MOSDAC & VEDAS
NEWSLETTER

BRINGING EARTH OBSERVATION DATA AND INSIGHTS CLOSER TO YOU

VOL. 1, NO. 2 | NOV 2026



Director's Message



The MOSDAC and VEDAS geo-portals of ISRO play a significant role in disseminating Earth Observation (EO) data, derived products and value-added services to a wide range of stakeholders, including the scientific community, decision-makers, academic institutions, industry, start-ups and citizens. These portals continue to evolve through the integration of new features, innovative applications and enhanced capabilities, making satellite-based information more accessible and useful.

We are pleased to present this edition of the newsletter, highlighting recent developments, new applications and technological advancements across the MOSDAC and VEDAS portals. We hope this edition will further enhance awareness of these platforms and their growing range of geospatial data, products and services, bringing the benefits of satellite-based observations and analytics closer to users. We welcome your valuable feedback and suggestions to help us further enrich these portals and future editions of the newsletter.

With warm regards,

Dr. CH V Narasimha Rao,
Director, Space Applications Centre, ISRO

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MOSDAC: From Satellite Observations to Weather and Ocean Insights

Meteorological and Oceanographic Satellite Data Archival Centre (MOSDAC) is a Data Centre of Space Applications Centre (SAC) and has facility for satellite data reception, processing, visualization, analysis and dissemination. MOSDAC is operationally supplying earth observation data from Indian meteorology and oceanography satellites, to cater to national and international research requirements.

MOSDAC has recently upgraded its core technological infrastructure to ensure better performance, accessibility, security and user experience across all platforms. Here is what MOSDAC features in this volume:

NEW & REVAMPED

Revamped LIVE Portal

A fully transformed GIS experience for advance immersive data visualization.

Optimum Ship Routing

A new dedicated tool for safe and efficient maritime navigation.

SPOTLIGHTS

MOSDAC Eddy App

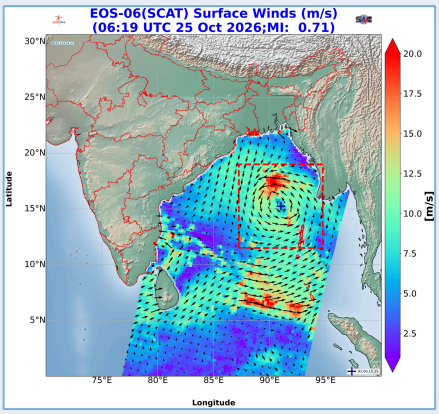
Data Hub for Global Mesoscale Eddies

GSMaP_ISRO

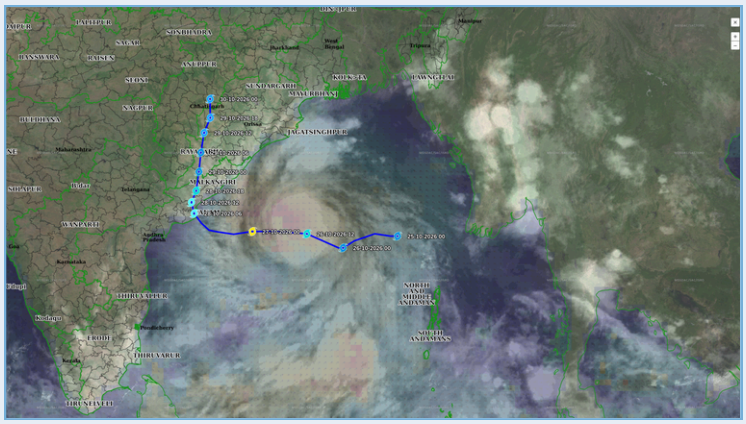
ISRO-JAXA collaboration for high-resolution, precision precipitation mapping.

MOSDAC IN ACTION: SATELLITE BASED NRT TRACKING OF CYCLONE ARNAB

The operational power of MOSDAC's real-time observation capabilities was recently demonstrated during the monitoring of Cyclone ARNAB. By leveraging high-resolution satellite imagery, the platform provided critical insights into the storm's evolution and structure.



Observation of CycloGenesis: Initial organisation of convective cloud systems as captured by EOS-06 Scatterometer (25 Oct 2026, 0619 UTC).



Near Realtime Tracking of Cyclone Arnab using INSAT-3DS TIR1 on MOSDAC at: https://mosdac.gov.in/scorpio

Through the integration of these satellite products, MOSDAC continues to provide the essential data needed for rapid response and disaster mitigation, ensuring that critical intelligence is available when it matters most.

Explore MOSDAC at : https://mosdac.gov.in

VEDAS : Advancing Geospatial Intelligence for Society

Visualisation of Earth Observation Data and Archival System (VEDAS) is ISRO's premier Earth Observation (EO) data visualisation and analytics platform. Developed indigenously at the Space Applications Centre (SAC), it provides powerful geospatial analytical capabilities integrated with GeoAI, powering advanced geospatial applications and important decision support systems for evidence-based governance and planning. Over the years, VEDAS has established vital key applications, including Unified Visualisation and Analysis (UVA), Vegetation & Drought Monitoring, KrishiDSS, Hydrological Applications, Energy Map of India (incollaboration with NITI Aayog), Desertification Dashboard, Renewable Energy Potential Assessments, Sangrahi Field Data Collection Application, Urban Sprawl Information System and customized geospatial portals for Ladakh and Bihar. Expanding on this foundation, VEDAS has introduced four new applications supporting land governance, water resources, and agriculture.

New & Featured Applications on VEDAS

Space Technology Assisted Land Administration (STAL):

Gujarat Revenue Department

STAL brings cadastral records and satellite evidence together into a unified system. It connects parcel boundaries with AI-derived built-up and tree-cover information, helping officers examine land use at village and individual-parcel scales and detect unauthorized activity or changes.

NDVI-Based Irrigation Impact Assessment:

Gujarat State Water Data Centre

This tool evaluates vegetation and cultivation patterns around water recharge projects. It combines project location with multi-year satellite observations and cropping intensity layers to assess irrigation impact over time.

KrishiChat:

Krishi-DSS

KrishiChat is an AI-powered conversational assistant embedded within the Krishi-DSS (Decision Support System) dashboard. It enables researchers, policymakers, and agricultural officers to query complex Earth Observation datasets and insights using natural language dialogues.

Satellite Assisted Inspection of Land Parcels (SAIL):

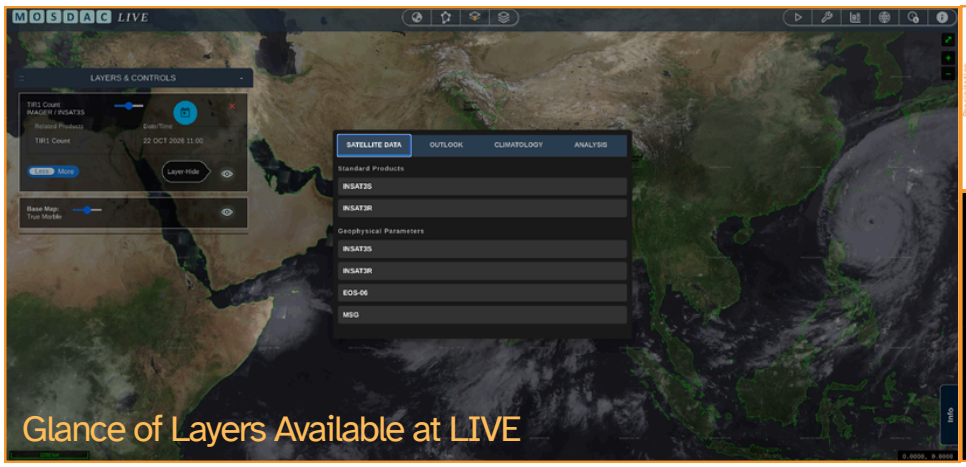
Income Tax Department, Gujarat

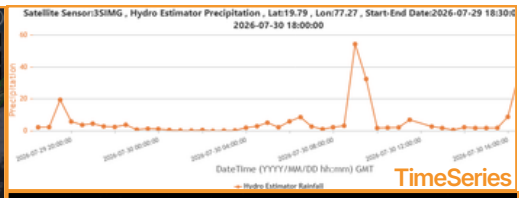
SAIL utilizes Sentinel-2 satellite observations and spatial analytics to assess agricultural land parcels. It tracks seasonal cropping patterns and harvest cycles, automatically generating analytical summary reports with statistical confidence scores for verification of agricultural income.

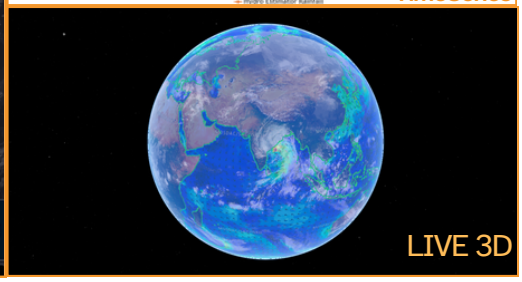
Explore VEDAS at : https://vedas.sac.gov.in

Empowering Earth Observation with MOSDAC LIVE

MOSDAC is pleased to present **LIVE (Let's Interactively Visualize the Earth)**, a user-friendly, responsive, and highly interactive visualization application built on the latest geospatial technologies. Designed to bridge the gap between complex data and scientific insight, LIVE provides a seamless environment for exploring over 150 diverse satellite data layers. The platform specializes in the visualization of multiple Indian Meteorological and Oceanographic satellite products, along with their derived geophysical parameters, spanning across the ocean and atmosphere domains.







Key Platform Capabilities

- 150+ Satellite Data Products
- Simultaneous Multi-layer Visualization
- Layer Opacity & Visibility Controls
- Animations
- 3D Globe Visualization
- Range & Style Controls

Integrated Online Web-Analytics

- Point Probe
- Vertical Profiles & Tephigrams
- Region Growing
- Time Series
- Contour Mapping
- Spatial Analysis

Explore LIVE at: https://mosdac.gov.in/live

VEDAS APPLICATION IN FOCUS

NDVI Based Irrigation Impact Assessment

Satellite evidence for irrigation and water recharge project review

The Irrigation and Water-recharge Project Impact Assessment Tool on VEDAS helps the Gujarat State Water Data Centre examine vegetation and cultivation patterns around water projects. The tool was developed and hosted on VEDAS, with training provided to departmental staff, as recorded in June 2026. It combines project geography, satellite observations and analytical views.

SPATIAL VEGETATION RESPONSE

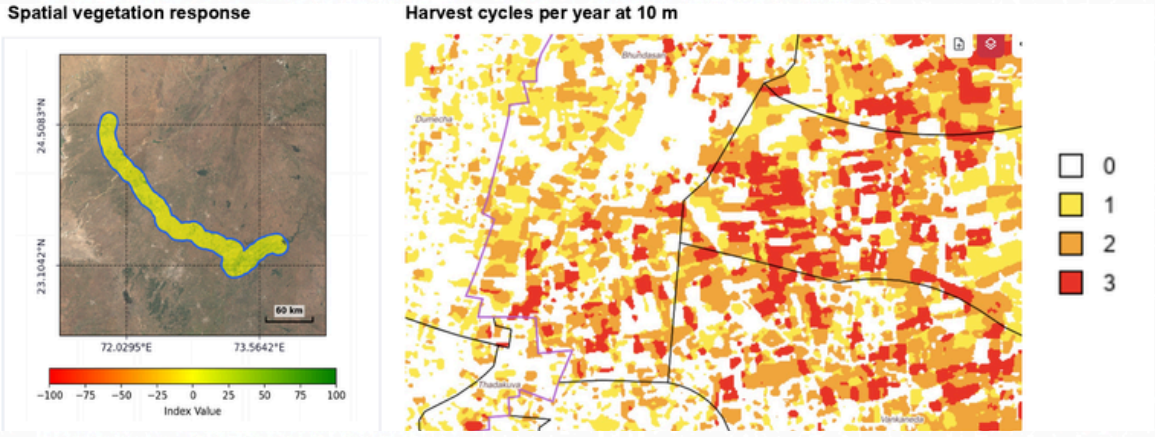
Maps illustrate the spatial pattern of vegetation response within the project influence area.

CROPPING INTENSITY

Shows the number of harvest cycles per year, indicating repeated cultivation across season

NDVI TIME-SERIES TREND

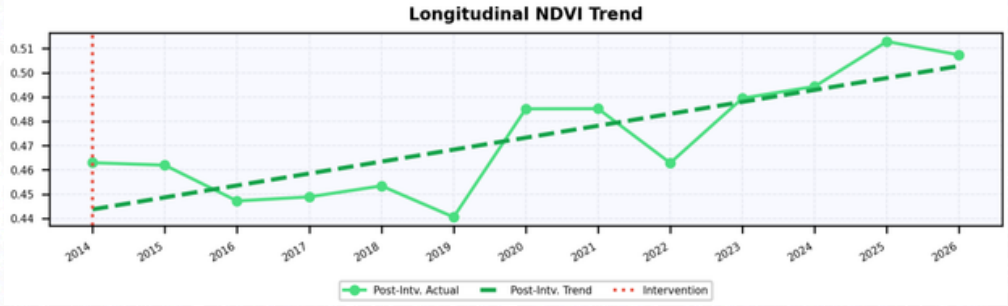
Time-series charts reveal changes in vegetation greenness over successive years.



Canal vegetation response at left and a complementary 10 m harvest–cycle map at right.

The assessment examines vegetation response and cropping intensity across project areas, seasons and years. NDVI, the Normalized Difference Vegetation Index, describes vegetation greenness through time. Spatial response maps show the pattern of vegetation response, while time-series charts reveal changes over successive years.

The Sujalam Sufalam Spreading Canal example illustrates the vegetation assessment within a mapped project influence area. A complementary cropping-intensity layer shows harvest cycles per year at 10 m, adding information on repeated cultivation across seasons. These views help users examine vegetation behaviour alongside cultivation patterns.



Example NDVI trajectory for 2014 to 2026, as presented in the supplied canal assessment.

The longitudinal NDVI chart helps users examine whether a response persists across years and identify locations requiring closer review with project records or field observations.

Vegetation response should be interpreted alongside rainfall, crop choices, project operation and field information. NDVI trends and harvest-cycle maps describe vegetation and cultivation change. Attributing those changes to an irrigation intervention requires supporting project and field evidence.

Explore at https://vedas.sac.gov.in/vta/

Safe Navigation though Optimum Ship Routing

An automated, near-real-time safe ship routing system is developed at ISRO's Meteorological and Oceanographic Satellite Data Archival Centre (MOSDAC) to optimize marine transit by minimizing exposure to hazardous ocean conditions. The system determines the optimal marine tracks between the user-specified source and destination coordinates, providing a critical tool for maritime risk mitigation without requiring vessel-specific parameters.



Under the Hood: How the Tech Works

The routing technique relies on Dijkstra's algorithm applied across a discretized geographical grid. To assign edge weights, the module computes a combined cost function incorporating dynamic ocean state forecasts like significant wave height (SWH) and wind forcing from WAVEWATCH III (with assimilated satellite altimeter data) and ocean currents from the MOM5 circulation model alongside static bathymetry from ETOPO-5. For ocean depths shallower than 400 meters, an added penalty is applied to the cost function so that those locations get avoided.

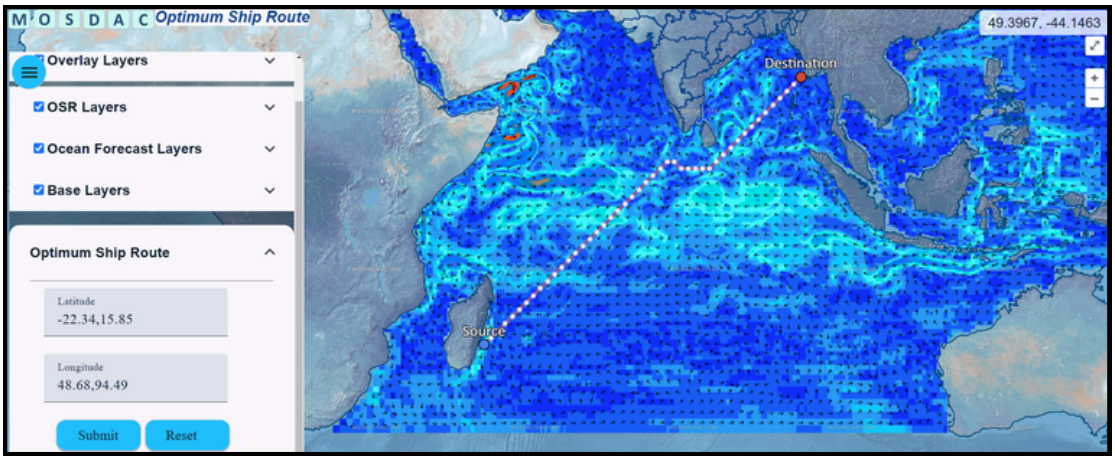
Real-World Validation to Operation

When validated in cyclonic conditions, the system demonstrated its ability to safely bypass high-sea hazard areas while maintaining the most efficient direct route during normal weather.

Getting a safe route is simple: users email their coordinates, and MOSDAC delivers a precise and compressed route coordinates and visual maps un under five minutes. Interactively, user can visit the application on MOSDAC web portal.

Up Next

Future enhancements will take routing a step further by integrating vessel-specific data like speed and fuel consumption, though forecast accuracy remains foundational.



Screenshot of the Optimum Ship Route (OSR) web application displaying a secure navigation path.

Explore OSR at: https://mosdac.gov.in/OSR

Space Technology Assisted Land Administration

STAL for the Gujarat Revenue Department

Space Technology Assisted Land Administration (STAL) brings cadastral records andsatellite evidence together for the Gujarat Revenue Department. Developed through VEDAS at Space Applications Centre, ISRO, the application helps officers examine land use at village and individual-parcel scales. It connects the location and recorded use of a parcel with built-up and tree cover information derived from satellite Imagery.

SATELLITE-EVIDENCE CONTEXT

STAL combines cadastral parcel boundaries with satellite-derived land cover evidence.

BUILT-UP & TREE COVER FROM SATELLITE IMAGERY

Artificial intelligence is used to extract built-up and tree cover information from satellite imagery.

PARCEL STATISTICS AND LAND USE

Linked parcel statistics show recorded land use, built-up area and plot area.



The work began with bulk extraction and GIS restructuring of cadastral datasets. Cadastral, taluka and district boundaries were organised into spatially consistent layers, providing a common geographic framework for analysis. Artificial intelligence was used to extract built-up and tree-cover information from 30 cm imagery.

Viewing these layers with parcel boundaries helps identify locations requiring closer administrative examination. The map is linked to parcel-wise statistics, including survey number, recorded land use, built-up area, built-up percentage and plot area. Officers can examine a location visually and refer to its corresponding statistics during review. This connection between map evidence and land-record attributes supports focused inspection and follow-up.

No	Survey No	Land Use	Built Up (sq.mt)	Built Up (%)	Plot Area (sq.mt)
1	1197	Gauchar	2205	1.7	129532
2	121	Gauchar	55.5	1.3	428
3	1071	Gauchar	0	0	18319
4	7	Gauchar	0	0	595
5	948	Gauchar	0	0	107

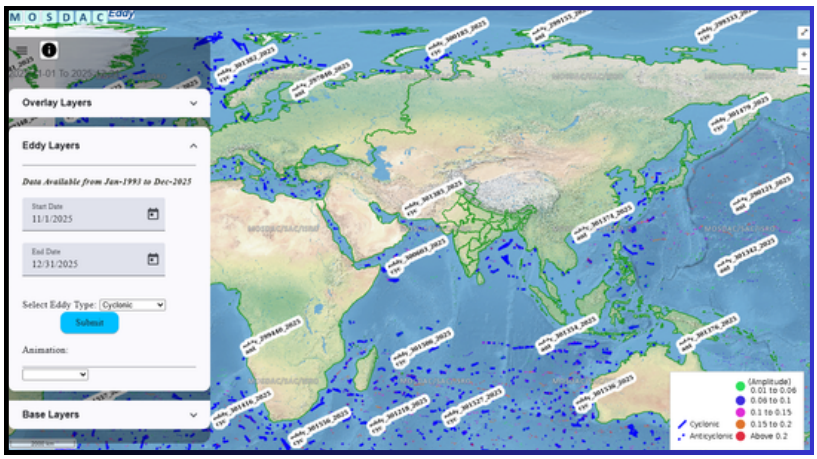
Developed under an MoU with the Gujarat Revenue Department, STAL was launched on 3 October 2025 at the National Conference on Digital Land Record Modernization Program and Disaster Management. Its outputs are integrated through an API with the operational Revenue Officer Diary application, helping revenue officers identify and prioritise ground action.

Repeated Sentinel-2 observations extend the workflow to detection of new built-up areas. Satellite indications support administrative review alongside authoritative land records and ground verification.

Explore STAL at: https://vedas.sac.gov.in/vstatic/gujarat_revenue/index.html

Deciphering Ocean Dynamics via Global Eddy Tracking

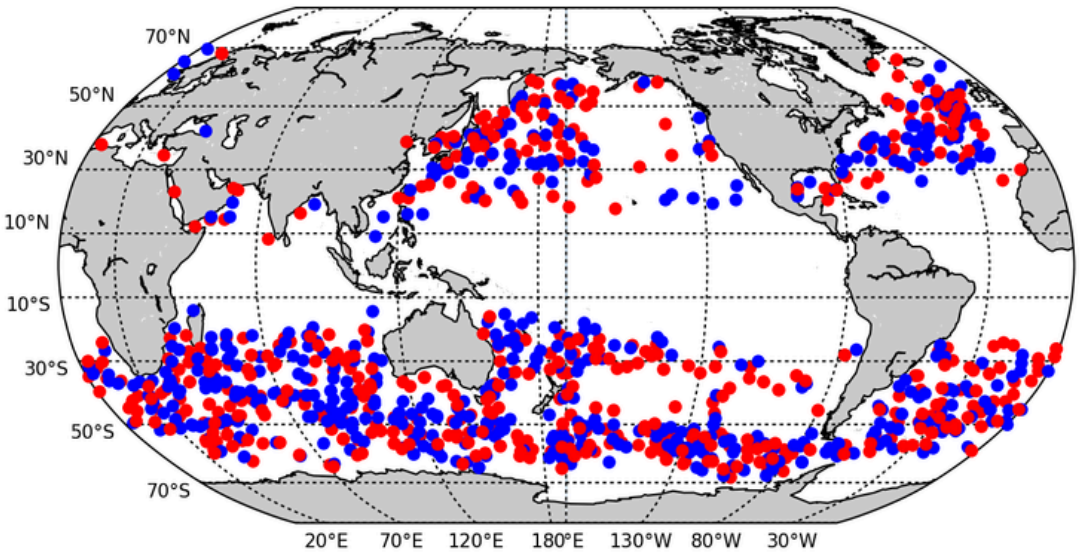
Eddies are the "weather systems" of the ocean—massive, swirling vortices that transport heat, nutrients, and carbon across the globe. To help scientists understand these complex dynamics, MOSDAC provides a comprehensive multi-year archive of Global Ocean Mesoscale Eddy parameter dataset spanning from 1993 to 2025. To ensure the database remains a robust foundation for ongoing oceanographic research, it is systematically updated on an annual basis.



MOSDAC Ocean Eddy

The Science of Tracking the Swirl

The identification of these features relies on a rigorous closed-contour detection approach, integrated with shape criteria and automated tracking algorithms. This methodology allows for the precise identification and analysis of both cold-core (cyclonic) and warm-core (anticyclonic) eddies across their entire lifespans. By effectively filtering long-wavelength signals (50–500 km scale) and evaluating contour amplitude and pixel area constraints, the system accurately computes eddy trajectories and lifecycle dynamics—distinguishing the emergence of new eddies from those undergoing dissipation.



The spatial distribution of the global meso-scale eddies formed in January 2025. The blue and red dots are showing the anti-cyclonic and cyclonic eddies, respectively.

Visualization Platform

To facilitate the exploration of this vast dataset, MOSDAC has deployed a dedicated visualization application - **MOSDAC Eddy App**

Explore Eddies at: https://mosdac.gov.in/eddy

KrishiChat: Deterministic Conversational AI for Drought Monitoring

Monitoring agricultural health requires rapid, ad-hoc access to live Earth Observation (EO) data. Traditional static dashboards lack the flexibility needed for complex spatial querying, while standard conversational AI struggles with the deterministic rigor required for scientific data retrieval. To solve this, VEDAS has deployed KrishiChat directly on the KrishiDSS portal. Built on the in-house IConIQ (Intelligent Conversational Interface for Querying) framework, it provides a natural language gateway to live EO pipelines, ensuring precise data retrieval without sacrificing operational privacy and risk associated with third-party AI Systems.

From Natural Language To Precise Data Retrievel

Because EO data is continuously ingested, static pre-trained models are ineffective for real-time monitoring. Instead, KrishiChat operates on live data through a rigorous, multi-stage deterministic pipeline designed specifically to eliminate LLM hallucinations. It parses natural language into structured logic, dynamically constructs a plan of analytical tools, and executes it directly against backend databases to retrieve exact mathematical values rather than probabilistic text. Engineered with a deep semantic understanding of agro-climatic workflows, the system seamlessly maps natural linguistic variations to exact database variables. This allows users to easily query critical thematic parameters, such as NDVI with or without crop masks, rainfall deviations, and fractional irrigated area, without needing to memorize rigid database syntaxes.

Understanding Spatial and Temporal Context

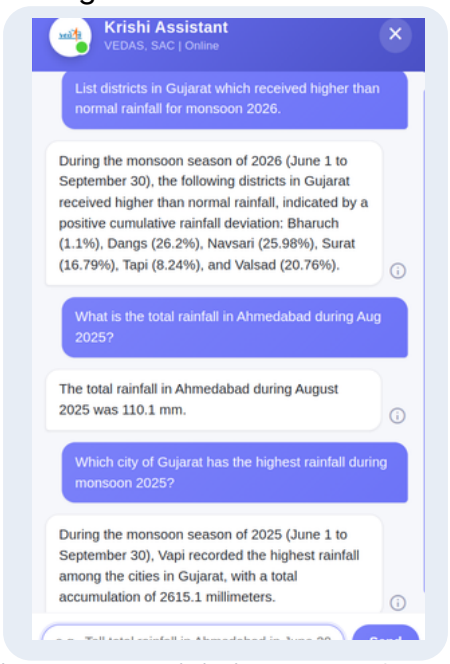
The framework's intelligence extends deeply into complex temporal and spatial dimensions. It effortlessly translates vague, domain-specific bounds such as "Rabi","Kharif" or "Monsoon" seasons into precise, queryable date ranges.

Furthermore, it understands administrative hierarchies from the state down to the taluka level, alongside complex spatial relationships. This enables users to execute advanced comparative queries across neighbouring geo-entities, such as evaluating drought indicators in one taluka against all its adjacent regions in a single conversational prompt.

Secure, On-Premises AI Architecture

For institutional deployments handling sensitive government data, security and latency are paramount. Hosted entirely on-premises at VEDAS, KrishiChat utilizes local LLM inference to guarantee zero data leakage and high-speed execution.

The architecture is built to scale dynamically, gracefully accommodating new high-resolution datasets or satellite parameters as they are ingested into KrishiDSS. Additionally, IConIQ features a plug-and-play design that allows seamless upgrades to newer open-source foundation models. This ensures that the system's reasoning, query planning, and data summarization capabilities will continuously improve, keeping KrishiChat at the cutting edge of geospatial artificial intelligence.



KrishiChat: Deterministic answers for natural language user queries

Explore KrishiChat at: https://vedas.sac.gov.in/vapps/krishi_dss/dashboard/index.html#ai_chat=1

Precision Precipitation Mapping: The GSMaP_ISRO Initiative

The Indian Summer Monsoon is the lifeline of the region's agriculture and water resources. However, capturing the precise spatial and temporal distribution of rainfall—especially intense events in the Himalayas and Western Ghats—remains a significant challenge. While rain gauges provide accuracy, their distribution is often sparse; conversely, satellite products offer coverage but can exhibit regime-dependent biases.

To resolve this, the Space Applications Centre (SAC), ISRO, under the ISRO–JAXA Implementation Arrangement, developed GSMaP_ISRO. This advanced product adjusts the Japan Aerospace Exploration Agency's (JAXA) Global Satellite Mapping of Precipitation Microwave-Infrared (GSMaP_MVK) estimates using IMD and NOAA CPC gridded gauge rainfall, providing high-resolution hourly precipitation estimates at 0.1° × 0.1° over the Indian region.

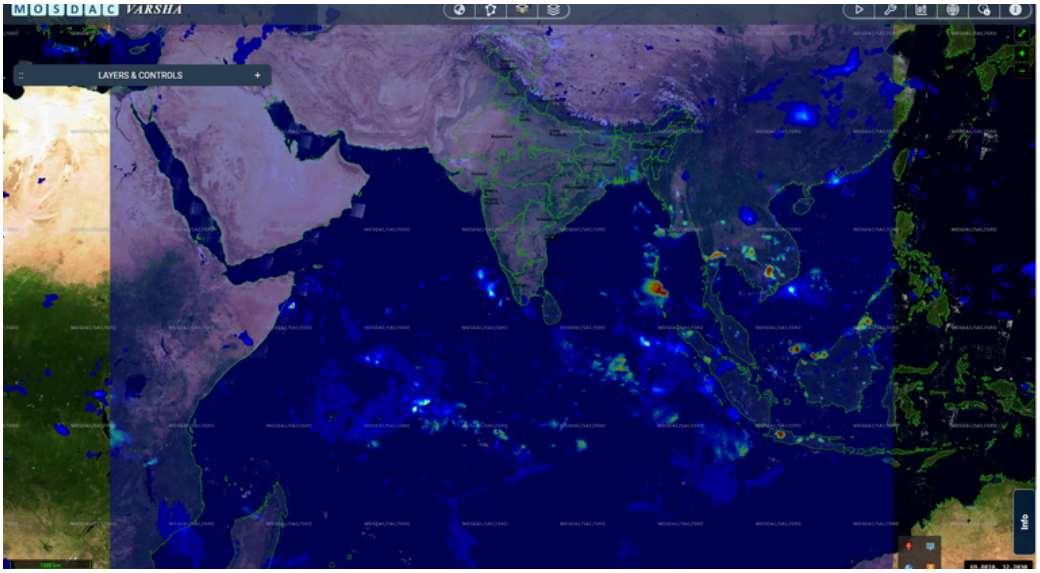


Fig. Snapshot of the VARSHA application on MOSDAC, displaying the rendered 'GSMaP ISRO Rainfall' and 'INSAT Multispectral Rainfall' data layers.

Assimilation Methodology & Results

The product utilizes a sophisticated hybrid assimilation scheme, combining two-dimensional variational analysis (2D-Var) with a Kalman-filter update. Validation studies demonstrate a significant leap in accuracy, reducing the root-mean-square difference (RMSD) from 15.6 to 8.9 mm day^{-1} during the 2018 monsoon. Independent evaluations further confirm that GSMaP_ISRO outperforms other global products, including CHIRPS and IMERG, particularly across India's major river basins. For further details, refer to the article - https://mosdac.gov.in/gsmap-isro-rain

Availability & Scientific Utility

Now openly available through MOSDAC from March 2000 onwards, GSMaP_ISRO serves as a critical resource for hydrological modeling, extreme-rainfall assessment, and the continuous improvement of atmospheric and climate models.

Access Data at: https://mosdac.gov.in/opendata/GSMaP_SAC_RAIN/

Satellite Assisted Inspection of Land Parcels (SAIL)

For Income Tax Department, Gujarat

Powered by Sentinel-2 satellite imagery, this VEDAS application utilises spatial analytics to segment land parcels into distinct clusters, revealing diverse cropping patterns and seasonal agricultural cycles. To facilitate data-driven decision-making, it automatically generates comprehensive analytical reports. These reports feature a concise summary statement backed by an associated statistical confidence score, ensuring users receive precise, reliable, and actionable insights into regional agricultural dynamics.

SPATIAL SEGMENTATION & HARVEST MAPPING

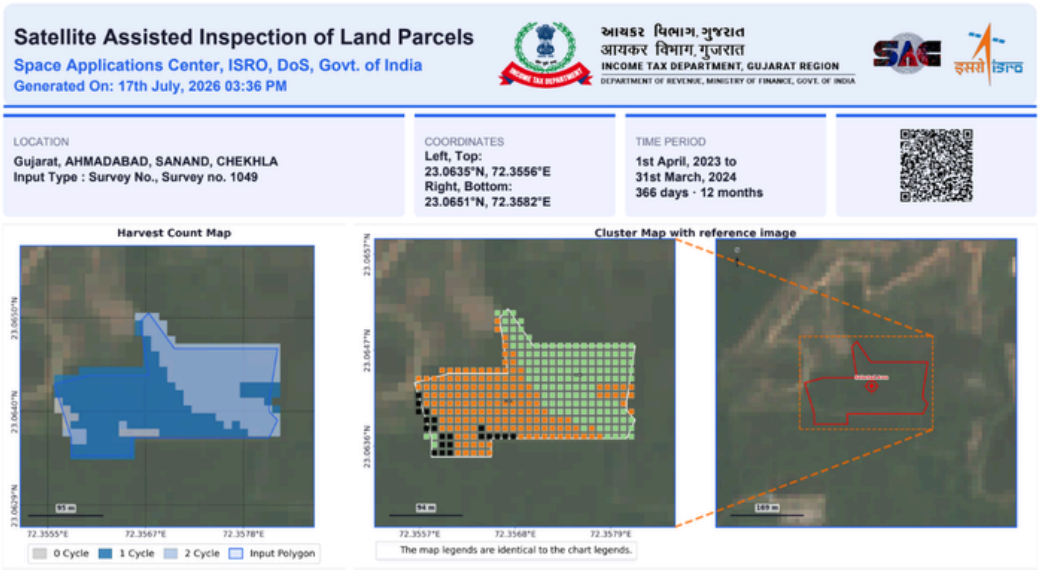
Utilizing Sentinel-2 imagery to map distinct land boundaries and regional zones, paired with color-coded spatial visualizations that detail 0-cycle, 1-cycle, and multi-cycle harvest frequencies within the area of inspection.

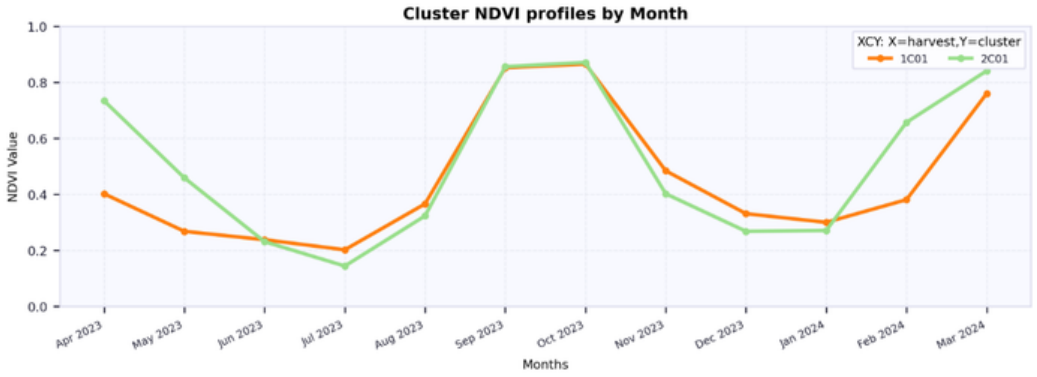
TEMPORAL NDVI TRACKING & SEASONAL TRENDS

Delivering continuous time series of vegetation index to monitor seasonal crop emergence and harvest cycles showcasing dynamic cropping behaviours across clusters.

CLUSTER ANALYSIS & CONFIDENCE SCORING

Presenting a comprehensive breakdown of agricultural activity categorized by specific land area percentages, validated by statistical confidence scores and accompanied by supporting statements to substantiate the analysis





Cluster Analysis

Cluster	Confidence Score	Area (%)	Analysis
1C01	0.85	50.15	Agricultural activity detected (NDVI pattern suggests a seasonal crop; crop failure is also plausible). Emergence signal(s) detected: 1. Drop/harvest-like signal(s) detected: 2. Peak greenness around Oct aligns broadly with kharif/monsoon (Jun Oct) cropping timing.
2C01	0.85	43.43	Agricultural activity detected (NDVI pattern suggests multiple cropping within the year). Emergence signal(s) detected: 2. Drop/harvest-like signal(s) detected: 2. Peak greenness around Oct aligns broadly with kharif/monsoon (Jun Oct) cropping timing.
others	-	6.43	N/A

Developed under a formal Memorandum of Understanding (MoU) with the Income Tax Department Government of India, and scheduled for full operationalisation and field integration by the Income-Tax department from the next financial year

Explore SAIL at https://vedas.sac.gov.in/sail/home

Guidance: Rashmi Sharma (ddepsa@sac.isro.gov.in), Shivani Shah, Pankaj Bodani, Jayaprasad P, Bimal Bhattacharya, Mehul Pandya, Pradeep Thaplilyal, Deepak Putrevu, Rajesh Upadhyaya, Praveen Gupta

Contributors: Pankaj Bodani, Shweta Mishra, Arpit Agarwal, Kishan patel, Vikrant Chauhan, Prashant Kumar, Suchandra Aich Bhowmick, Jishad M, Mohit Gupta

Editorial Team: Shweta Mishra, Mohit Gupta, Kishan Patel

Recent Events, Training & Partnerships



MOSDAC & VEDAS Team at Regional Meet for Space Applications for Gujarat, Daman, Diu and D&N Haveli (Under the National Meet 2.0) on 22 July, 2025



EUMETSAT delegation led by Director General visit at SAC on 3-4 Sep 2026, post ISRO-EUMETSAT International Aggrement.



Indian Air force Officers Visit at MOSDAC and VEDAS facilities at SAC as a part of training on Satellite Data Utilization for Meteorological Applications held during 05-09 October, 2026



JAXA Precipitation Team visit at SAC during 16-17 Sep 2026 for joint science collaboration discussion on satellite based precipitation estimates

Space Applications Centre

Indian Space Research Organisation (ISRO)

Ahmedabad, 380015