Mission Mausam
Mission Mausam
Mission Mausam

PROCEEDINGS
&
RECOMMENDATIONS

BRAINSTORMING WORKSHOP
on
MISSION MAUSAM : FORECAST TO FIELD
(TECHNIQUES AND TARGETS FOR AMRITKAAL)

Sponsored By

Ministry of Earth Sciences
Govt of India

November 27 - 28, 2024

ICAR-IARI, New Delhi, India

Organized By

Association of Agrometeorologists
https://agrimetassociation.org/

ICAR-Indian Agricultural Research Institute
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Summary of Recommendations

The transformation of weather forecasts into actionable agrometeorological advisories is a crucial step for enabling farmers to make informed decisions. However, there are significant gaps listed below in this process that limit the effectiveness and impact of these advisories at field level, particularly for smallholder and marginal farmers.

1. *The gaps in location-specific weather forecasts often arise due to several factors, including limitations in data collection, modeling, and communication. Efforts to address these gaps include expanding the deployment of weather stations, radars, and satellites in underserved regions; leveraging machine learning and AI for better modeling of microclimates and real-time forecasting; improving the accessibility and localization of forecast communication and encouraging global cooperation to share weather data and technological advancements.*

   (Action: IMD, IITM, NCMRWF)

2. *The lack of a robust local database on climate and weather is a significant issue that limits the accuracy, relevance, and usability of weather forecasts and climate models. This problem affects not only day-to-day weather prediction but also long-term planning for agriculture, infrastructure, disaster management, and climate adaptation. Local climate and weather data may be strengthened by expanding observation networks; use of remote sensing and IoT; integrate and modernize historical data; public-private collaboration; capacity building; focus on open data and embrace machine learning.*

   (Action: IMD / ICAR / SAUs)

3. *Research on developing methodologies to assess the impact of weather forecasts on production systems is crucial for improving efficiency, risk management, and decision-making in agriculture and associated sectors. To assess the impact, the key objectives should include quantification of economic impacts; assessment of decision-making outcomes; optimization of forecast utilization and to understand how user responses to forecasts affect outcomes and feedback into the system.*

   (Action: ICAR / SAUs)

4. *The lack of analytical techniques for evaluating different management interventions in farming hinders the ability to identify the most efficient and cost-effective operational practices. Addressing this gap requires tailored approaches that account for the unique complexities of agricultural systems, including environmental variability, market uncertainties, and the interconnected nature of farming activities. Network*

pilot studies/ projects need to be undertaken for local data collection; to develop accessible tools tailored to smallholder farmers; capacity building to train farmers and extension workers in using analytical tools and interpreting results and interdisciplinary collaboration among domain experts to ensure comprehensive evaluations.

(Action: IMD / ICAR / SAUs)

5. *The absence of an agrometeorological component in the teaching and research programs of nearly 25 SAUs and several ICAR institutes is a critical gap that needs to be addressed to strengthen agricultural education, research, and outreach. Agrometeorology, the study of weather and climate's impact on agriculture, is crucial for climate-resilient farming, efficient resource management, and sustainable production systems. Inclusion of Agrometeorological component in SAUs / ICAR Institutes is necessary so as to address the impact of climate change; to improve decision-making in agriculture; to bridge knowledge gaps and further to align with national goals/programs like National Mission on Sustainable Agriculture (NMSA) etc.*

(Action: ICAR / SAUs)

6. *The lack of basic understanding and knowledge among extension personnel to interpret weather forecasts and relate them to local relief creates a significant gap in transferring actionable weather information to farmers. This limits the effectiveness of weather-based advisories that could otherwise improve agricultural productivity and resilience. The strategy to address this issue should include capacity building for extension personnel; development of easy-to-use tools and resources; simplified communication techniques; establishment of localized agrometeorological units, continuous skill development programs and regular monitoring and evaluation.*

(Action: IMD / ICAR / SAUs)

Mission Mausam

The Union Cabinet approved Mission Mausam in September, 2024, with a budget outlay of 2,000 crores over two years, is an ambitious initiative of the Government of India. It aims to make India 'Weather Ready' and 'Climate Smart'. The mission seeks to exponentially enhance the country's weather and climate observations, understanding, modeling and forecasting, leading to better, more useful, accurate and timely services. Mission Mausam has the goal of making Bharat a "Weather-ready and Climate-smart" nation, so as to mitigate the impact of climate change and extreme weather events and strengthen the resilience of the communities and will be implemented during 2024-26. The mission aims to establish 50 Doppler Weather Radars (DWR), 60 Radio Sonde/Radio Wind (RS/RW) stations, 100 disdrometers, 10 Wind Profilers, 25 Radiometers, 1 Urban Testbed, 1 Process Testbed, 1 Ocean Research Station and 10 Marine Automatic Weather Stations with upper air observation.

Mission Mausam will improve forecasts on both spatial and temporal scales and air quality data and help strategize weather management/intervention in the long run. "By March 2026, a wider network of radars, wind profilers, and radiometers for better observations will be in position. It will help in better understanding the physical processes and the science of weather forecasting. There will be improved data assimilation with increased ingestion of the observations. There will also be fusion of physics-based numerical models and data-driven AI/ML to improve the forecasts with more innovations, R&D and advancements in atmospheric sciences. Dissemination of data and services and capacity-building will also be expanded to benefit citizens and stakeholders. No weather system in the country will go undetected. MoES will provide improved services for weather, climate, and natural hazards, thereby ensuring the transfer of commensurate economic and social benefits to the various sectors.

Three institutes of the MoES: IMD, NCMRWF and the Indian Institute of Tropical Meteorology, will primarily implement Mission Mausam supported by other MoES institutions (Indian National Centre for Ocean Information Services and National Institute of Ocean Technology) along with collaborating national and international institutes, academia and industries, furthering India's leadership in weather and climate sciences and services.

With Mission Mausam taking off, more dependable weather forecasts with very high spatial resolution will be available eliminating the uncertainties to a large extent. The KRISHI DSS will provide high-quality data base integrating information generated from different sources. The ICAR too has recently modified the mandate of KVKs for effective transfer of modern techniques & technologies. These developments provide an opportunity for agricultural meteorologists to connect with KVKs and regional research stations of different SAUs/CAUs/other Institutes and Start-ups by reorientation of operational research. In a world where accurate forecasting is critical to managing climate change and protecting communities, Mission Mausam brings together experts, scientists, and field specialists to discuss and innovate how weather forecasts can be seamlessly translated into on-farm strategies and actions.

By leveraging the weather based farm / agrometeorological advisory services through integration of weather forecasts with agricultural techniques & technologies and digital tools, the farmers can be guided particularly on issues which they may not have prior knowledge/ experience. The agrometeorological advisories developed with scientific hypothesis will strengthen the confidence of farmers and other stake holders connected with agriculture and allied sectors will significantly impact agriculture by enhancing resilience, increasing productivity, and fostering sustainable farming practices using various outreach platforms including KVKs/State Agricultural Departments. This approach bridges the gap between scientific forecasting and field application, ensuring that farmers have the tools and information they need to thrive in the face of changing weather and climate patterns.

Role of Agricultural Meteorology from Forecast to Field

Agricultural meteorology plays a crucial role in the interface between meteorology and agriculture. It involves the application of meteorological information, data, and research to optimize agricultural practices, increase yields, and reduce risks associated with weather events. Here's a breakdown of its importance in the "Forecast to Field" mission, which spans the entire process from meteorological forecasting to practical, on-the-ground farming decisions:

- **Weather Forecasting for Agriculture**
  - **Short-term Forecasts**: Agrometeorological services provide farmers with weather forecasts in short and medium range every day, helping them make timely decisions on irrigation, planting, harvesting, and pesticide application.
  - **Seasonal Forecasts**: Longer-term forecasts allow farmers to plan for upcoming seasons, decide on crop choices, and manage resources based on expected weather patterns, such as droughts or excessive rainfall.
- **Disaster Preparedness and Risk Management**
  - **Early Warning Systems**: Agrometeorology uses data to predict extreme weather events, like floods, droughts, or frosts. By providing early warnings, farmers can take preventive actions, reducing crop loss and financial risk.
  - **Climate Adaptation**: Understanding long-term weather patterns helps in adapting farming techniques to changing climates. Agrometeorology aids in planning for climate-resilient crops, modifying planting schedules, and managing water resources effectively.
- **Water Management and Irrigation Planning**
  - **Soil Moisture Monitoring**: Agrometeorological data on rainfall, evaporation rates, and soil moisture content supports efficient irrigation practices. This helps optimize water usage and maintain soil health, crucial for sustainable farming.
  - **Drought Management**: By predicting dry spells, agrometeorology helps farmers anticipate and mitigate drought effects. This may include strategies like mulching, selecting drought-resistant crops, or implementing water conservation techniques.

- **Crop and Pest Management**
  - **Pest and Disease Forecasting**: Weather patterns can influence pest and disease outbreaks. Agrometeorological services use data to predict and monitor pest populations, enabling farmers to apply preventive measures.
  - **Optimal Application Timing**: Knowledge of weather conditions can guide farmers on the best timing for pesticide or fertilizer application to avoid losses due to rain or wind, maximizing effectiveness.
- **Yield Forecasting and Food Security**
  - **Yield Prediction**: Using agrometeorological models, forecasts can estimate crop yields based on weather patterns. This is valuable for planning local and regional food supply chains.
  - **Supporting Food Security**: Reliable forecasts allow governments and organizations to anticipate food shortages and take proactive measures, such as distributing resources or planning imports, enhancing food security at national and global levels.
- **Supporting Precision Agriculture**
  - **Data-Driven Decisions**: With the integration of satellite data, sensors, and weather forecasts, agrometeorology aids in precision agriculture, allowing farmers to make data-driven decisions on a micro-level.
  - **Field-Specific Advice**: Farmers receive targeted advice based on hyper-local forecasts and real-time weather data, helping them respond swiftly to changing conditions within specific plots.

In essence, agrometeorology transforms meteorological data into actionable insights, bridging the gap between complex weather systems and the everyday decisions farmers need to make. By enhancing agricultural resilience and sustainability, agrometeorology is integral to the 'Forecast to Field' mission, promoting productivity and stability in the face of ever-changing weather patterns.

Agrometeorological Skills in Solving Field Problems

There are numerous problem-solving weathered skills to address complex issues related to agriculture, weather, and climate, e.g.-

- **Climate Change Impact Assessment** - By analyzing climate models to predict future changes and develop adaptation strategies.
- **Weather Forecasting** - By using numerical models and statistical techniques to predict weather events affecting agriculture.
- **Crop Yield Prediction** - By developing models integrating weather, soil, and crop data to forecast yields.
- **Drought Management** - By developing strategies for water conservation and optimal irrigation scheduling.

- **Pest and Disease Management** – By using weather and climate data to predict outbreaks and develop control measures.
- **Agricultural Water Management** – By optimizing irrigation systems and water allocation.
- **Soil Erosion Prevention**- By developing conservation tillage and cover crop strategies.

To address on farm complex issues through agrometeorological approaches, it is essential that the production system should have and involve comprehensive concerns *viz*.,-

- **Problem Solving Skills –**
  - Analytical thinking
  - Logical reasoning
  - Creative thinking
  - Decision-making
  - Communication
- **Tools and Techniques** –
  - Mathematical modeling
  - Statistical analysis (e.g., regression, time series)
  - Geographic Information Systems (GIS)
  - Remote sensing technologies
  - Machine learning algorithms
  - Decision-support systems (DSS)
  - Scenario planning
- **Case Studies-**
  - Developing drought-tolerant crop varieties
  - Implementing precision irrigation systems
  - Predicting frost events for fruit crops
  - Assessing climate change impacts on agricultural productivity
  - Creating early warning systems for extreme weather events
- **Benefits** –
  - Improved crop yields
  - Enhanced climate resilience
  - Optimized resource allocation
  - Reduced economic losses
  - Increased food security
- **Challenges**-
  - Data quality and availability
  - Complexity of agricultural systems
  - Uncertainty in weather forecasts
  - Limited input support
  - Limited resources (e.g., funding, expertise)
  - Communicating complex information to stakeholders

- **Best Practices**-
  - Interdisciplinary collaboration
  - Stakeholder engagement
  - Continuous monitoring and evaluation
  - Adaptation to changing conditions
  - Integration of traditional and scientific knowledge

With the above backdrop, the use of new tools and techniques in weather forecasting, Dialogue on Gaps in Forecast to Field, Dialogue on Role of Industry in Developing and Strengthening Techniques to fill Gaps, Dialogue on Developmental Needs (Education, Research, Capacity Building & Outreach) etc were discussed at a National Brainstorming Workshop jointly organized by the Association of Agrometeorologists and Division of Agricultural Physics, ICAR-IARI by inviting select group of experts and stakeholders during 27- 28th November, 2024 at Water Technology Center Auditorium, ICAR-IARI, New Delhi, India.

Inaugural Session

During the inaugural session, Dr Mrutyunjay Mohapatra, Director General of Meteorology, India Meteorological Department, Government of India graced the occasion as Chief Guest and Dr SK Chaudhari, Dy Director General (NRM), ICAR was guest of honor.

Dr KK Singh, President, Association of Agrometeorologists and former ADGM cum Head AAS of IMD welcomed the dignitaries and informed the purpose and objectives of the brainstorming workshop and importance of bringing all stakeholders and experts into a single platform to discuss Mission Mausam: Forecast to Field (Techniques and Targets for AmritKaal).

Chief Guest, Dr Mrutyunjay Mohapatra mentioned the new initiative of Indian Government namely Krishi Sakhi and Pashu Sakhi, to reach out the farming community through Ministry of Panchayati Raj and Ministry of Rural Development. The final goal is to issue 1 km x 1 km resolution weather forecast to each household through village bodies/panchayats. Initiations are taken to reach through WhatsApp groups at all levels and the same must be done by SAUs and AICRP on Agrometeorology. Multi-level mechanism to reach out to farmers with accurate, regular and timely forecast and actionable advisories must be developed. Collaboration with states who have their own Mobile Apps / networking need to be developed on priority. He emphasized the need for development of Dynamic Crop Weather Calendar for all crops and from all zones / states.

Dr SK Chaudhari, DDG (NRM), ICAR mentioned that Agricultural Meteorology students are now considered for 3 other departments for higher education and jobs under ICAR / ASRB systems. He emphasized that resolution of data needs to be enhanced, collected, and used and the challenge is how we can accommodate the private agencies for weather forecasting for the betterment of farming community. He stressed the need for quality and robustness of data, use, forecasts, and actionable advisories. Focused requirements and services for crop planning, drought / flood management, post-harvest technologies have to be developed to promote

sustainable agriculture. Seamless and smooth sharing / accessibility to data at national and regional level and capacity building needs more focus with up-skill current and new generation of agrometeorologists through short-term highly specialized trainings / hands-on sessions on instrumentations and workshops should be there.

Dr D Raji Reddy, Vice Chancellor, SKLTHU, Telangana emphasized that ownership and commitment at institutional / scientific level is an issue and more focus should be on operational research and impact analysis for climate resilient agriculture. Prof BV Ramana Rao, Chairman, Advisory Board – AAM emphasized that our focus should be on location specific quality data including soil moisture and forecast accuracy. Prof Rao further forwarded six gaps which need to be addressed immediately i.e., location specific weather forecasts, lack of local data base on climate and weather, lack of research on developing methodologies for assessment of the impact of forecast on production systems, lack of analytical techniques for evaluation of different management interventions to identify efficient and cost effective operation, lack of agrometeorological component involved in teaching / research in nearly 25 SAUs and several of the ICAR institutes. Agrometeorological education and research is key input for Climate Resilient Agriculture and extension personnel lack basic understanding and knowledge to interpret weather forecasts in relation to local utility. Dr Subash. N Pillai, Vice President, AAM and Head, Division of Agricultural Physics, ICAR-IARI proposed vote of thanks.

The workshop started with a technical session consisting of 3 presentations experts from IMD and NCMRWF, MoES, Govt of India on the status and prospectus of different weather forecasts services for various sectors in India. During the session, the main highlights of the presentations and the discussion are as given herein:

- IMD is planning to go upto 5 km resolution for forecasting. To improve forecast further and to enhance resolution upto 10 km coupled model should be developed/used for better applications.
- The weather data collection will be improved with the help of dense network of Radars/ AWS for improving weather forecasting as local weather is very important and may affect the forecast.
- Joint Data Acquisition System by various agencies of MoES, Govt of India is being implemented for improving weather forecast.
- Ocean and atmospheric observations should be coupled and collection of data on initial conditions should also be included for improving weather forecast.
- Seamless Modeling System is being used by NCMRWF recently as a unified and upgraded system. And Ensemble Prediction System (EPS) is being used to remove uncertainties in weather forecast.
- Multi Hazard Early Warning Systems should be developed to empowers individuals and communities threatened by hazards to act in sufficient time and in an appropriate manner to reduce the impending risk of life and property.
- Forecast should also include information on the solar radiation (quality & quantity) and soil moisture status.

- Forecast should also include the impact quantification of the forecast; it will improve its acceptability.
- Shared Risk Matrix should be included to assess the various risks of weather and climate hazards.
- Coupled information about the parameters to be considered to prepare heat wave index to minimize the health risks.

After elaborative discussion, a consensus was emerged out to address these challenges further, continued advancements in weather forecasting technology, including the use of advanced modeling techniques and satellite data, intense network of Radars/AWSs etc are crucial under Mission Mausam. Additionally, efforts to improve the communication and dissemination of medium-range weather forecasts to farmers, along with the promotion of climate-resilient agricultural practices, can help mitigate the impact of forecast uncertainties at local level on farmer's field for better agricultural productivity and livelihoods.

Session I: Panel Discussion on 'Dialogue on Role of Industry in Developing and Strengthening Techniques to fill Gaps'

There are structured set of following recommendations emerged out of a panel discussion from the above session:

- New techniques for improving the forecast for 3-7 days and beyond for a season should be developed.
- The knowledge of multidisciplinary team should be integrated to improve the accuracy of weather forecasting.
- There is a need of accurate downscaling of rainfall data along with spatial rainfall accuracy enhancement. More rain gauges should be installed for improving the micro level weather forecast.
- Nowcasting and forecast accuracy of hailstorms, thunderstorms and extreme events should be enhanced.
- Forecasting of tropical cyclone has substantially improved but it needs to be further improved to minimize all types of losses.
- Integration of different sources of weather and climate data from all the departments/agencies to improve the accuracy.
- Use of AI, ML Models to improve the accuracy should also be there instead of using statistical model only. Various algorithms should be developed for Indian conditions by using different data science techniques like AI, Big data analysis and block chain technology.
- There is a need to synergize all the government programs at the district level to bring agricultural transformation in small irrigated, rainfed and tribal agricultural system.
- Mathematics, statistics and computer science departments should be associated with IMD to promote research in the field of meteorology.
- IT infrastructure should be developed in Universities to provide weather related services and digitized Agrometeorological Advisory Service.

- Climatic variability in rainfall should be addressed so that the losses can be minimized especially due to uneven and variable rainfall at different crop growth stages.
- Forecast of soil moisture & temperature, wind speed should be improved substantially. Soil moisture data should be improved by integrating the model values and actual values.
- Threshold values of different crops should be identified and dynamic crop calendar should be prepared.
- Fog prevalence/alerts should also be incorporated in forecasting system to improve the agrometeorological advisory services.
- A strong belief about forecast system should be created among the farmers so that they can understand its causes and effects for better understanding and execution of agrometeorological advisory services.
- Use of indigenous knowledge of farmers and tribal communities can also be incorporated on forecasting after proper validation.
- Farmers and crop centric weather oriented advisories should be provided and relevant WhatsApp groups need to be created for actionable agrometeorological advisories.
- Agriculture related start-ups from agricultural organizations should be promoted at village panchayat level.
- Integrated land and water management is essentially required for overall farm management.
- Electronic/Print media reporters and social media bloggers need to be sensitized and trained for scientifically authentic accurate information about the weather and climate and their impacts.

Session II: Panel Discussion on 'Dialogue on Developmental Needs'

Comprehensive recommendations emerged out of detailed discussion held among elite panelists/ domain experts of the above session are listed herein:

- **Focus on Farm-Specific Advisory**: More emphasis should be there on farm-specific advisories rather than region specific advisories.
- **Single Window System**: Establish a single window system for farm advisory and input support to the farmers.
- **International Collaboration**: Enhance international collaborations for students to expand more scientific learning and exposure.
- **Internship Institutionalization**: Develop ways to institutionalize internship programs in the industry for postgraduate students in the subject.
- **Student Involvement in Government Projects**: Students participation should be pro active / mandatory in the implementation of Govt's projects / schemes in meteorology for rural development and food security.
- **Stipend during Internships**: Replace benchmark fees with stipends for student internships to ensure affordability and inclusivity.

- **Role of Agrometeorologists**: Agrometeorologists should not be expected to master all agricultural subjects. Instead, they should focus on weather-related expertise for inclusion in farm advisory.
- **Modern Techniques in Agrometeorology**: Encourage the use of advanced technologies *viz*.,
    - Remote Sensing and AI/ML (Artificial Intelligence/Machine Learning)
    - Crop Simulation &Heuristic Modeling and Quantum Computing
    - **Geospatial Agrometeorology**: Introduce a specialized MSc program in Geospatial Agrometeorology to address emerging needs.
    - **Internship Working Group**: The Association of Agrometeorologists should establish a working group to formalize industry internship programs for postgraduate students.
    - **Capacity Building Programs**: The association should also create a structured capacity-building program with potential funding from organizations *viz*.,
        - MoA&FW (Ministry of Agriculture and Farmers' Welfare)
        - MoES (Ministry of Earth Sciences)
        - Mission Mausam & Other Flagship Programs
- **Routine Advisory Overlap**: Address the issue of multiple routine advisories overwhelming farmers and streamlinethe delivery process.
- **Weather Threshold Identification**: Perform 40-year data analyses to identify weather thresholds for various weather hazards.
- **Improving Remote Sensing Applications**: Enhance the usefulness of remote sensing technology in agrometeorological advisories.
- **Crop Pest-Disease Models**: Develop crop pest-disease models to improve the accuracy and utility of agrometeorological advisories.
- **Decision-Support Inclusion**: Identify issues where farmers need support for inclusion in agrometeorological advisories.
- **Centre for Pest and Disease Forecasting**: Establish a Centre of Advanced Studies for Pest and Disease Forecasting, with agrometeorologists playing a central role.
- **Public-Private Partnerships**: Initiate a public-private partnership consortium to include students in collaborative projects and programs.
- **Employment Opportunities**: Address the lack of employment opportunities in agrometeorology, which deters talented students.
- **Flexibility in Course Selection**: Provide students with greater freedom in selecting MSc/PhD courses to match their interests, goals and opportunities.
- **Dean's Committee Report**: The ICAR's Dean's Committee Report for course syllabus design and selection should serve as a reference rather than a mandatory framework.

Major Recommendations

The major recommendations emanated from the respective sessions were vetted on concluding day of the brainstorming workshop regarding the improvement of forecast accuracy and actionable agrometeorological advisories at farm level with ease for enhanced acceptability among the users/stakeholders. The summary of recommendations thus emerged for immediate actions at various levels are as:

- The gaps in location-specific weather forecasts often arise due to several factors, including limitations in data collection, modeling, and communication. Efforts to address these gaps include expanding the deployment of weather stations, radars, and satellites in underserved regions; leveraging machine learning and AI for better modeling of microclimates and real-time forecasting; improving the accessibility and localization of forecast communication and encouraging global cooperation to share weather data and technological advancements.
- The lack of a robust local database on climate and weather is a significant issue that limits the accuracy, relevance, and usability of weather forecasts and climate models. This problem affects not only day-to-day weather prediction but also long-term planning for agriculture, infrastructure, disaster management, and climate adaptation. Local climate and weather data may be strengthen by expanding observation networks; use of remote sensing and IoT; integrate and modernize historical data; public-private collaboration; capacity building; focus on open data and embrace machine learning.
- Research on developing methodologies to assess the impact of weather forecasts on production system**s** is crucial for improving efficiency, risk management, and decision-making in agriculture and associated sectors. To assess the impact, the key objectives should include quantification of economic impacts; assessment of decision-making outcomes; optimization of forecast utilization and to understand how user responses to forecasts affect outcomes and feedback into the system.
- The lack of analytical techniques for evaluating different management interventions in farming hinders the ability to identify the most efficient and cost-effective operational practices. Addressing this gap requires tailored approaches that account for the unique complexities of agricultural systems, including environmental variability, market uncertainties, and the interconnected nature of farming activities. Network pilot studies/ projects need to be undertaken for local data collection; to develop accessible tools tailored to smallholder farmers; capacity building to train farmers and extension workers in using analytical tools and interpreting results and interdisciplinary collaboration among domain experts to ensure comprehensive evaluations.

- The absence of an agrometeorological component in the teaching and research programs of nearly 25 SAUs and several ICAR institutes is a critical gap that needs to be addressed to strengthen agricultural education, research, and outreach. Agrometeorology, the study of weather and climate's impact on agriculture, is crucial for climate-resilient farming, efficient resource management, and sustainable production systems. Inclusion of Agrometeorological component in SAUs / ICAR Institutes is necessary so as to address the impact of climate change; to improve decision-making in agriculture; to bridge knowledge gaps and further to align with national goals/programs like National Mission on Sustainable Agriculture (NMSA) etc.
- The lack of basic understanding and knowledge among extension personnel to interpret weather forecasts and relate them to local belief creates a significant gap in transferring actionable weather information to farmers. This limits the effectiveness of weather-based advisories that could otherwise improve agricultural productivity and resilience. The strategy to address this issue should include capacity building for extension personnel; development of easy-to-use tools and resources; simplified communication techniques; establishment of localized agrometeorological units, continuous skill development programs and regular monitoring and evaluation

In view of above recommendations, the Association of Agrometeorologists (AAM) in conjunction with ICAR-IARI endorse that IMD, MoES; and ICAR, MoA&FW; Govt of India along with other stakeholders must take immediate necessary following steps viz.,

- **Establishing a Task Force** - Comprising representatives from ICAR, IMD, and other stakeholders to identify gaps and develop a roadmap for strengthening education and research in Agricultural Meteorology.
- **Collaborative Research Projects** - Initiate collaborative research projects between ICAR, IMD, and universities to address specific research gaps and develop location-specific agrometeorological advisory services.
- **Capacity Building Programs** - Organize capacity-building programs, workshops, and training sessions for ICAR/SAUs/PUs faculty, scientists, researchers, and students to enhance their knowledge and skills in Agricultural Meteorology.
- **Involve Farmers and Stakeholders** - Engage with farmers, agricultural extension workers, and other stakeholders to understand their needs and priorities, ensuring that research and education initiatives are relevant and effective.
- **Inter-Ministerial Coordination** - Foster inter-ministerial coordination between the Ministry of Agriculture and Farmers Welfare, the Ministry of Earth Sciences, and other relevant ministries to ensure a cohesive approach to promoting Agricultural Meteorology.

Under recently launched 'Mission Mausam' and other flagship programs of Union Govt, the proactive steps listed above are to address the gaps in weather forecasts immediately to strengthen farmer's field level capabilities for the effective utilization of agrometeorological services which is very crucial for enhancing productivity, ensuring food security, and mitigating the impacts of changing climatic pattern at farm/local/regional scale.

Agenda Program

Venue: Water Technology Centre (WTC) Auditorium, ICAR-IARI, New Delhi

Day 1 : November 27th , 2024 - Wednesday	
09.30 – 10.00 hrs	Registration of Delegates
Opening Session	
10.00 – 11.00 hrs	Inaugural Program
11.00 – 11.30 hrs	**Group Photo & High Tea**
Setting the Workshop Chair: Prof D Raji Reddy, VC, SKL Telangana Horticulture Univ, Telangana Co Chairs: Dr Jagvir Singh, Advisor, MoES, GoI, New Delhi Rapporteurs: Dr SS Sandhu, PAU, Ludhiana, Punjab Dr Saon Banerjee, BCKV, Kalyani, West Bengal	
11.30 – 12.00 hrs	Current Status and Future Plan for of Seasonal Forecast – Dr DR Pattnaik, IMD, New Delhi
12.00 – 12.30 hrs	Medium Range Weather Forecasting and related Services – Dr Mohn S Thota, NCMRWF, NOIDA
12.30 – 13.00 hrs	Current Status and Future Plan for Short Range Forecast & Nowcasting – Dr RK Jenamani, IMD, New Delhi
13.00 – 13.30 hrs	Discussions
13.30 – 14.30 hrs	**Lunch Break**
14.30 – 16.00 hrs	**Dialogue on Gaps in Forecast to Field and Role of Industry in Developing and Strengthening Techniques to fill Gaps** Moderator: Dr N Subash, VP-AAM and Head, Division of Agril Physics, ICAR-IARI Panelists: Prof Raihana Habib Kanth, Dean-FoA, Wadura, SKUAST, Kashmir Prof UC Mohanty, Distinguished Professor, Centre for Climate Smart Agric Prof M Moni, Professor Emeritus, Shobhit University, Delhi NCR Dr Ravi H Patil, Head, Dept of Agrometeorology, UAS, Dharwad Dr Uttam Singh, RMSI Pvt Ltd Rapporteurs: Dr Sita Ram Mishra, Head, Dept of Agrometeorology, NDUAT, Faizabad Dr Himani Bisht, WTC, ICAR-IARI, New Delhi
Day 2 : November 28th , 2024 - Thursday	
10.00 – 11.45 hrs	**Dialogue on Developmental Needs** Moderator: Prof VK Sehgal, ICAR-IARI, New Delhi Panelists: Prof Surender Singh, CCS HAU Hisar, Haryana

	Dr SC Bhan, Former Head AASD, IMD, New Delhi Dr YS Ramakrishna, Former Director, ICAR-CRIDA, Hyderabad Dr GGSN Rao, Former PC-AICRPAM, ICAR-CRIDA, Hyderabad Prof Saon Banerjee, BCKV, Kalyani, West Bengal Rapporteurs: Dr Joydeep Mukherjee, ICAR-IARI, New Delhi Dr Raj Kumar Dhakar, ICAR-IARI, New Delhi
11.45 – 12.00 hrs	**Tea Break**
12.00 – 13.20 hrs	**Concluding Session & Recommendations** Chair: Prof MC Varshneya, Former VC, AAU & Kamdhenu University Co-Chair: Dr SD Attri, Member (T), CAQM in NCR & Adjoining Areas Presentations from Rapporteurs of Different Sessions (5 minutes each) Observations from House
13.25 – 13.30 hrs	Vote of Thanks by Dr Anantha Vashisht, ICAR-IARI, New Delhi
	Lunch

Inaugural Program

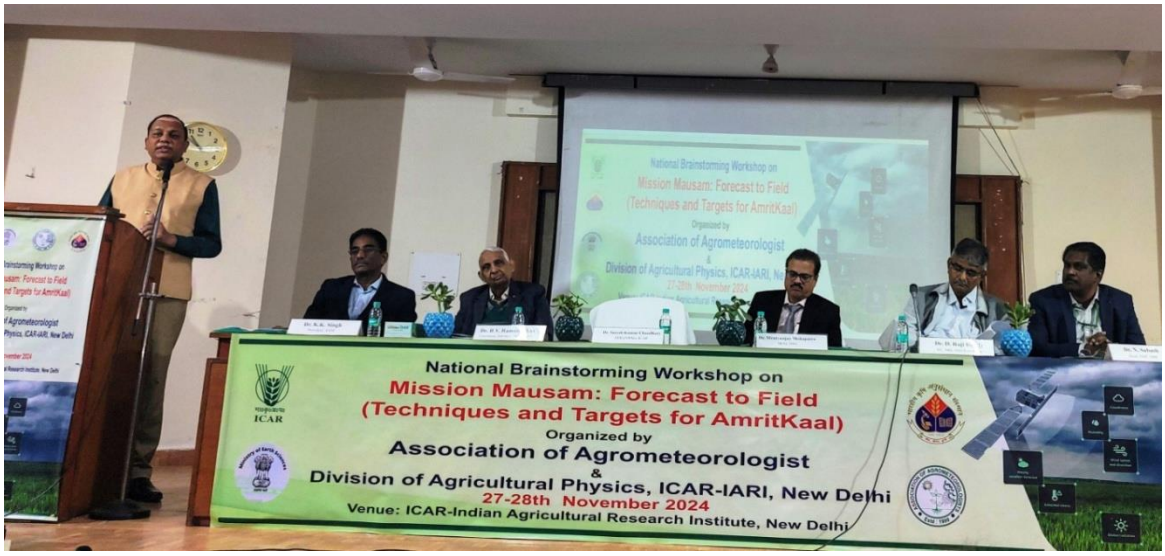
27th November, 2024 (09.30 to 11.00 hrs)

09.30 – 10.00 hrs	Registration	
10.00 – 10.05 hrs	Welcome the Dignitaries & Lighting of Lamp	
10.05 – 10.15 hrs	Welcome Address & Objectives of Workshop	Dr KK Singh President–AAM
10.15 – 10.20 hrs	Future Outlook	Prof BVR Ramana Rao Chairman, Advisory Board–AAM
10.20 – 10.30 hrs	Remarks by	Prof D Raji Reddy Vice Chancellor, SKLTSH University
10.30 – 10.40 hrs	Remarks by	Dr Suresh Kumar Chaudhari DDG (NRM), ICAR, MoA&F
10.40 – 10.55 hrs	Address by Chief Guest	Dr Mrutyunjay Mohapatra DGM, India Met Department, MoES
10.55 – 11.00 hrs	Vote of Thanks	Dr N Subash, VP-AAM Head, Div of Agril Physics, ICAR-IARI

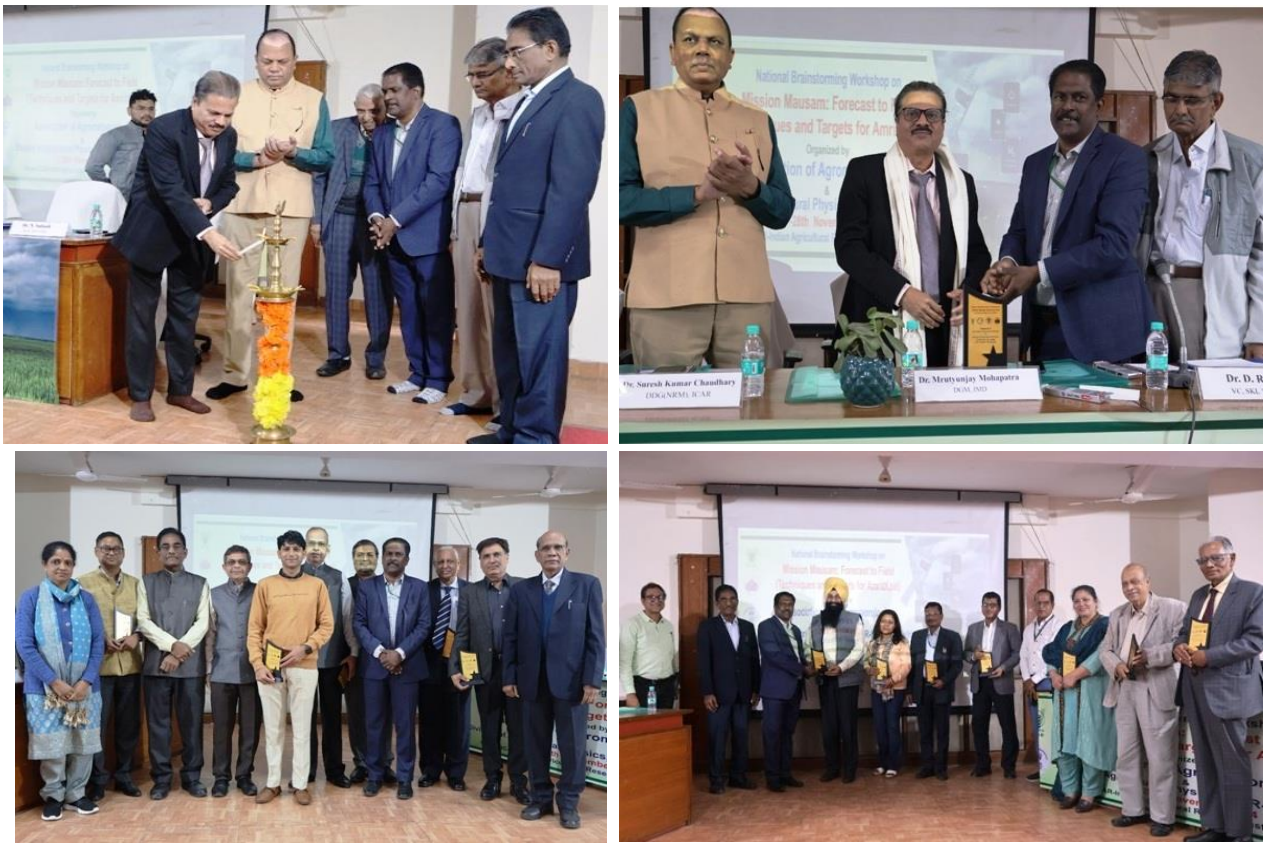
List of Participants

- ***IMD / NCMRWF / IITM etc***
  - Dr Mrutyunjay Mohapatra, Director General of Meteorology, IMD, New Delhi
  - Dr RK Jenamani, Scientist-G and Head (NWFS) IMD, New Delhi
  - Dr VS Prasad, Scientist-G and Head, NCMRWF, New Delhi
  - Dr SC Bhan, Former Head AASD, IMD, New Delhi
  - Dr Atul K Srivastava, Scientist F, IITM, Pune/New Delhi
  - Dr Raju Mandal, Scientist-D, IITM, Pune
- ***ICAR Headquarter, New Delhi***
  - Dr SK Chaudhari, Dy Director General (NRM), ICAR, New Delhi
- ***ICAR-IARI, New Delhi***
  - Dr PS Brahmanand, Project Director, Water Technology Centre
  - Dr N Subash, Head, Division of Agril Physics
  - Dr VK Sehgal, Principal Scientist, Division of Agril Physics
  - Dr DK Das, Principal Scientist, Division of Agril Physics
  - Dr Ravinder Kaur, Principal Scientist, Water Technology Centre
  - Dr Ananta Vashisth, Principal Scientist, Division of Agril Physics
  - Dr Joydeep Mukherjee, Principal Scientist, Division of Agril Physics
  - Dr Raj Kumar Dhakar, Scientist, Division of Agril, Physics
  - Dr Himani Bisht, Scientist, Water Technology Centre
- ***AICRPAM-CRIDA, Hyderabad***
  - Prof BV Ramana Rao, Ex-PC, AICRP on Agrometeorology
  - Dr GGSN Rao, Ex-PC, AICRP on Agrometeorology
  - Dr YS Ramakrishna, Ex-Director & PC, AICRP on Agrometeorology
- ***SAUs / PUs / Institutes / Others***
  - Prof MC Varshneya, Former Vice Chancellor, AAU & Kamdhenu University, Gujrat
  - Dr D Raji Reddy, Vice Chancellor, SKLTSHU, Siddipet, Telangana
  - Dr SD Attri, Member (Technical), CAQM in NCR & Adjoining Areas
  - Prof UC Mohanty, Distinguished Professor, Centre for Climate Smart Agric
  - Prof M Moni, Professor Emeritus, Shobhit University, Delhi NCR
  - Dr Surender Singh, Principal Scientist, CCS HAU Hisar & Ex-Vice President, AAM
  - Dr Saon Banerjee, Principal Scientist, BCKV, Kalyani, West Bengal
  - Dr Ravi H Patil, Head, Dept of Agrometeorology, UAS, Dharwad
  - Dr Uttam Singh, RMSI Pvt Ltd
- ***Associations (AAM) / Others***
  - Dr KK Singh, President-AAM & Ex ADGM & Head Agromet, IMD, New Delhi
  - Dr N Subash, Vice President-AAM & IMS, ICAR-IARI, New Delhi
  - Dr SS Sandhu, Vice President-AAM, PAU, Ludhiana
  - Dr SR Mishra, Zonal Rep (Central Zone)-AAM, NDUAT, Faizabad
  - Dr Jagvir Singh, Co-Opted Member - AAM, MoES, GoI, New Delhi
  - Dr Raihana H Kanth, Co-Opted Member - AAM, SKUAST, Kashmir

- **Photo Gallery**



Inaugral Session: Digntaries on the Dias; Dr Mrutyunjay Mohapatra, Dr SK Chaudhari, Dr D Raji Reddy and Prof BV Ramana Rao alonwith President & Vice President - AAM



Workshop Glimpses

Acknowledgments

The Association of Agrometeorologists in India is grateful to Dr M Ravichandran, Secretary, MoES, Govt of India whose vision made Mission Mausam a reality with commitment to extend the benefits of Agrometeorological Advisory Services to the entire farming community in the country and prompted us to plan and organize this Brainstorming Workshop though he could not join us in person because of prior official commitments. Your visionary leadership and ardent concerns in promoting R&D efforts in Agrometeorological Advisory & related domains are praiseworthy.

The Association is deeply indebted to Dr Mrutyunjay Mohapatra, Director General of Meteorology, IMD, MoES, Govt of India for gracing the 'Mission Mausam' *Brainstorming Workshop as the Chief Guest. Your presence and inspiring address have been a tremendous source of encouragement, setting the tone for meaningful discussions and innovative ideas so as to realize the maximum benefits of weather and climate services.*

I, on behalf of the Association also wish to place on record the tactical support of Dr SK Chaudhari, DDG (NRM) for assured pledge of Council in promoting advance research in agrometeorology. Your insightful perspectives and profound knowledge have greatly enriched our discussions, providing a clear roadmap for connecting forecasts to farmer fields. We also extend our deepest gratitude to Dr D Raji Reddy, Vice Chancellor, SKLT State Horticultural University, Telangana for inspiring words and visionary insights that have set the stage for fruitful discussions, highlighting the critical link between meteorological forecasts and their applications in horticulture sector.

On behalf of Association of Agrometeorologists, I take this opportunity to express a deep sense of gratitude to Dr TR Sharma, Deputy Director General (Crop Science) ICAR & Director, IARI, Prof MC Varshneya (Former Vice Chancellor, AAU & KU, Gujarat); Prof BV Ramana Rao (Chairman, Advisory Board - AAM); Dr YS Ramakrishna (Former Director-CRIDA); Dr GGSN Rao, (Former PC of AICRPAM); Dr UC Mohanty (Distinguished Professor-CCSA); Dr M Moni (Professor Emeritus, Shobhit University); Dr SD Attri (Member-Technical, CAQM); Dr SC Bhan (Former Head-AASD, IMD); Dr JV Singh (Advisor, MoES); Dr PC Brahmanand (PD, IARI-WTC); Dr N Subash & Dr SS Sandhu (Vice Presidents-AAM); Dr Surender Singh (Pr Scientist, CCS HAU Hisar); Dr Saon Banerjee (Pr Scientist, BCKV Kalyani); Dr Ravi H Patil (Sr Scientist, UAS Dharwad); Other Officers/Experts from ICAR, IARI, IMD, NCMRWF, SAUs, Private Institutes & Industries etc, Office bearers of Association of Agrometeorologists and other stake holders for their active participation, expert opinion, prophet guidance and precious inputs for conducting the discussions and enriching the workshop with tangible recommendations to strengthen foundation for actionable strategies, ensuring the success of Mission Mausam for sustainable development in Agriculture and Allied Sectors.

December 5th, 2024

(Dr KK Singh)
President- Association of Agrometeorologists
Former Head, Agromet Division & Additional Director General / Scientist 'G'
India Met Department, Ministry of Earth Sciences, New Delhi, India

ASSOCIATION OF AGROMETEOROLOGISTS

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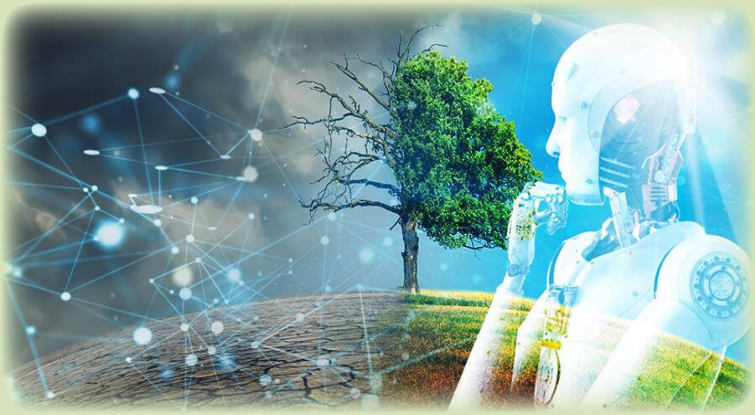
November 2024

Mission Mausam



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