



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

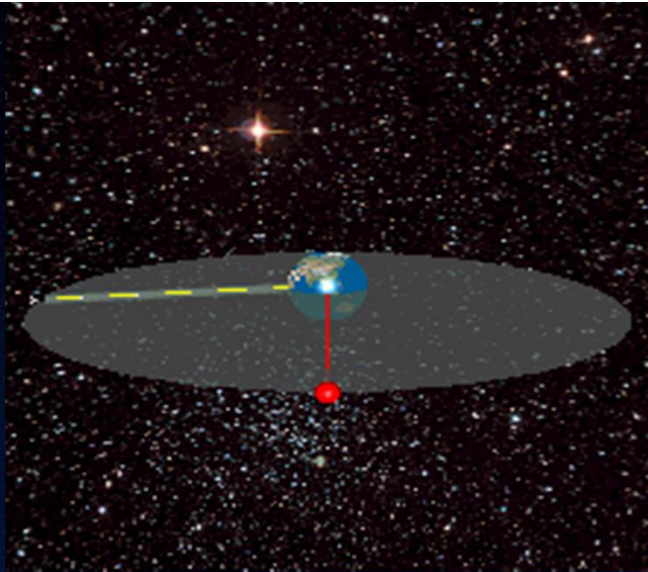
**Earth Observations
for water resources
management**

Climate & Environment



Disaster Management Support Programme

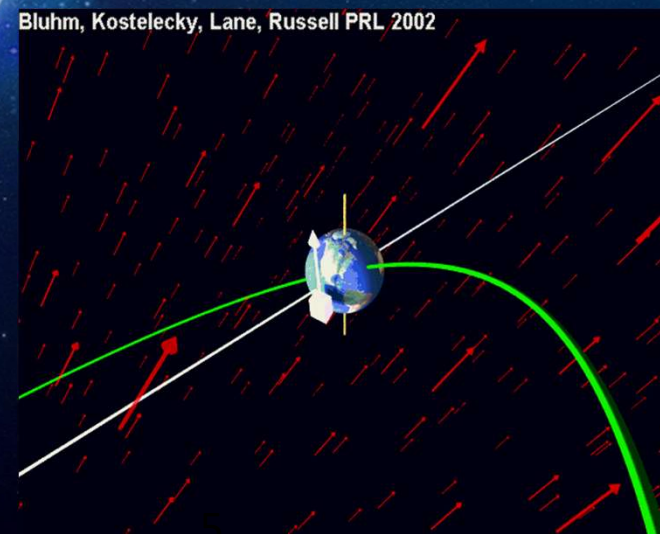
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← Geosynchronous orbit



Sun synchronous orbit →



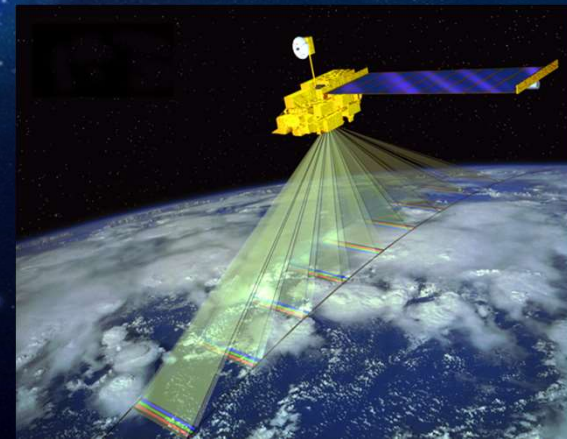
Earth Observation

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.



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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.

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 acronym 'SAG' (Space Applications Centre), and the text 'मॉस्टैक Meteorological & Oceanographic Satellite Data Archival Centre Space Applications Centre, ISRO'. Navigation links include 'Skip to main content', 'Android App', 'Login', and 'SignUp'. Language options for 'हिन्दी' and 'English' are available. A main navigation bar contains 'Home', 'Missions', 'Catalog', 'Galleries', 'Data Access', 'Cal/Val', 'Atlases', 'Tools', 'Research Programme', 'Sitemap', and 'Help'. Below this, there are tabs for 'Highlights', 'Satellite Images', 'RADAR', 'LIVE', and 'Alerts'. The central content area features a video player for satellite data, titled 'Sat Dec 12 2020 16:00:00 GMT+0530 (India Standard Time)'. The video player includes a timeline from 12-12-2020_16:00 to 12-12-2020_19:00 and a '8 Frames' dropdown menu. Below the video player, there are links for 'Fullscreen' and 'Services'. The 'Services' section includes tabs for 'Forecast', 'Nowcast', 'Current Events', 'Past Events', 'Visualisation', 'Met Applications', and 'Ocean Applications'. A grid of service icons is shown, including '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

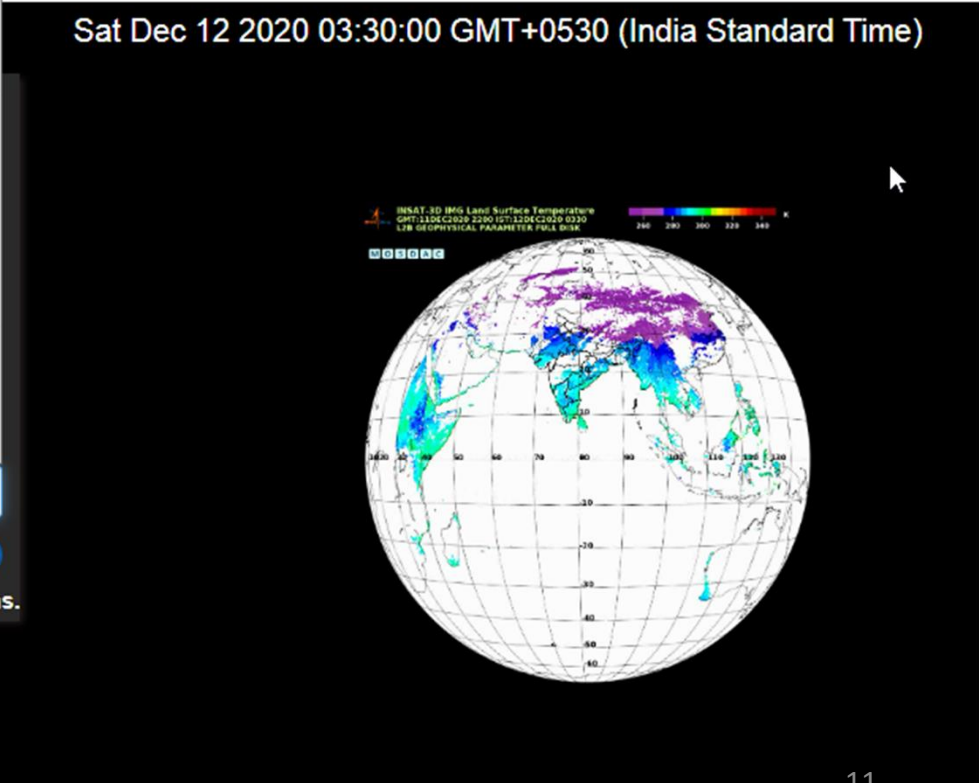
AutoLoad 15mins.

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

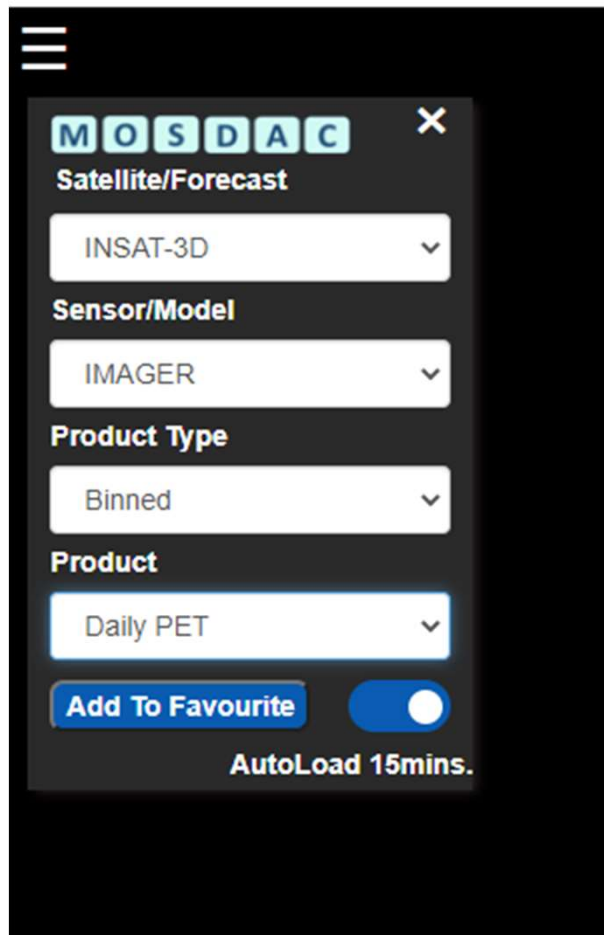
- Dust
- Cloud Effective Radius
- Cloud Optical Thickness
- Aerosol Optical Depth
- Snow**
- Fog
- Fire & Smoke
- IR Wind
- WV Wind
- VIS Wind
- MIR Wind
- Merged IR Wind(INSAT-3D & 3DR)

Add To Favourite

AutoLoad 15mins.



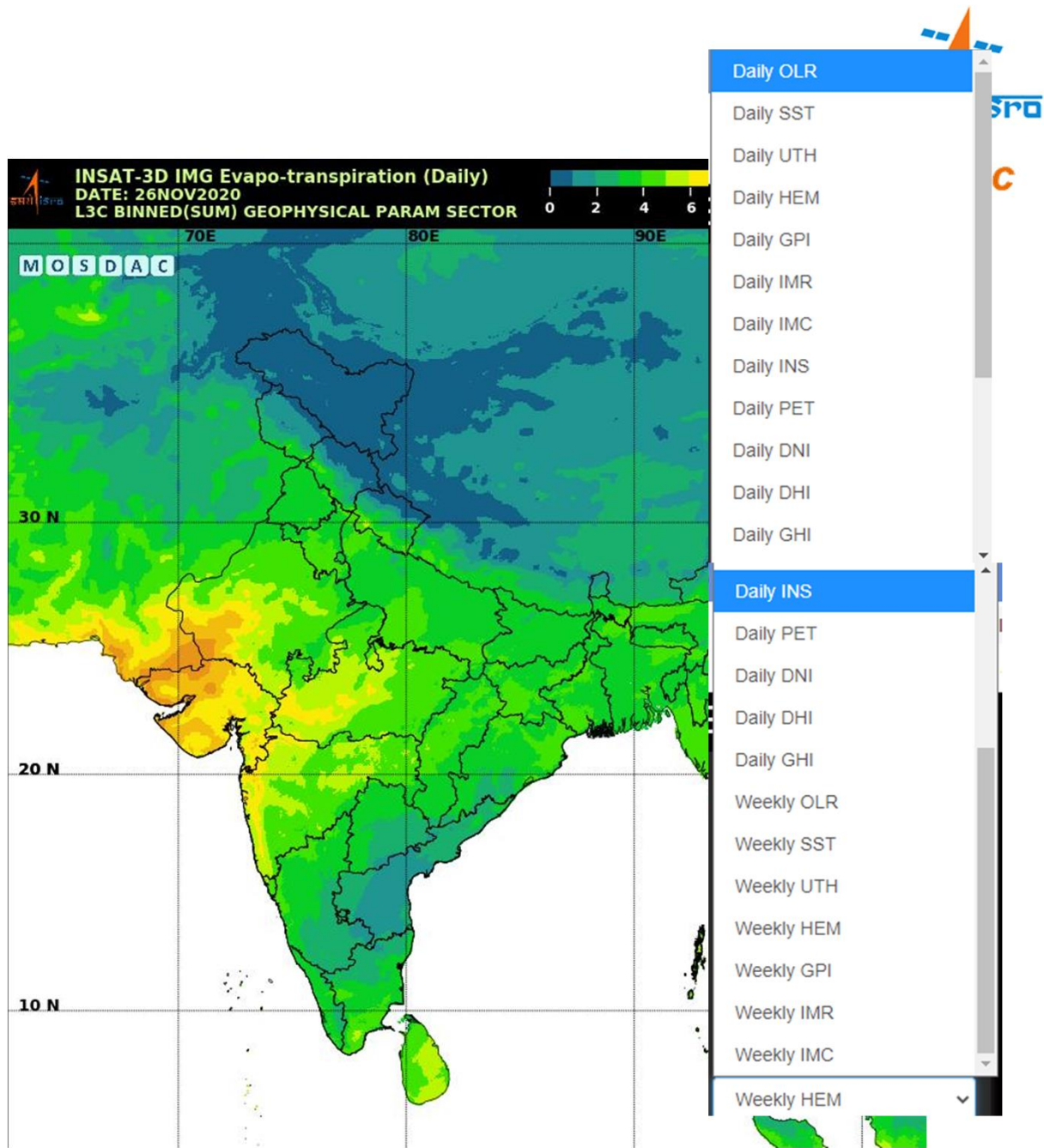
Reference document :
INSAT3D ATBD
12/18/2020



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

Data visualization and data download

12/18/2020



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

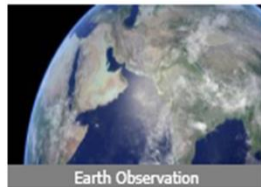


Visualisation of Earth Observation Data and Archival System

Space Applications Centre, ISRO



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



Earth Observation



Vegetation and Crop Monitoring



New and Renewable Energy



Urban

Announcements

Vegetation Condition Index (VCI) Dashboard

ERTD Training Announcement (New)

Geospatial Calculator

Solar Calculator for Africa (Beta Version)

Exploring the Antarctic

This book presents the highlights of various scientific studies in the Antarctic region undertaken by Space Applications Centre (SAC-ISRO) during the decade long experience (2009-2019) of participation in the expeditions to Antarctica coordinated by National Centre of Polar and Ocean Research (NCPOR), Ministry of Earth System Science, Government of India.

Focus : Remote Sensing based earth observations and its applications

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

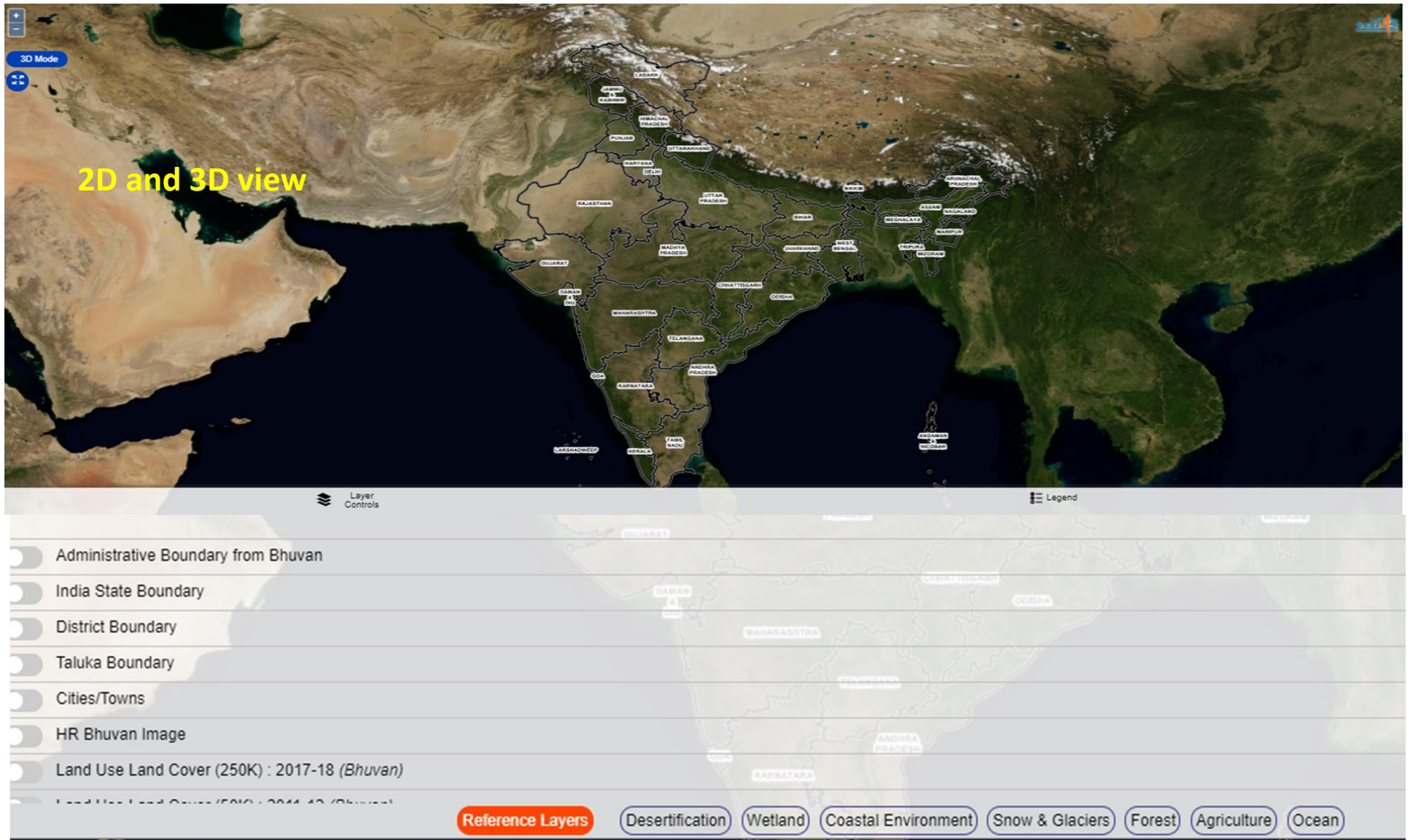
IPOWER - Indian Potential Offshore Wind Energy Resource

Geospatial Energy Maps of India

Snow cover monitoring

12/18/2020 <https://vedas.sac.gov.in/vcms/en/home.html>

Earth Observations



12/18/2020

<https://vedas.sac.gov.in/vstatic/Eo/index.html>

Vegetation and crop monitoring



Vegetation Indices

Soil Moisture

Rainfall

Temperature

Surface Dryness Index

Potential Evapotranspiration

SAR Backscatter

Crop Cutting Experiments

Weather Forecast (72 Hour)

Theme: Vegetation Indices

Reference Layers

Data Visualization

Data Analysis

MODIS - 16 Day Max NDVI [500m]

MODIS - District Level

MODIS - Taluka Level

MODIS - 16 Day Max NDVI Prediction (Beta)

AWIFS - 15 Day Max NDVI [56m]

AWIFS - 10 Day Max NDVI [56m]

AWIFS - District Level

AWIFS - Village Level (Gujarat)

AWIFS - Taluka Level

Sentinel2 - 5 Day Max NDVI [10m]

Sentinel2 - 10 Day Max NDVI [10m]

PROBA - 10 Day Max NDVI [330m]

OCM - Daily NDVI [360m]

LISS IV - Daily NDVI [5m]

MODIS - 16 Day NDWI Composite [500m]

AWIFS - 15 Day Max NDVI [56m]

Theme: Image Difference

Data: MODIS - 16 Day Max NDVI [500m]

Show Data Layer:

Year over Year Profile:

A of (A-B): 24-11-2020

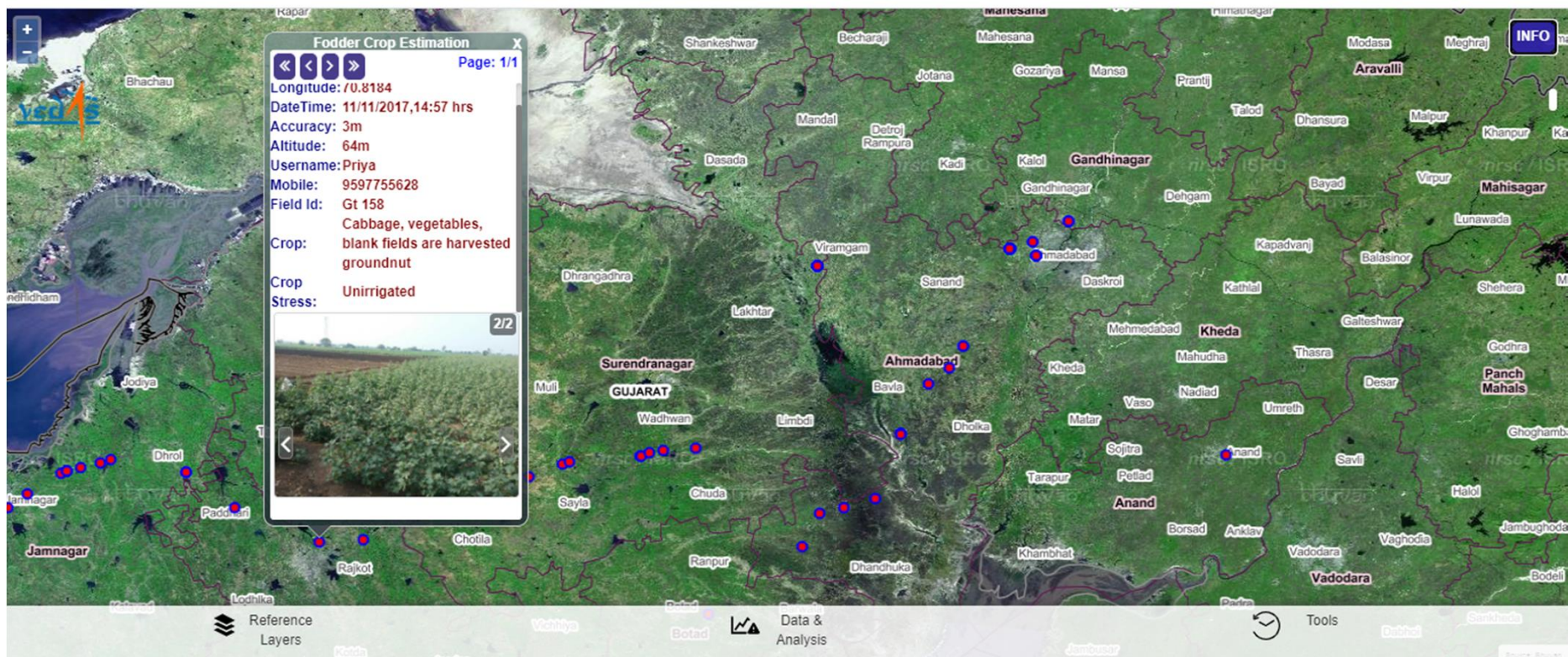
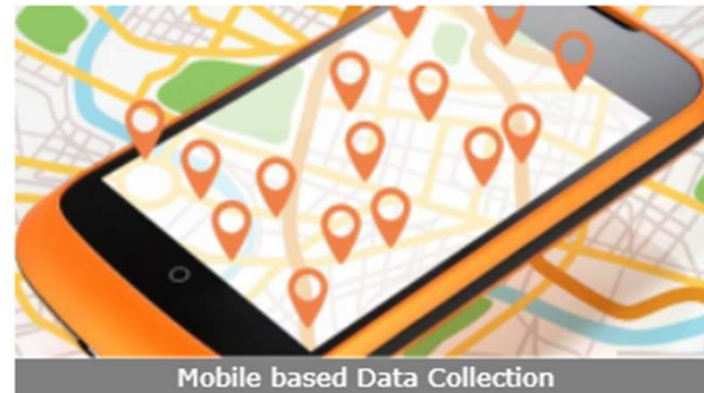
B of (A-B): 24-11-2019

Enable swipe mode

Data visualization and data analytics both

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

Mobile Based Data Collection

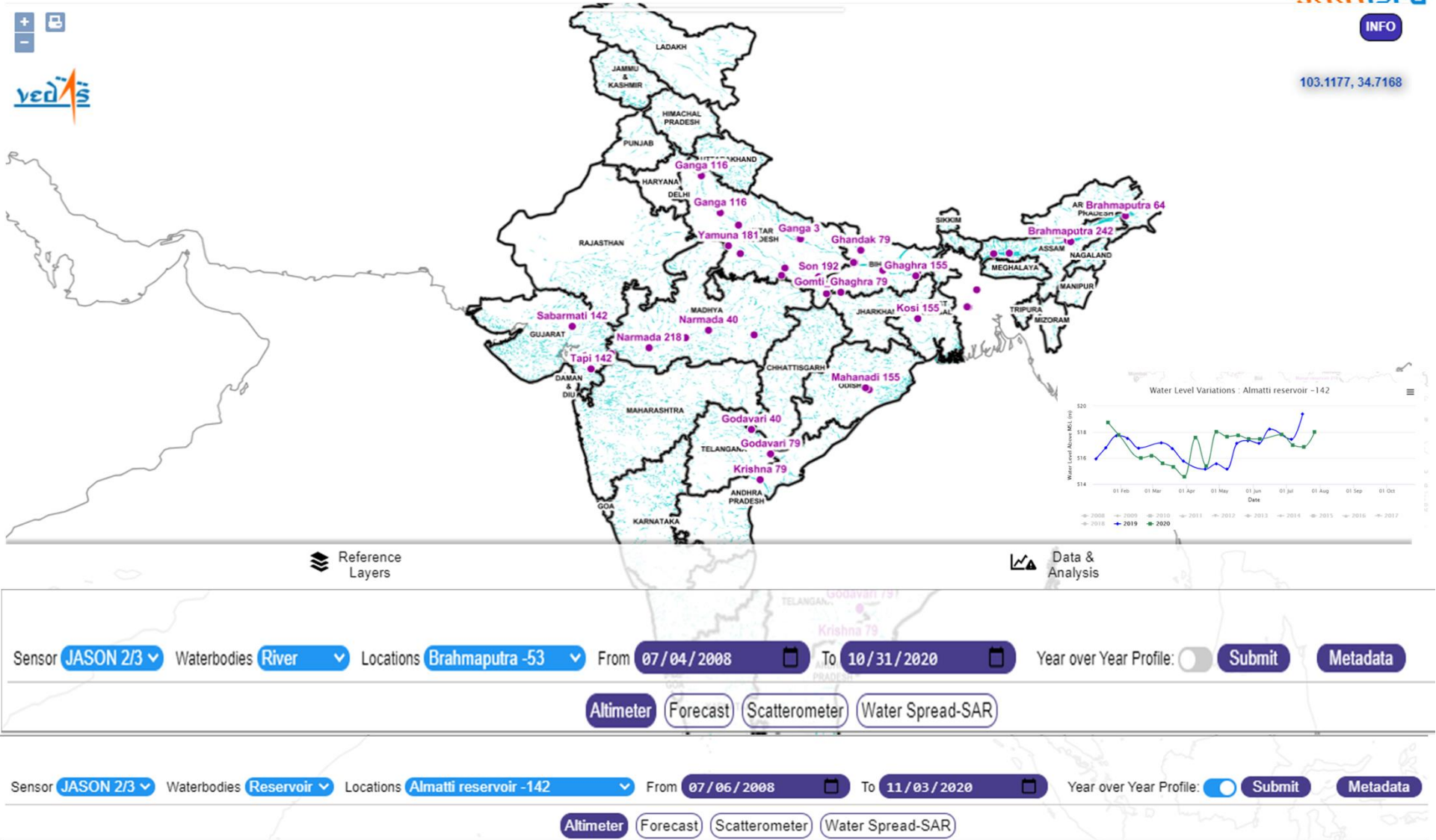


Hydrological Science and Applications



INFO

103.1177, 34.7168



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



Satellite Data Availability

Satellite	Sensors
LANDSAT-8	OLI+TIRS - Georeferenced Terrain Corrected Products
SENTINEL-1A & 1B	Interferometric Wide Swath (IW) - VV+VH pol, L1-GRD
SENTINEL-2A & 2B	MSI - Level 1C, Level 2A
OCEANSAT/2	OCM - GAC - Georeferenced Terrain Corrected Products

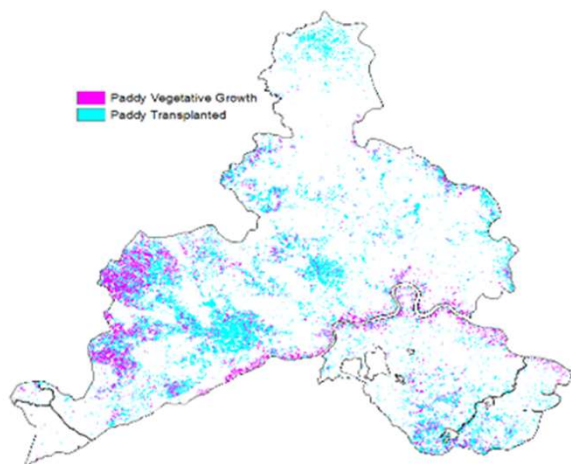
<https://bhoonidhi.nrsc.gov.in/bhoonidhi/index.html>

Sentinel 1 : Composed of a constellation of two satellites, **Sentinel-1A** and **Sentinel-1B**,

- C-Band Synthetic Aperture Radar (SAR) data
- Spatial resolution of down to 5 m and a swath of up to 400 km
- 12-day repeat cycle

Applications of the data collected via the Sentinel-1 mission:

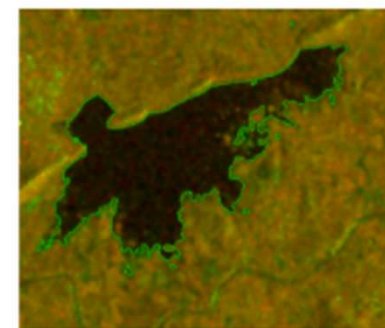
- ✓ sea and land monitoring (ex. Crop map detection, mapping of water spread area)
- ✓ emergency response due to environmental disasters



Detection of crop map



Detection of water spread area



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

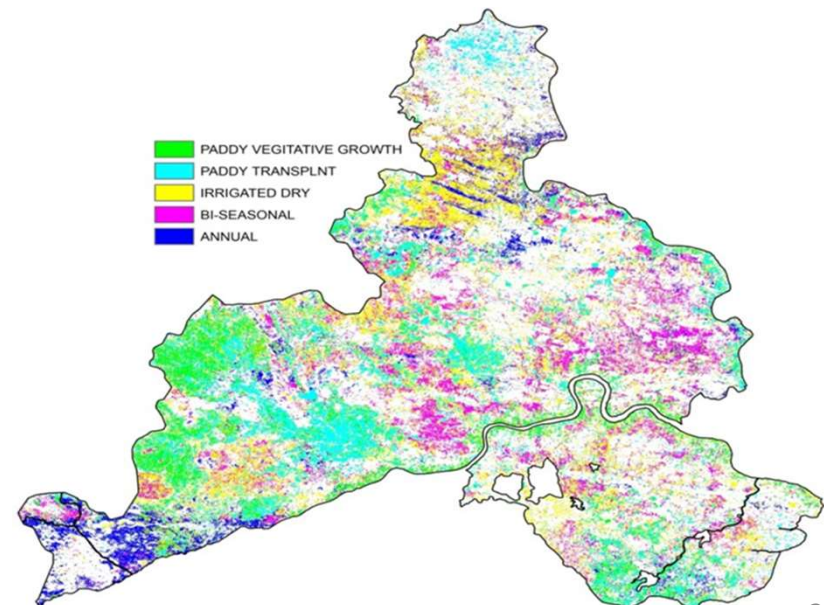
Multi Spectral imager (MSI) with 13 bands in the visible, near infrared (NIR) and short wave infrared (SWIR)

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

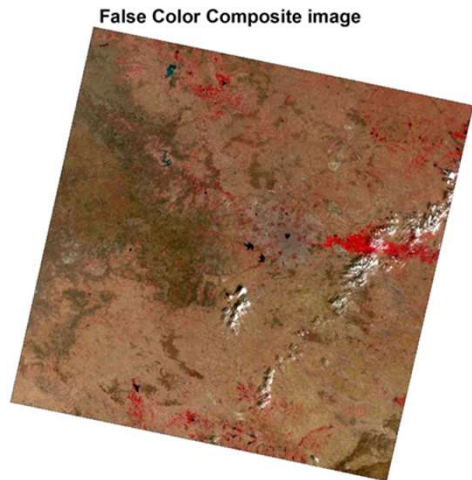
Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS)



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

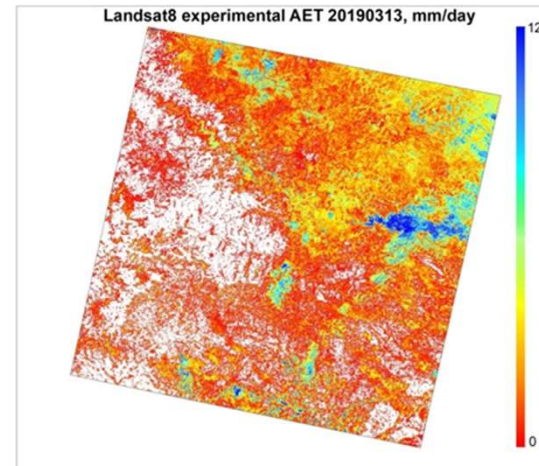
Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) Launched February 11, 2013	Bands	Wavelength (micrometers)	Resolution (meters)
	Band 1 - Coastal aerosol	0.43 - 0.45	30
	Band 2 - Blue	0.45 - 0.51	30
	Band 3 - Green	0.53 - 0.59	30
	Band 4 - Red	0.64 - 0.67	30
	Band 5 - Near Infrared (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

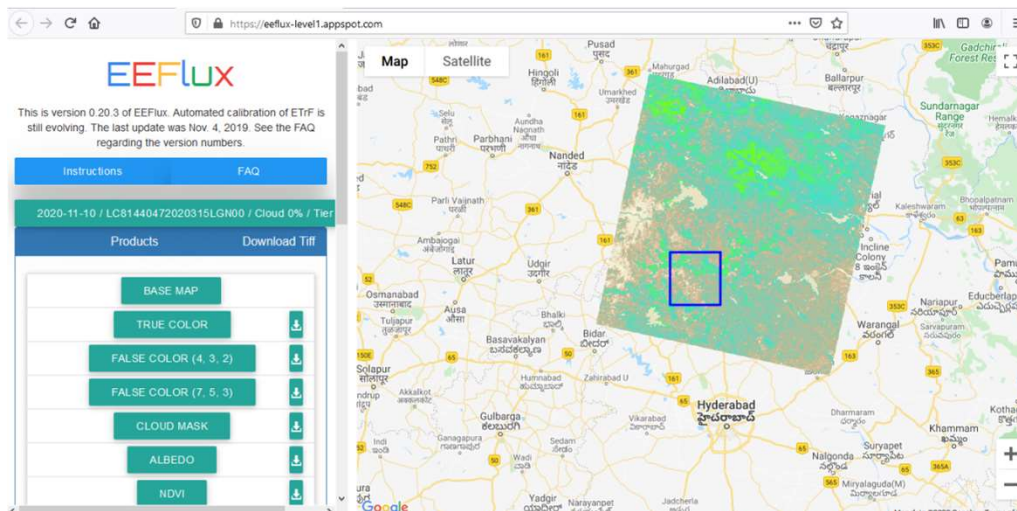


Landsat 8 FCC image for part of Hyderabad

Predicting Water Demand



Landsat 8 based Field level actual evapotranspiration



EEFLUX

This is version 0.20.3 of EEFLUX. Automated calibration of ETrF is still evolving. The last update was Nov. 4, 2019. See the FAQ regarding the version numbers.

Instructions FAQ

2020-11-10 / LC81440472020315LGN00 / Cloud 0% / Tier

Products Download Tiff

- BASE MAP
- TRUE COLOR
- FALSE COLOR (4, 3, 2)
- FALSE COLOR (7, 5, 3)
- CLOUD MASK
- ALBEDO
- NDVI

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

The screenshot displays the Bhoonidhi beta website interface. At the top, there are logos for the Government of India, ISRO, and the National Remote Sensing Center (nrsc). The main header features the text "Bhoonidhi beta" and "ISRO's Open Data Access" alongside a globe icon. Below this, there are navigation links for "Explore", "Archives", and "Utilities". A "Login" modal window is open, containing a graphic of two people and a key, with the word "Login" and a key icon. The modal includes input fields for "Username" and "Password", and buttons for "Login", "New User", and "Forgot Password". To the right of the modal is a satellite map of India with zoom controls (+ and -) and a mouse cursor. The footer of the page lists supported browsers: "Firefox 60+, Chrome 78+, Edge 18+, Opera 64+", and provides links for "About Us", "Help", and "Terms&Conditions".



<https://uops.nrsc.gov.in/ImgeosUops/FinalImgeosUops/OdapUserRegister.html>

The screenshot shows the "User Order Processing System" website. The header includes the ISRO logo and the text "National Remote Sensing Center". The main title "User Order Processing System" is displayed in large yellow letters over an aerial satellite image of a city. Below the title, there is a navigation menu with links for "Home", "Bhoonidhi", "Help", and "Terms and Conditions". A blue banner at the bottom of the page contains the text "User Registration".

12/18/2020

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



**Thank you for kind
attention**

12/18/2020

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