



NRSC Satellite Data Products and Services

Dr N Aparna , Group Director , NRSC Data Centre

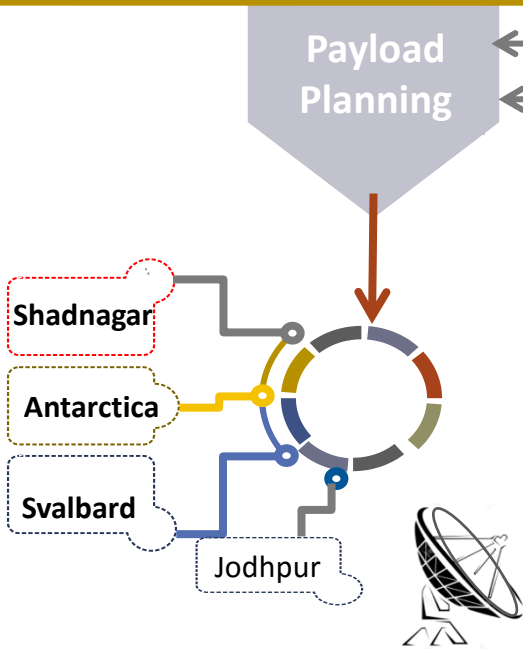
NATIONAL REMOTE SENSING CENTRE

INDIAN SPACE RESEARCH ORGANIZATION

UIM 2022

Data Processing for EO Satellites

Data Acquisition



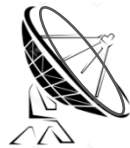
Payload Planning

Shadnagar

Antarctica

Svalbard

Jodhpur



Data Pre processing

Data assimilation from multiple ground stations and Level-0 Processing

Data Processing

- All IRS
- NON IRS
- Data from IGS
- VGS: Komsat
- Collaborative :NOVASAR

Value added products

- Tailor made products
- Large area mosaics
- Data extractions

Data Quality Evaluation

- All user products are certified
- Provision for Calibration of all the sensors – feedback to mission

Data Dissemination



Emergency < 1-2h
Standard < 24h



More than 2000 products daily ,
3.5 Lakh products /year

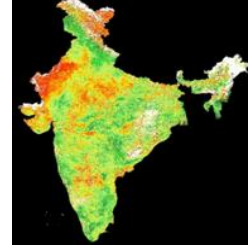
75--95 Satellite Passes daily

100 Processing nodes

More than 100 workflow processing chains

Automatic Workflow
34 missions (24 inorbit)

1.8 TB data /day



Strategic Users
Stations support Planning , product generation software's and hand holding

Data products & Services

Users

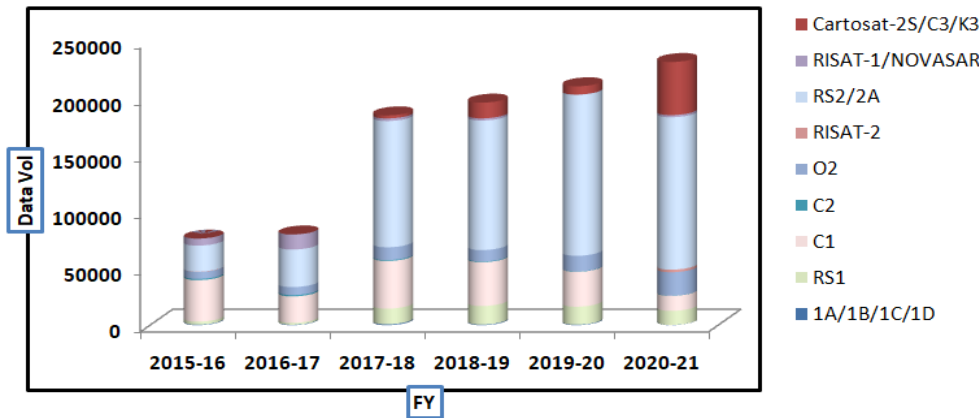
Continuous support to all user needs

1. Indian Users
2. International users
3. International Ground stations

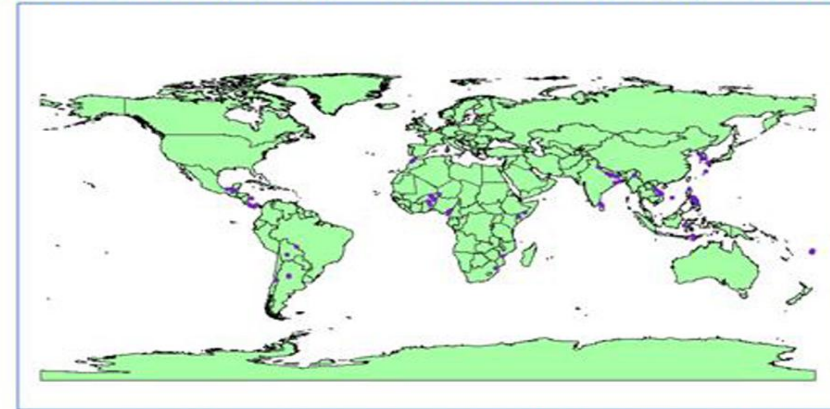
Supported data for all National projects . In 20-21- 32 National projects (IWMP, Mining surveillance system ,Urban, Gas Grid Coastal zone, wet land, Clean Ganga & BIMSTAC etc)

More than 3000 active users.

Data Utilisation



ISRO SUPPORT FOR INTERNATIONAL DISASTER ACTIVITIES DURING THE FY 2020-21



Disaster Events Serviced during the FY Apr.20 - Mar.21

International Charter	35
Type of Disaster	
Floods, Storm, Cyclone, Hurricane	19
Landslide	11
Earthquake	2
Wildfire	3

Satellite data provided to International Charter during the FY Apr.20 - Mar.21

Satellite	No. of Scenes
Resourcesat-2/2A	107
Cartosat-2E	25
Total No. of products disseminated	132

~ 2 lakh products per year

~ 30 Disasters support every year

Data products & Services

More than 50 sensors data from RS satellites

Standard

- Orthorectified
- RADOrtho KIT
- GeoOrtho KIT
- Large Mosaics
- Merged
- DEM

Geophysical

- Wind vectors
- FIRE alerts
- Water spread
- Albedo prod
- NDVI

Emergency

User Products

- Urgent
- Normal
- Subscription

Thematic

- NRT Fire Alerts,
- Water spread
- Customized Value

Special & Strategic

- Foreign data Verification
- Strategic requests
- Charter
- Catalogue-CEOS

Data Access Hub

UOPS - Bhoonidhi (Priced)

FTP

Bhoonidhi (Free)

BHUVAN (Free)

Users

NDC (User Support)

Online Internet Users

Value Added products

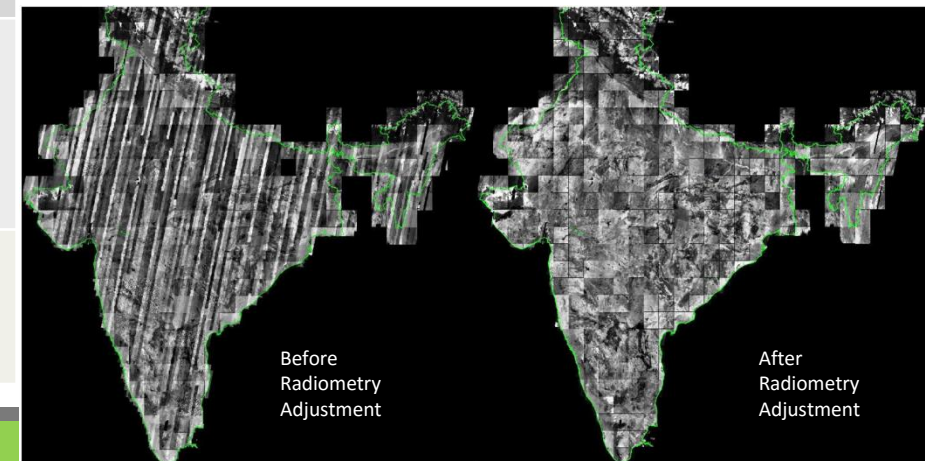
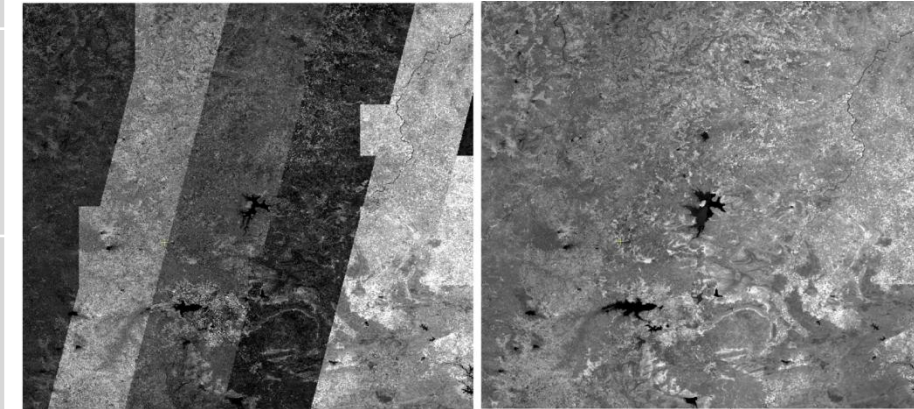
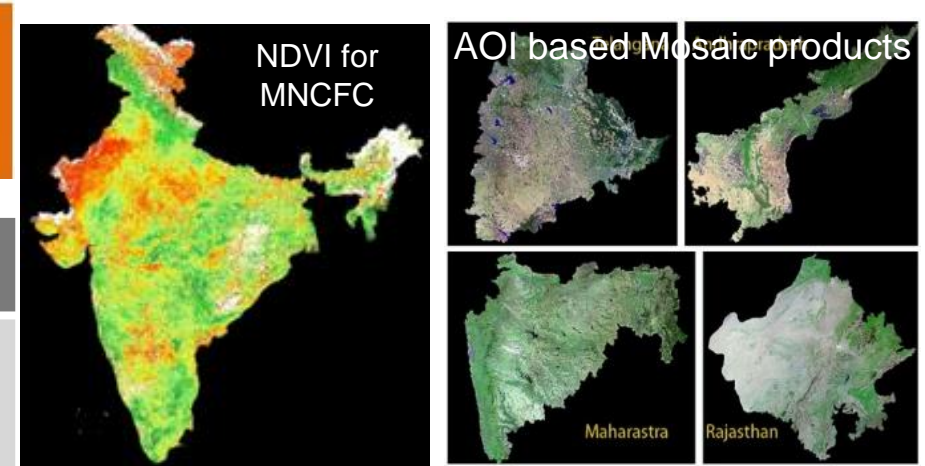
Generating AOI based-ortho mosaic & merged product for C2S, C3 & other missions using

Generating - temporal consistent products across the strips/paths.

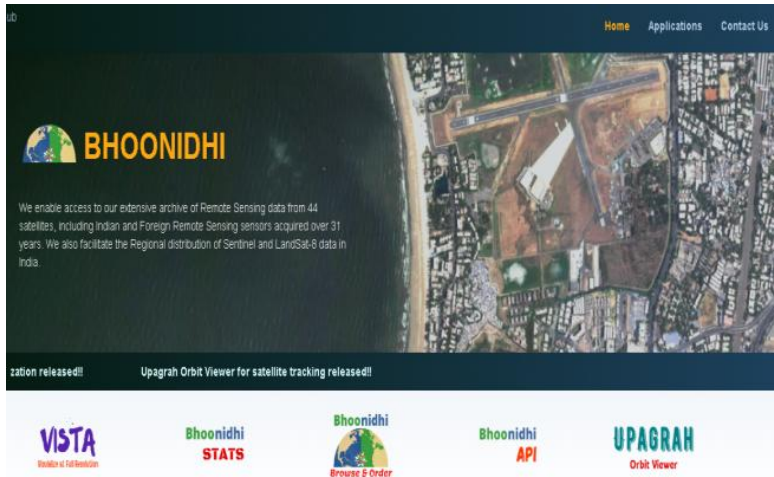
Generation of NDVI full India products at monthly basis

Carto DEM datum conversion from existing Ellipsoidal heights to **Mean Sea Level heights & Radiometrically balanced Carto ortho tiles** for the entire India. The data is available now for the users.

Generation of **Improved Carto DEM** with best geometric and radiometric quality using COTS Bundle Block Adjustment API in automation



New products & Readiness wrt. new policy



New Products

- ✓ **Surface Reflectance** products from Resourcesat missions
- ✓ Ortho products From **Legacy** Missions (1A/1B/1C/1D)
- ✓ **DEM at 2.5m postings**

Readiness: Upcoming Space Policy (Remote Sensing)

•Proposed that data up till 5m resolution will be free to all users . As soon as the policy is released the following will be made available through BHOONIDHI



Satellite -sensor

RS1-LISS-III,AWiFS

RS2-AWiFS ,LISS3 ,LISS1V

RS2A-AWiFS, LISS3 ,LISS1V

RISAT 1 : CRS, MRS

OCM : LAC & GAC

SCATSAT



Statue of Equality , C2S

Upcoming

Full India **NDVI &NDWI** from AWiFS (Cycle wise & 10 days interval)

LANDSAT -9 data will be available through Bhoonidhi from 15th May 2022

NovaSAR Mission Overview

Payloads

- S-band SAR
- AIS (Automatic Identification of Ships)

Mission Specifications

- Altitude : 580 km
- Orbit : Polar Sun synchronous
- Local time : 10:30AM Ascending at Equator
- Inclination: 97.5deg
- Resolution: 6-50m
- Swath : 13 – 400km
- Polarisation : Linier, Dual, Tri, Co Cross
- Design Life : 7 years

S-band SAR data is crucial for the forthcoming NISAR mission for calibration and validation of S-band SAR algorithms and applications

NovaSAR Acquisition Planning

The following modes are available

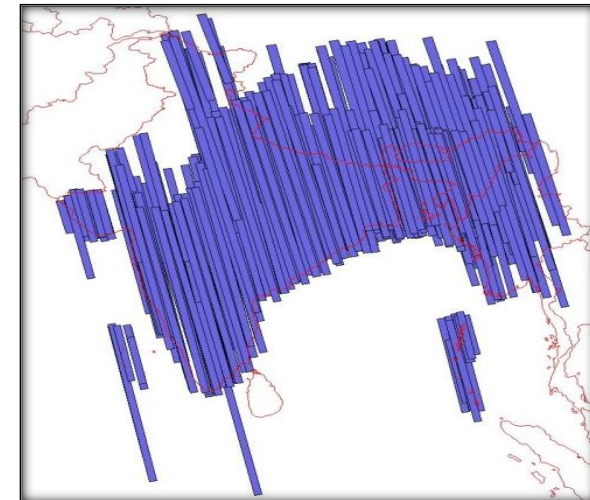
- ✓ SCANSAR
- ✓ MARITIME
- ✓ STRIPMAP

- For each mode only a specific discrete incidence angle only can be planned
- Incidence angle will be given to the centre of the strip, while planning. This will vary along the strip (depends on the strip length)
- Repeativity varies with swath (For 195 Km 16 days)
- Exact geographical coverage may vary across cycles (depends on orbit)
- The incidence angles given in the following tables can be planned, for both left and right look (+/-)
- A maximum of one month can only be given for tentative feasibility.

User Requirements specification to be given for planning :

- ✓ AOI
- ✓ Mode
- ✓ Look direction
- ✓ Node
- ✓ I. Angle & Polarization
- ✓ Frequency
- ✓ Whether for ground truth or not Etc ..

Novasar : 20m Scansar data Availability in
2020-21



CARTOSAT 2S & CARTOSAT 3

➤Payloads :

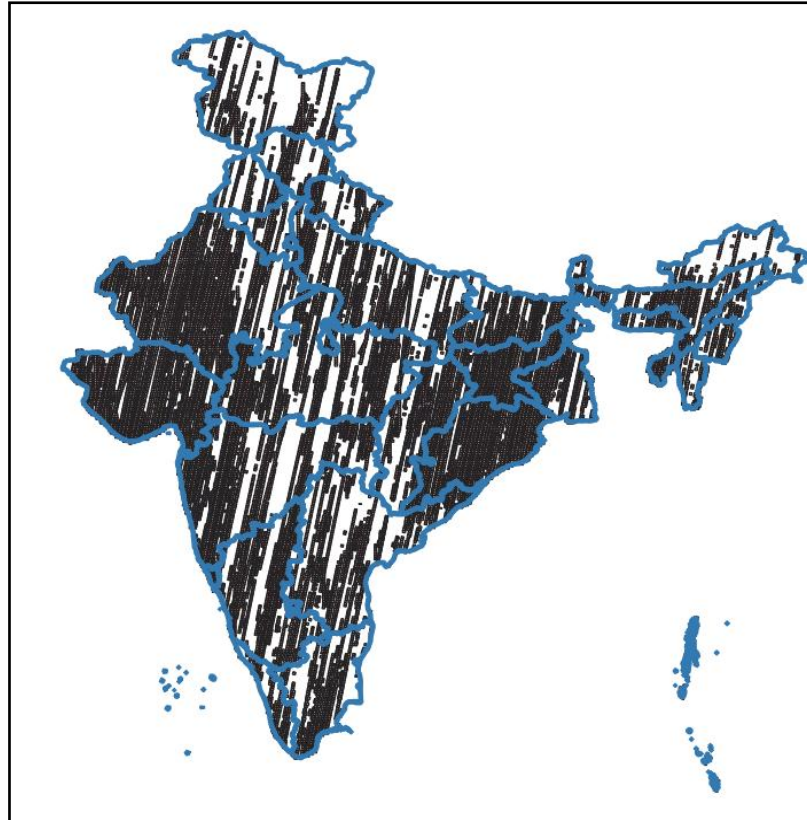
✓ PAN – Resolution
0.64m ,

✓4 Band MX of 2.0m

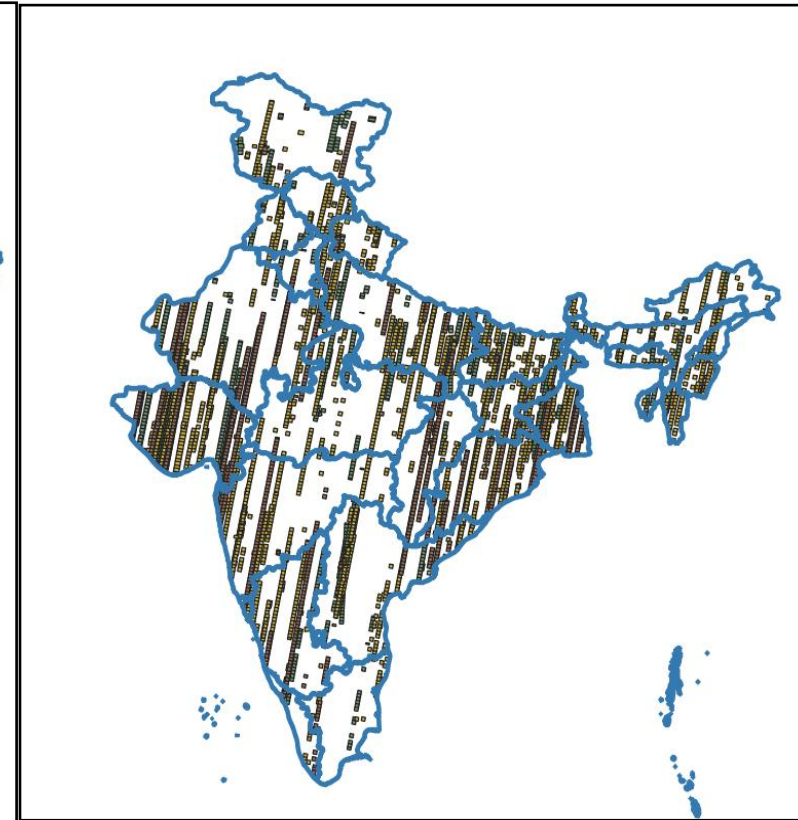
➤Products :

➤Standard(Georeferenced
& Ortho kits)

➤Merged (0.64m Multi
spectral data)



**CARTOSAT 2 Cloud free coverage's
2020+2021+2022**



**CARTOSAT 3 Cloud free coverage's
2021+2022**

➤Payloads :

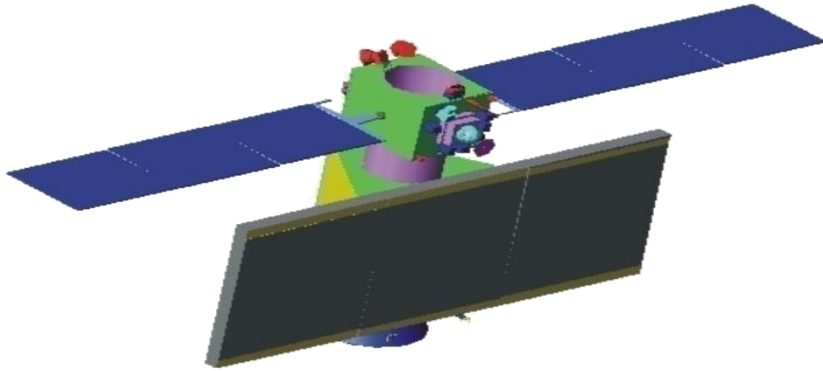
✓ PAN
Resolution-0.30m

✓4 Band MX
Resolution-1.2m

➤Products :

➤Standard(Geo-
referenced &
Ortho kits)

C-band SAR -Continuation missions



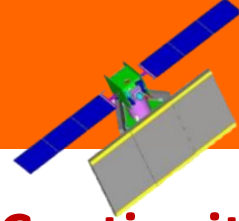
RISAT DEPLOYED EV SIDE

EOS-04:

- Planned repeat satellite(s) with Active Antenna based C-band SAR payload
- Mission Objective: All weather Land monitoring similar to RISAT-1 with better re-visit when used together with RISAT-1 and also to provide continuation of services after RISAT-1

Launched on 14th Feb 2022

Calibration of the sensor is "ON"



EOS-04 -Salient Features

Continuity Mission of RISAT-1 (C-band SAR launched in April 2012 and operational up to September 2016)

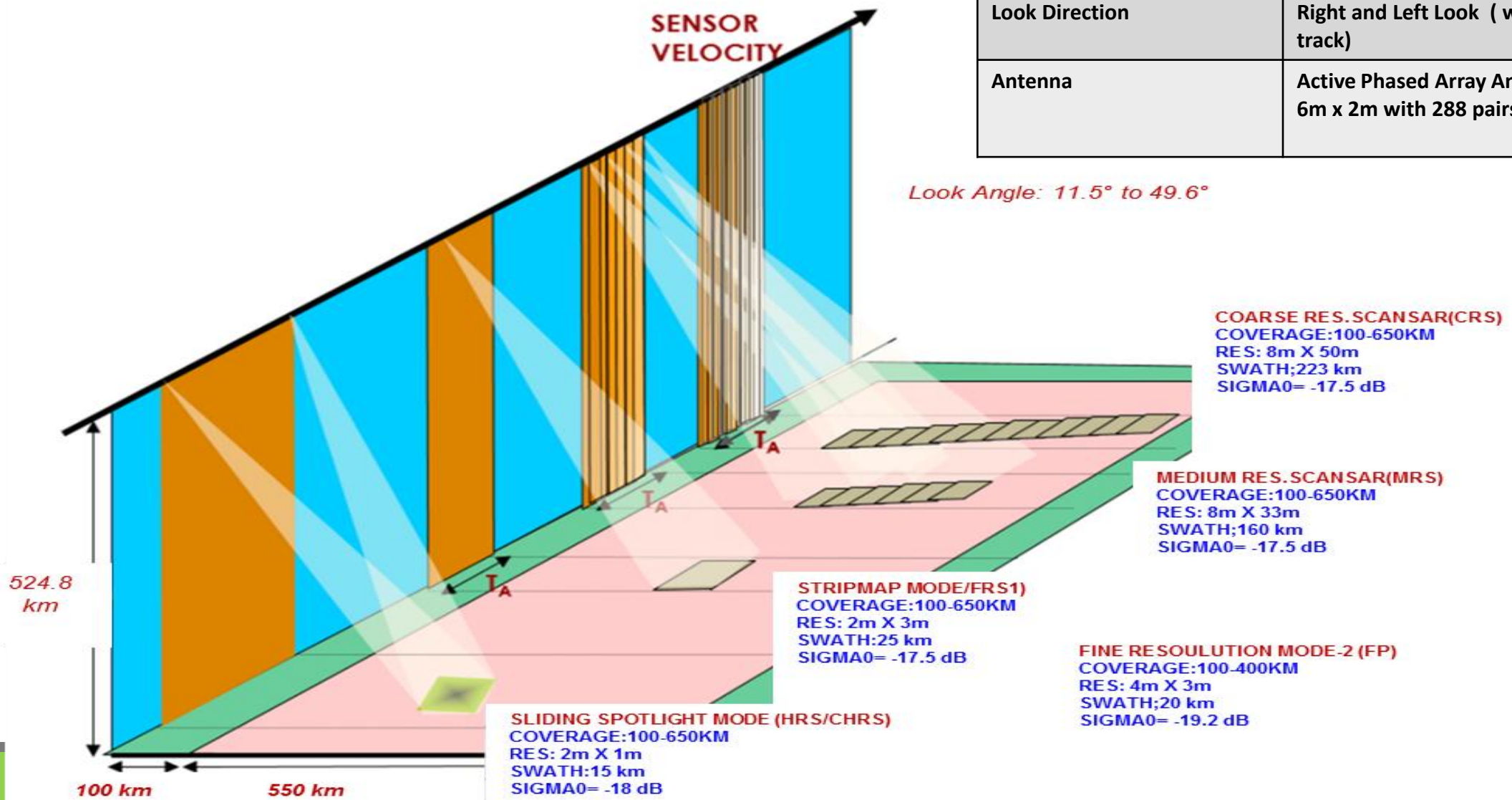
Additional features in EOS-04 :

- **FRS-2 (Quad-pol of RISAT-1) replaced by Full-polarimetric Mode in EOS-04**
- **Improvement in Sigma 0 performance**
- **Value Added Products for enhanced data utilization for various RS applications**
 - **Polarimetric products**
 - **Mosaic products**
 - **Interferometric Products**

Systematic Coverage over Indian region is available in Medium Resolution Mode (32m) with 17 days repetivity.

EOS-04 Imaging Geometry

Frequency	5.4 GHz (C-band)
Nominal Altitude	524 km
Orbit	Sun-synchronous (6AM/6PM Equatorial Crossing)
Look Direction	Right and Left Look (with 36° on either side of flight track)
Antenna	Active Phased Array Antenna 6m x 2m with 288 pairs of TR-Modules



Specifications of EOS-04 Data Products

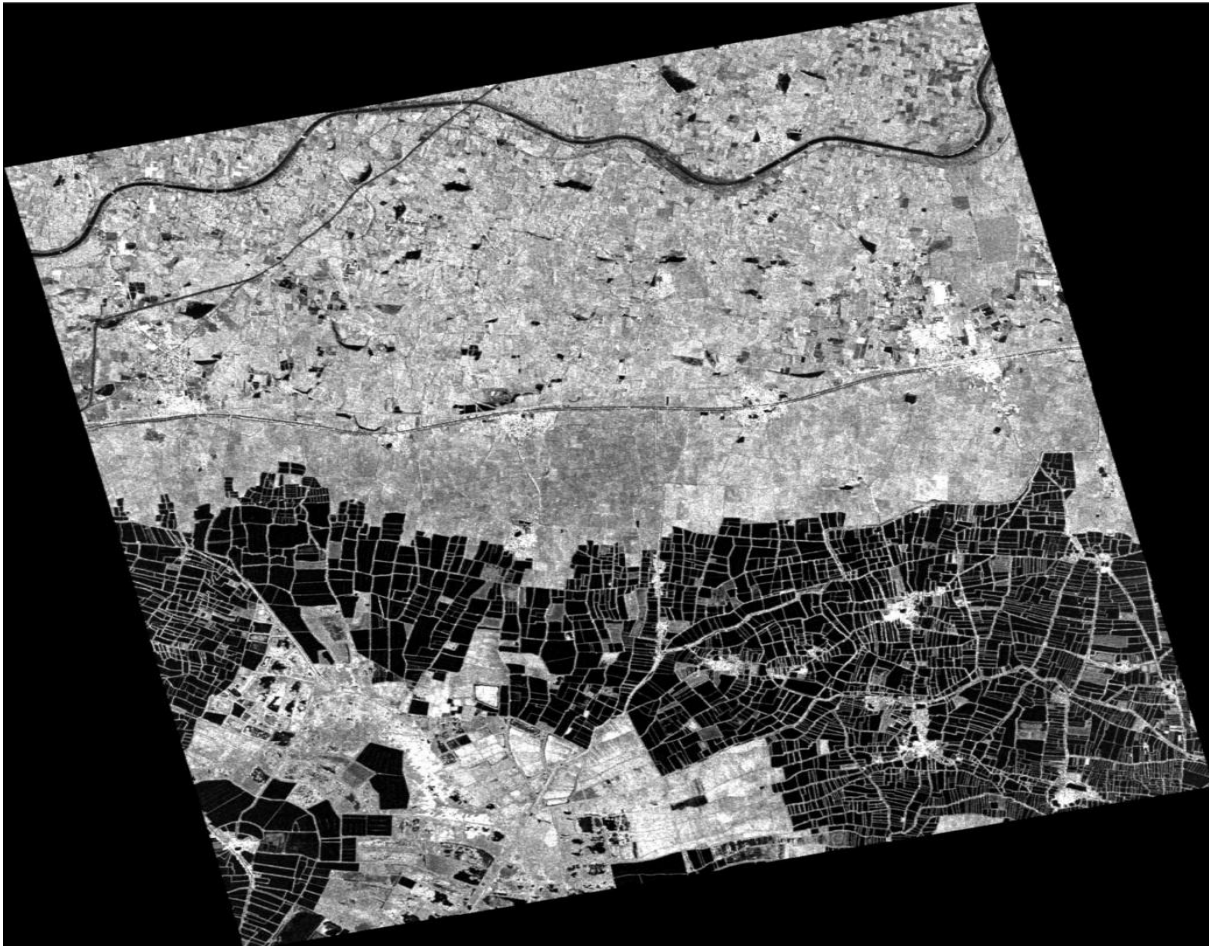
MODES	FRS-1(FRS-1(FP))	FRS-2 (FRS-2 FP)	6-beam / 8-beam MRS / CRS	ScanSAR – FP (6/8/12 beam)	HRS
Chirp Bandwidth(MHz)	75	37.5	18.75	18.75	75
PRF(Hz)	2800-3200	5600-6400	2800-3200	5600 - 6400	3000-3700
Worst Sigma Naught (dB)	- 17.5	-19.2	- 17.5	-16	-18
Swath (km)	25(20)	25(20)	115 / 160 / 223	87/115/168	15
Off-Nadir (km)	100 – 650 (100-400)	100-650 (100 – 400)	100 - 650	100 - 400	100 - 650
Slant range resolution(m)	2	4	8	8	2
Ground range resolution(m)	9.3 – 2.4	18.6 – 6.3	37.2-9.7	37.2-12.6	9.3 – 2.4
Azimuth Resolution(m)	3	9	23 / 33 / 50	23/33/50	1
Polarisation	S/D/C/F	S/D/C/F	S/D/C/F	S/D/C/F	S/D/C

Specifications of EOS-04 Data Products

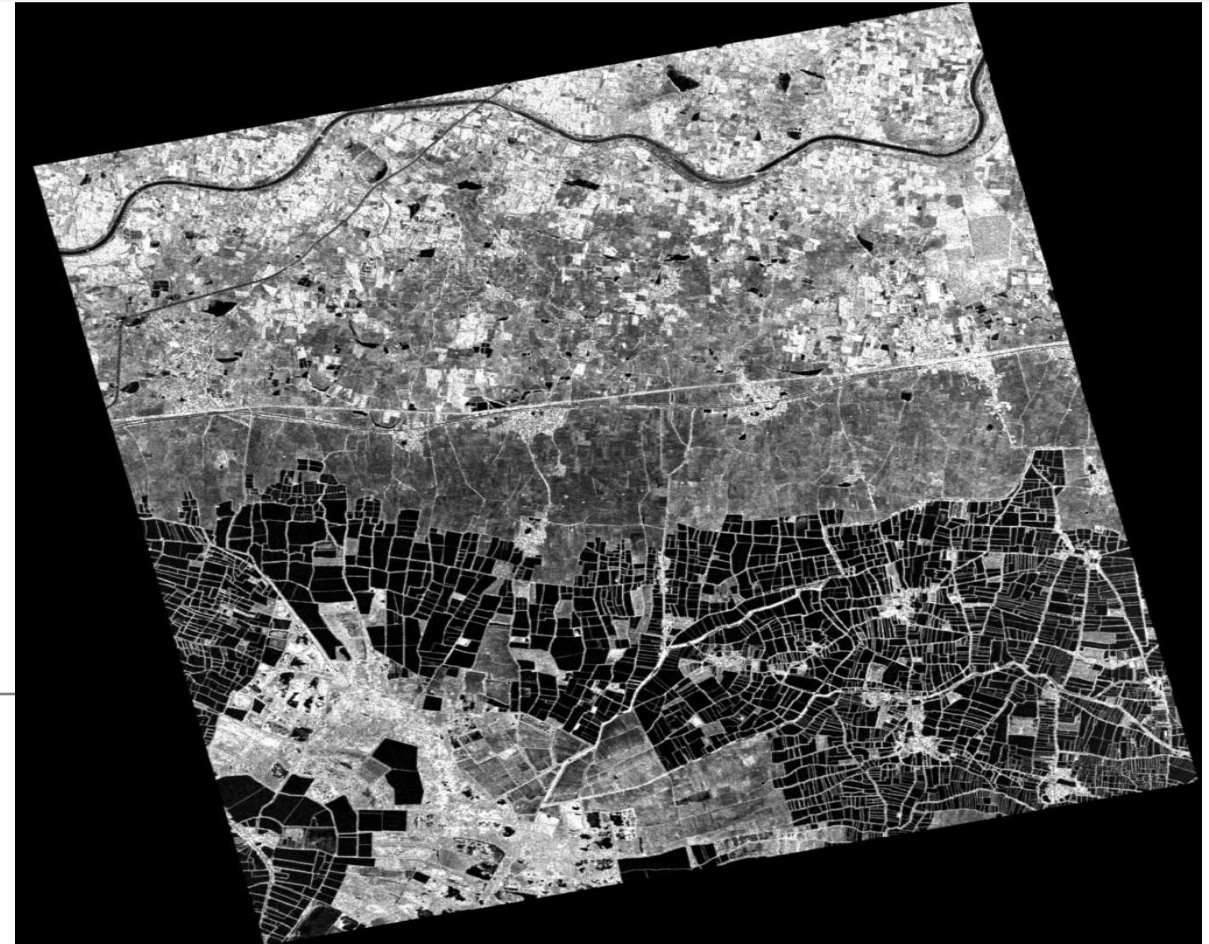
Parameters	Value
Geo-Location Accuracy (RMSE)	< 50 meters
Radiometric Resolution (SLC)	3.1 dB
PSLR	-17 dB
Relative Radiometric Accuracy	1 dB
Absolute Radiometric Accuracy	± 1dB

Levels of Data Products	
Level-0	Raw Signal Product (Generic Binary)
Level-1	Slant Range Geo-Tagged Product Ground Range Products (CEOS/GeoTiff)
Level-2 GEOREF	Enhanced Terrain corrected Geo Referenced Product (GeoTiff)
Value Added Products	
Level-1C	Geo-tagged Polarimetric products
Level-3A	Geo-referenced Polarimetric products
Mosaic	Large Area Mosaic Full Strip Mosaic India Mosaic (for systematic coverage)
Projection: UTM/ Polyconic (Level-2) Datum : WGS84 (Level-2) Resampling : CC (Level-2)	

SAMPLE IMAGES OF EOS-04



RH Pol
FRS-1, DoP: 14th Mar 2022

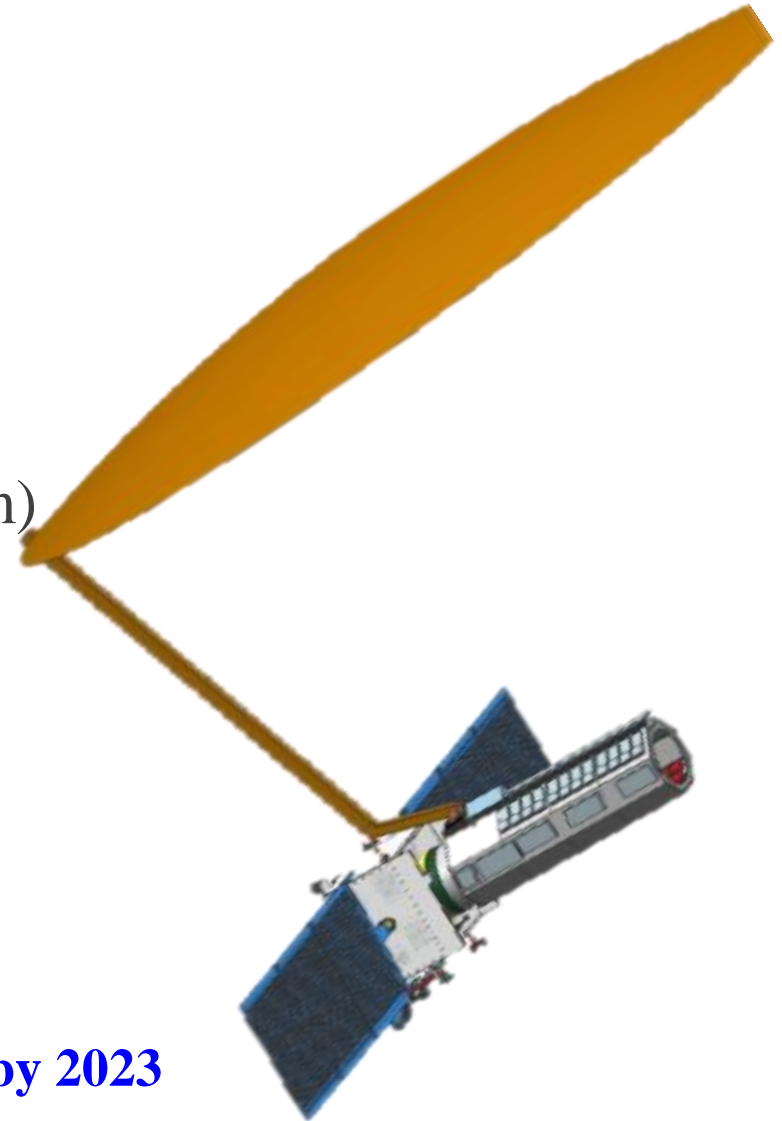


RV Pol
Agriculture fields in west godavari district

L & S-band SAR

NISAR :

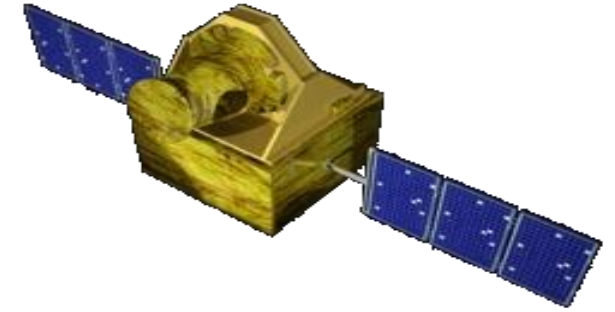
- Collaborative mission (Nasa-Isro SAR)
- L & S band SAR
- Global repetitive mapping mission with interferometric SAR (InSAR) capability
- Mission Objectives: Land Deformation, Eco-systems, Ice dynamics monitoring with 5m – 100m resolution range (240km)
- Indian applications of Geology, Land-use, Glacier monitoring included
- Limited disaster area imaging applications
- Nominal mission life : 3 years



Launch planned by 2023

Payloads

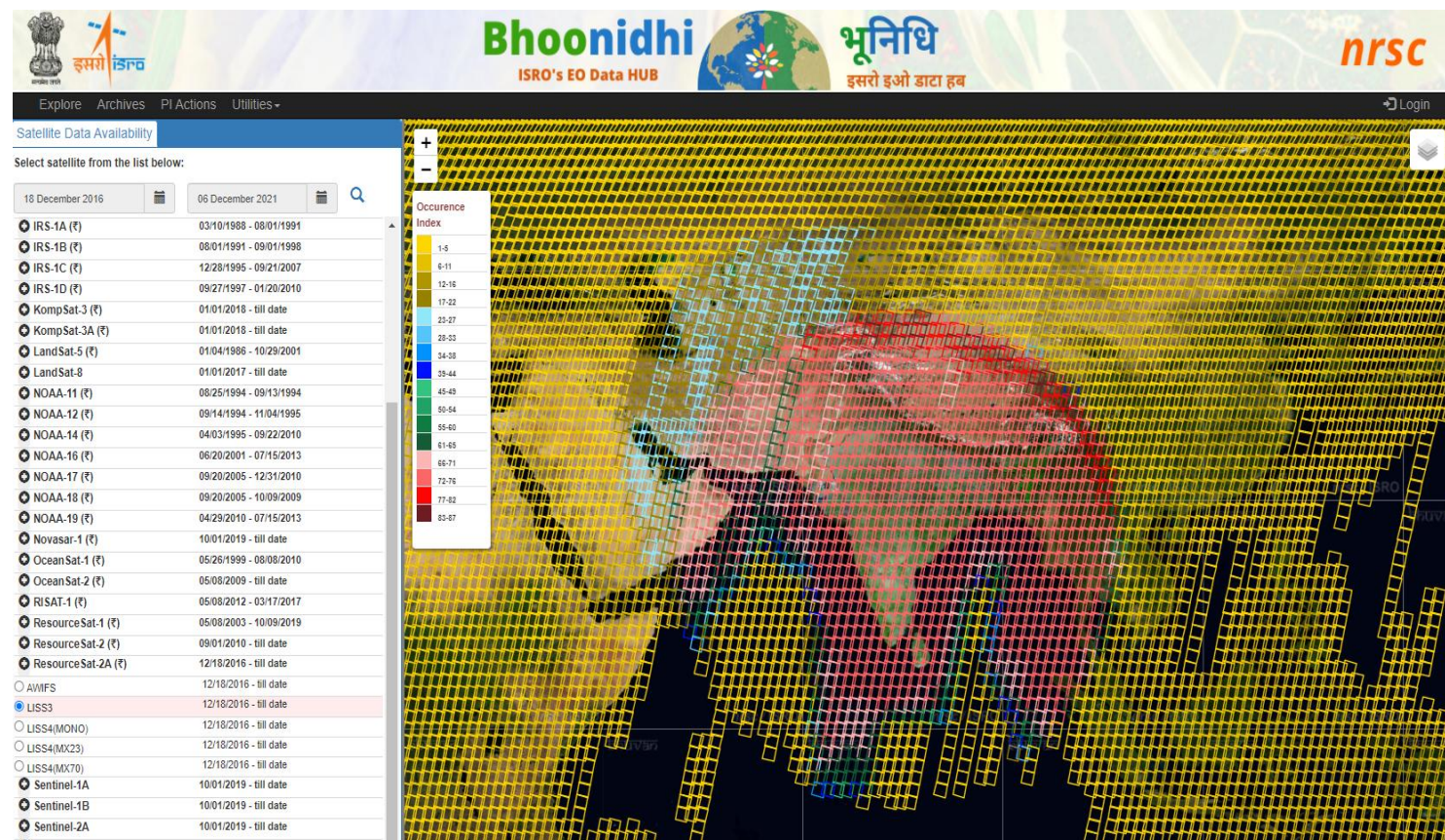
- Scatterometer-3
- OCM -3
- Sea Surface Temperature Measurement (2 TIR Bands)-1
- SNR better than 1000 at ocean radiance
- Narrow spectral bands 10nm (Optics)



EOS – 06 - Improvements over Earlier missions

Parameter	Earlier	Present
Ocean Color Monitor		
No. of OCM Bands	8	13
OCM Coverage	Lat 45N,45S	Full sunlit duration
Swath	1440Kms	1440Kms
Tilt of OCM	± 20°	± 20°
Digitization-OCM	12 bits	14/16 bits
Resolution	LAC 360mtrs/GAC 1km	LAC 360mtrs/GAC 1km
SNR	360	Min 1000
Sea Surface Temperature Monitoring		
No of SST bands	-----	2(TWO)
Coverage	-----	continuous
Scatterometer		
Scatterometer Frequency	13.515 GHz (Ku Band)	13.515 GHz (Ku band)
Resolution of Scatterometer	25 x 46 km	25 x 46 km
Swath width of Scatt.	1400 km / 1800 km	1400 km / 1800 km

- ❑ Single-window quick-look catalogue for ISRO's EO data archive
- ❑ Indian and non-Indian remote sensing sensors archives
- ❑ New technologies providing seamless ordering and dissemination of Open & Paid satellite data products
- ❑ Faster, simplified 3-step process to download open satellite data.
- ❑ Serves as a regional data hub for the Sentinel data products (*< 1.30 hour data on-boarding time for all Sentinel datasets*)



Thank you...