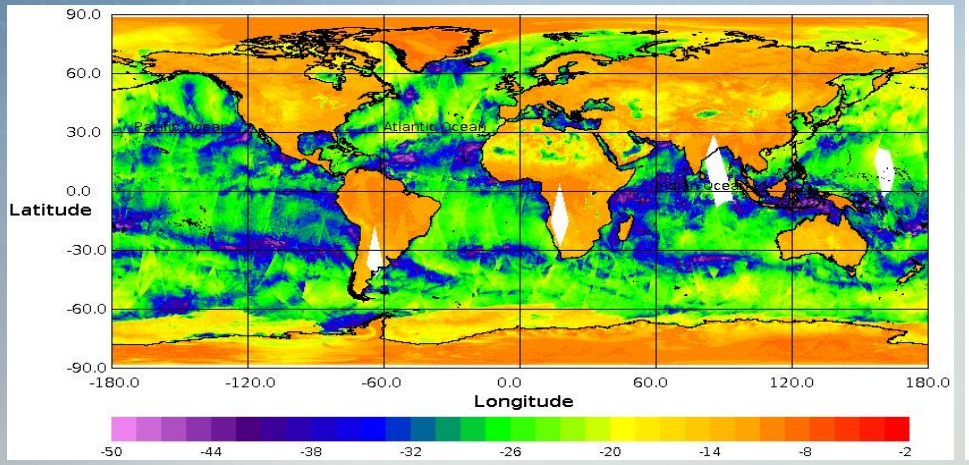
Spacecraft Altitude	734-767 Km
Inclination	98°
Orbit	Polar, Sun Synchronous
Yaw rotation over an orbit	±4°
Frequency	13.5156 GHz
Polarization	HH for Inner and VV for Outer beams
Swath	1400 Km (both HH and VV beams available) 1400-1800 Km (only VV beam available)
Wind Speed Range	3-30 m/s
Wind Direction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

Table : EOS-06 SCAT System Parameters (Nominal Mode)

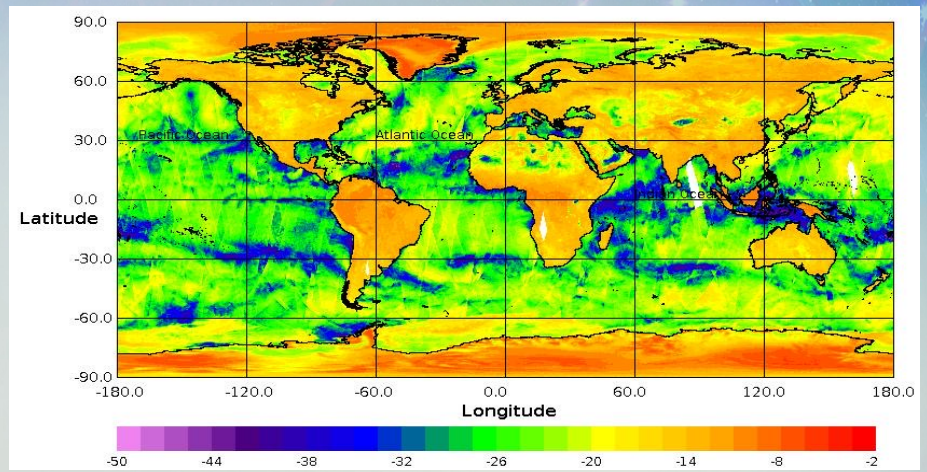
Parameter	Inner Beam	Outer Beam
Satellite Altitude	740 km	
Frequency	13.51 GHz	
Wavelength	0.022 meters	
Swath	1400 km	1800 km
Polarization	HH	VV
One Way 3dB Foot Print (Az x El)	19.4 km X 31.7 km	23.4 km X 44 km
Beam width (Az x El)	1.05° X 1.12°	1.08° X 1.08°
Peak Transmit Power (dBm)	50	
Scan Rate	16 rpm	
Antenna Diameter	1.4 m	
Nominal PRF	193 Hz	
Transmit Pulse width	1.35 ms	
Transmit Modulation	LFM	
Transmit Chirp Bandwidth	400 kHz	
Sampling Frequency	1.953 MHz	

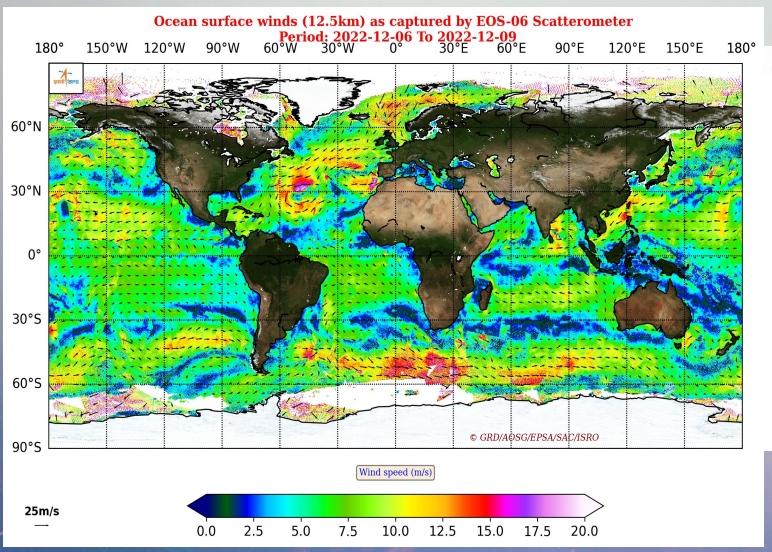
EOS-06 (Oceansat-3) Scatterometer

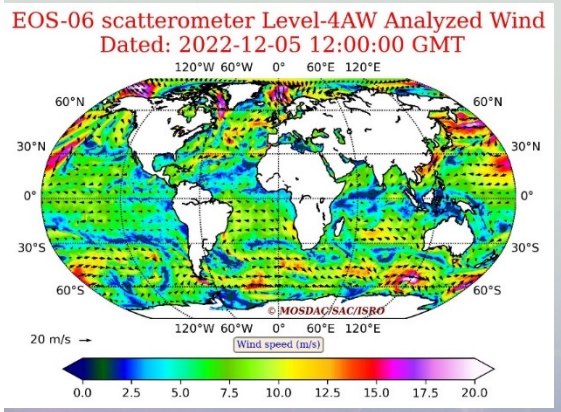
Inner-beam (HH) Backscattering coefficient (dB) from EOS-06 Scatterometer
Period: 2022-12-06 To 2022-12-09



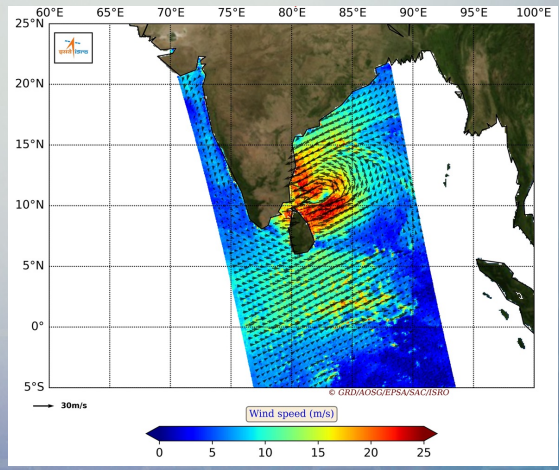
Outer-beam (VV) Backscattering coefficient (dB) from EOS-06 Scatterometer
Period: 2022-12-06 To 2022-12-09







Tropical cyclone “Mandous” as captured by EOS-06 SCAT
08-Dec-2022, 17:58 UTC



EOS-06 SCAT Products Availability

Category	Parameter	Resolution	Format	Availability	To be provided
L1B	Scan mode σ^o	-	HDF5	www.nrsc.gov.in	Cal-Val Team
L2A	Swath grid σ^o	12.5,25 km	HDF5	www.nrsc.gov.in	All
L2B	Swath grid Winds	12.5,25 km	HDF5	www.nrsc.gov.in	All
L3S	σ^o (Daily Global gridded)	12.5, 25 km	HDF5	www.nrsc.gov.in	All
L3W	Winds (Daily Global gridded)	12.5, 25 km	HDF5	www.nrsc.gov.in	All
L3IC	Global Ice cover	12.5, 25 km	Geotiff	www.mosdac.gov.in	All
L4AW	Analyzed winds	25 km	Netcdf	www.mosdac.gov.in	All
L4HW	High Resolution Winds	6.25 km	Netcdf	www.mosdac.gov.in	All
L4INDIA, FULLGLOBE, NPOLAR, SPOLAR	σ^o, BT	2 km	Geotiff	www.mosdac.gov.in	All

International Collaboration

Collaboration with NOAA in utilizing Fairbanks ground station for downloading the data and commanding the satellite and Data sharing

Continuation of the successful Collaboration with NASA, NOAA KNMI, EUMETSAT, ECMWF in Scatsat data production and algorithm fine tuning and Cal/Val

Data sharing and dissemination through EUMETCAST

Data continuity assurance in Ocean colour and Wind vector

Part of Ocean Surface Vector Wind (OSVW) virtual constellation

Opportunities

- Free access to Global Ocean Colour Data at 1km resolution.
- Validation opportunity at global sites.
- Development of region specific algorithms for ocean colour products
- Reception of High resolution data (360m) by establishing a ground station.
- Near real time availability of Scatterometer data (within 180 minutes).
- Feedback on the quality of the data Scatterometer L1 & L2 data.
- Benefit operational users with better quality ocean surface wind data.
- Benefit the Science community with a >20 year ocean vector winds data set enriching the climate data records.

Thank you..