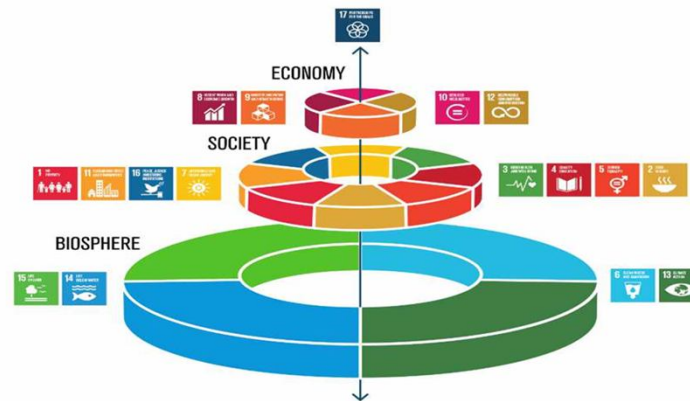
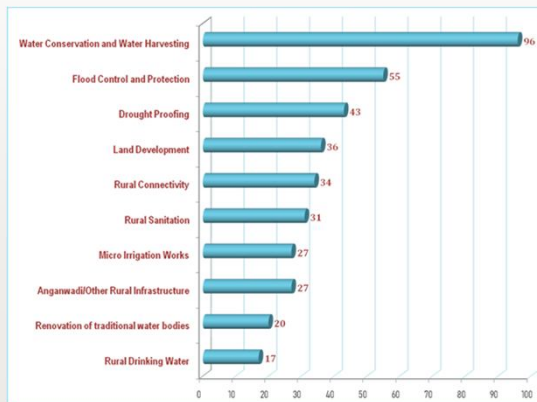


# EO Data needs for Sustainable Development



# Towards the sustainable development goals

Zero Hunger.  
Health.  
Education. ...  
Energy.  
Economic Growth.  
Infrastructure, industrialization.  
Climate Action.  
Oceans.  
Biodiversity, forests, desertification



To meet all these ISRO is supporting through services in the form of



Convert satellite data into actionable insights delivered as web or mobile based products

**Product**



Offer Computing environment allowing access to aggregated data, algorithms and infrastructure focused on analysis –ready data

**Platform**



Build and launch satellites to collect different kinds of data from space with direct licensing

**Data**

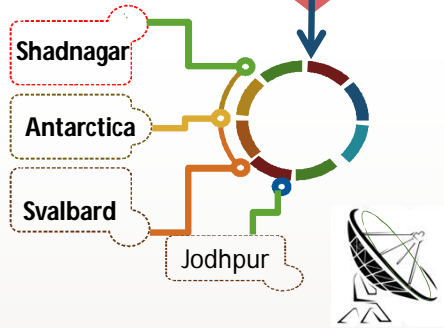
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# Data Processing for EO Satellites

PRODUCTS

Data Acquisition

Payload Planning



**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

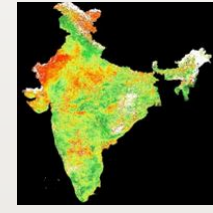
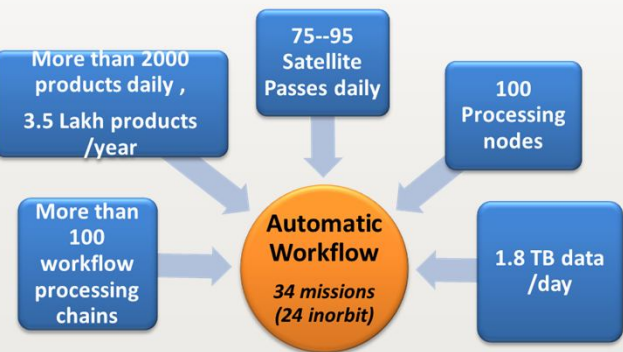
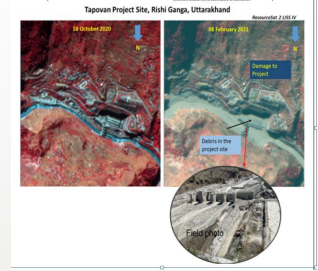
**Value added products**

- 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**  
**Bhoonidhi**  
Emergency < 1-2h  
Standard < 24h



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

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# Remote Sensing Data users & demand



Continuous support to all user needs

1. Indian foot prints ( Civilian & trans border )
2. International users
3. International Ground stations
4. Strategic user requirements

~ 3000 active users

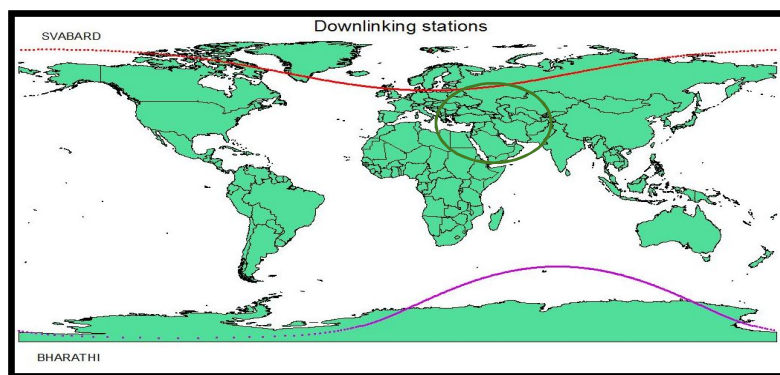
• One Virtual Ground Station & One IGS

• Four Support Stations :  
Antractica , Svalbard ,  
Tromso & Fairbanks

• ~ 2.2 lakhs products per  
year ( sales)

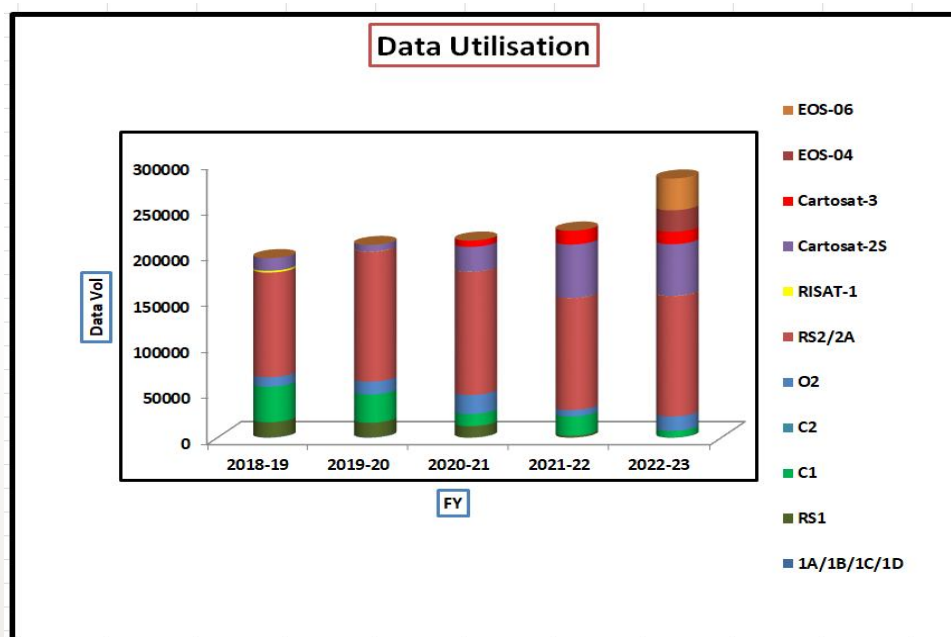
• Support to disaster  
needs

• Free data through  
• BHUVAN  
• BHOONIDHI

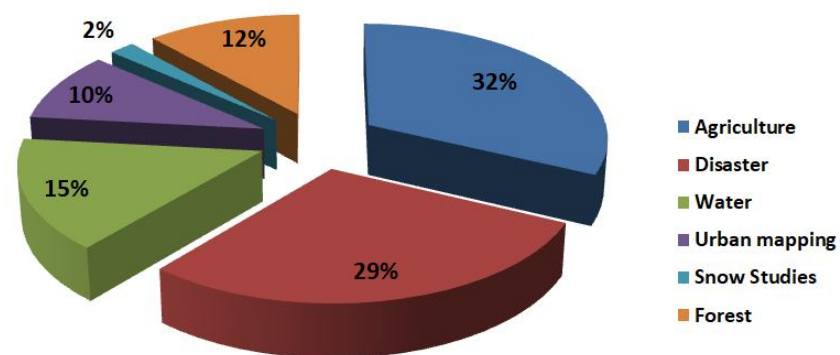


Space policy implemented from Dec 2023.

# Remote Sensing Data utilisation



## Thematic Applications based utilisation



**Total 1 lakh downloads during Dec to March  
2500 new users registered.**

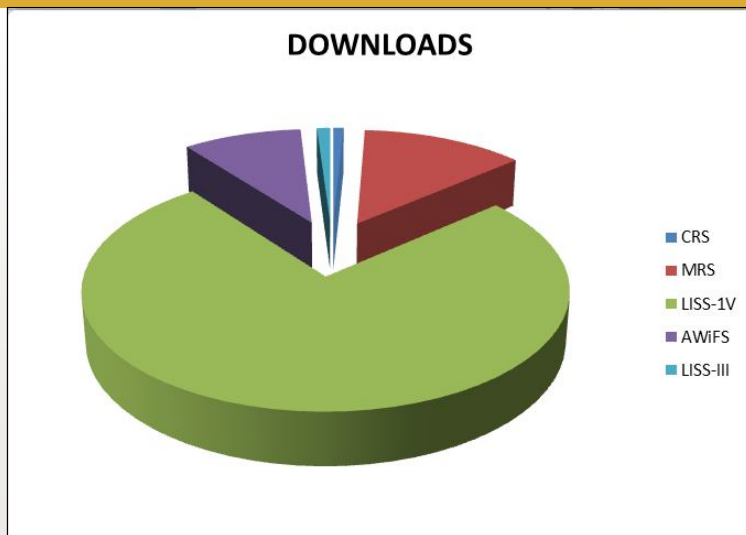
**In Dec 2023 the Space policy is implementation**

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National Remote Sensing Center, Hyderabad**

# Implementation of Space Policy

- Data upto 5m is free for all
- Data better than 5m is free for Govt. entities and nominally priced for private
- No masking for high resolution data - but no attributes to be put
- Only for data better than 30cm to be informed to InSAPCE
- Any one can source data from any where .

All the data from RS1, RS2 , RS2A , RISAT 1 , RISAT 1A , OCM 1, OCM 2 OCM 3 , IRS -1A, 1B 1C , 1D are made available through BHOONIDHI



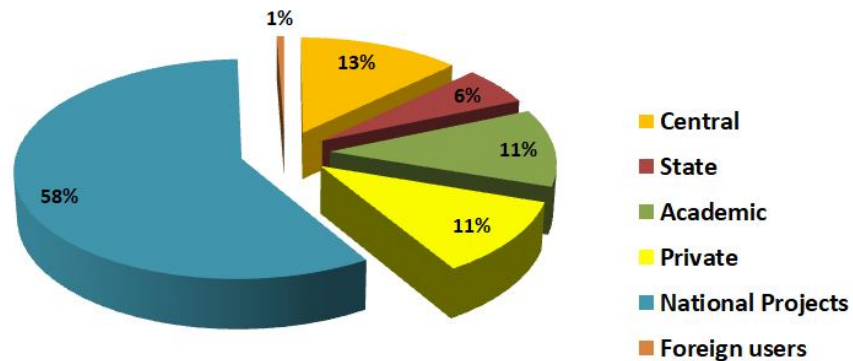
Ortho products are the default products that will be generated in Near Real Time from all operational satellites with Spatial resolution up to 5m. (Resouresat, RISAT, Oceansat series datasets).

For data of better than 5m system corrected products are default and on demand ortho products are generated.

All value added products are priced for all. ( DEM , MOSAICS etc)

# Implementation of Space Policy

Free Data Downloads from Bhoonidhi



## Value added products / tailor made products

1. GATISHAKTI
2. IWMP
3. NDVI
4. DEM

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PAN Sharpened

MX-Standard

PAN-Standard

## Data products

### Standard Products

#### OpenData\_ReadyAvailable

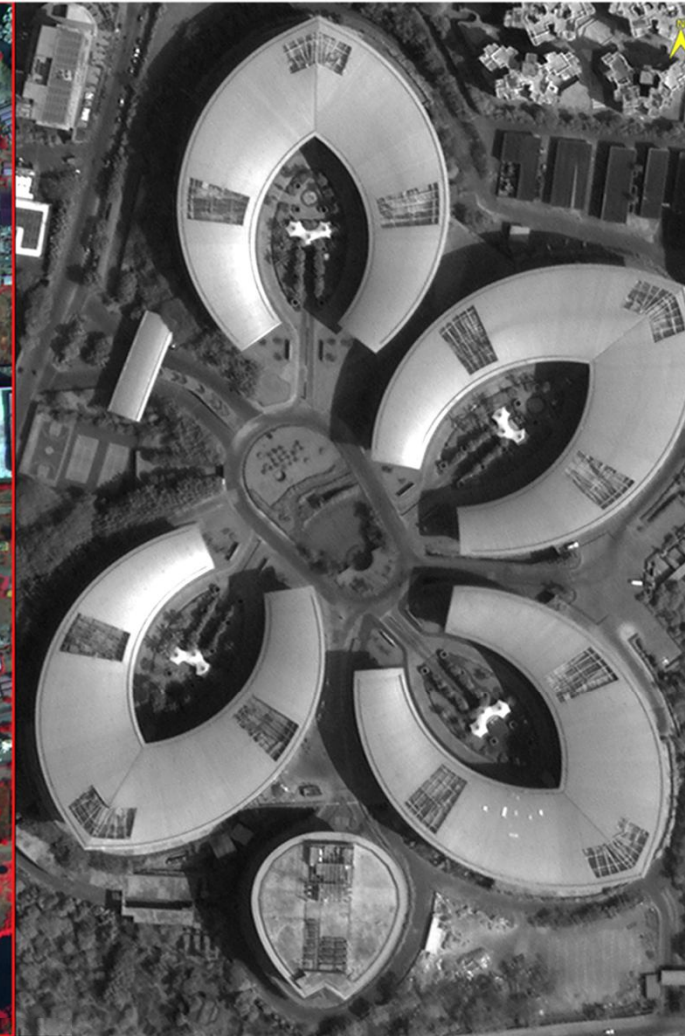
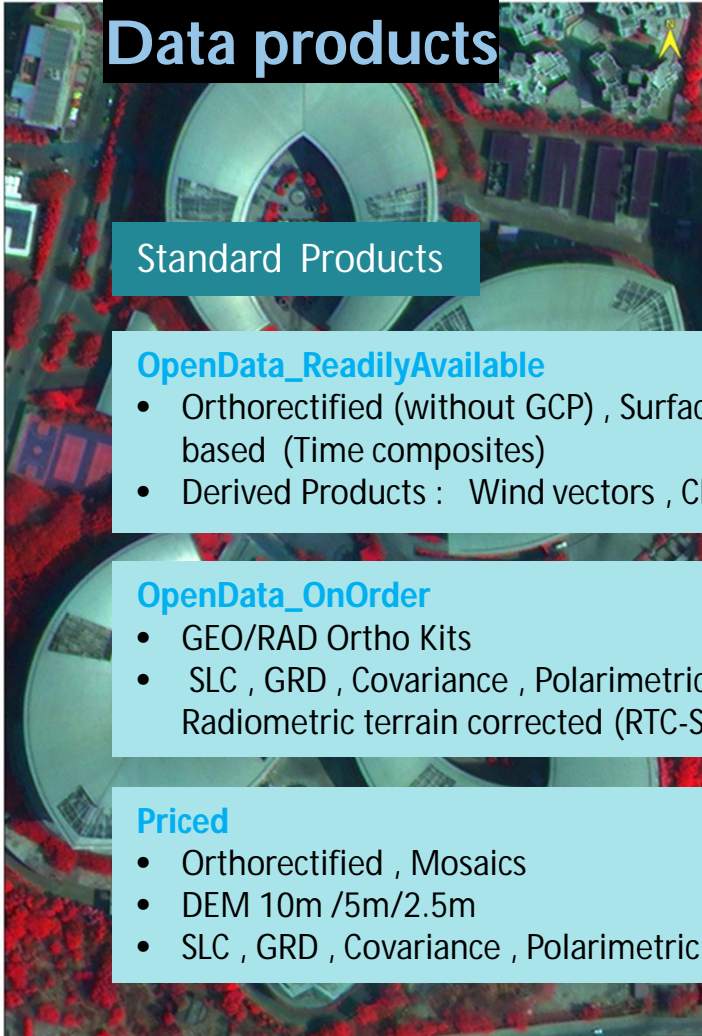
- Orthorectified (without GCP) , Surface reflectance , Tiles based (Time composites)
- Derived Products : Wind vectors , Chlorophyll ,NDVI,..

#### OpenData\_OnOrder

- GEO/RAD Ortho Kits
- SLC , GRD , Covariance , Polarimetric decomposed , Radiometric terrain corrected (RTC-SAR)

#### Priced

- Orthorectified , Mosaics
- DEM 10m /5m/2.5m
- SLC , GRD , Covariance , Polarimetric decomposed



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# Value Added Data Processing

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

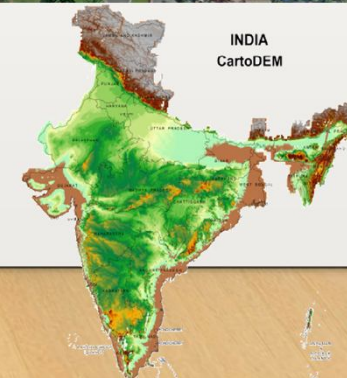
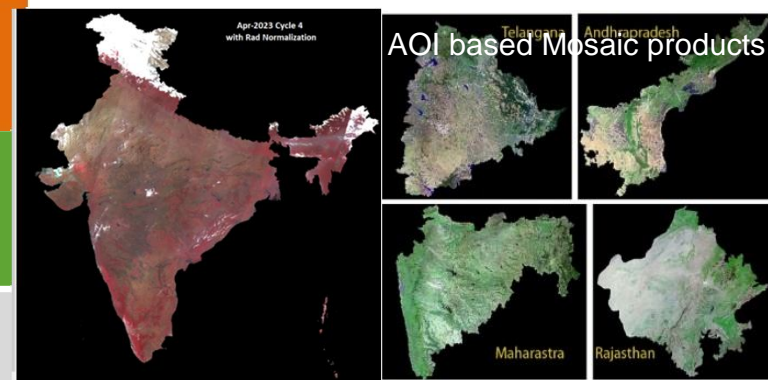
*Generating - Time series composite like IWMP , NABARD etc by ortho correction and Radiometry balancing across the strips/paths.*

Generation of NDVI full India products at monthly basis -GAC as AWIFS National and Global level

SWIR band synthesis .

Generation of **Improved Carto DEM** using the latest data from 2013 to 2017 with best geometric and radiometric quality

**Future plan** : Based on the experienced gained, **Bundle Block adjustment** based image registration will be realized **with AI/ML techniques** to replace COTS tools .



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# Gamut of Current Data Utilisation - 5m to 56m

## National level

IWMP  
NABARD  
FSI  
Disaster  
MNCFC  
CWC

## State level

DEERS  
V&E Direc  
WRD-Guj  
Agriculture  
MBDA  
ITDA

## Private

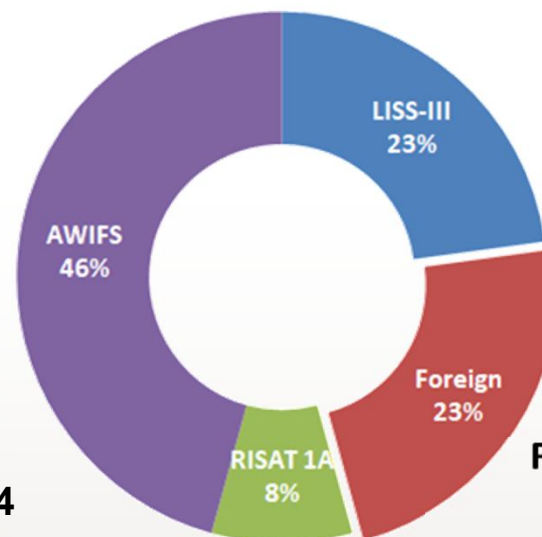
AMNEX  
VLTech  
N-Dimen  
MINING  
C-GS  
L&T

## Foreign

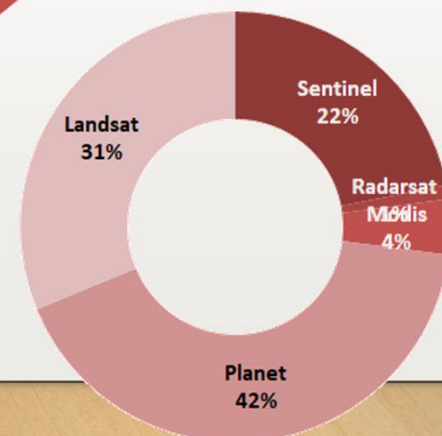
BRICS  
Euromap  
USGS  
CNES-MDA  
NASRDA  
OMAN

- RS2 & RS2A with complimentary data from LANDSAT & SENTINEL.
- RS2 /RS2A – LISS-III (11 days) AWiFS ( 5 days) LISS-1V ( 24 days ) systematic collections over India
- RISAT 1A : MRS ( 17 days ) systematic collections over India
- Demand based planning – LISS-1V & RISAT 1A
- Emergency planning – 8- 10 hours

## Indian Satellite Data



## Foreign Satellite Data



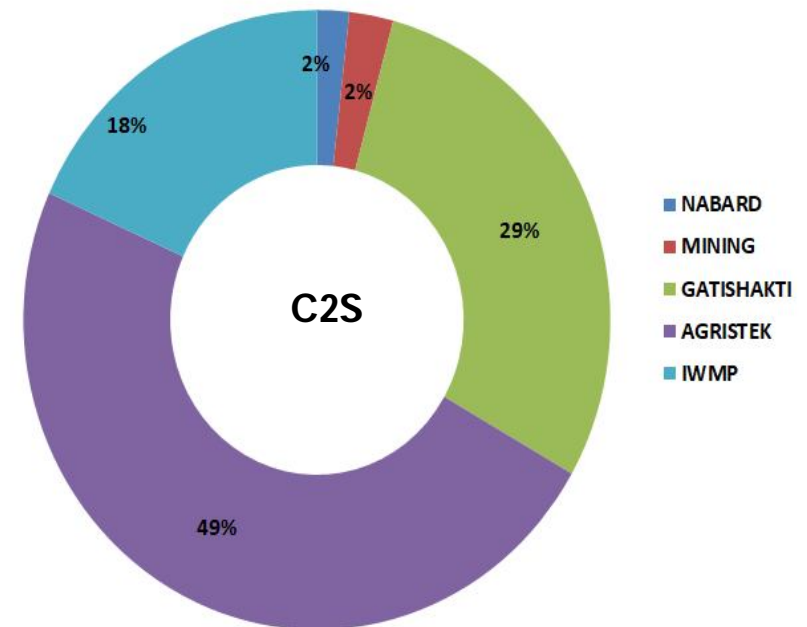
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# Current Satellites – Utilisation 30cm to 5m

## Demand

- Base map for all states
- NABARD
- IWMP
- Mining
- Gatishakthi
- Agristack –Digital Agriculture
- Inputs for Crop insurance
- High resolution data : C2 E ( 60 cm PAN & 1.6 m MX ) & C3 ( 30 cm PAN & 1.2m MX) ( New : Variable swath and resolution)
- The satellite is planned based on requirements from users
- The demand is more than the capacity and hence complemented by Foreign satellites

Major Projects getting serviced

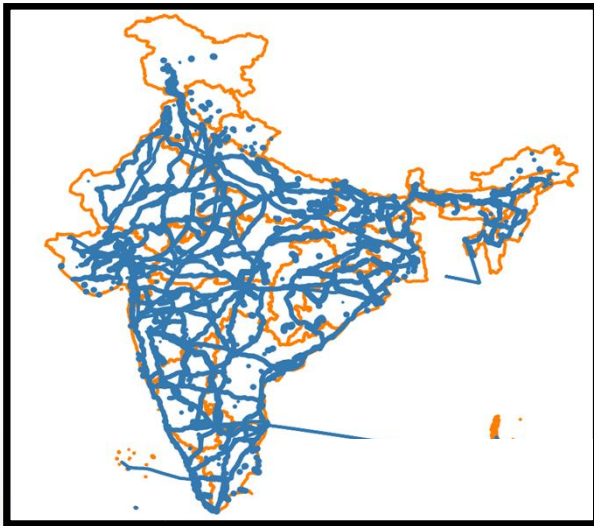


UIM -2024 , 12 – 13 March

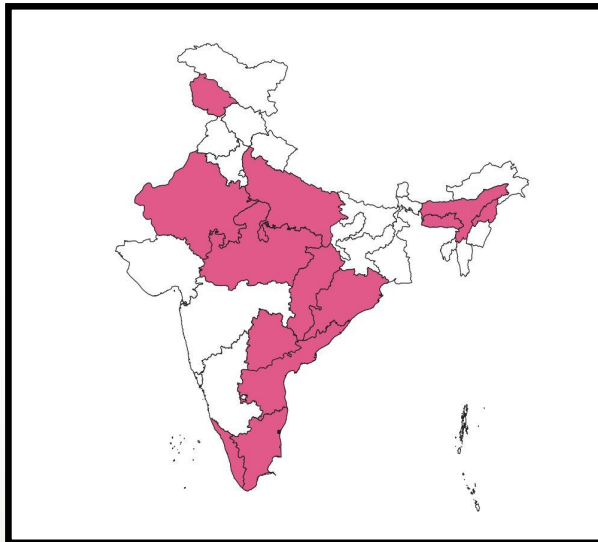
National Remote Sensing Center, Hyderabad

# Current Satellites – Utilisation 30cm to 5m

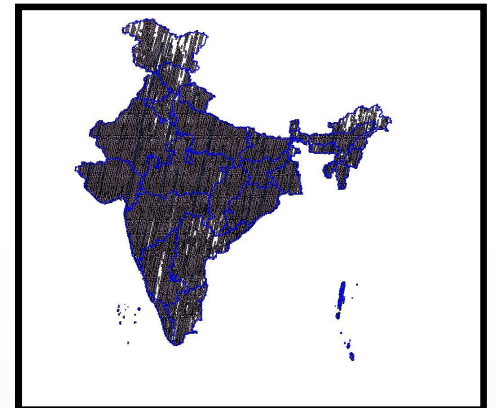
## Gatishakthi



## Agristack



Cartosat S –  
cloud-free coverage  
(2017 - 2023)



Cartosat 3 –  
cloud-free coverage  
(2021 - 2023)



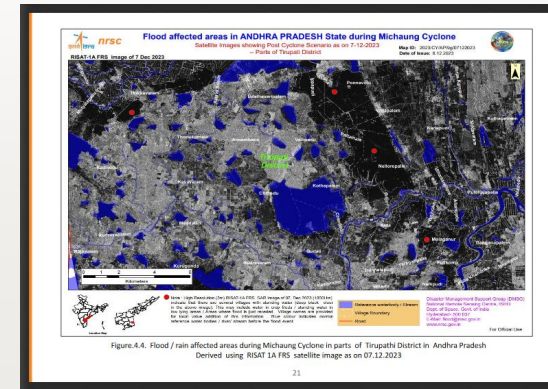
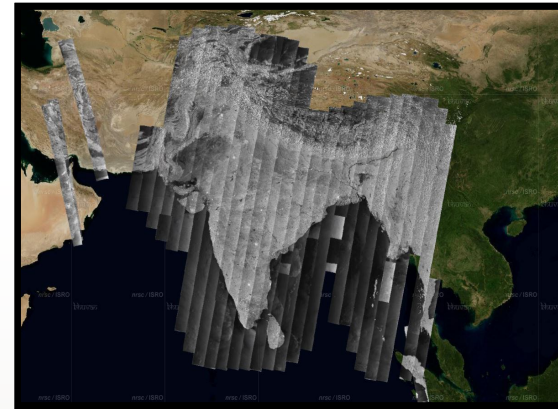
# Demand based Services : Radar Imaging Satellite (EOS -04)

**Demand : MOA , MHA ,MOE,MOJalshakti .....**

- C band SAR 5.35 GHz frequency;
- 5 imaging modes
- Single, dual quad polarisation & Circular modes

S NO	MODE	RESOLUTION	SWATH in Km	POLARISATION
1	FRS-1	3*2	25	Single dual & circular
2	FRS2	3*4	20	Full pol.
3	MRS 6 Beam	25*8	115	Single , Dual & Circular
4	MRS 8 Beam	33*8	160	Single , Dual & Circular
5	CRS	50*8	223	Single , Dual & Circular

**MRS systematic collection in 17 days**



- Data is made available through Bhoonidhi
- Free to all Govt. users
- Data within 24h
- Emergency planning within 8-10h and products within 1h

# NovaSAR



## Operating Modes :

Modes	ScanSAR	Maritime Surveillance	Stripmap	ScanSAR (Wide)
Swath (km)	100	>400	15-20	140
Spatial Resolution (m)	20	6 X 13.7	6	30
Revisit frequency for SSPO (Days)	4	1.8	3.6	3.1
Incidence Angle (Deg)	16-30	34.5-57.3	16-31	14-32



First Microwave satellite with s-Band

Available on Bhoonidhi

### Polarization :

- ✓ Single – Strip map, Maritime & Scansar
- ✓ Dual & Tripol – Scansar

### Incidence Angle :

Only discrete Incidence Angles are available for all the modes of operation

***User can place the request anywhere on India by specifying area of interest, Period of interest, mode, I. angle & polarization***

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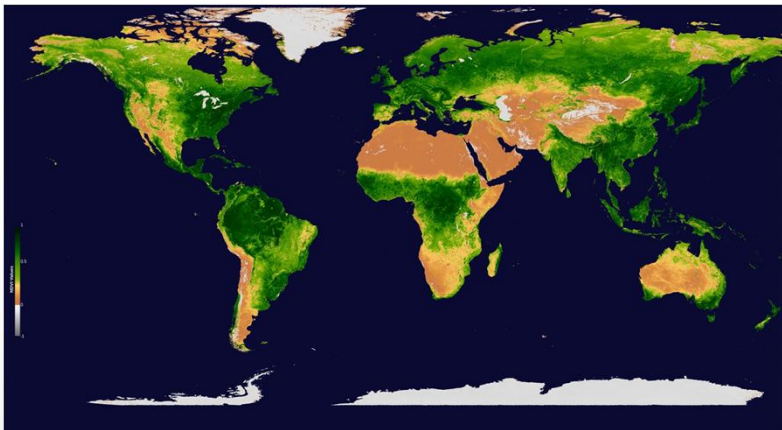
## Demand based Services : EOS-06 (Oceansat -3)

### Demand : Ministry of Earth Sciences

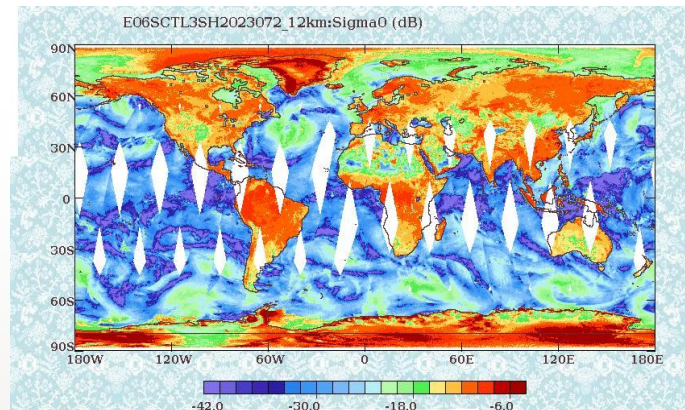
Parameter	Earlier	Present
<b>Ocean Color Monitor</b>		
No. of OCM Bands	8	13
OCM Coverage	Lat 45N,45S	Full sunlit duration & Marching Orbit
Swath	1440Kms	1440Kms
Tilt of OCM	± 20°	± 20°
Digitization-OCM	12 bits	14/16 bits
Resolution	LAC 360mtrs/GAC 1km	LAC 360mtrs/GAC 1km
SNR	360	Min 1000
<b>Scatterometer</b>		
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

# Demand based Services : EOS-06 (Oceansat -3)

- 2 days full Global data at 1km resolution ( systematic coverage)
- 2 days Local area coverage at 360m resolution
- Marching orbit : Glint free global coverage in 13 days



OCM-NDVI - GAC



SCAT

- Free to all users.
- Data within 180 min for SCATSAT & OCM < 1h
- Emergency planning within 8-10h and products within 1h
- INCOIS ground station

❖ Scatterometer-3 nominal mode provides 12.5 X 12.5 km grid for wind vector and high resolution mode provides 5 X 5 km grid size (experimental)

*The data is made available through Bhoonidhi*

132607  
downloads

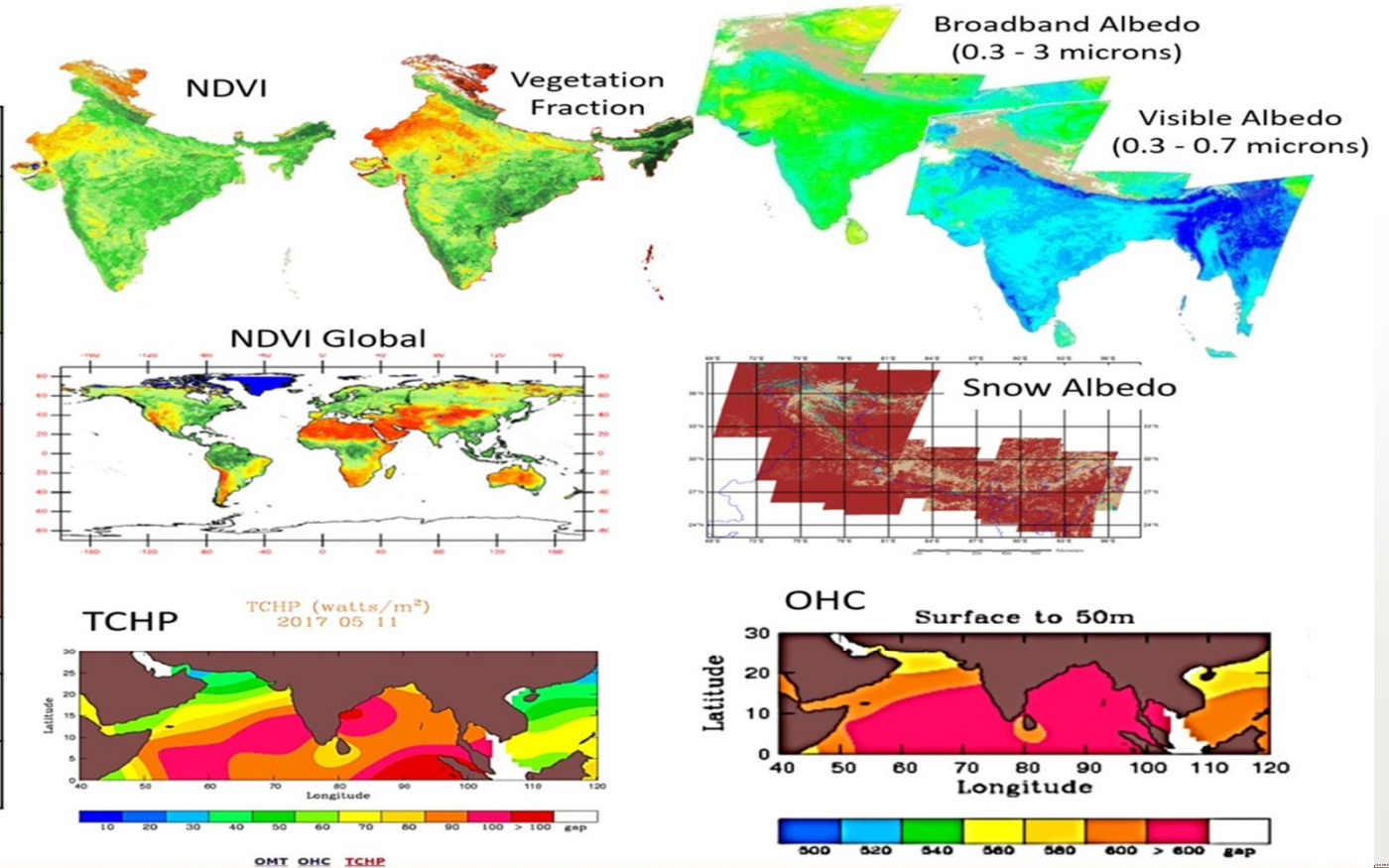
- Level-1 (Basic Data Products)
  - L1B : Radiance Product
  - L1C : Geo-referenced Product
- Level-2 Geophysical Parameters
  - ( Chlorophyll , Suspended sediments, Yellow-substance, AOD)

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# Land Geophysical Data Products ( OCM,AWIFS,Liss-3)

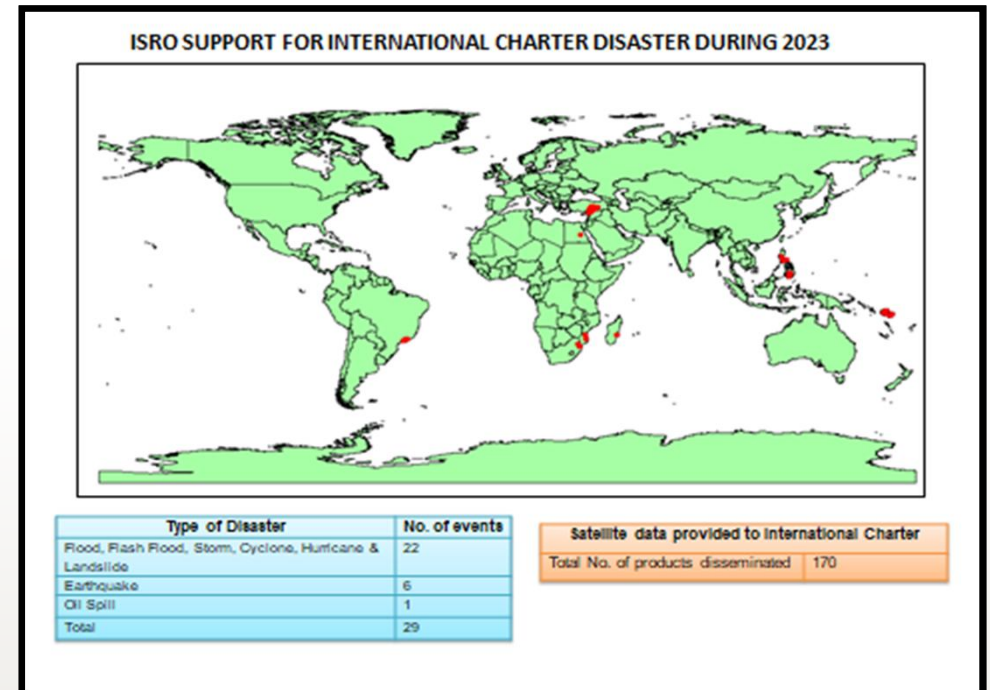
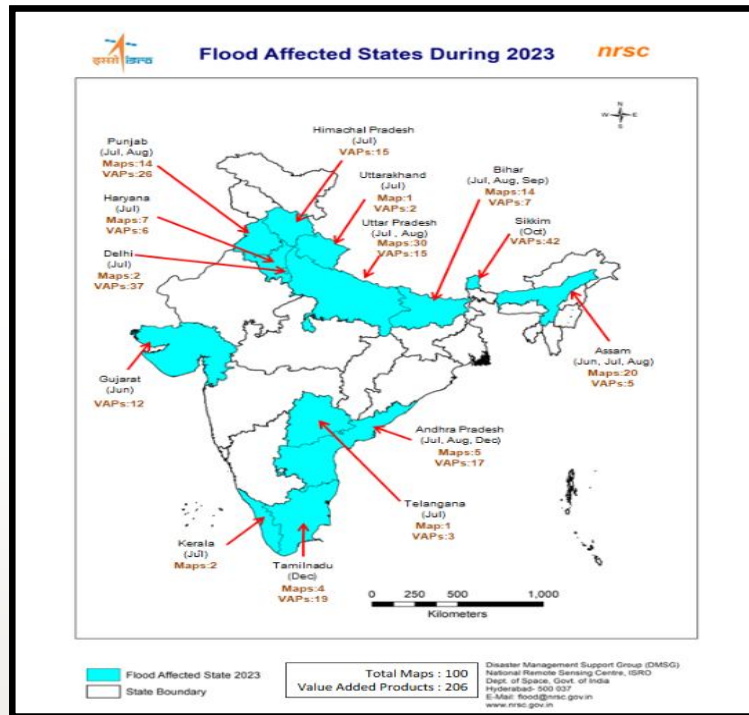
Product
NDVI (India)
NDVI ( Global)
Filtered NDVI
Vegetation Fraction
Broadband Albedo
Visible Albedo
Snow Albedo
OHC,OMT,TCHP
Enhanced Resolution Sigma Naught Products
Surface Reflectance



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# Demand based Services : Disaster Support

Planning within 8-10h



Charter : Globally 29 disasters , Sentinel (25) and Over India almost 13 states had floods

RISAT -1A , RS2/2A AWiFS , LISS-1V are the major contributors

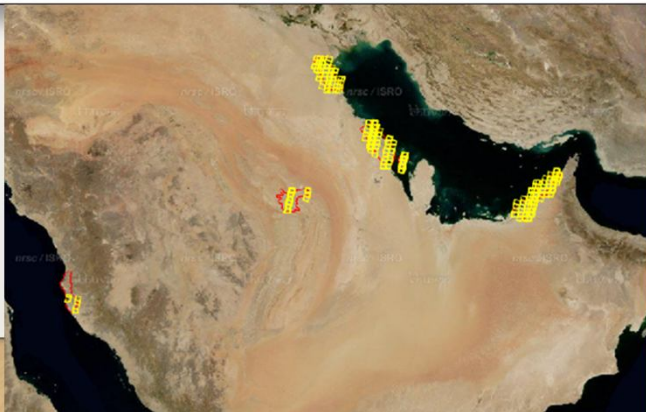
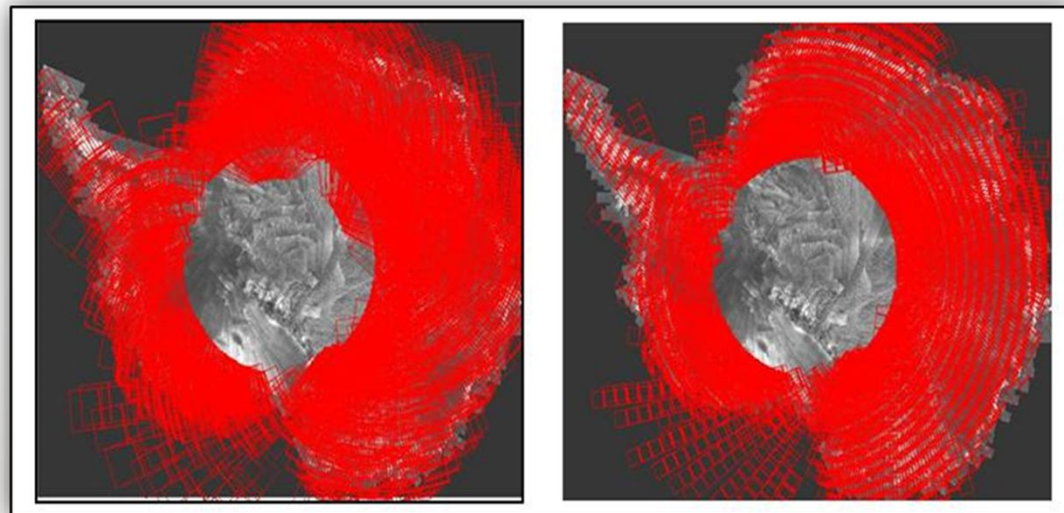
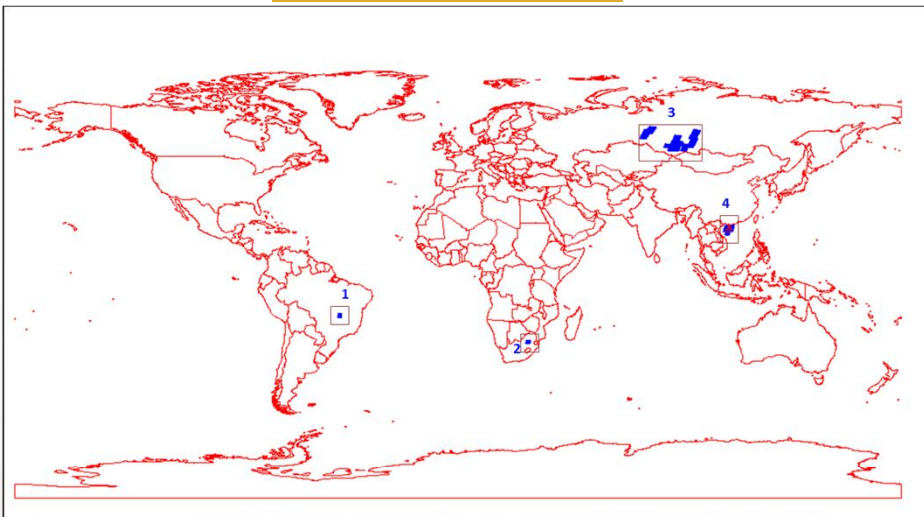
Data within - 1-2h

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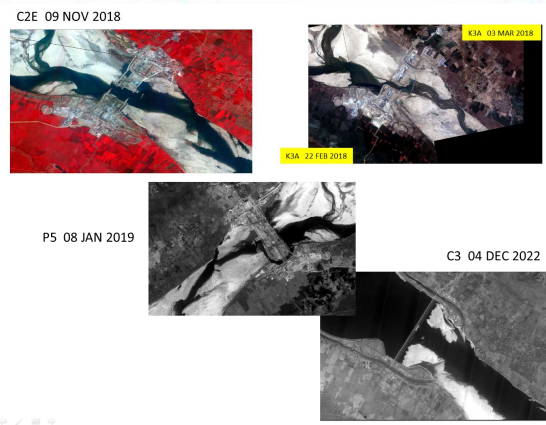
# Demand based Services

## GLOBAL AREAS

## ANTRACTICA AREA



Medigadda



## ISRO's Regional Data Hub : Indian and Non-IRS

### BHOONIDHI

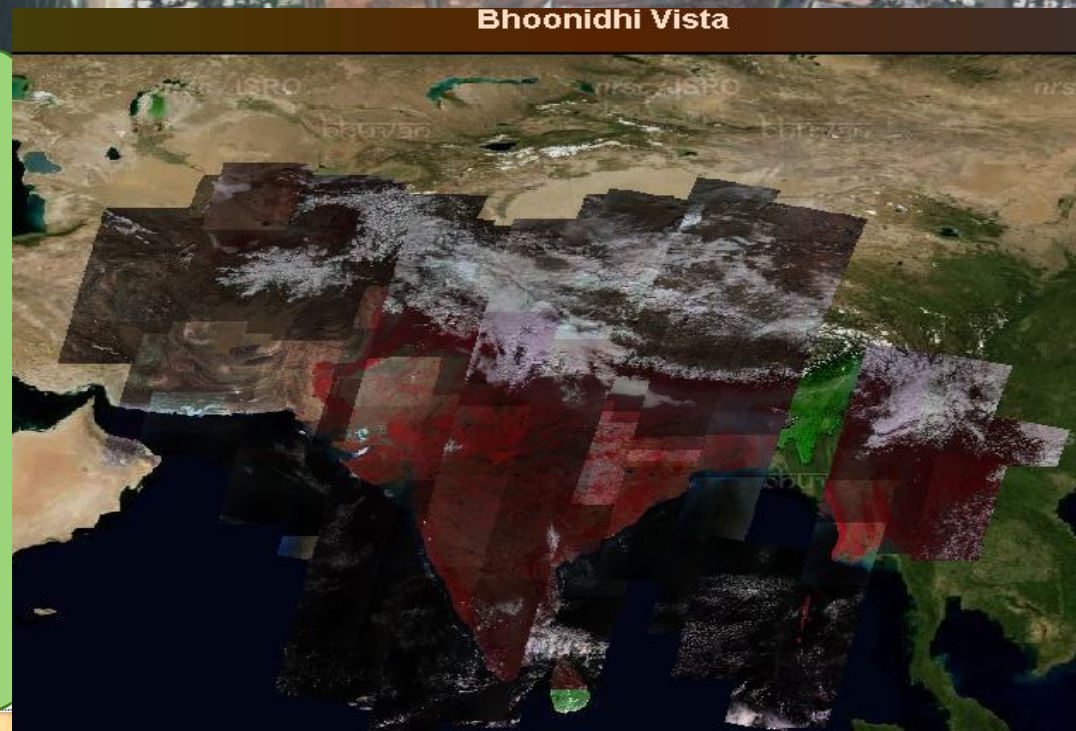
We enable access to our extensive archive of Remote Sensing data from 44 satellites, including Indian and Foreign Remote Sensing sensors acquired over 31 years. We also facilitate the Regional distribution of Sentinel and LandSat-8 data in India.

#### Services for Open & Priced products dissemination

- ✓ Planning Request Management
- ✓ EO data Search for Area of interest
  - Mission wise
  - Date wise / Resolution / events specific ,...
- ✓ Cart based Ordering from
  - Browse Catalogue
  - Products Catalogue
  - Derived/Geophysical Catalogue
- ✓ Data Visualizations
- ✓ Dissemination mode : FTP, Media, Https, API ,  
Data on CLOUD with Online Processing



Bhoonidhi Vista



# Next Gen Data processing

During IMGEOS Initial Days



Tiered SAN storage



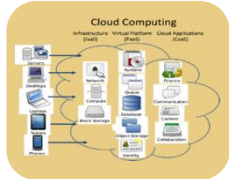
Current Time frame



Virtualization and Containerization With augmented infrastructure



Near Future Time frame



Scalable Processing in Private and Public cloud Big data



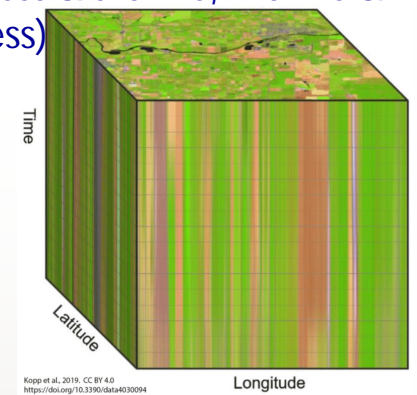
Next Gen



AI/ML Platform and Cloud services

## Object storage

Hybrid data archival (process & archive, Archive & process)



Input Image



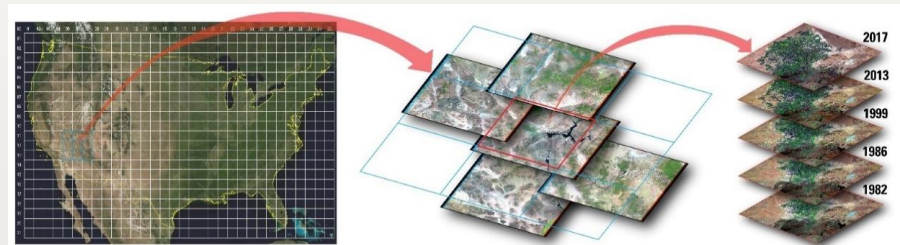
Intel Arria 10 FPGA Board

Resampled Output



Image resampled using cubic convolution

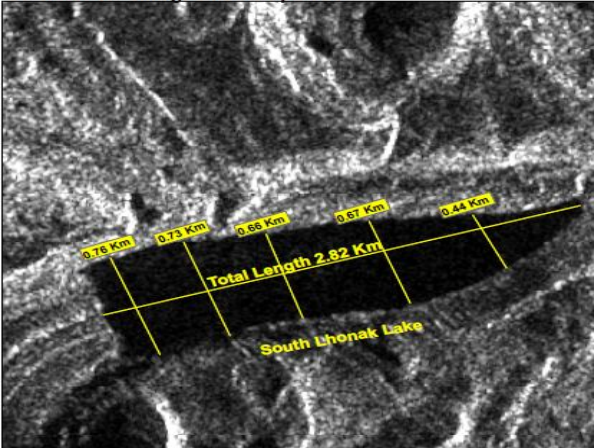
## On-Demand processing & Analysis Ready products



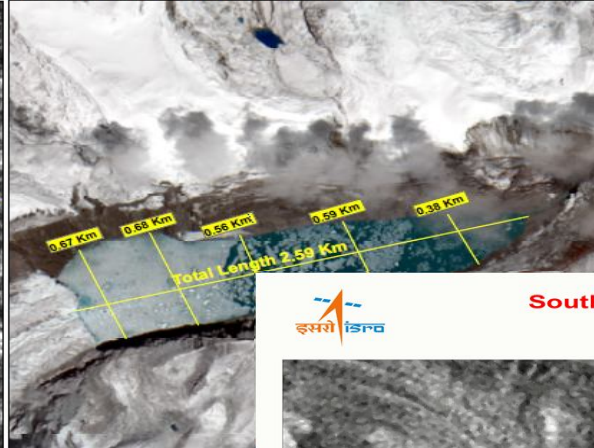
# Bhoonidhi Data : Liss-4 , C2S,C3 , MRS,FRS

## South Lhonak Lake outburst - Pre and Post

Sentinel-1A image of 28-Sep-2023



Resourcesat-2A LISS IV image of 5-Oct-2023(1030Hrs)



Date of Issue : 06-10-2023  
MAP ID: 2023/FL/SIK/05-VAP/05-Oct-2023



## South Lhonak Lake Outburst - Pre and Post Scenario

RISAT-1A, 17 Sep 2023



nrsc



Rakshas Taal

Bhoonidhi data : Disaster Resilience



## Part of Ayodhya

As Viewed by Cartosat 3



Cartosat-3, 0.6m  
Date of Acquisition: 11 Feb 2024

Scale: 1 : 2500

Best Compliments  
NRSC / ISRO

Thank you  
[www.nrsc.gov.in](http://www.nrsc.gov.in)  
[data@nrsc.gov.in](mailto:data@nrsc.gov.in)

# Statue of Equality as viewed by Cartosat-2E PAN + Mx acquired on 8<sup>th</sup> Feb2022



Presentation - Chairman, ISRO & Sec, DOS, 11<sup>th</sup> Feb 2022

