



सत्यमेव जयते  
Ministry of Earth Sciences  
Govt. of India



# Mausam SANKALP

Systematic Agrometeorological Analytics,  
Knowledge and Advisory enabling Platform



A Decision Support System for Climate-Resilient Agriculture

India Meteorological Department





# Mausam SANKALP

*Systematic Agrometeorological aNalytics,  
Knowledge and Advisory enabLing Platform*

**AGROMET ADVISORY SERVICES DIVISION**  
**India Meteorological Department | Ministry of Earth Sciences**  
**Government of India, Mausam Bhawan, Lodhi Road,**  
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### FOREWORD

Delivering climate services for agriculture at a national scale requires strong institutional frameworks, sustained cross-sectoral coordination, and the ability to translate scientific capability into reliable public services. The experiences presented in this compendium “Voices from the Field” reflect the steady evolution of India’s agrometeorological service from a forecast-centric approach to an integrated, decision-support framework.

Under the Gramin Krishi Mausam Sewa (GKMS), the Ministry of Earth Sciences, through the India Meteorological Department, has focused on building durable institutional linkages that enable weather and climate information to flow seamlessly into agricultural planning and extension systems. The role of Agrometeorological Field Units (AMFUs) extends well beyond advisory preparation to include coordination with ICAR institutions, IITs, NGOs, localization of advisory content, and systematic feedback collection. The success stories documented in this volume demonstrate how such an institutionalized approach has improved consistency, credibility, and operational uptake of agrometeorological services across diverse Agro-climatic regions of the country.

Within the framework of Mission Mausam, the Ministry of Earth Sciences is strengthening institutional convergence, standardized workflows, and interoperable platforms to ensure that weather and climate services are delivered in a coordinated, scalable, and sector-responsive manner. This mission-driven approach is enabling agrometeorological services to move from isolated interventions to system-level solutions.

As India advances towards becoming a climate-smart and weather-ready nation, the lessons emerging from AMFU operations assume particular significance. They underscore the importance of governance, coordination, and service design in converting scientific advances into measurable outcomes. This compendium therefore serves not only as a record of field-level success, but also as a guide for future policy formulation, programme design, and operational strategies aimed at strengthening climate-resilient agricultural systems in India.

I congratulate the scientists and experts involved in the preparation of this report and express my deep appreciation to them for their valuable contributions.

(M. Ravichandran)



# डॉ. मृत्युंजय महापात्र

मौसम विज्ञान विभाग के महानिदेशक,  
विश्व मौसम विज्ञान संगठन में भारत के स्थाई प्रतिनिधि  
विश्व मौसम विज्ञान संगठन के तीसरे उपाध्यक्ष

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Third Vice President of WMO

भारत सरकार  
पृथ्वी विज्ञान मंत्रालय  
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## PREFACE

The India Meteorological Department (IMD) has been at the forefront of delivering science-based agrometeorological support to Indian agriculture through its nationwide operational framework. Effective agrometeorological services depend on the ability to convert advances in atmospheric science into reliable, timely, and locally actionable guidance. Agrometeorological advisories have steadily evolved since their inception from forecast dissemination to integrated, impact-oriented decision support. The success stories presented in this compendium are a direct outcome of that evolution.

Under Mission Mausam, IMD is consolidating advances in observations, numerical weather prediction, impact-based forecasting, and digital dissemination to strengthen end-to-end service delivery. The mission provides a structured pathway to improve forecast skill and translate improved skill into actionable agrometeorological advisories. IMD has significantly enhanced forecast quality and service delivery through various initiatives including the implementation of Bharat Forecast System, expansion of high-resolution numerical weather prediction, and a transition towards impact-based forecasting. Initiatives such as Panchayat Mausam Sewa, integration of advisories with Ministry of Panchayati Raj portals, Ministry of Rural Development services, State Government digital portals, and the creation of Panchayat-level WhatsApp dissemination networks have multi fold improvement in the last-mile delivery.

These efforts are laying a strong foundation for scalable agrometeorological advisories. Notably, this approach is now being extended beyond crops to support emerging sectoral services for poultry, livestock, and fisheries, reflecting a broader and more inclusive climate services framework.

The experiences documented in this volume demonstrate how this science-service interface has improved the relevance, consistency, and usability of agrometeorological advisories across regions. As IMD advances under Mission Mausam towards digital, and impact-oriented climate services, the lessons emerging from Agrometeorological Field Units (AMFUs) operations highlight the importance of strong science operation linkages, standardization, and feedback-driven refinement. This compendium therefore serves as a practical reference for strengthening forecast utilization and service design in support of climate-resilient and sustainable agriculture in India.

I extend my heartiest congratulations and appreciation to the scientists and experts involved in the preparation of this report.

(M. Mohapatra)

## ACKNOWLEDGEMENT

The development and operationalization of the *Systematic Agrometeorological aNalytics, Knowledge and Advisory enabLing Platform (Mausam SANKALP)* represents a significant step forward in strengthening India's agrometeorological advisory framework. This initiative has been made possible through the collective vision, leadership, and dedicated efforts of several individuals and institutions committed to advancing climate-resilient agriculture in the country.

We express our sincere gratitude to the Hon'ble Minister, Dr. Jitender Singh, Ministry of Earth Sciences, for his visionary leadership in advancing weather and climate based services for agriculture. We are deeply grateful to Dr. M. Ravichandran, Secretary, Ministry of Earth Sciences, for his strategic guidance and unwavering support in promoting impact-oriented climate services for agriculture. We also thank Dr. M. Mohapatra, Director General of Meteorology, for his continued encouragement and technical direction in strengthening Agrometeorological Advisory Services.

Agrometeorological Advisory Services Division (AASD) acknowledges the valuable contributions of scientists, software developers, domain experts, and project teams within IMD who worked tirelessly on the conceptualization, design, development, and deployment of the platform. We are equally grateful to our partners from State Agricultural Universities, IITs, AMFUs, and allied institutions, for their field-level insights.

Mausam SANKALP embodies our shared commitment to delivering timely, consistent, and actionable agrometeorological advisories that empower farmers to manage climate risks more effectively. We are confident that this platform will continue to strengthen India's climate services for agriculture and contribute meaningfully to resilient, sustainable, and productive farming systems.

**(D. S. Pai)**

## **Executive Summary**

Agriculture in India is increasingly exposed to heightened climate variability and a rising frequency of extreme weather events. These changes pose significant risks to crop productivity, farm incomes, and national food security. Agrometeorological advisory services have played an important role in supporting farmers by translating weather information into farm-level guidance. However, the growing complexity of climate risks now requires a more advanced, analytical, and decision-oriented approach to advisory generation.

The Systematic Agromet Analytics, Knowledge and Advisory enabLING Platform (Mausam SANKALP) has been conceptualized and developed to strengthen the scientific foundation, consistency, and actionability of Agromet advisories across the country. The system represents a shift from descriptive dissemination of weather information to crop-centric, risk-informed decision support.

Mausam SANKALP integrates historical insights, real-time observations, and forecast information within a structured analytical framework that aligns weather conditions with crop stages and their thresholds. This enables a clearer understanding of how current and anticipated weather conditions influence crop growth, stress development, and management decisions.

The platform is designed to support forecasters, agrometeorological experts, extension agencies, and other field officers in agriculture by providing objective, parameter-wise analyses, visual interpretation and crop and stage specific insights. Rather than replacing expert judgement, Mausam SANKALP enhances it by offering a robust analytical backbone that improves advisory timeliness, relevance, and consistency across regions. With its operational focus, scalability, and alignment with national priorities on climate resilience and digital transformation, Mausam SANKALP marks a significant milestone in the evolution of India's agrometeorological services.

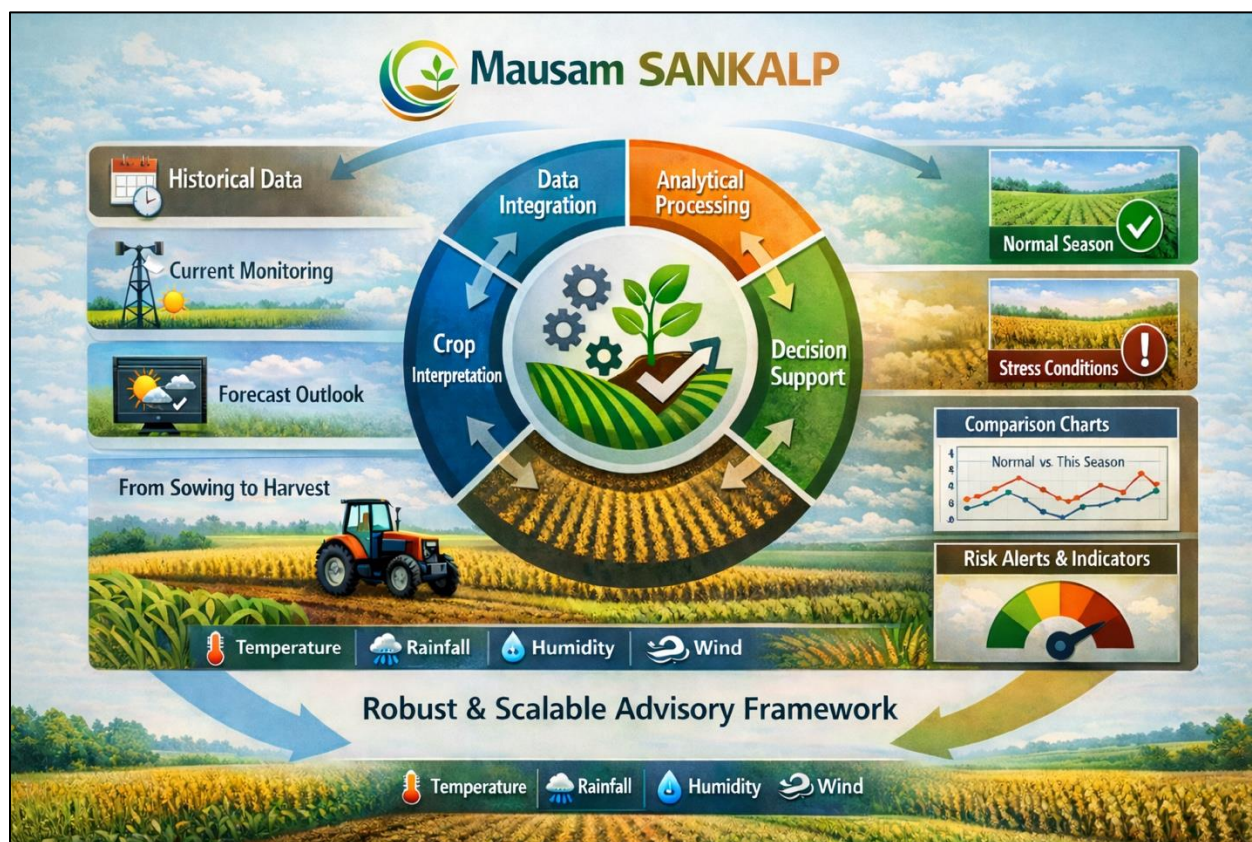
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# MAUSAM SANKALP: A DECISION SUPPORT SYSTEM FOR CLIMATE RESILIENT AGRICULTURE

## 1. MAUSAM SANKALP: A CONCEPT

Mausam SANKALP is built on a structured framework comprising data integration, analytical processing, crop-centric interpretation, and decision support. Weather parameters are analyzed in relation to operational requirement from sowing to harvest. The system integrates historical weather context, current season monitoring, and forecast outlooks to track evolving crop-weather interactions. This multi-temporal perspective allows users to assess whether the ongoing season is progressing within normal limits or deviating towards stress conditions. Standardized visual indicators and comparative plots support better interpretation and operational use. The framework emphasizes robustness and scalability to ensure sustained use in routine advisory services.



*Fig.1: Conceptual Framework of Mausam SANKALP*

Crop-stage-specific thresholds and weather triggers are embedded to translate complex analytics into actionable insights for field-level decision-making. Spatial and temporal comparisons enable identification of emerging risks, persistence of stress, and recovery signals across districts and Agro-climatic zones. This framework supports interoperability with existing agrometeorological advisory workflows, enabling smooth integration into operational services. By bridging data, diagnostics, and decisions, the system strengthens anticipatory planning and climate-resilient agricultural management.

## **2. MAUSAM SANKALP: OVERVIEW**

The Mausam SANKALP dashboard is designed as a comprehensive, one-stop analytical platform that brings together all critical weather and climate information required for agrometeorological advisory generation.

The Mausam SANKALP is a web-based, integrated platform consisting of:

- A user-centric front-end interface.
- A suite of dynamic, automated analytics and visualization tools.

### **2.1. Key Weather Parameters Integrated**

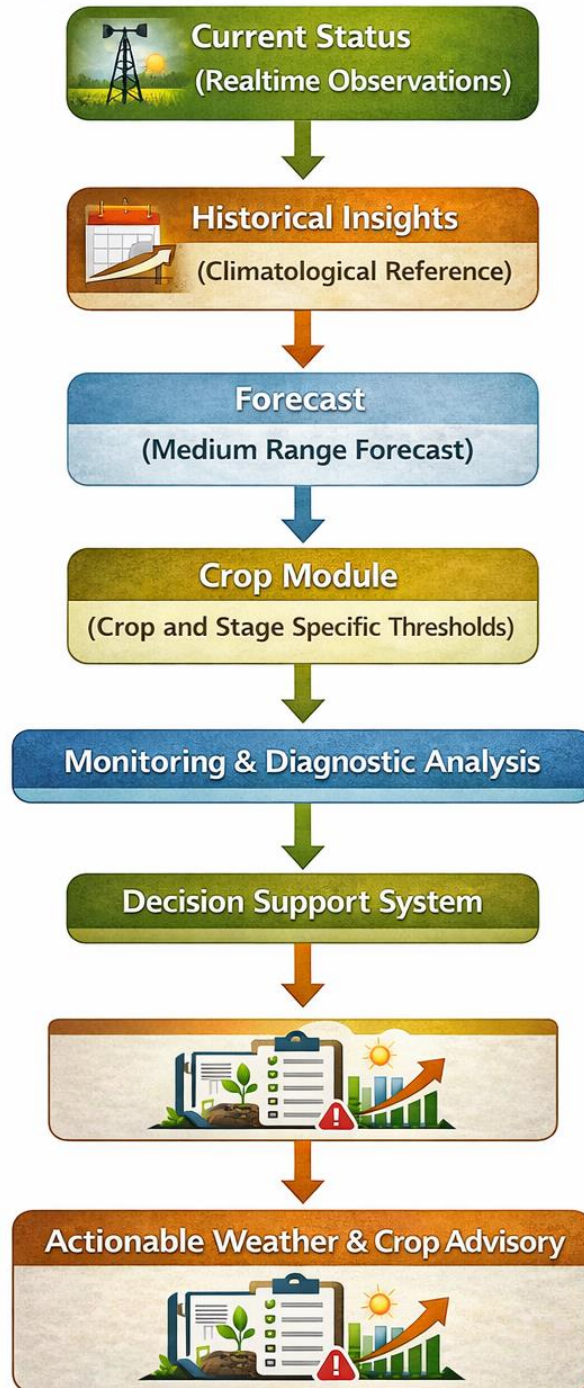
This platform provides access to past, present, and forecast datasets at block-level granularity, ensuring that advisories are grounded in local agro-climatic realities. It incorporates agriculturally relevant weather parameters, including:

- Rainfall
- Maximum temperature (Tmax)
- Minimum temperature (Tmin)
- Maximum relative humidity (RHmax)
- Minimum relative humidity (RHmin)
- Wind speed

These parameters are analyzed and interpreted through multiple temporal lenses to support strategic, tactical, and operational decision-making.



# Mausam SANKALP



*Fig.2: Architecture of Mausam SANKALP Platform*

### 3. DETAILS OF THE DATASETS UTILIZED IN MAUSAM SANKALP

#### 3.1. Historical Weather Datasets

Weather parameters	Unit	Data Source	Resolution
Rainfall	mm	Daily gridded rainfall data of India Meteorological Department (IMD)	$0.25^\circ \times 0.25^\circ$
Temperature Maximum (TMax)	°C	Daily gridded maximum & minimum temperature data of India Meteorological Department (IMD).	$0.5^\circ \times 0.5^\circ$
Temperature Minimum (TMin)			
Relative Humidity Maximum (RHmax)	%	Daily gridded data from AgERA5 agrometeorological dataset, tailored for agriculture based on hourly ERA5 (the fifth-generation global atmospheric reanalysis produced by ECMWF) reanalysis data from the European Centre for Medium-Range Weather Forecasts (ECMWF). AgERA5 aggregates hourly ERA5 data to daily values.	$0.1^\circ \times 0.1^\circ$
Relative Humidity Minimum (RHmin)			
Wind Speed	Kmph	Wind speed data obtained from the ERA5 reanalysis (the fifth-generation global atmospheric reanalysis produced by ECMWF), which are downscaled and tuned using the high-resolution ECMWF operational model (HRES) within the AgERA5 framework.	$0.1^\circ \times 0.1^\circ$

All datasets were spatially mapped to the administrative level of “blocks” to ensure consistency in analysis and interpretation. For each centroid of the block, nearest grid point was identified to the native spatial resolution of the dataset. The values from these nearest grid points were extracted to represent the respective blocks. This approach preserves the original data characteristics while enabling uniform block-level assessments. It ensures spatial coherence across multi-source datasets used in the analysis.

#### 3.2. Near Realtime Observations

Current year datasets for all the weather parameters are sourced from IMD observation network through the current weather API [[https://mausam.imd.gov.in/api/current\\_wx\\_api.php](https://mausam.imd.gov.in/api/current_wx_api.php)] and mapped to each block.

### 3.3. Forecast Datasets

Forecast Type	Forecast Lead Time	Weather Parameters	Data Source (IMD)	Spatial Resolution	Update Frequency
Nowcast	0–6 hours	Rainfall, Thunderstorm, Lightning, Wind Gusts	IMD Nowcasting System and surface observations	District Level	Every 3 hours
Short-Range Forecast (SRF)	1–3 days	Rainfall, Temperature, Relative Humidity and Wind Speed	IMD operational Numerical Weather Prediction (NWP) models - Mausam gram	~12 km × 12 km	Daily
Medium-Range Forecast (MRF)	3 – 7 days	Rainfall, Maximum & Minimum Temperature, Relative Humidity and Wind Speed	IMD Medium Range Forecast System (multi-model ensemble based)	~12 km × 12 km	Daily

### 3.4. Crop Weather Calendars and Thresholds

Crop specific thresholds are sourced from the crop weather calendars for major crops from the nationwide network of 130 Agrometeorological Field Units (AMFUs) operating under the Gramin Krishi Mausam Sewa (GKMS) programme. These calendars encapsulate region, crop and stage specific information on sowing windows, phenological stages, and critical weather thresholds, developed through long-term field experiments. The AMFU derived crop weather calendars ensure that agrometeorological advisories are scientifically grounded, location specific, and operationally relevant. By integrating these calendars with real-time observations and forecasts, the system enables stage-wise risk assessment and targeted advisory generation for farmers across diverse Agro-ecological regions of India.

#### 4. MODULES OF MAUSAM SANKALP

The Mausam SANKALP is organized into a set of interlinked analytical modules that together provide a seamless continuum from climate understanding to operational decision-making. These modules translate complex weather data across time scales into intuitive insights, ensuring relevance for both monitoring and planning purposes. By integrating historical context, real-time status, forecasts, and crop-specific intelligence as specific modules, the system supports informed, timely, and actionable agricultural decisions.

- **Historical Insights Module**

Provides annual, seasonal, monthly, and weekly statistics and analyses for all parameters, enabling users to understand climatological behaviour and variability.

- **Current Status Module**

Provides current-year observations along with anomalies from long-term normal, effectively informing users about the prevailing weather status and emerging deviations.

- **Forecast Module**

Integrates nowcast, short-range, and medium-range forecasts, ensuring continuity from real-time monitoring to anticipatory planning. This provides a seamless forecast information across time scales from hours to up to 10 days, supporting better decision making.

- **Crop Module**

A key advancement is the crop module, which is built around crop weather calendars containing crop-wise and growth stage-specific thresholds. These thresholds are dynamically evaluated against current-year observations, current-week conditions, and medium-range forecasts, enabling stage-specific interpretations that are highly relevant, timely and actionable.

Through this integrated and automated framework, the Mausam SANKALP transforms weather and climate data into operational intelligence, supporting informed decisions across crop planning, risk management, and climate-resilient agricultural practices.




## Mausam SANKALP

### Systematic Agrometeorological aNalytics, Knowledge and Advisory EnabLing Platform.

Agromet-Advisory Services Division  
India Meteorological Department | Ministry of Earth Sciences, Govt of India






### Secure Login

Access your Agromet Dashboard

Username

Password



The Honorable Prime Minister of India in the inaugural function of the 150<sup>th</sup> foundation day of IMD. Left to Right: Dr. Jitendra Singh Hon. Minister of Earth Sciences, Shri Narendra Modi Hon. Prime Minister of India, Prof. Celeste Saulo, Secretary General, WMO



#### Latest Updates & News

- Seasonal Rainfall Forecast for January to March 2026
- Statement on the Climate of India During 2025
- Long Range Forecast of Rainfall during Post-Monsoon Season 2025
- Farmer Registration (Hindi, English & Other Languages)
- Feedback for Agromet Advisory Services
- Damini - Lightning Alert System
- Standard Operating Procedure for AAS Bulletins



#### Success Stories

**AMFU, Lamphelat: Right Forecast, Right Harvest: Saving Kharif Rice from Post-Harvest Losses**



"Right Forecast, Right Harvest: Saving Kharif Rice from Post-Harvest Losses Agromet advisories provided timely alerts on late-October rainfall, coinciding with the maturity stage of Kharif rice. Acting on this forecast, farmers strategically delayed harvesting, preventing grain damage and minimizing post-harvest losses. Harvest timing is a critical decision that directly determines grain quality, market value, and storage safety. By aligning harvest operations with reliable weather advisories, farmers were able to harvest at the right window safe, dry, and intact effectively safeguarding their produce and income. Very accurate rainfall predictions helped save my crops!"

**Farmer: Pashel Lining Village: Modi, District: Chandel, Manipur**

**AMFU, Ananthapuram: Dry-Spell Forecasts Trigger Proactive Farmer Action in Groundnut**



Timely weather-based advisories issued during July dry-spell conditions, coinciding with the critical flowering stage of groundnut, enabled farmers to take proactive, life-saving irrigation measures to mitigate moisture stress. In addition, spraying operations were precisely aligned with dry weather windows, minimizing spray wash-off and ensuring higher efficacy. This strategic timing led to significant savings in chemical inputs and labour costs. This highlights how actionable agrometeorological advisories can effectively convert weather risks into tangible economic gains for farmers.

*Fig.3: Front page of Mausam SANKALP website displaying updates from IMD and Farmers Success stories*

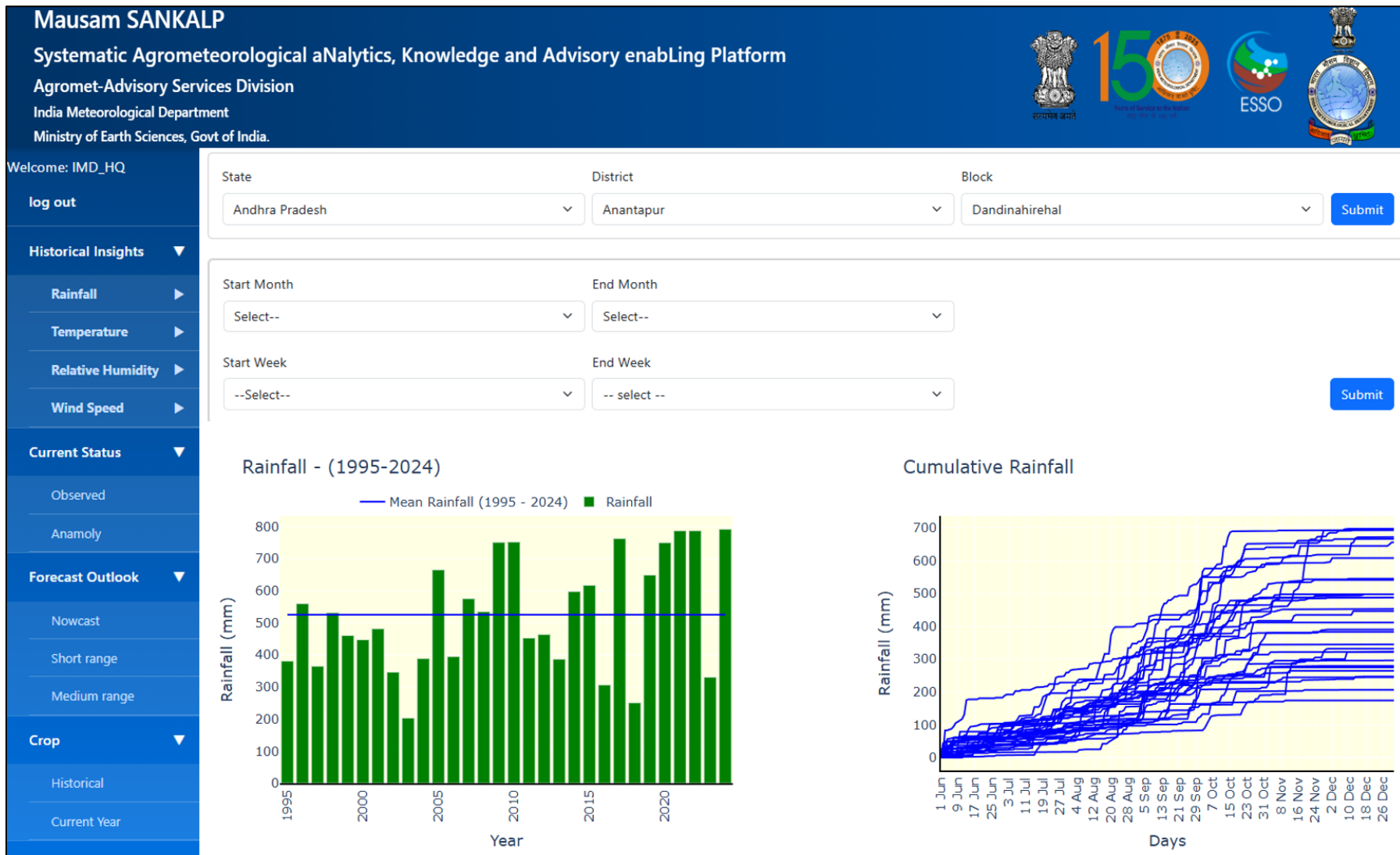


Fig.4: Visualization Interface of Mausam SANKALP

## 5. OPERATIONAL DECISION SUPPORT USE CASES

This tool transforms raw weather data into actionable advisories by interpreting historical and real-time climate signals in the context farm-level decision-making. Each analytics and visualization support a distinct advisory function, moving beyond “what the weather was” to “what it means for the crop.” This section details about some of the operational use cases from Historical Insights, Current status, Forecast and Crop modules.

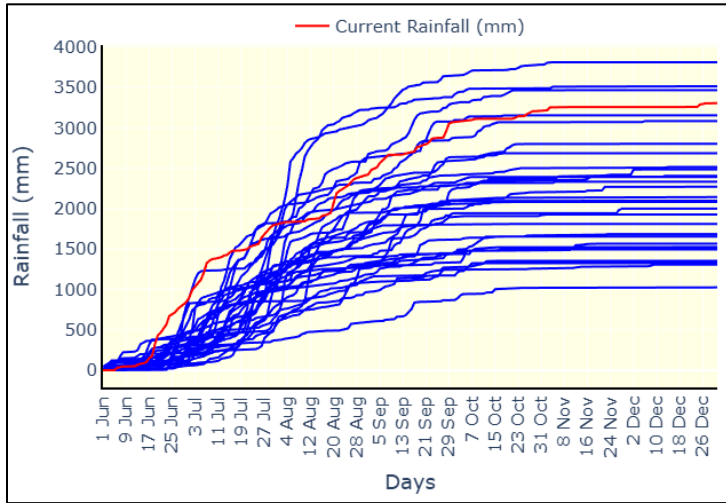
### 5.1. CURRENT STATUS MONITORING

The current status module provides a near real-time ground observation data of all the parameters and anomaly of ongoing rainfall and temperature conditions against historical patterns. By integrating cumulative rainfall progression and daily temperature (Tmax and Tmin) anomalies, the module enables rapid assessment of seasonal behaviour, early detection of weather extremes, and timely agrometeorological decision-making.

**Decision Support:** This module reveals interannual variability in rainy season onset, duration, and intensity through cumulative rainfall curves (1995–2024) along with current year status, while also contextualizing current-year temperature behaviour within historical TMax and TMin ranges. It allows identification of delayed or early monsoon onset, mid-season dry spells, abnormal rainfall accumulation, and emerging heat or cold stress conditions that can affect crop growth, water availability, and phenological stages.

**Operational Application:** The visualizations support experts in:

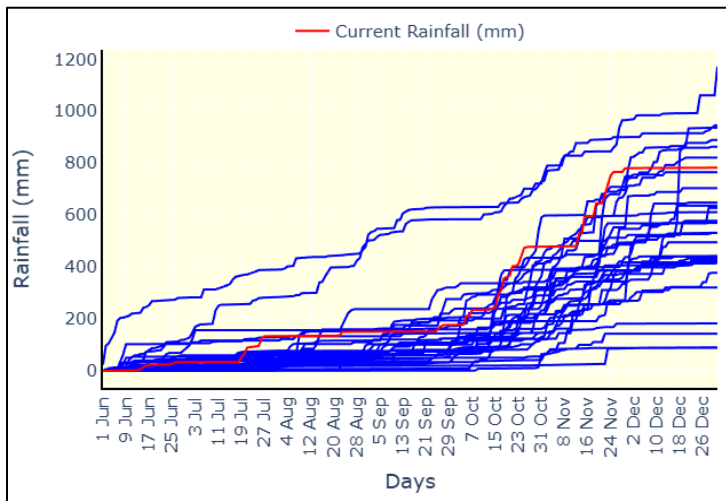
- Tracking rainy season onset, duration, and withdrawal phases.
- Identifying mid-season dry spells and late-season rainfall events.
- Comparing current-year rainfall accumulation with historical seasons.
- Detecting temperature anomalies relative to normal seasonal progression.
- Issuing early warnings for heat waves, cold spells, or moisture stress.



**Fig.5: Rainfall progression in “Trimbakeshwar” block, Nashik district, Maharashtra**

In this graph, daily rainfall values are cumulated from June to December. Each blue line in this graph represents progression of seasonal rainfall for the years from 1995 to 2024 for **Trimbakeshwar block** along with current season rainfall as a red line (2025).

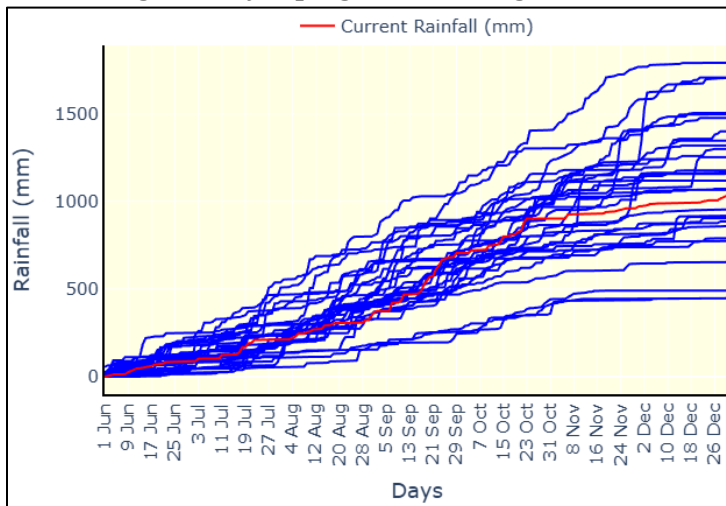
This graph clearly elucidates the **unimodal rainfall pattern** of this block. This block receives major rainfall during the **Southwest Monsoon (SWM)**.



**Fig.6: Rainfall progression in “Agastheeswaram” block, Kanyakumari district, Tamilnadu**

In this graph, daily rainfall values are cumulated from June to December. Each blue line in this graph represents progression of seasonal rainfall for the years from 1995 to 2024 for **Agastheeswaram block** along with current season rainfall as a red line (2025).

This graph clearly elucidates the **unimodal rainfall pattern** of this block. This block receives major rainfall during the **Northeast Monsoon (NEM)** season.



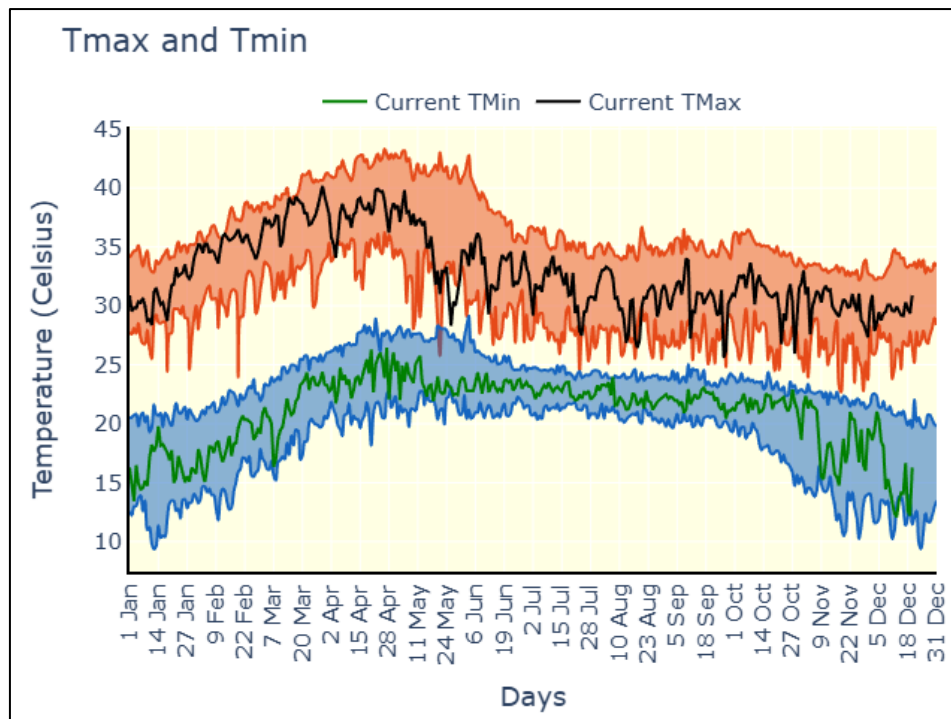
**Fig.7: Rainfall progression in “Mettur” block, Salem district, Tamilnadu**

In this graph, daily rainfall values are cumulated from June to December. Each blue line in this graph represents progression of seasonal rainfall for the years from 1995 to 2024 for **Mettur block** along with current season rainfall as a red line (2025).

This graph clearly elucidates the **Bimodal rainfall pattern** of this block. This block receives rainfall during both the **SWM and NEM** seasons.

### Agricultural Impact:

- Timely detection of rainfall onset and temperature suitability for better sowing and crop planning
- Proactive advisories mitigate damage from extreme weather and reduced crop losses.
- Judicial use of water through Irrigation scheduling in alignment with rainfall and temperature anomalies.



**Fig.8: Current year temperature along with historical ranges for the “Dandinahirehal” block, Anantapur district, Andhra Pradesh**

This graph presents the day-wise climatological maximum, minimum and average of maximum temperature (Tmax) and minimum temperature (Tmin) along with the current year’s conditions. The shaded bands represent the typical historical range and average values for Tmax (upper, red band) and Tmin (lower, blue band), while the black line indicates the current year’s Tmax and the green line shows the current year’s Tmin. Deviations of the current-year lines from the climatological envelope highlight periods of unusual heat or cold.)

- This visualization is extremely useful for identifying heat stress periods for crops.
- Planning sowing and harvesting windows, and issuing heat/cold advisories to farmers.

## 5.2. HISTORICAL INSIGHTS

This tab provides structured historical insights for key weather parameters such as rainfall and temperature, relative humidity and wind speed through dedicated analytical tabs. This rainfall module includes tabs such as rainfall quantum, intensity and extremes, dry/wet spell. The temperature and other parameters have a climatology and threshold exceedance analysis tabs. Each tab is designed to support operational decisions. The visual analytics enable users to quickly interpret long-term patterns and extremes at a block level. This ensures evidence-based agricultural planning using reliable agrometeorological information. A few representative operational decision support use cases were provided here.

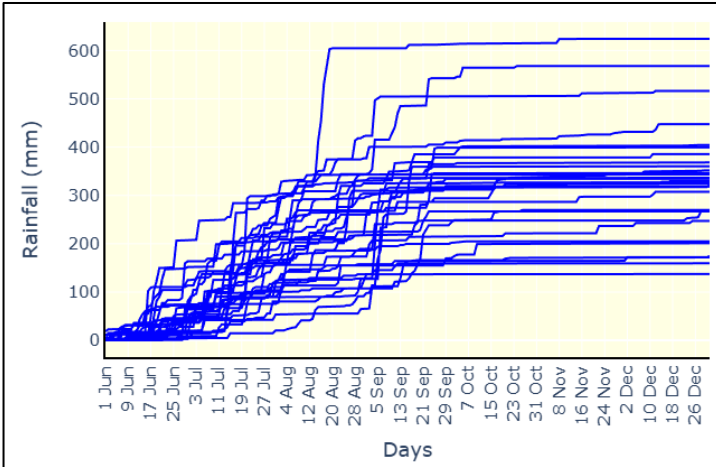
### 5.2.1(a) RAINFALL

#### QUANTUM | CUMULATIVE RAINFALL PROGRESSION

**Decision Support:** This Moves advisory generation from fixed calendar-based planning to season-progress-based planning. Indicates the major rainfall season of the specific block and its progression for better crop choice and sowing decision allows agromet experts to decide whether the season is advancing normally, delayed, or truncated relative to historical pattern.

**Operational application:** Adjustment of sowing windows (early/normal/late sowing advisories). Dynamic rescheduling of second crop and post-harvest operations. Early warning on season shortening or moisture deficit during critical stages. Any long dry/wet period specific to month can also be visualized.

**Agricultural Impact:** Improved crop establishment success in rainfed systems. Reduced input wastage due to resource optimization based on rainfall progress after sowing. Enhanced yield stability through timely agronomic interventions.



In this graph, daily rainfall values are cumulated from June to December. Each blue line in this graph represents progression of seasonal rainfall for the years from 1995 to 2024 for **Kotkapura block**. This graph clearly elucidates the **unimodal rainfall pattern** of this block. This block receives major rainfall during the **Southwest Monsoon (SWM)**.

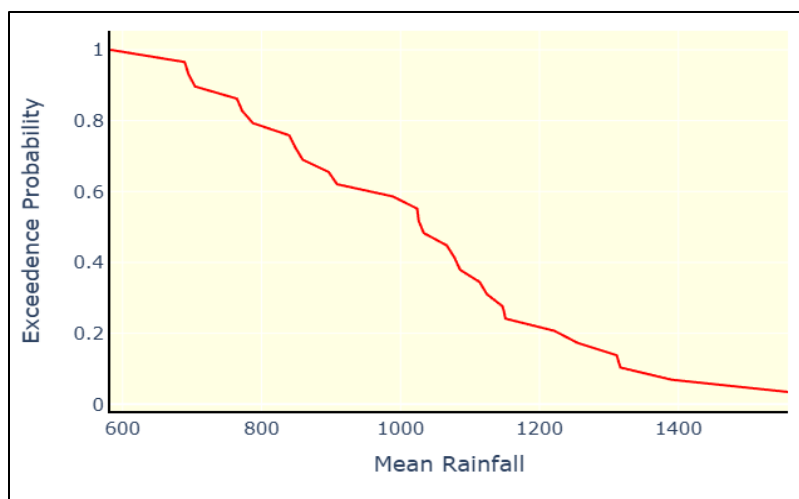
**Fig.9: Rainfall progression in “Kotkapura” block, Faridkot district, Punjab**

### QUANTUM | RAINFALL PROBABILITY OF EXCEEDANCE

**Decision Support:** Supports risk-informed crop planning by quantifying the likelihood that seasonal/Monthly rainfall will meet or exceed the minimum water requirements of different crops and their stages. Supports to assess rainfall reliability during critical crop growth stages and identifies the probability of water stress or surplus conditions.

**Operational Application:** The Rainfall Probability of Exceedance analysis for Tilda block of Raipur district, Chhattisgarh, presents expected rainfall amounts with corresponding probability levels. Experts can determine what rainfall amount can be expected at specific probability thresholds (e.g., 50%, 75%, 90%), evaluate monthly rainfall reliability, and align crop selection and sowing strategies with realistic rainfall scenarios.





Rainfall Probability of Exceedance graph presented here depicts the annual rainfall amounts and respective probabilities of “Tilda” block of Raipur district, Chhattisgarh.

**Fig.10: Seasonal (Kharif) ‘Probability of Exceedance’ for “Tilda” block, Raipur district, Chhattisgarh**

**Agricultural Impact:** Enables climate-resilient crop planning by reducing rainfall-related risks. Improves crop selection suitability, optimizes water management decisions, and enhances yield stability by aligning agricultural practices with probabilistic rainfall expectations.

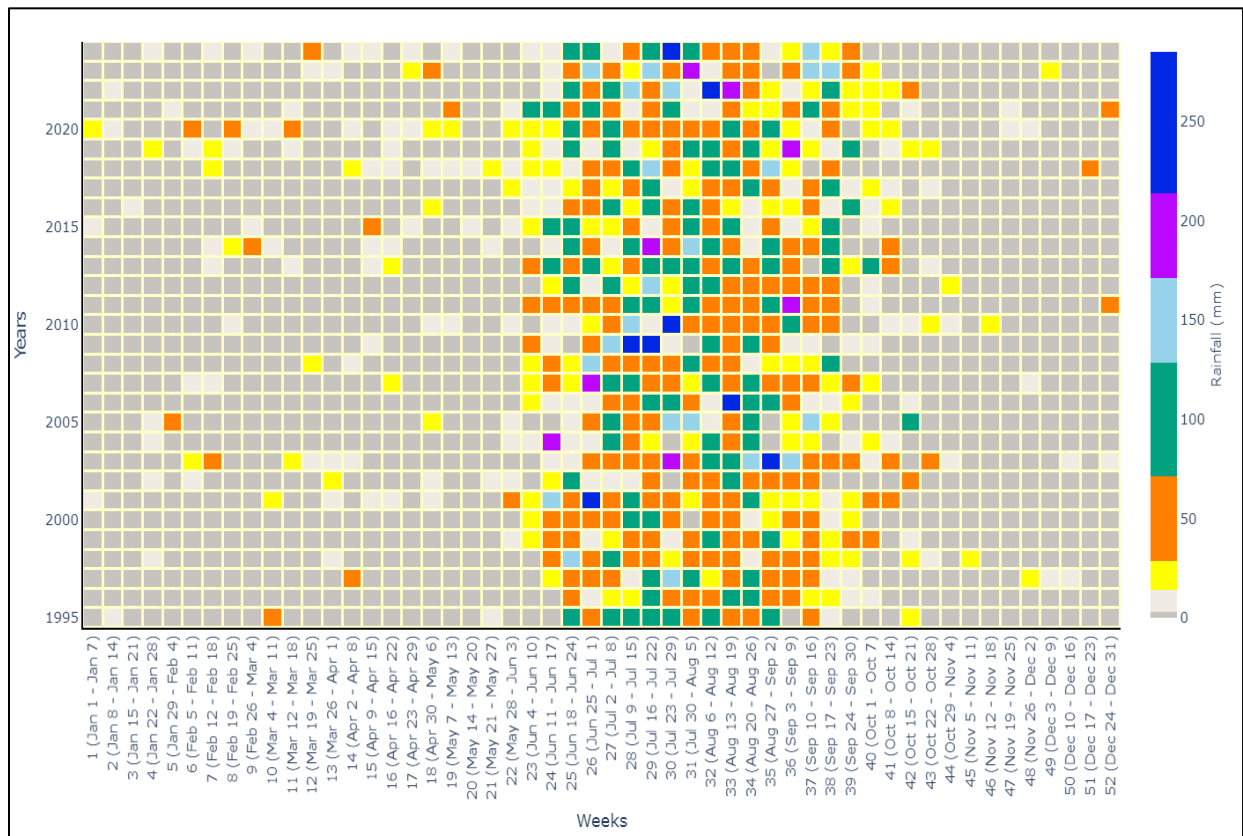
## QUANTUM | WEEKLY CUMULATIVE RAINFALL MATRIX

**Decision Support:** The weekly cumulative rainfall Matrix provides a multi-year visualization of intra-seasonal rainfall distribution across Standard Meteorological Weeks (SMWs). Each cell represents the total rainfall accumulated in a given week for a specific year, with darker shades indicating higher rainfall amounts. This enables identification of monsoon onset, peak rainfall phases, intermittent dry spells, and the withdrawal period. The recent appearance of darker patches interspersed with lighter tones indicates increasing rainfall variability, with heavy rainfall events occurring alongside short dry spells.

**Operational Application:** The Weekly Rainfall (mm) Matrix for Tilda block of Raipur district, Chhattisgarh allows experts to: (i) Identify effective monsoon onset around SMW 23–24 and withdrawal after SMW ~39. (ii) Detect peak rainfall weeks (SMW 26–34, up to ~250 mm) requiring drainage and waterlogging management. (iii) Recognize intermittent dry spells within the monsoon window for issuing life-saving irrigation and soil moisture conservation advisories and (iv) Monitor recent years variations in rainfall patterns with heavier rainfall events and intervening dry weeks, supporting climate-risk preparedness and adaptive crop management advisories. This supports dynamic advisory generation based on actual weekly rainfall behaviour rather than fixed seasonal assumptions.

## Agricultural Impact:

- Consistent rainfall during SMW 23–38 supports timely sowing of kharif crops such as rice, maize, cotton, soybean, and groundnut.
- High rainfall weeks trigger advisories on drainage management, reduced irrigation, and disease surveillance.
- Identification of intra-season dry spells enables timely life-saving irrigation, mulching, and fertilizer management.
- The increasing occurrence of heavy rainfall events interspersed with dry patches highlights growing rainfall variability, reinforcing the need for adaptive agronomic practices and climate-resilient planning.
- Reduced rainfall after SMW 39 supports harvest scheduling and rabi land preparation based on residual soil moisture.



**Fig.11: Weekly Rainfall (mm) of Tilda' block of Raipur district, Chhattisgarh**

### **5.2.1.(b). INTENSITY AND EXTREMES | RAINFALL INTENSITY AND EXTREMES**

**Decision Support:** Rainfall threshold exceedance ( $\geq 25\text{mm}$ ,  $\geq 50\text{mm}$ ,  $\geq 75\text{mm}$ ) and percentile-based extremes (90<sup>th</sup>, 95<sup>th</sup>, 99<sup>th</sup>) together provide a comprehensive assessment of both the frequency and intensity of heavy rainfall events. While threshold analysis indicates how often heavy rainfall occurs, percentile extremes reveal the severity of rare downpours. These metrics help evaluate risks of waterlogging, soil erosion, nutrient leaching, flooding, and crop damage, as well as detect long-term trends in rainfall intensity.

**Operational Application:** Combined intensity and extreme rainfall analysis enables experts to:

- Identify years with frequent heavy rainfall events and severe downpours.
- Assess flood, waterlogging, and crop lodging risks.
- Recommend improved drainage, bund strengthening, and soil conservation measures.
- Advise staggered fertilizer application to reduce nutrient losses.
- Strengthen early warning and preparedness for extreme rainfall episodes.
- Support climate adaptation planning using observed intensity trends.

#### **Agricultural Impact:**

- Improved drainage and soil management reduce the risk of waterlogging and erosion.
- Staggered fertilizer application minimizes nutrient losses during heavy rainfall.
- Early surveillance helps control fungal infections and lodging-related losses.
- Farmers can choose suitable crops based on expected rainfall intensity patterns.
- Threshold-based rainfall analysis supports adaptive, risk-informed farming strategies at district and state levels.

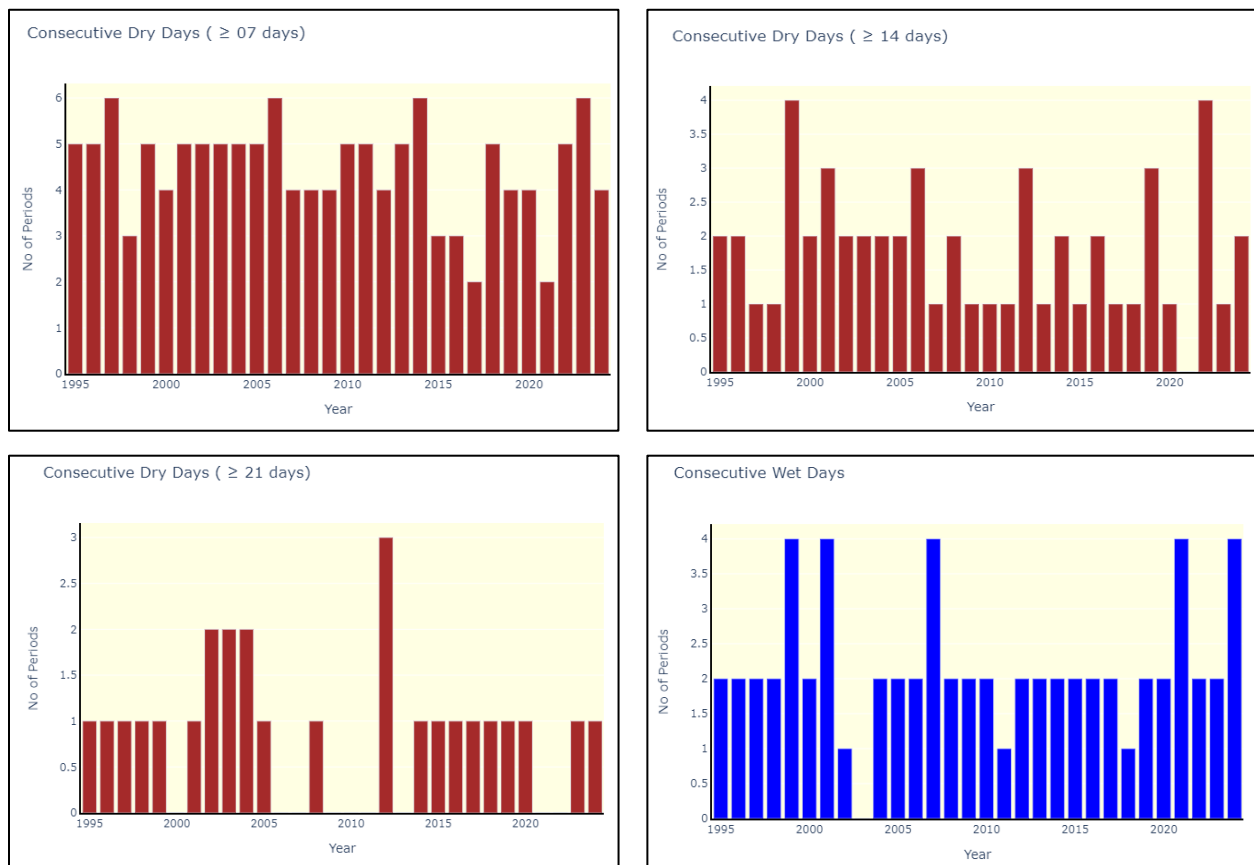


**Fig.12: Number of days rainfall exceeding thresholds ( $\geq 25$ mm,  $\geq 50$ mm,  $\geq 75$ mm) and Extreme rainfall at (90<sup>th</sup>, 95<sup>th</sup>, 99<sup>th</sup> percentile) of the “Tlangnuam” block of Aizawl district, Mizoram**

### 5.2.1.(c). DRY / WET PERIOD | CONSECUTIVE DRY DAYS (CDD) AND CONSECUTIVE WET DAYS (CWD)

In this analysis, a day is considered as dry day when rainfall is less than 2.5 mm, and as wet day when rainfall is  $\geq 2.5$  mm. Consecutive Dry Days (CDD) of 7, 14, and 21 days, represent dry periods while Consecutive Wet Days (CWD), represent continuous 5 wet days as one wet period.

**Decision Support:** Consecutive Dry Days (CDD) and Consecutive Wet Days (CWD) analyses provide a clear measure of rainfall persistence and intra-seasonal moisture stress. CDD identifies prolonged dry spells of 7, 14, and 21 days, which indicate potential drought stress, soil moisture depletion, and crop water deficits. CWD captures extended wet periods of 5 continuous rainy days, reflecting conditions that may lead to waterlogging, reduced field accessibility, and increased pest and disease risks.



**Fig.13: Consecutive Dry Days (CDD) of 7, 14, and 21 days period and Consecutive Wet Days (CWD) continuous 5 day duration of the “Settur” block of Anantapur district, Andhra Pradesh**

**Operational Application:** CDD and CWD assessments enable agrometeorological experts to:

- Detect critical dry spells requiring life-saving irrigation or contingency crop measures.
- Identify prolonged wet periods that necessitate drainage management and field protection.
- Adjust fertilizer application timing to avoid nutrient losses during wet spells.
- Issue crop-specific advisories for moisture stress, disease surveillance, and soil conservation.
- Support adaptive sowing, irrigation scheduling, and crop protection planning based on rainfall persistence patterns.

**Agricultural Impact:**

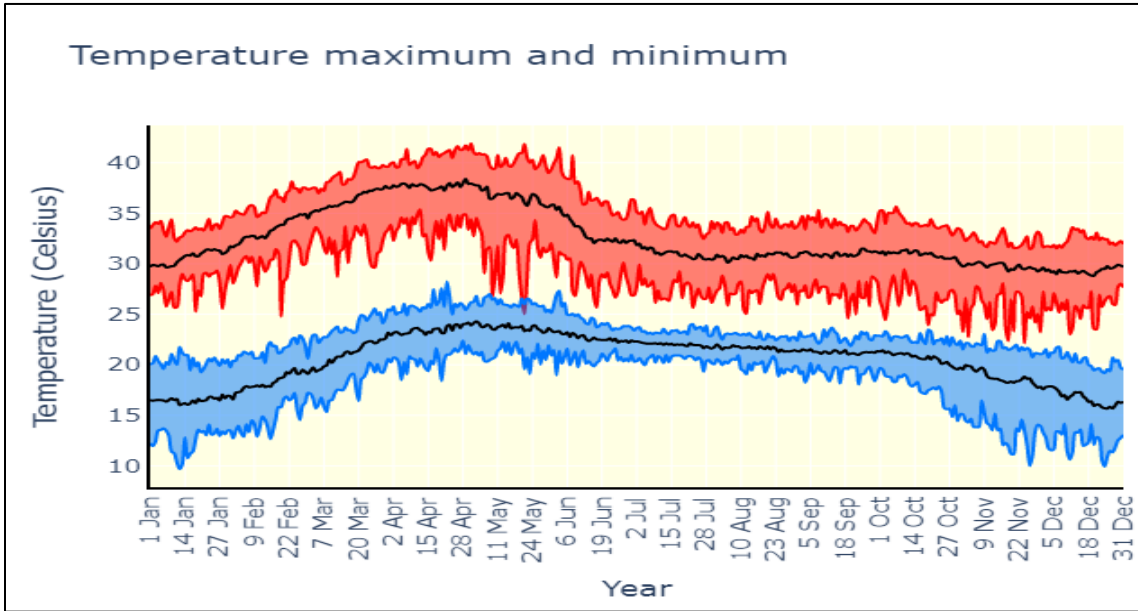
- Timely irrigation and moisture conservation reduce crop losses during extended dry spells.
- Drainage interventions minimize waterlogging during prolonged wet periods.
- Early warnings help manage fungal and humidity - driven infestations.
- Fertilizer and pesticide losses are minimized through weather-informed application timing.
- Farmers are better prepared to cope with rainfall variability and extreme moisture conditions.

## 5.2.2. TEMPERATURE | CLIMATOLOGY & THRESHOLDS

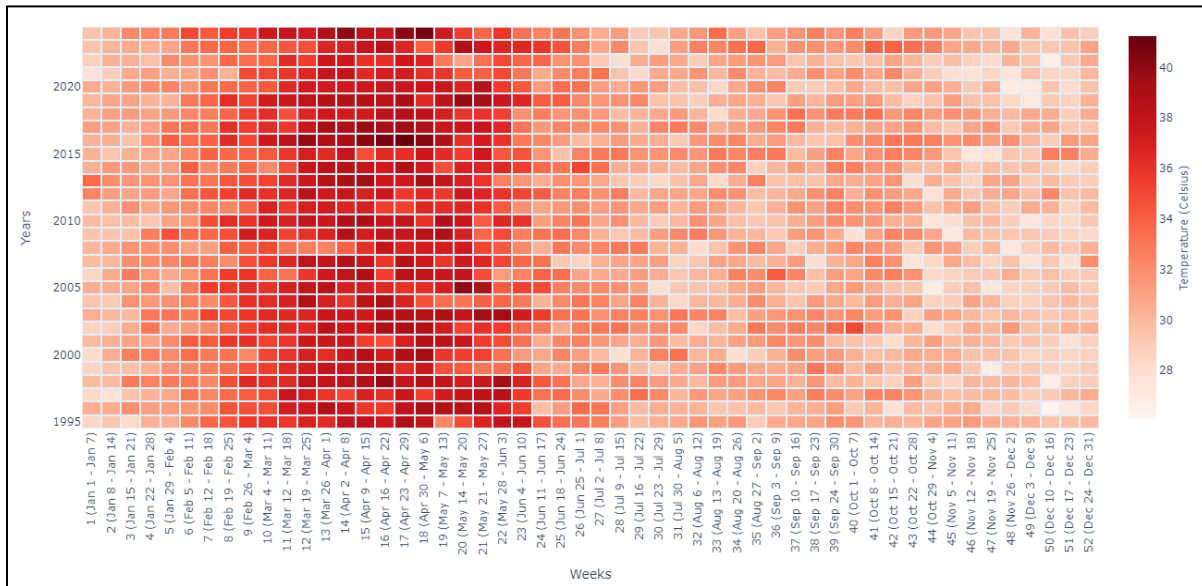
The Temperature (Maximum and Minimum) climatology graph of Maximum and Minimum temperature depicts the 30 year historical maximum, historical minimum and climatological mean along with the current-year values for each day of the year. The temperature threshold exceedance ( $\geq 36^{\circ}\text{C}$ ,  $\geq 38^{\circ}\text{C}$ ,  $\geq 40^{\circ}\text{C}$ ,  $\geq 42^{\circ}\text{C}$ ,  $\geq 44^{\circ}\text{C}$ ,  $\geq 46^{\circ}\text{C}$ ,  $\geq 48^{\circ}\text{C}$ ,  $\leq 20^{\circ}\text{C}$ ,  $\leq 18^{\circ}\text{C}$ ,  $\leq 16^{\circ}\text{C}$ ,  $\leq 14^{\circ}\text{C}$ ,  $\leq 12^{\circ}\text{C}$ ,  $\leq 10^{\circ}\text{C}$ ,  $\leq 08^{\circ}\text{C}$ ) tracks the number of days exceeding critical temperature.

**Decision Support:** This visualization allows agricultural experts to assess whether the ongoing season's temperatures are within the normal historical range or if exceptionally high or low temperatures are being recorded. Such deviations help identify emerging heat or cold stress conditions that may require immediate advisory interventions. Further, the weekly temperature heat maps provide a visual assessment of periods when maximum or minimum temperatures across weeks coinciding with critical crop stages. These patterns help identify weeks prone to

heat stress, cold stress, or unfavourable thermal conditions that can affect crop physiology, pest incidence, and water demand. The thresholds based heat stress identification helps to assess the intensity and persistence of thermal stress beyond the cardinal limits affecting crop growth and productivity.



**Fig.14: Temporal Variation of Maximum temperature ( $T_{max}$ ) and Minimum temperatures ( $T_{min}$ ) of the “Rayadurg” block of Anantapur district, Andhra Pradesh**



**Fig.15: Heat map for weekly Maximum temperature of the “Rayadurg” block of Anantapur district, Andhra Pradesh**

**Operational Application:** By comparing the current year's temperatures with historical limits, agrometeorological experts can:

- Detect early-season heat or cold anomalies.
- Identify periods when temperatures exceed historical maxima, indicating severe heat stress.
- Recognize unusually low temperature events linked to cold or frost stress.
- Issue timely advisories on heat mitigation (irrigation, mulching and shading) or cold protection measures.

**Agricultural Impact:**

- Protective measures to minimize crop losses during extreme heat events.
- Advisories are based on real-time deviations, not just heat perception towards historical averages.
- Farmers are informed in advance to adapt more effectively to emerging heat stress.
- Enables timely heat mitigation measures, reducing crop damage during extreme temperature events and improving yield stability under rising heat stress conditions.

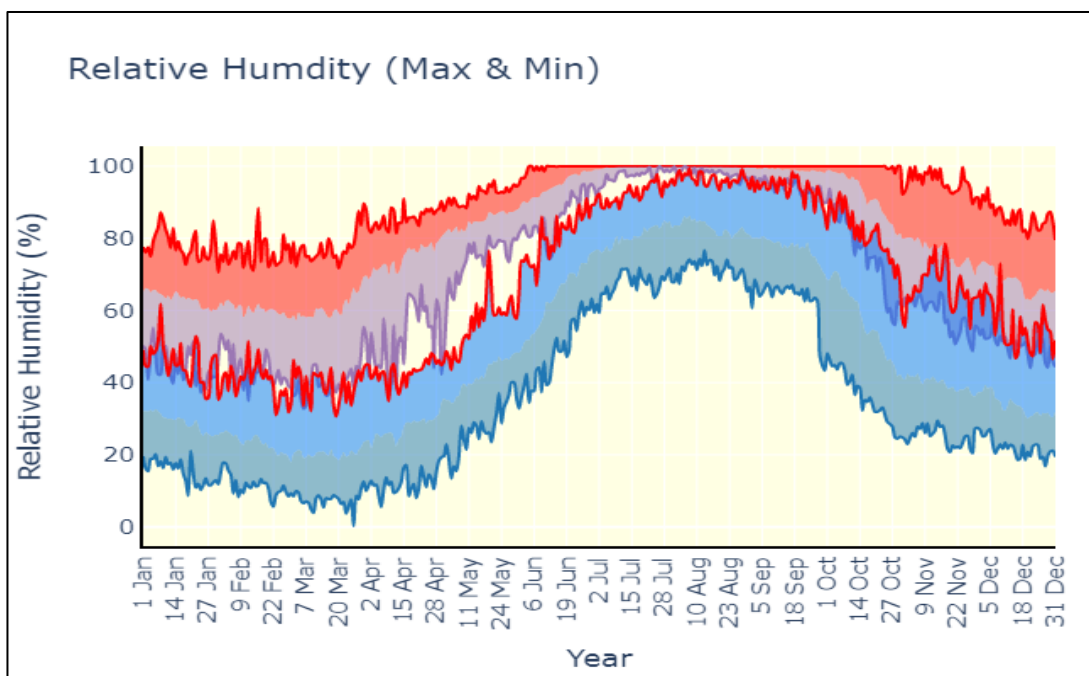
### **5.2.3. RELATIVE HUMIDITY | CLIMATOLOGY & THRESHOLDS**

The Relative Humidity (RH) (Maximum and Minimum) climatology graph depicts the 30 year historical maximum, historical minimum and climatological mean.

**Decision Support:** Relative Humidity (RH) climatology and weekly heat maps analyses help identify periods of persistently high or low moisture in the air that influence crop stress, disease development, and evapotranspiration.

**Operational Application:** This combined RH analysis enables experts to:

- Detect high-humidity periods that favour fungal and bacterial diseases.
- Identify low-humidity phases associated with moisture stress and higher irrigation demand.
- Issue timely advisories for disease surveillance, irrigation scheduling, and crop protection measures based on weekly RH behaviour and threshold exceedance.



**Fig.16: Climatology of Maximum and Minimum Relative Humidity of the “Mawal” block of Pune district, Maharashtra**

**Agricultural Impact:**

- It helps understand RH patterns that are favourable or unfavourable conditions for crop growth and pest outbreaks.
- Supports in identifying stress conditions prophylactically along with the patten of temperature and rainfall conditions.
- Identify low-humidity phases associated with moisture stress and higher irrigation demand.

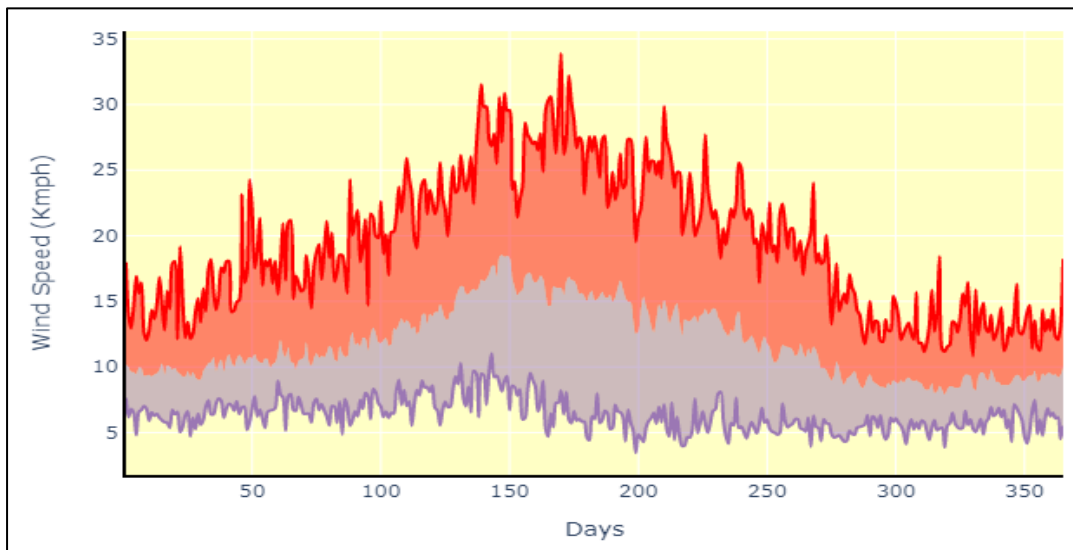
**5.2.4. WIND SPEED | CLIMATOLOGY & THRESHOLDS**

The Wind speed climatology graph depicts the 30 year historical maximum, historical minimum and climatological mean of maximum wind speed recorded in each day.

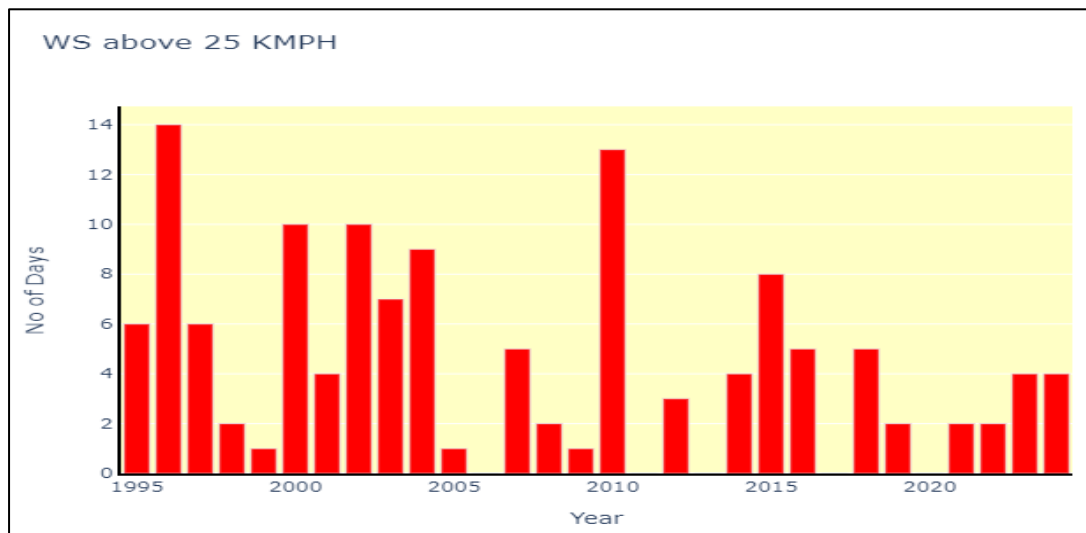
**Decision Support:** Wind speed climatology, weekly heat maps, and threshold exceedance analyses provide insights into normal wind regimes and extreme wind events that can affect crop lodging, evapotranspiration, spraying efficiency, and physical crop damage.

**Operational Application:** This integrated wind analysis supports agrometeorological experts to:

- Identify high-wind periods that may cause crop lodging (Banana plantation) or structural damage (Garden trellis, Stacks etc).
- Plan pesticide and fertilizer spraying during low-wind conditions for better efficiency and avoiding spray drift during high wind days.
- Issue advisories for crop protection, staking, and shelter management during gusty phases.



*Fig.17: Wind speed climatology of the “Jawaja” block of Ajmer district, Rajasthan*



*Fig.18: Frequency of Wind Speed  $\geq 25$  kmph in Jawaja Block of Ajmer District, Rajasthan*

## Agricultural Impact:

- It helps understand RH patterns that are favourable or unfavourable conditions for crop growth and pest outbreaks.
- Supports in identifying stress conditions prophylactically along with the pattern of temperature and rainfall conditions.
- Identify low-humidity phases associated with moisture stress and higher irrigation demand.

## 5.3. FORECAST

The Forecast module of the Mausam - SANKALP platform provides access to seamless suite consisting of weather forecasts such as Nowcast (0–6 hours), Short-Range Forecast (1–3 days), and Medium-Range Forecast (4–10 days) products. These forecasts are presented in tabs alongside historical climatology and current weather status, enabling users to interpret upcoming weather conditions within a broader temporal context. The integration of real-time forecasts with past and present weather information supports proactive agricultural decision-making for sowing, irrigation scheduling, pest and disease management, and extreme weather preparedness. This comprehensive forecasting framework enhances the operational relevance of agrometeorological advisories by linking expected weather events with observed seasonal trends and long-term climate behaviour.

Nowcast	
2026-01-11 Time of Issue: 1800 IST valid up to:2130 IST No Weather	

**Fig.19: Nowcast for Dahi block, Dhar district, Madhya Pradesh**

Date	Humidity Max (%)	Rain in mm	Temperature Max (C)	Wind Direction	Wind Speed (knot)	WEATHER MESSAGE
2026-01-11	58.41	0.0	26.98	East-North Easterly	2.29	Mainly Clear Sky
2026-01-12	51.22	0.0	28.0	Easterly	2.66	Mainly Clear Sky
2026-01-13	49.67	0.0	30.06	North Westerly	2.28	Mainly Clear Sky

**Fig.20: Short Range Forecast (Mausam Gram) for Dahi block, Dhar district, Madhya Pradesh**

Date	Rain in mm	Humidity Min (%)	Humidity Max (%)	Temp Max (C)	Temp Min (C)	Wind Speed (knot)
12/01/2026	0.0	75.3	33.0	28.9	18.8	3.7
13/01/2026	0.0	82.0	39.2	29.9	19.7	10.8
14/01/2026	0.0	83.2	34.4	31.0	19.5	7.2
15/01/2026	0.0	78.4	28.8	32.4	19.9	6.8
16/01/2026	0.0	80.2	28.6	32.5	19.9	7.7
17/01/2026	0.0	78.4	26.5	32.2	18.9	8.0
18/01/2026	0.0	79.4	25.4	31.8	17.9	5.8
19/01/2026	0.0	74.7	21.8	32.0	17.5	6.4
20/01/2026	0.0	75.8	20.5	31.8	17.2	4.6
21/01/2026	0.0	79.7	22.8	32.6	17.2	5.9

**Fig.21: Medium Range Forecast for Dahi block, Dhar district, Madhya Pradesh**

#### **5.4. CROP MODULE| WEATHER - CROP INTERACTION**

The interactive crop module enables users to conduct “*what-if*” analyses by simulating a crop’s growth timeline against weather data from any past year. For a selected historical year and sowing date, the system projects the timing of critical crop stages and evaluates whether the weekly temperature and rainfall conditions during those stages remained within or exceeded the crop’s optimal threshold ranges. By aligning historical weather patterns with crop phenology, the tool provides a precise, year-by-year assessment of how favourable growing conditions were. This helps minimize exposure to damaging weather extremes during sensitive growth phases and supports risk-informed sowing date selection. Rather than relying on fixed calendar dates, this approach translates historical climate variability into actionable guidance. Users can identify sowing windows that have historically kept the crop within its ideal thermal and moisture environment, thereby avoiding predictable seasonal hazards.

##### **Use Case for Wheat (Rabi 2023–24) over the Sutrapada Block, Junagadh District, Gujarat with Early sowing on 42<sup>nd</sup> standard meteorological week (SMW) (15–21 October 2023)**

Based on the historical analysis for wheat sown in Week 42 of 2023 in Sutrapada block, Junagadh district, Gujarat, the crop experienced heat stress across initial growth stages. Maximum temperatures remained at or above the upper optimal limits from sowing through Tillering, with early-stage Tmax reaching 35–36°C during emergence, continuing near 33–35°C during crown root initiation. This sustained thermal stress on early crop development might impact the vegetative growth and tiller formation. While minimum temperatures remained within a non-stress range, indicating that cold stress was not a limiting factor in this season.

From an operational perspective, this historical scenario demonstrates the importance of avoiding early sowing windows that expose wheat to high temperatures during sensitive stages. The analysis supports advisories promoting timely sowing, heat-tolerant varieties, and supplemental irrigation or moisture conservation practices to reduce heat-induced stress under dry conditions.

Parameter	Sowing and Emergence		Seedling		Crown Root Initiation			Tillering			Booting		Flowering		Milking		Dough Formation			Physiological Maturity
	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7		
Rainfall	0.0	0.0	0.0	0.0	0.0	0.0	45.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tmax	35.6	36.2	35.7	35.2	34.4	33.7	29.0	30.4	30.9	29.2	31.3	29.4	30.9	29.3	30.2	30.5	31.1	33.1		
Tmin	23.2	22.4	20.2	21.0	19.9	19.8	18.5	19.0	16.4	17.2	15.6	13.6	16.4	14.0	13.1	16.4	16.8	16.8		

*Fig.22: Stage-wise Weather Conditions during wheat Crop Growth Period for the Sutrapada Block, Junagadh District, Gujarat*

By aligning sowing dates with optimal thermal windows, farmers can minimize exposure initial to terminal heat stress and improve wheat yield stability in heat-prone regions. Similarly current season progress along with the influence of current weather and forecast can be captured for operationally actionable advisories.

## 6. CONCLUSION

Mausam SANKALP represents a significant step in the evolution of agrometeorological advisory decision. This platform transforms weather data into actionable agricultural intelligence. Mausam SANKALP enables impact-oriented interpretation by linking weather conditions directly with crop phenology, stress thresholds, and management decisions. This strengthens the scientific basis of advisories, enhances their regional relevance, and improves consistency across Agro-climatic Zones.

The system supports proactive risk management by identifying emerging weather extremes, rainfall variability, and thermal stress patterns in advance, thereby enabling timely interventions for sowing, irrigation, crop protection, and harvest and post-harvest planning. Through its modular design, user-friendly visualizations, and operational focus, Mausam SANKALP empowers forecasters, agrometeorological experts, extension agencies, and field officers to deliver more precise, reliable, and climate-resilient advisories to farmers.

## 7. WAY FORWARD

To further strengthen the operational impact and scalability of Mausam SANKALP, the following strategic directions are envisaged:

- Future versions of the platform can include additional crops, and other sectors such as Horticulture, Poultry, Livestock and Fisheries.
- Incorporating satellite-derived indicators such as vegetation indices, soil moisture, and evapotranspiration will enhance real-time crop condition monitoring and early stress detection.
- Linking weather forecasts with quantified crop impact models will support more robust Impact-Based Forecasting (IBF) for agriculture, enabling better preparedness for extreme events.
- Establishing structured feedback loops from field users and farmers will help validate advisories, refine thresholds, and improve system performance.
- Regular training programmes for AMFUs, forecasters, and extension officers will ensure effective operational use of the platform and consistent advisory quality across regions.
- Rule-based and AI-assisted advisory engines can be developed to generate standardized, location-specific advisories automatically at Farm level in alignment with the VISION 2047 of IMD.

## **8. ALIGNMENT WITH NATIONAL PRIORITIES AND INITIATIVES**

Agrometeorological Advisory Services (AAS) play a crucial role in supporting various national initiatives by delivering operational, weather-based advisories to the agricultural sector, enhancing climate resilience, improving crop productivity, and thereby contributing to national food security.

- **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) – “Per Drop More Crop”**

Through the shared vision of ‘Har Khet ko Pani’ this dashboard through AAS supports efficient water use through rainfall variability analysis, dry spell monitoring and irrigation advisories directly contributing to improved water productivity.

- **Climate-Resilient Agriculture and National Mission for Sustainable Agriculture (NMSA)**

Enhances adaptive capacity by providing early warning of weather extremes, crop-stage-specific stress interpretation, and risk-informed advisories aligned with climate resilience objectives.

- **Digital Agriculture and Data-Driven Decision Support**

Aligns with India’s vision of leveraging digital platforms for scalable, standardized, and evidence-based agricultural services, reducing dependence on manual and person-centric processes.

- **Doubling Farmers’ Income (DFI) – Risk Reduction Pathway**

Contributes indirectly by reducing weather-induced losses, optimizing input use, and improving yield stability through timely and actionable advisories.

- **Disaster Risk Reduction and Early Warning Systems**

Strengthens agricultural early warning through impact-based forewarning (IBF), supporting preparedness and loss minimization during extreme weather events.

## 9. ALIGNMENT WITH INTERNATIONAL FRAMEWORKS

Agrometeorological Advisory Services (AAS) contribute to global commitments by delivering operational, weather- and climate-based advisories that strengthen climate resilience, support sustainable agricultural productivity, and enhance food security, in alignment with international frameworks on climate action, disaster risk reduction, and sustainable development.

### ➤ **Global Framework for Climate Services (GFCS)**

Contributes to strengthening climate services for agriculture by translating climate information into sector-specific, decision-relevant products.

### ➤ **United Nations Sustainable Development Goals (SDGs) – under the United Nations framework:**

**SDG 2 – Zero Hunger:** Supports sustainable food production systems agricultural practices by improving climate-informed decision-making.

**SDG 1 – No Poverty:** Reduces livelihood vulnerability of farmers by climate-related crop losses.

**SDG 6 – Clean Water and Sanitation:** Promotes efficient agricultural water use through improved rainfall interpretation and irrigation advisories.

**SDG 13 – Climate Action:** Enhances adaptive capacity to climate variability and extremes through early warning and impact-based advisory services.

### ➤ **Sendai Framework for Disaster Risk Reduction (2015–2030)**

Aligns with priorities on understanding disaster risk and strengthening early warning systems by integrating climate extremes, exposure, vulnerability, and impacts in agriculture.

### ➤ **WMO’s Impact-Based Forecasting (IBF) Approach**

Operationalizes IBF principles in the agricultural sector by shifting from hazard-based forecasts to impact-oriented advisories and daily forewarning alerts.

### ➤ **FAO Climate-Smart Agriculture (CSA) Pillars**

- Supports all three CSA pillars.
- Productivity enhancement through improved advisory quality.
- Adaptation through climate-risk-informed decisions.
- Mitigation co-benefits through efficient resource use.

# About Mausam SANKALP

**Mausam SANKALP** is a next-generation decision support *platform* developed by the **India Meteorological Department (IMD)** to strengthen climate-resilient agriculture in India.

The platform seamlessly integrates real-time observations, historical climate intelligence, and forecast information with crop- and growth-stage-specific thresholds to support informed agricultural decision-making.

Through structured analytics and intuitive **visualisations**, **Mausam SANKALP** enhances the consistency, relevance, and operational actionability of agrometeorological advisories, enabling timely, location-specific guidance for farmers across India's diverse agro-climatic regions.

**India Meteorological Department**  
**Ministry of Earth Sciences**  
**Government of India**

*Service to Farmers through Science*