



Space based products for water resources management

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Water resources management is the activity of planning ,developing , distributing and managing the optimum use of water resources.

An aspect of water cycle management

Incorporate earth observations into water resource management

Components of water cycle:

1. Precipitation
2. Runoff
3. Evapotranspiration
4. Condensation
5. Infiltration
6. Percolation

Is it possible to retrieve these components from satellite observation directly or indirectly ??

Useful for water resources management and hydrological model input

Direct measurement

1. Rain
2. Soil Moisture
3. Snow and ice
4. Temperature
5. Humidity
6. Winds
7. Surface Radiation

Indirect measurement

1. Ground Water
2. Vegetation index
3. Evapotranspiration
4. Runoff

From satellite as well as land surface models

Application of space science in Water Recourses Domain

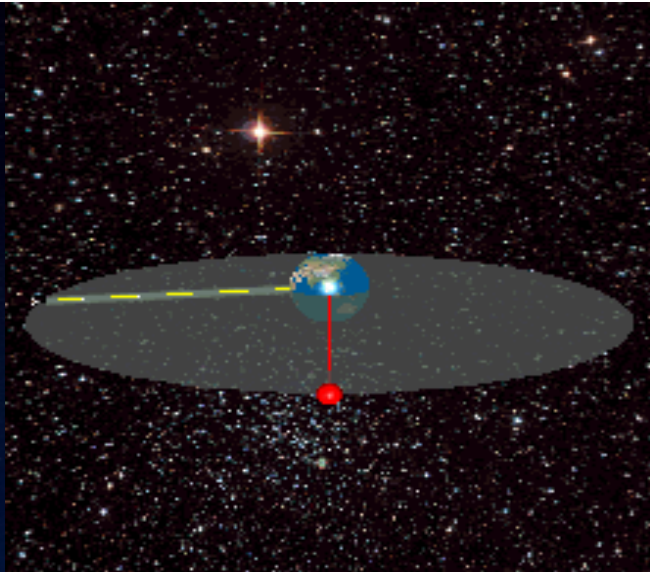
**Earth Observations
for water resources
management**

Climate & Environment



Disaster Management Support Programme

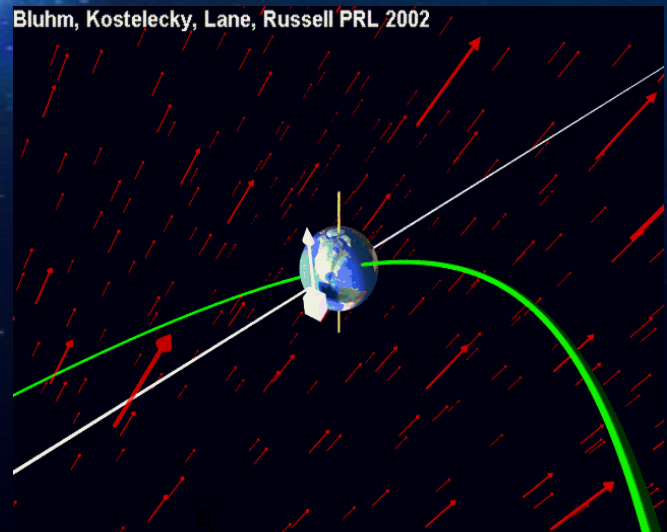
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← Geosynchronous orbit



→ Sun synchronous orbit



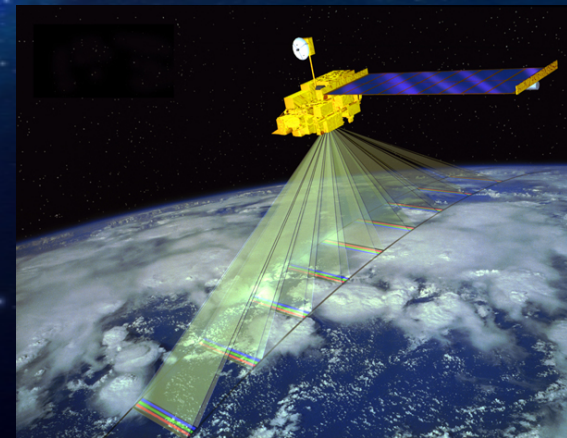
Bluhm, Kostecky, Lane, Russell PRL 2002

Earth Observation

14 operational satellites (Sun-synchronous orbit) – RESOURCESAT-1, 2, 2A, CARTOSAT-1, 2, 2A, 2B, 3, RISAT-1 and 2, OCEANSAT-2, Megha-Tropiques, SARAL and SCATSAT-1, and 4 (Geostationary orbit)- INSAT-3D, Kalpana & INSAT 3A, INSAT -3DR.

IRS-1A in 1988

APPLICATIONS: agriculture, **Water Resources Management**, urban planning, rural development, mineral prospecting, environment, forestry, ocean resources and disaster management.



6/25/2021

Disaster Management Support Programme

Flood



Extreme rainfall events



Cyclone



Agricultural Drought



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Climate & Environment

Satellites and ground based observations systems for studying the climate and environmental parameters of earth.



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Earth observation data for water resources management



Data obtained from earth observation satellites (Historical and Near Real Time) is available on 3 different ISRO's web portals MOSDAC , VEDAS and Bhoonidhi.

- Standard products
- Geophysical products

Direct estimation of water cycle components

OR

Hydrological models or numerical models (Geophysical parameters)

Portal hosts retrieved parameters from satellite data as well as developed applications from satellite data.

Geo-Platforms

<http://www.bhuvan.nrsc.gov.in>

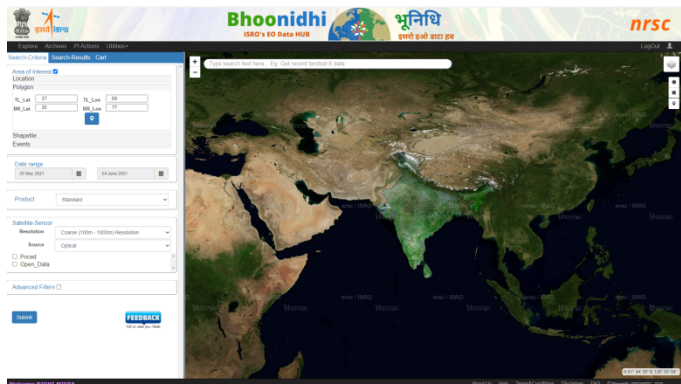


Water Services in Bhuvan :

TWRIS , WBIS, Sat-AIBP , Near Real Time hydrological modeling

Multi-sensor, Multi-platform and Multi-temporal satellite imageries , Varieties of thematic maps, Geo Spatial applications for Central and State Governments Departments, Academia and Industry

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



Data available on Bhoonidhi:

High to coarse resolution satellite

One stop hub which facilitates the dissemination of coarse medium and high resolution satellite data products, Data from IRS and NON-IRS sensors

<http://www.mosdac.gov.in>



Satellite based Meteorological & Ocean standard and geophysical products, In-situ data, Weather forecasts data, Cyclone Predictions

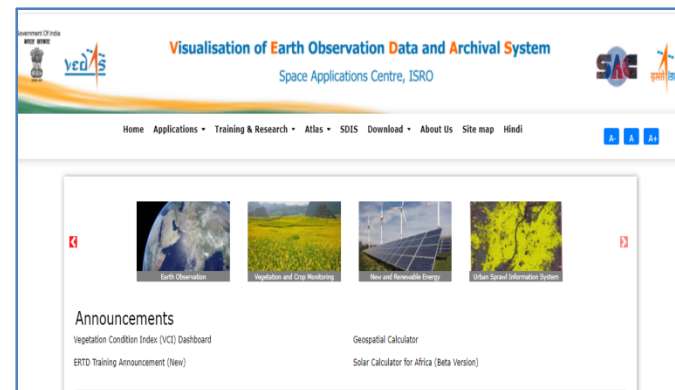


Data related to missions :

SCATSAT-1, INSAT-3DR, INSAT3D, KALPANA-1, INSAT3A, Megha Tropiques, SARAL-AliKa, Oceansat-2

Geophysical parameters (for Hydrological Models)

<https://vedas.sac.gov.in>



Applications on Vedas:

Earth observations , Vegetation and crop monitoring, Snow Cover ,monitoring , Polar science, Hydrological Science and its applications

Focus on Remote Sensing based observation modules and its applications , Data visualization , Data Analysis platform with multiple remote sensing based layers

Meteorological & Oceanographic Satellite Data Archival Centre (MOSDAC) Space Applications Centre, ISRO



Data related to missions :

SCATSAT-1, INSAT-3DR, INSAT3D, KALPANA-1, INSAT3A, MeghaTropiques, SARAL-Altika , Oceansat-2

The screenshot displays the MOSDAC website interface. At the top, there is a header with the Government of India logo, the text 'भारत सरकार Government of India' and 'मॉस्टैक SAG', and the MOSDAC logo. The main title is 'Meteorological & Oceanographic Satellite Data Archival Centre' and 'Space Applications Centre, ISRO'. There are links for 'Skip to main content', 'Android App', 'Login', and 'SignUp'. Language options for 'हिन्दी' and 'English' are available, along with accessibility icons. A navigation menu includes 'Home', 'Missions', 'Catalog', 'Galleries', 'Data Access', 'CalVal', 'Atlases', 'Tools', 'Research Programme', 'Sitemap', and 'Help'. Below the menu are tabs for 'Highlights', 'Satellite Images', 'RADAR', 'LIVE', and 'Alerts'. The main content area features a video player titled 'Sat Dec 12 2020 16:00:00 GMT+0530 (India Standard Time)' showing a satellite image of a storm system. The video player includes a timeline from 12-12-2020_16:00 to 12-12-2020_19:00 and a '8 Frames' dropdown. Below the video player are links for 'Fullscreen' and 'Services'. The 'Services' section has tabs for 'Forecast', 'Nowcast', 'Current Events', 'Past Events', 'Visualisation', 'Met Applications', and 'Ocean Applications'. Below these tabs are several service tiles: 'WEATHER', 'SEA STATE', 'RIP CURRENT', 'LIGHTNING', 'HEAVY RAIN', 'HEAT WAVES', 'CONTRAIL', 'COLD WAVES', and 'CITY WEATHER'.

Geophysical parameters (for Hydrological Models):



- Land Surface Temperature
- Upper Tropospheric Humidity
- Outgoing Longwave Radiation
- Sea Surface Temperature
- Insolation
- Hydro-Estimator Rain
- INSAT Multi Spectral Rain
- Quantitative Precipitation Index
- Cloud Mask
- Diffused Normal Irradiance(DNI)
- Direct Horizontal Irradiance(DHI)**
- Global Horizontal Irradiance(GHI)

Add To Favourite

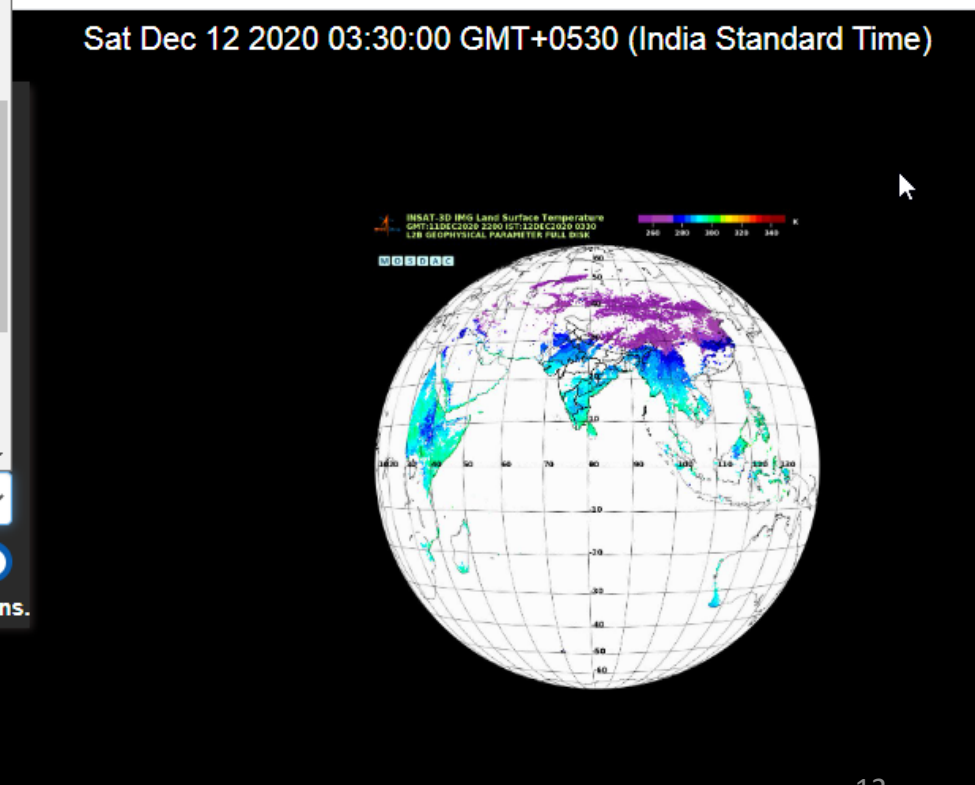
AutoLoad 15mins.

Fri Dec 11 2020 21:45:00 GMT+0530 (India Standard Time)

- Dust
- Cloud Effective Radius
- Cloud Optical Thickness
- Aerosol Optical Depth
- Snow**
- Fog
- Fire & Smoke
- IR Wind
- WV Wind
- VIS Wind
- MIR Wind
- Merged IR Wind(INSAT-3D & 3DR)

Add To Favourite

AutoLoad 15mins.



Reference document :
INSAT3D ATBD
6/25/2021

MOSDAC X

Satellite/Forecast

INSAT-3D

Sensor/Model

IMAGER

Product Type

Binned

Product

Daily PET

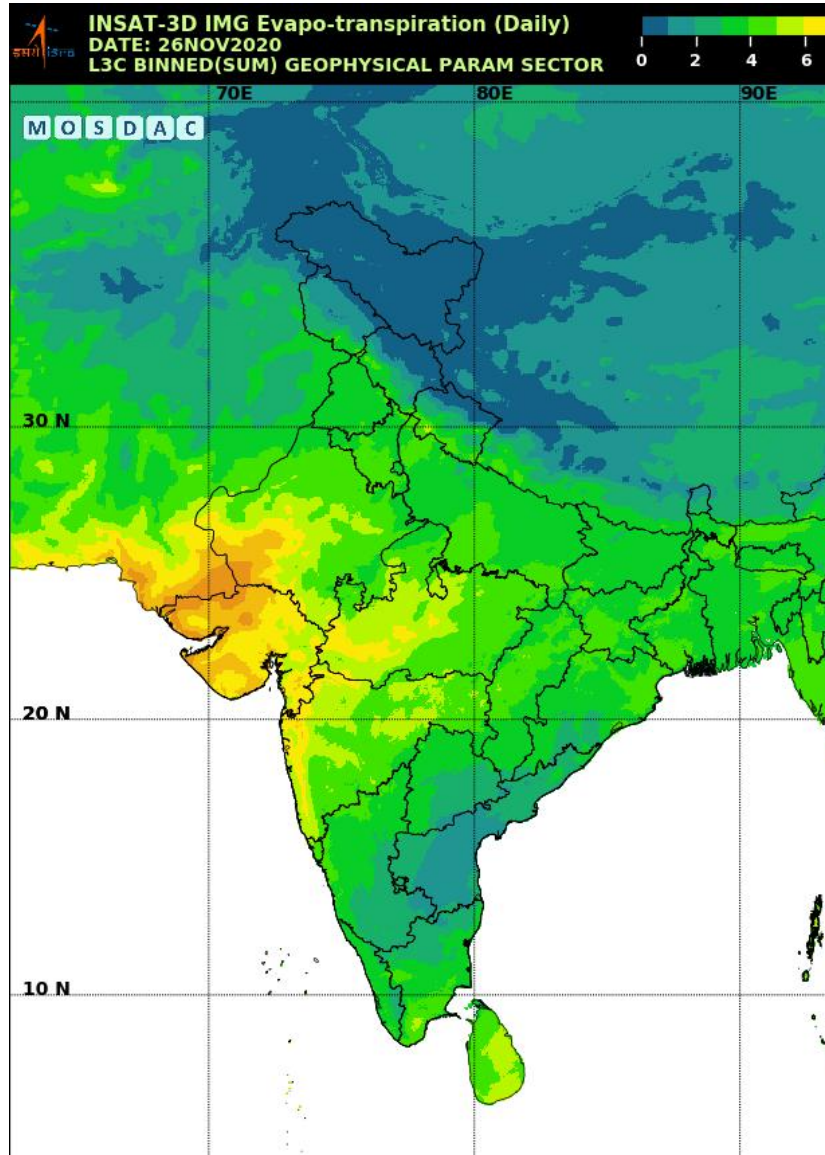
Add To Favourite

AutoLoad 15mins.

<https://www.mosdac.gov.in/>

Data visualization and data download

6/25/2021



- Daily OLR
- Daily SST
- Daily UTH
- Daily HEM
- Daily GPI
- Daily IMR
- Daily IMC
- Daily INS
- Daily PET
- Daily DNI
- Daily DHI
- Daily GHI
- Daily INS**
- Daily PET
- Daily DNI
- Daily DHI
- Daily GHI
- Weekly OLR
- Weekly SST
- Weekly UTH
- Weekly HEM
- Weekly GPI
- Weekly IMR
- Weekly IMC
- Weekly HEM

Visualization of Earth observation Data and Archival System (VEDAS) Space Applications Centre, ISRO



Visualisation of Earth Observation Data and Archival System
Space Applications Centre, ISRO



Home Applications Training & Research Atlas SDIS Download About Us Site map Hindi



Announcements

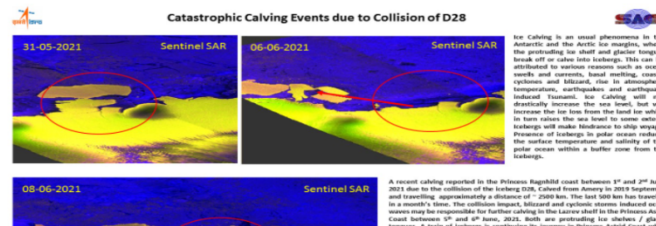
Vegetation Condition Index (VCI) Dashboard

3D City Model - Ahmedabad

Geospatial Calculator

AdVance HYPerspectral data Analysis Software (AVHYAS-version-1)

Catastrophic Calving Events due to Collision of D28



Focus : Remote Sensing based earth observations and its applications

6/25/2021 <https://vedas.sac.gov.in/vcms/en/home.html>

Earth Observation

New and Renewable Energy

Vegetation and Crop Monitoring

Air Quality Monitoring

Urban Sprawl Information System

Polar Science

- North Pole (Ice melt product)
- North Pole
- Safer Ship Navigation
- South Pole (Effective Sea Ice Thickness)
- South Pole

Planetary Science

Hydrological Science & Applications

Mobile based Data Collection

Special Products

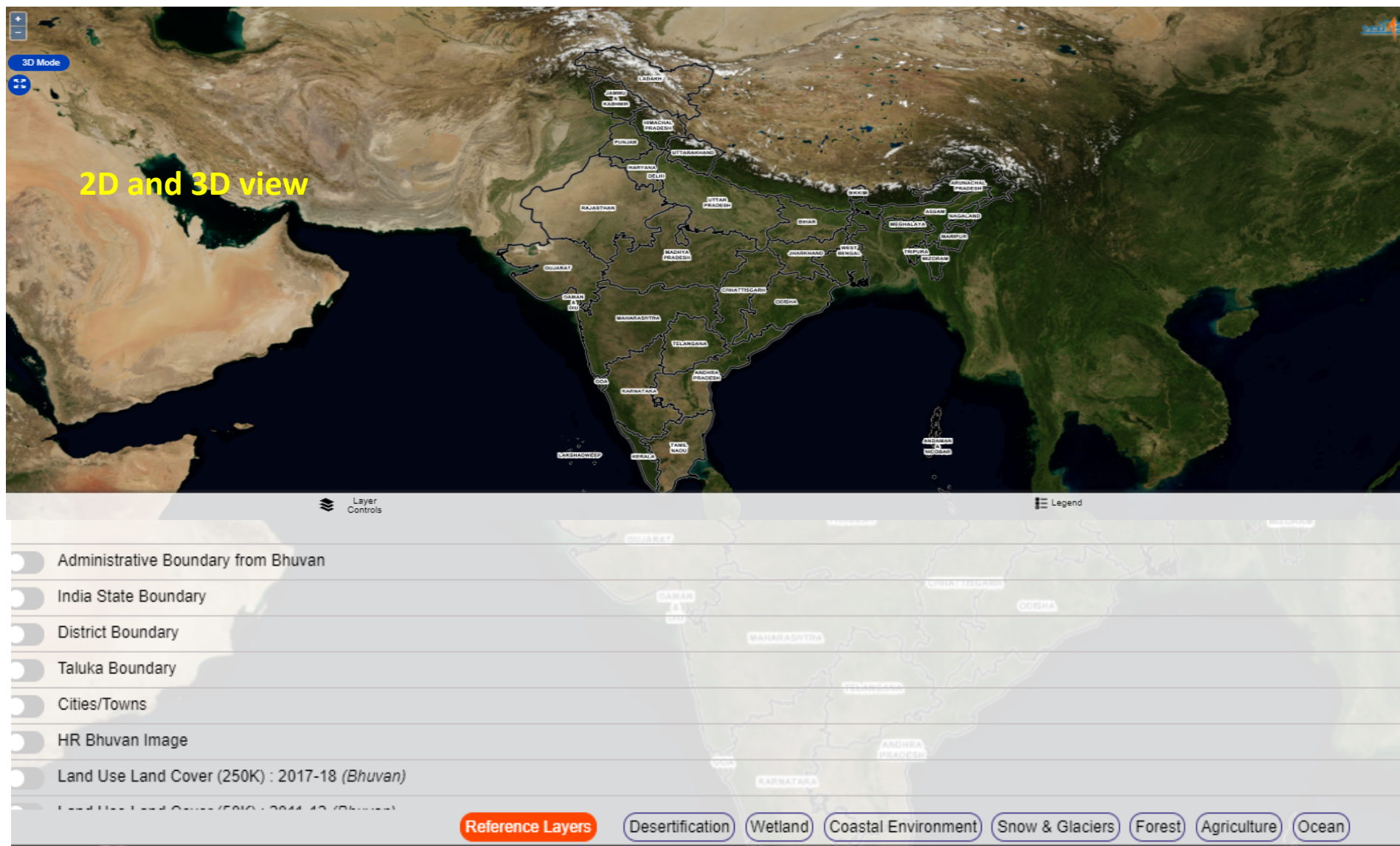
IPOWER - Indian Potential Offshore

Wind Energy Resource

Geospatial Energy Maps of India

Snow cover monitoring

Earth Observations



Vegetation and crop monitoring



Data visualization and data analytics both

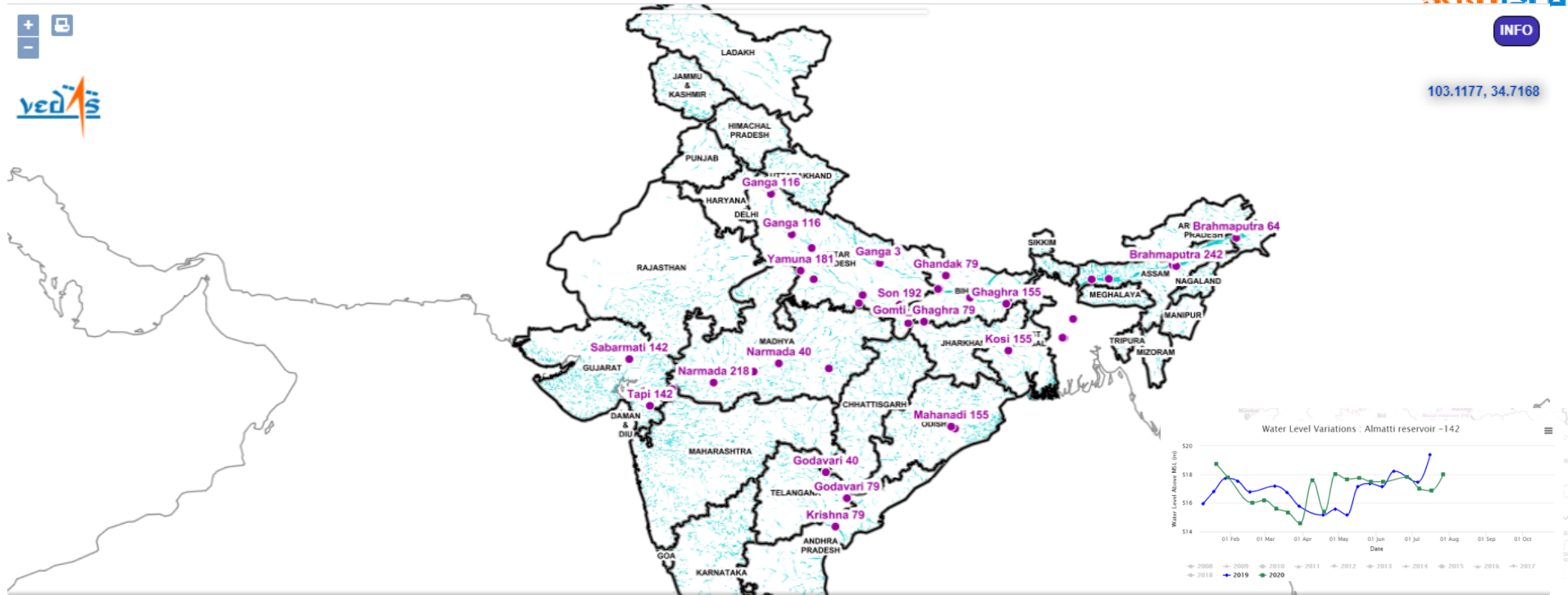
https://vedas.sac.gov.in/vstatic/vegetation_monitoring/index.html

Hydrological Science and Applications



INFO

103.1177, 34.7168



Reference Layers

Data & Analysis

Sensor **JASON 2/3** Waterbodies **River** Locations **Brahmaputra -53** From **07/04/2008** To **10/31/2020** Year over Year Profile: **Submit** **Metadata**

Altimeter **Forecast** **Scatterometer** **Water Spread-SAR**

Sensor **JASON 2/3** Waterbodies **Reservoir** Locations **Almatti reservoir -142** From **07/06/2008** To **11/03/2020** Year over Year Profile: **Submit** **Metadata**

Altimeter **Forecast** **Scatterometer** **Water Spread-SAR**

Bhoonidhi (ISRO's Open Data Access) National Remote Sensing Centre, ISRO



A screenshot of the Bhoonidhi web application interface. The page features a header with the ISRO logo, the text 'Bhoonidhi ISRO's EO Data HUB', and the Hindi text 'भूनिधि इसरो इओ डाटा हब'. Below the header is a navigation bar with 'Explore', 'Archives', 'PI Actions', and 'Utilities'. The main content area is divided into a left sidebar and a right map area. The sidebar contains search criteria filters: 'Area of Interest' (Location, Polygon, TL/Lat, BR/Lat, Shapefile, Events), 'Date range' (25 May 2021 to 24 June 2021), 'Product' (Standard), 'Satellite-Sensor' (Resolution: Coarse (100m - 1000m), Source: Optical), and 'Advanced Filters'. A 'Submit' button and a 'FEEDBACK' button are at the bottom of the sidebar. The map area shows a satellite image of the Indian subcontinent and surrounding regions, with a search bar at the top and a coordinate display at the bottom right. The footer contains 'Welcome NIDHI MISRA' and a navigation menu with 'About Us', 'Help', 'Terms&Conditions', 'Disclaimer', 'FAQ', and '© Bhoonidhi: ISRO/nrsc, 2020'.

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

Sentinel 2 : **Sentinel-2A** and **Sentinel-2B**

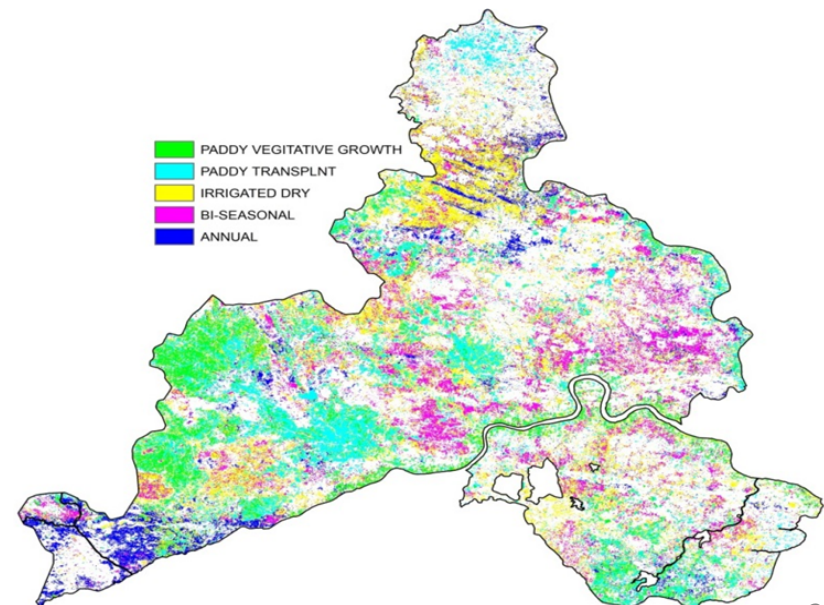
Multi Spectral imager (MSI) with 13 bands in the visible, near infrared (NIR) and short wave infrared (SWIR)

Sentinel-2 bands	Sentinel-2A & 2B		
	Central wavelength (nm)	Bandwidth (nm)	Spatial resolution (m)
Band 1 – Coastal aerosol	442.7	21	60
Band 2 – Blue	492.4	66	10
Band 3 – Green	559.8	36	10
Band 4 – Red	664.6	31	10
Band 5 – Vegetation red edge	704.1	15	20
Band 6 – Vegetation red edge	740.5	15	20
Band 7 – Vegetation red edge	782.8	20	20
Band 8 – NIR	832.8	106	10
Band 8A – Narrow NIR	864.7	21	20
Band 9 – Water vapour	945.1	20	60
Band 10 – SWIR – Cirrus	1373.5	31	60
Band 11 – SWIR	1613.7	91	20
Band 12 – SWIR	2202.4	175	20

Applications:

- ✓ land cover classification or water quality
- ✓ Monitoring land cover change for environmental monitoring
- ✓ Agricultural applications, such as crop monitoring and management to help food security
- ✓ Observation of coastal zones (marine environmental monitoring, coastal zone mapping)
- ✓ Inland water monitoring
- ✓ Glacier monitoring, ice extent mapping, snow cover monitoring
- ✓ Flood mapping & management

Crop map detection based on
Sentinel 2 data



Landsat 8 OLI +TIR

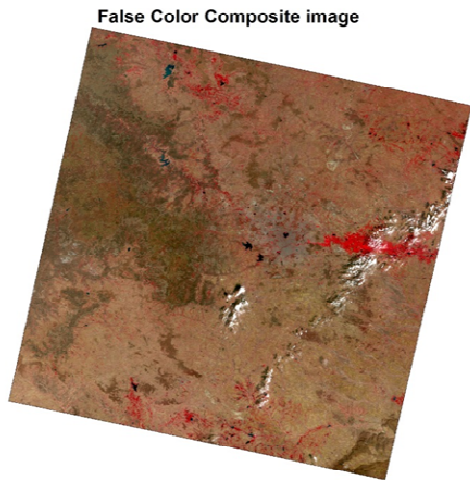
Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS)



agriculture and forestry, land use and mapping, geology, hydrology, coastal resources and environmental monitoring

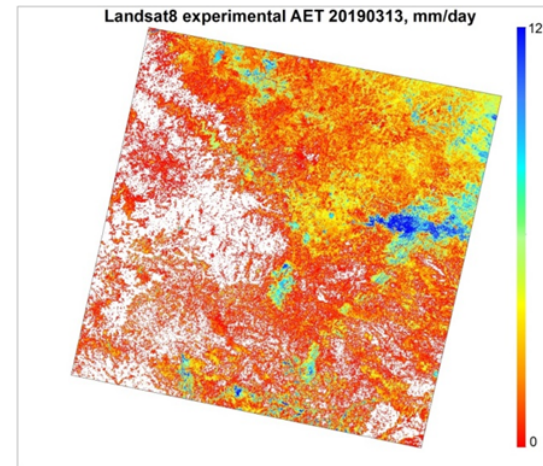
Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) Launched February 11, 2013	Bands	Wavelength (micrometers)	Resolution (meters)
	Band 1 - Coastal aerosol	0.43 - 0.45	30
	Band 2 - Blue	0.45 - 0.51	30
	Band 3 - Green	0.53 - 0.59	30
	Band 4 - Red	0.64 - 0.67	30
	Band 5 - Near Infrared (NIR)	0.85 - 0.88	30
	Band 6 - SWIR 1	1.57 - 1.65	30
	Band 7 - SWIR 2	2.11 - 2.29	30
	Band 8 - Panchromatic	0.50 - 0.68	15
	Band 9 - Cirrus	1.36 - 1.38	30
	Band 10 - Thermal Infrared (TIRS) 1	10.60 - 11.19	100
	Band 11 - Thermal Infrared (TIRS) 2	11.50 - 12.51	100

Tracking Agricultural Water Use From Space



Landsat 8 FCC image for part of Hyderabad

Predicting Water Demand



Landsat 8 based Field level actual evapotranspiration



<https://eeflux-level1.appspot.com/>

A satellite-style map of a coastal region, likely the Chesapeake Bay area, showing a complex network of rivers and waterways. The map is overlaid on a dark blue background. The text "Thank you for kind attention" is written in large, bold, yellow font on the left side of the image.

**Thank you for kind
attention**

6/25/2021

Image Courtesy : <https://appliedsciences.nasa.gov/what-we-do/water-resources>