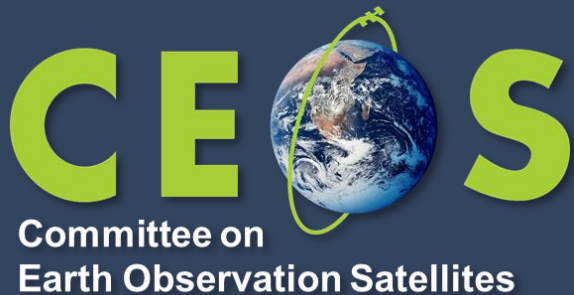


LSI-VC-17

Latest activities related to SAR CEOS-ARD products from ISRO



P.V. Jayasri

Raghav Mehra

V.M. Ramanujam

H.S.V Usha Sundari

Agenda Item # 13.3

LSI-VC-17, Tsukuba, Japan

14-16 April, 2025

ISRO's SAR Missions for CEOS-ARD Compliance

Capabilities of EOS-04 (follow-on mission of RISAT-1 – C-band SAR): In-Orbit

- Imaging Modes: Stripmap, ScanSAR and Sliding-Spotlight
- Polarizations: Single, Dual, Compact (CP) & Full (FP)
- Swath Coverage: 10 Km to 223 Km
- Spatial Resolutions: 1m to 50m

Launched in
February, 2022

Capabilities of EOS-09 (follow-on mission of EOS-04 – C-band SAR):

- Polarizations: Single, Dual, Compact (CP) & Full (FP)
- Swath Coverage: 10 Km to 223 Km
- Spatial Resolutions: 1m to 50m
- Imaging Modes: Stripmap, ScanSAR and Sliding-Spotlight



Additional Payload: Automatic Identification System(AIS)

Capabilities of NISAR (L-band from JPL, S-band from ISRO):

- ✓ Collaborating Agencies: ISRO and NASA
- ✓ Imaging Technique: SweepSAR
- ✓ Repeat cycle: 12 days with Larger Swath & Global coverage
- ✓ High Spatial Resolution(~6m) with Full Polarimetric & Interferometric Operations



ISRO's Data Dissemination Portal - "Bhoonidhi"

<https://bhoonidhi.nrsc.gov.in/>



CEOS Endorsement for ISRO's Products



EOS-04 Level-2B NRB Data products

Date of Endorsement: 2nd April 2024.

SAR Product Family Specification: v 1.0

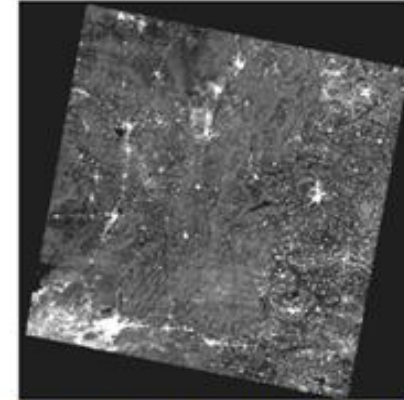
Evaluation : at Threshold Level

Product availability: ScanSAR Imaging mode

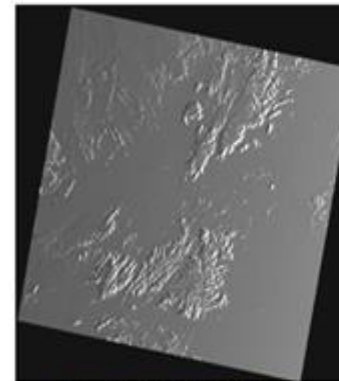
Medium Resolution ScanSAR (MRS): 18 meters spacing, scene-based Single, Dual, Circular and Full -polarization single-date Gamma0 products.

Coarse Resolution ScanSAR (CRS): 36 meters spacing, scene-based Single, Dual, Circular and Full -polarization single-date Gamma0 products .

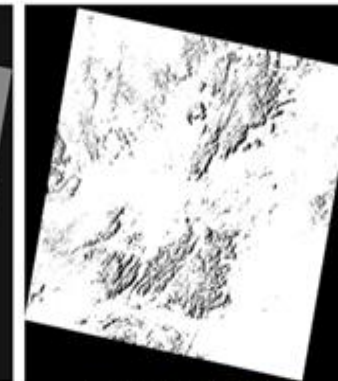
Product Download: ISRO's Bhoonidhi Web portal
(Free to User Community)



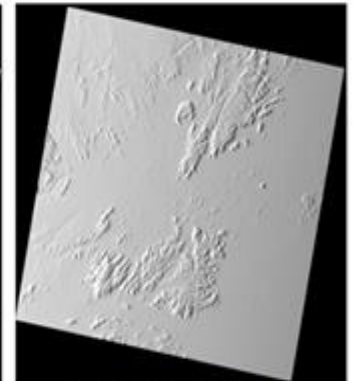
Level-2B Terrain Normalized ARD Product



Local Illumination Area



Layover Shadow Mask



Local Incidence Angle

CEOS Endorsement for ISRO's Products



EOS-04 - Tile based India Mosaic NRB product

Date of Endorsement: 6th January 2025

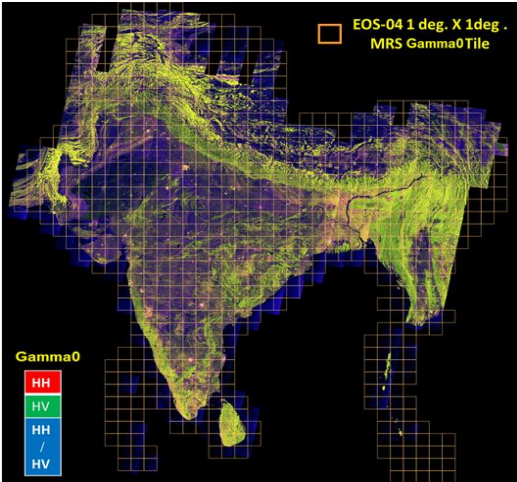
SAR Product Family Specification: v 1.1

Evaluation : at Threshold Level

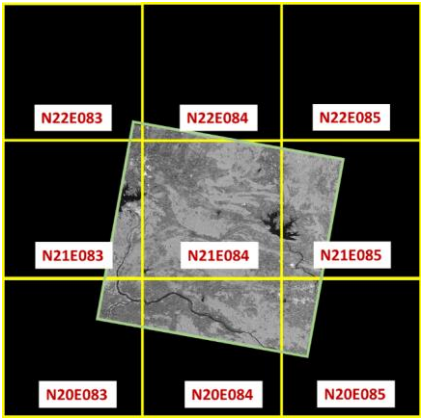
Product availability: For MRS systematic collections over Indian Carpet region with 17 days repetivity

Medium Resolution ScanSAR (MRS) India Mosaic :
18 meters spacing, 1 deg X 1 deg tile-based, Dual HH-HV –pol, multiple-date Gamma0 products.

Product Download: ISRO's Bhoonidhi Web portal
(Free to User Community)



EOS-04 MRS- India Mosaic ARD Gamma0 Product
available every 17 (~10 +[EOS-09]) days



India Mosaic Product Structure

E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_HH.aux	AUX File	44 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD.kmz	KMZ File	503 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_browse.geo.png	PNG File	293 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_browse_rgb.geo.png	PNG File	860 KB
BAND_META.txt	Text Document	2 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_area.tif	TIF File	186,072 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_date.tif	TIF File	664 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_HH.tif	TIF File	84,045 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_HV.tif	TIF File	72,475 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_lla.tif	TIF File	179,218 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_mask.tif	TIF File	626 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_browse.geo.wld	WLD File	1 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_browse_rgb.geo.wld	WLD File	1 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_browse.geo.png.aux...	XML Document	1 KB
E04_SAR_MRS_03JUL2024_50_N23E071_FIGC00ZTD_browse_rgb.geo.png...	XML Document	1 KB
product.xml	XML Document	16 KB
product.xsd	XSD File	21 KB

UTM projected MRS scene
re-sampled to equal Latitude-Longitude
tiles of size 1° X 1° at 0.000164° spacing
(degree equivalent of 18 m)



CEOS Analysis-Ready Datasets

The following table summarises all of the satellite EO datasets that have been assessed as CEOS Analysis Ready Data (CEOS-ARD) or which are working towards it (either under development or at the peer review stage). DOI links are provided for access, along with links to further information, sample products, and the completed CEOS-ARD self-assessment and peer review outcome documents.

Hide fields Filter Group Sort ...								
☐	Name	Status	Type	Version	Agency/Orga...	Mission / Instrument(s)	Access	
17	PROBA-V L3 (0.1/0.333/1 km) TOC	CEOS-ARD	Surface Reflectance	v5.0	VITO / ESA	PROBA-V	Link	
18	RISAT-1A (EOS-04) NRB	CEOS-ARD	SAR-NRB	v1.0	ISRO	RISAT-1A (EOS-04)	MRS	
19	RISAT-1A (EOS-04) NRB India Mosaic	CEOS-ARD	SAR-NRB	v1.1	ISRO	RISAT-1A (EOS-04)	Link	
20	Sentinel-1 RTC	CEOS-ARD	NRB	v5.5	Sinergise & Digit...	Sentinel-1A, 1B	Link	
21	Sentinel-2 Level-2A	CEOS-ARD	Surface Reflectance	v5.0	ESA	Sentinel-2A, 2B	Link	

Respective DOIs are populated in CEOS ARD website against each product.

https://doi.org/10.46693/NRSC/10/E04_SAR_MRS_STUC00ZTD

https://doi.org/10.46693/NRSC/10/E04_SAR_MRS_FIGC00ZTD

Bhoonidhi

ISRO's EO Data HUB

भूनिधि

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Search-Results
Cart

Pricing: OpenData_DirectDownload

Sat_Sen: E04_SAR_MRS_L2B_DH

Scene: 17356_17356_23308_12

Dop: 07-Apr-2025

Pricing: OpenData_DirectDownload

Sat_Sen: E04_SAR_MRS_L2B_DH

Scene: 17356_17356_23308_13

Dop: 07-Apr-2025

Pricing: OpenData_DirectDownload

Sat_Sen: E04_SAR_MRS_L2B_DH

Scene: 17356_17356_23308_14

Dop: 07-Apr-2025

Pricing: OpenData_DirectDownload

Sat_Sen: E04_SAR_MRS_L2B_DH

Scene: 17356_17356_23308_15

Dop: 07-Apr-2025

Pricing: OpenData_DirectDownload

Sat_Sen: E04_SAR_MRS_L2B_DH

Scene: 17356_17356_23308_16

Dop: 07-Apr-2025

Pricing: OpenData_DirectDownload

Sat_Sen: E04_SAR_MRS_L2B_DH

Scene: 17356_17356_23308_17

Dop: 07-Apr-2025

Pricing: OpenData_DirectDownload

Sat_Sen: E04_SAR_MRS_L2B_DH

Scene: 17356_17356_23308_18

Dop: 07-Apr-2025

Pricing: OpenData_DirectDownload

Sat_Sen: E04_SAR_MRS_L2B_DH

Scene: 17356_17356_23308_19

Dop: 07-Apr-2025

Pricing: OpenData_DirectDownload

Sat_Sen: E04_SAR_MRS_L2B_DH

Scene: 17356_17356_23308_20

Dop: 07-Apr-2025

Pricing: OpenData_DirectDownload

Latitude: 28° 09' 14" N Longitude: 87° 49' 00" E

Browsers supported: Firefox 60+, Chrome 78+, Edge 18+, Opera 64+

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Meta Data Information



Brightness : 0Contrast : 0

Product Id:
E04_SAR_MRS_07APR2025_097002433293_17356_STUC00ZTD_23308_13_DH_D_R_N17449_E0824

SCENE DETAILS

Satellite: E04

Sensor: SAR

Date of Pass: 07-Apr-2025

Imaging Orbit No: 17356

Ground Orbit No: 17356

Sensor Specification: E04_SAR_MRS_L2B_DH

Sensor Specification Scheme: Satellite_Sensor_ImagingMode_Product_TxPol

Scene Specification: 17356_17356_23308_13

Scene Specification Scheme: GroundOrbit_ImagingOrbit_Strip_Scene

Transmit Polarization: H

Receive Polarization: H+V

Incidence Angle: 37.78261

Node: DESCENDING

Look Direction: RIGHT

COVERAGE DETAILS

Top Left Lat: 18.156876

Top Left Lon: 81.7997

Top Right Lat: 17.89757

Top Right Lon: 83.2795

Bottom Right Lat: 16.476317

Bottom Right Lon: 83.0027

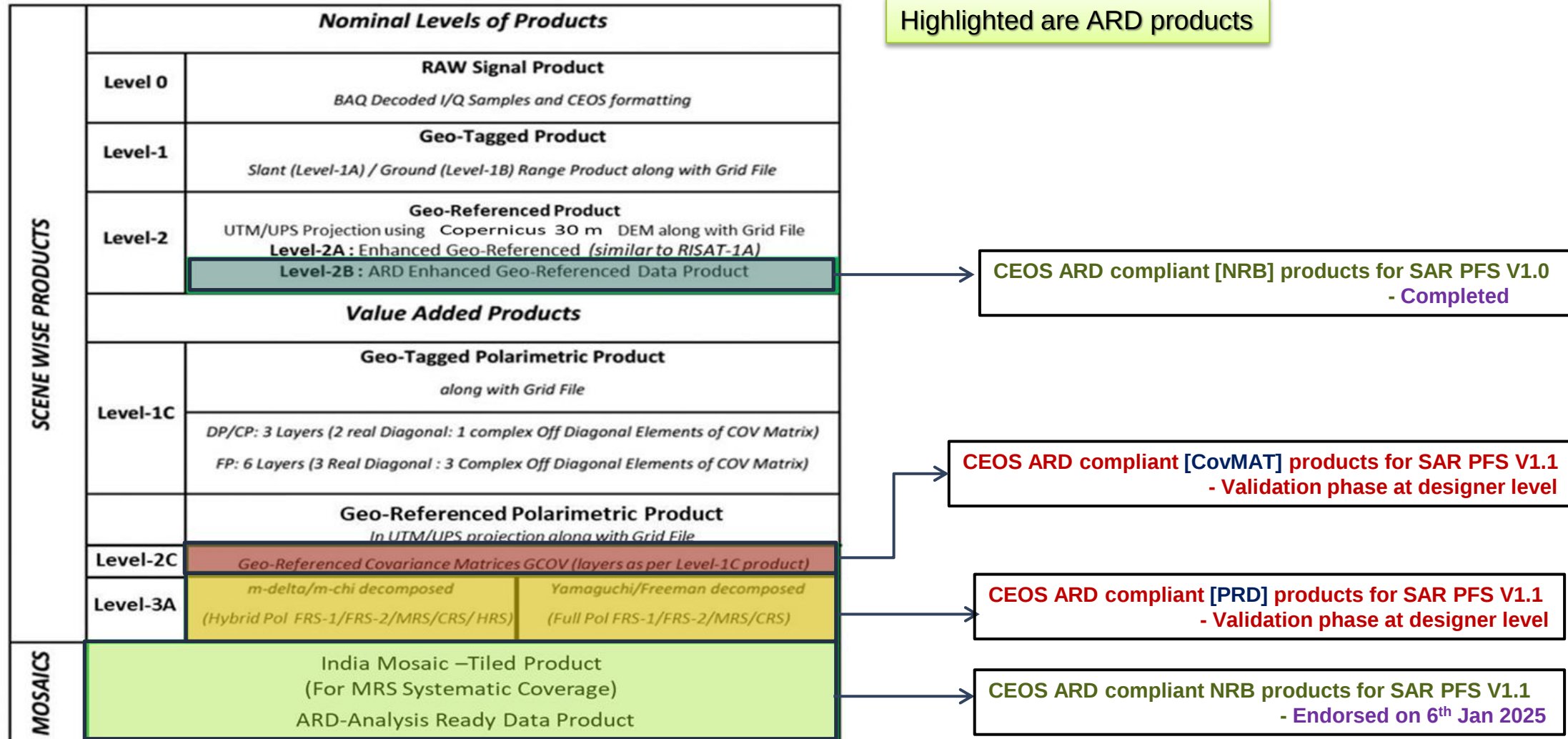
Bottom Left Lat: 16.737046

Bottom Left Lon: 81.5346

Center Latitude: 17.317394

Center Longitude: 82.401

Download Meta



Geocoded Covariance Matrix and SLC product:

$$\begin{pmatrix} C_{11} & C_{12} \\ C_{12}^* & C_{22} \end{pmatrix}$$

Dual, Circular
Polarization

$$\begin{pmatrix} C_{11} & C_{12} & C_{13} \\ C_{12}^* & C_{22} & C_{23} \\ C_{13}^* & C_{23}^* & C_{33} \end{pmatrix}$$

Full
Polarization

Geo-Coded Covariance
Matrix Product

[CovMAT]

EOS-04, EOS-09, NISAR

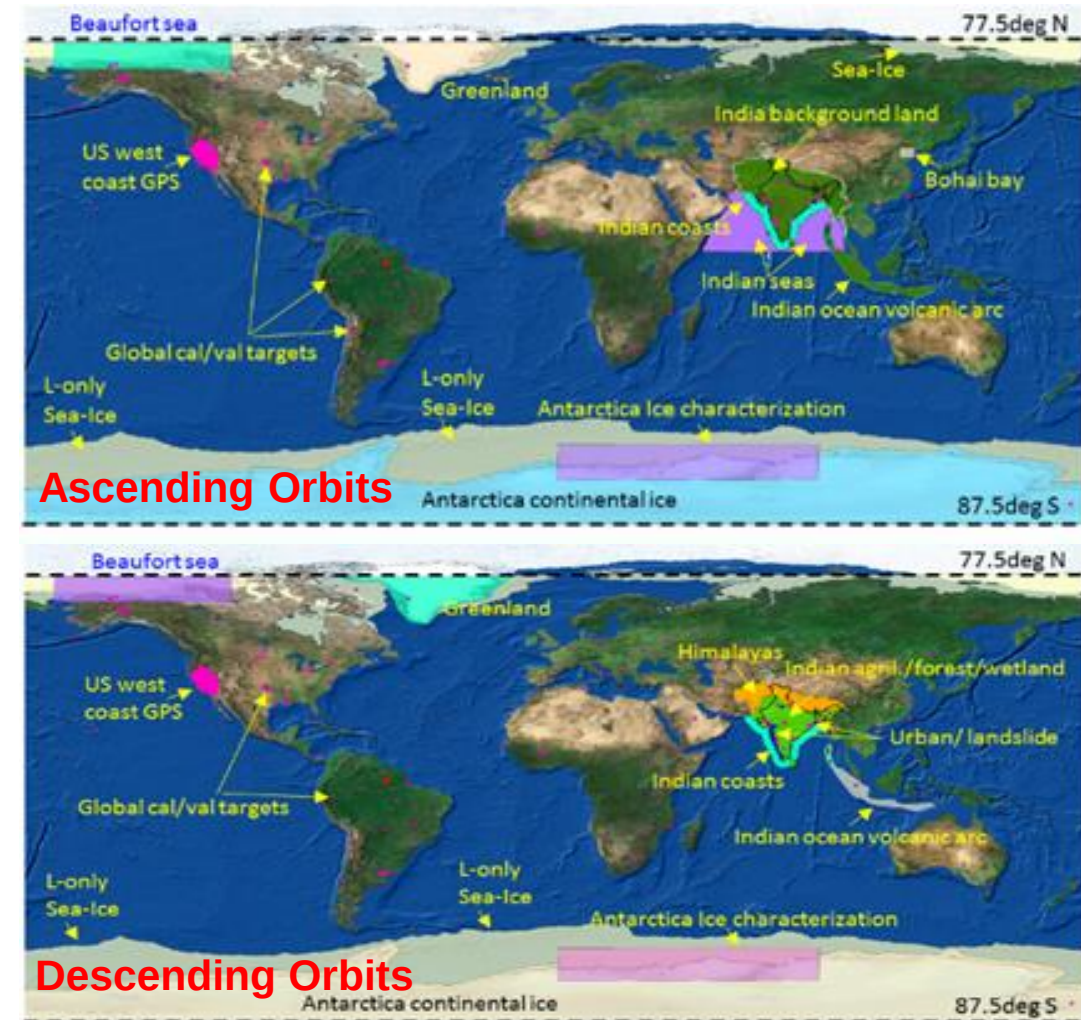
India, Antarctica Mosaics

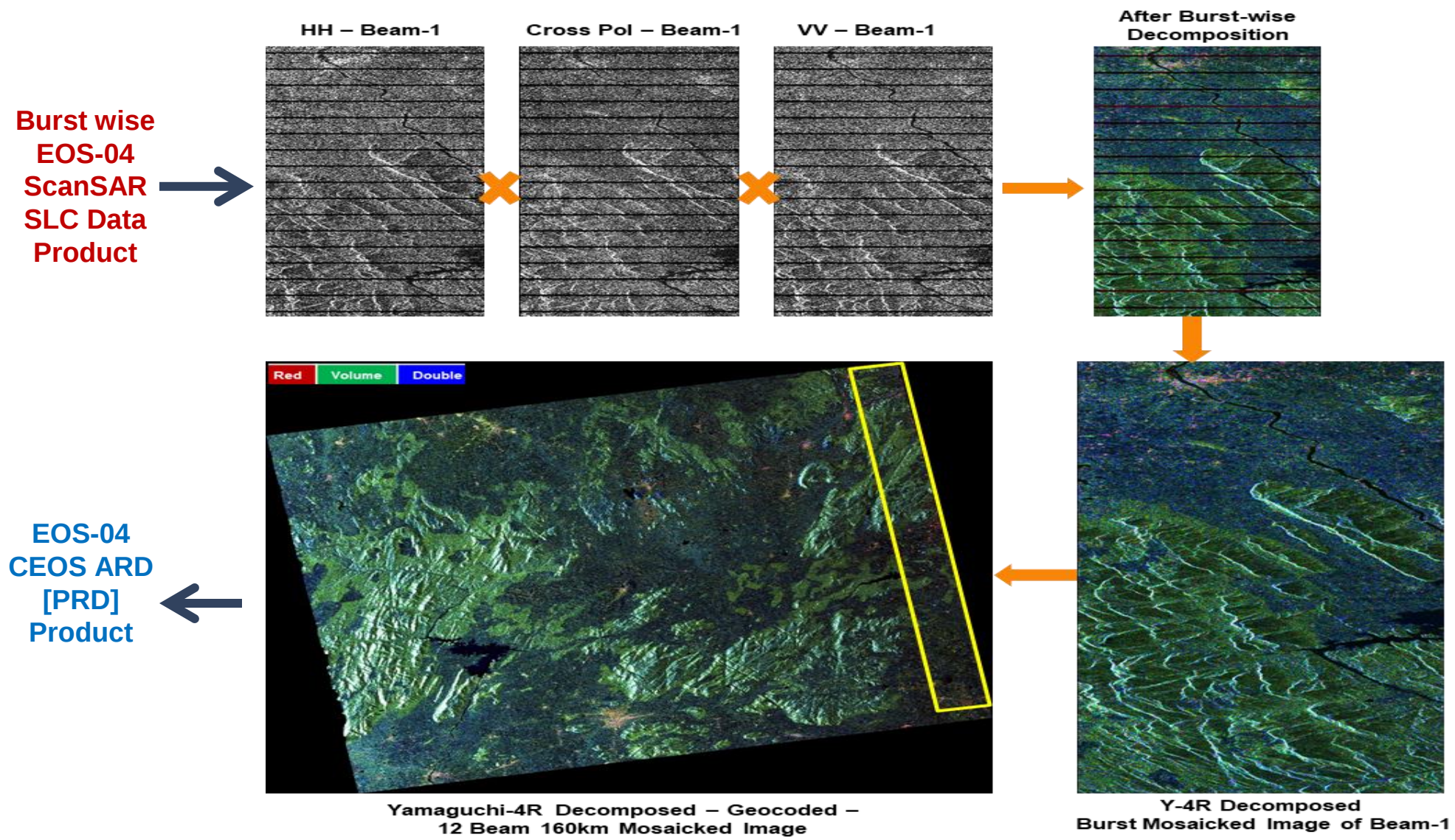
Geo-Coded Single Look
Complex Product

[GSLC]

NISAR

NISAR ISRO's Observation Plan



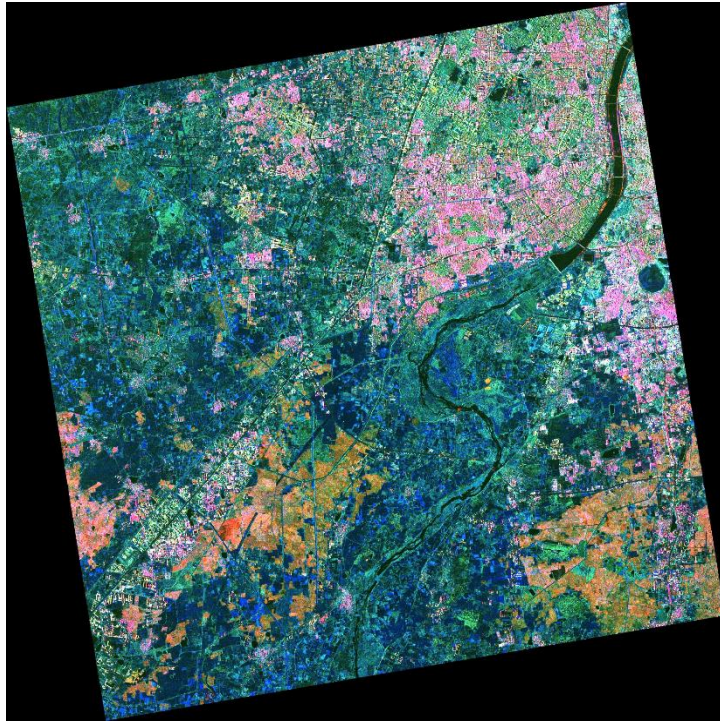


ISRO's Polarimetric SAR [PRD] Analysis Ready Data Products

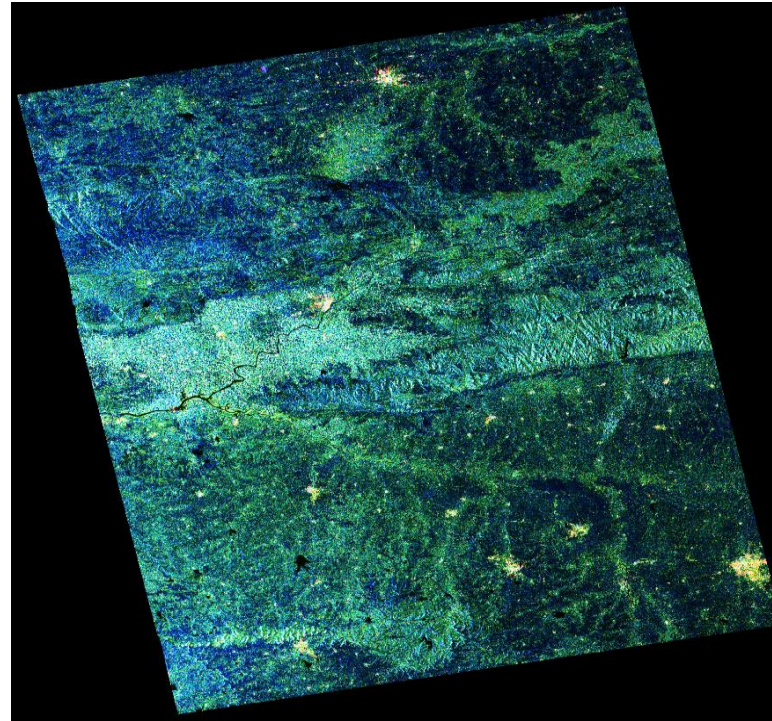
(For Hybrid and Full Polarimetric Acquisitions)



Fine Resolution Stripmap (FRS-1) Mode



Medium Resolution ScanSAR (MRS) Mode



Coarse Resolution ScanSAR (CRS) Mode

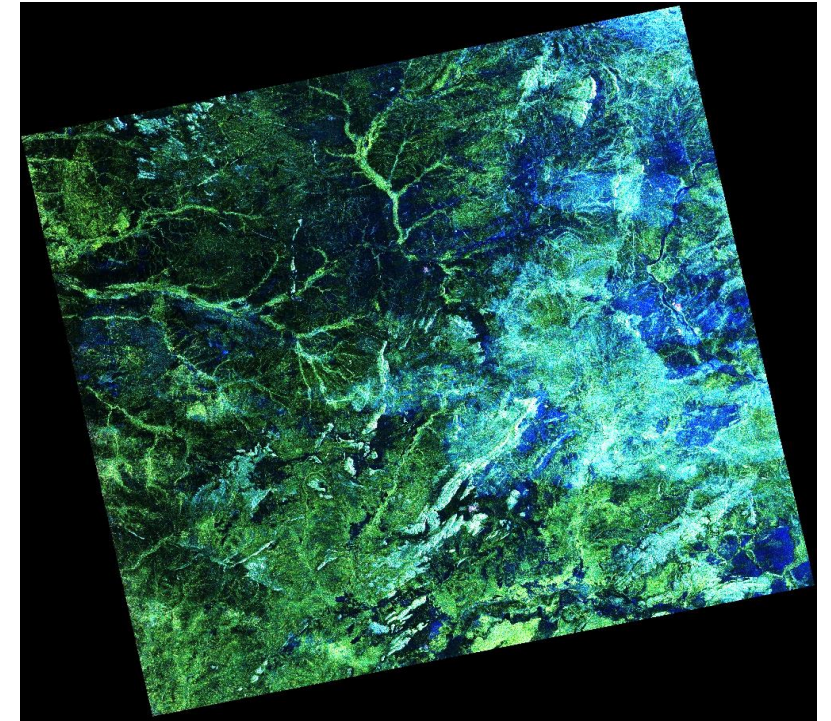


Image Size	20 Km X 20 Km
Date of Pass : Region	3 rd Apr '22 : Ahmedabad , India
Mode : Resolution	StripMap : 3 meters

Image Size	160 Km X 115 Km
Date of Pass : Region	10 th March '22 : Burhanpur, India
Mode : Resolution	ScanSAR (8 beams) : 33 meters

Image Size	160 Km X 168 Km
Date of Pass : Region	10 th June '22 : Chad, Central Africa
Mode : Resolution	ScanSAR (12 beams) : 48 meters

Yamaguchi Full Polarimetric Decomposition

Even Volume Odd

ISRO CEOS-Compliant ARD Product Generation – A Road Map



SNO	ARD Product	Sensor	Product Type	Timeline	CEOS Endorsement Status
1	Normalised Radar Backscatter	EOS-04 / EOS-09* (RISAT-1A / RISAT-1B)	Level2B[NRB]	2024 / 2025*	Completed
		EOS04/ EOS-09*	India Mosaic[NRB] (Tiled Product)	2024 / 2025*	Completed.
2	Polarimetric Radar	EOS04/ EOS-09*	Geocoded Polarimetric Decomposition Products (Level-3B) [PRD]	2025	Design level product package is under validation at ISRO
		EOS04/ EOS-09*	GCOV (Geocoded Covariance Product) [CovMAT]	2024 / 2025*	Design level product package is under validation at ISRO
		NISAR	GCOV (Level-2)	2025	-
3	Geocoded Single Look Complex	NISAR	GSLC (Level-2)	2025	-
4	Interferometric Products	NISAR	GUNW (Geocoded – Unwrapped Interferogram)	2025/26	-

* - Launch planned in second quarter of 2025 - EOS-09 (follow-on of EOS-04 C-band SAR)

Thank You...