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Review Article

The Agrometeorological edge: Transforming agriculture in a changing climate

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ABSTRACT

Agrometeorology can be summed up as being a critical node where meteorological science meets the agricultural sector. It is highly important in bringing adaptation tools and strategies to the farmers' realm in response to climate-related challenges. Agrometeorology discusses impacts from extreme weather events as well as the resource constraints in relation to the climatic changes through the center of early warning and climate-resilient agriculture. This paper focuses on the role of agrometeorology in reducing the adverse effects of climate change on farming through tools such as remote sensing, agroclimatic zoning, and advanced models. Case studies from India will demonstrate practical applications and transformative potential for agrometeorological services in developing sustainable, climate-smart agricultural systems. Several integration challenges, such as data gaps, infrastructure deficiencies, and lack of farmer awareness on integrating AI technologies that promise a revolution in precision farming, are high. This underlines the use of a multi-disciplinary approach, with appropriate robust policies and technologies, toward building agricultural resilience to a changing climate.

Keywords: Agrometeorology, Climate change, Agricultural adaptation, Extreme weather events, Climate-resilient agriculture.

Agrometeorology is the interdisciplinary science of the location, relationship, and application of research relative to biological phenomena and associated water and weather components related to agriculture. It seeks to provide the farmer and the agriculturalist with the information and insight needed to enhance yield and combat climatic challenges (Chattopadhyay and Chandras, 2018). Climate change is associated with global alterations in precipitation relevant to agriculture, levels of carbon dioxide rising across the globe, and average temperature increases; such climatic shifts jeopardize international operations of grain and cereal agriculture across the planet as they make the potential for natural disasters from drought to flooding more likely (Habib-Ur-Rahman *et al*., 2022). The technologies necessary for improved food security and better climate adaptive capacity in agriculture include climate-smart agriculture, precision agriculture, and next-generation forecasting technologies (Praveenkumar *et al*., 2024). In populous developing countries such as India, the Agrometeorological Advisory Services (AAS) require large investments in developing the advisories and the institutional setup needed to disseminate advisories (Nannewar *et al*., 2023). To combat the problems created by climate change, namely famine, malnutrition, loss of agriculture and biodiversity, loss of land and soil, droughts and floods with poverty, there is a need to know more how to manage your natural resources. The new integrated agrometeorological strategies for improving technologies and good practices are required to manage crops and livestock and to manage the soil, land and ecological resources of the country (Chattopadhyay and Chandras, 2018). Some concerns in areas of agrometeorological system consist of agrometeorological data, study, and relations i.e. impact of weather, climate, crops, pests, and diseases, weather forecasts of different timescales, decision support, and dissemination to end users. These include inadequate access to agrometeorological observations, imperfect weather inputs and poor knowledge of crop weather relationships (Rathore, 2020). The Agrometeorological edge also involves the use of Artificial Intelligence (AI) in which there is a system to incorporate incremental technological advancement and, at the same time, balance, automate and manage huge amounts of data and different challenges. It is commonly employed across several mapping use cases in agricultural sciences via different learning methodologies such as machine learning (ML), deep-learning (DL), and artificial neural network (ANN) models (Pokhariyal *et al*., 2024).

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Table 1: Key research studies in agrometeorology

Focus	Key Findings	Proposed Strategies	Author(s)
Transformational adaptation in agriculture under climate change	Discussed the practical applications of adaptive measures in the face of extreme weather, reduced water availability, and changing crop productivity	Rethinking resource use, redesigning agricultural systems, fostering community resilience	Vermeulen *et al.,* (2018)
Transforming agriculture and food systems to address sustainable development goals	Highlighting the integrated approaches to transform agriculture for sustainability. It particularly sets priority areas in climate-smart agriculture, resilient supply chains, and sustainable diets	Climate-smart agriculture, resilient supply chains, sustainable diets, and scalable solutions	Campbell *et al.,* (2018)
Transition to climate-smart regenerative agriculture	Investigated change adoption processes in relation to persistence and processes of adopting certain practices: crop diversification; conservation tillage and improving soil health	Crop diversification, conservation tillage, knowledge-sharing networks, and supportive policy frameworks	Gosnell *et al.,* (2019)
Digital transformation in agriculture	Discussed how technologies such as IoT, AI, and big data have helped revolutionize agriculture. Specially mentioned the new innovations such as smart irrigation, automated machinery, and precision farming	Adoption of IoT, AI, big data, implementation of smart irrigation, automated machinery, and supportive policy measures	Dayioglu and Turker (2021)

ROLE OF AGROMETEOROLOGY IN MANAGING EXTREME WEATHER EVENTS AND AGRICULTURE

Agrometeorology serves as a vital link between meteorological research and agricultural practices. It enhances sustainable farming methods and lessen agriculture's susceptibility to climate unpredictability, this multidisciplinary discipline combines meteorological data with agricultural activities (Chandio *et al*., 2020). Advanced satellite imagery, radar, and computer modeling are required to detect and predict aberrant weather phenomena and issue early warnings regarding such impending events as cyclones, floods, or heatwaves, preparing farmers to take advance measures in protection of crops, livestock, and equipment on farms. Agrometeorology also supports climate-resilient agriculture, which is a form of agriculture that can cope with the emerging climatic conditions (Arora, 2019). Numerous studies have been conducted in the field of agrometeorology, covering a range of topics such as digital transformation and transformational adaptation in agriculture; some of the key findings include the practical implementation of adaptive measures and integrated approaches to transform agriculture for sustainability; other suggested strategies include climate-smart agriculture and redesigning of agricultural system (Table 1).

Agrometeorology research at ICAR began in May 1983 with the launch of the AICRPAM at ICAR-CRIDA, which had 10 cooperating centers in Anantapur, Anand, Bangalore, Hisar, Jabalpur, Ludhiana, Mohanpur, Ranchi, Solapur, and Varanasi.The study was expanded to include 25 SAUs nationwide in order to conduct research with the primary goals listed below: (i) To investigate how crop planning and crop production potential evaluation relate to the agricultural climate in various agroclimatic zones.(ii) To determine crop-weather connections for the main crops that are irrigated and rainfed in various agroclimatic zones. (iii) To compare the various methods of crop microclimate alteration in order to increase crop productivity and water usage efficiency.(iv) To investigate how weather affects the occurrence and dissemination of field crop pests and illnesses (Rathore e*t al*., 2025).

CLIMATE CHANGE IMPACTS ON AGRICULTURE

Climate change is threatening agricultural output in areas with food insecurity, particularly in Asian nations. Numerous climate-related extremes, such as heat waves, drought, storms, floods, and unpredictable and heavy rainfall patterns, negatively impacted farmers livelihoods (Habib-ur-Rahman *et al*., 2022). The connection between climate change and agriculture is illustrated by (Fig. 1) demonstrating how droughts and food loss are caused by unpredictable rainfall patterns; heat stress lowers crop production; and pests and agricultural diseases are more common in warmer climates.

The effects of climate change on crops

Greenhouse gas (GHG) emissions brought on by global warming have emerged as a major hazard to agricultural operations. Due to decreased agricultural output, climate change has a direct impact on food security and supply chains. It has affected crops differently in different parts of the world (Bhatta *et al*., 2024). Semi-arid to arid regions of Asia are already dealing with low productivity and drought stress. Grain production and wheat crop quality have decreased due to the detrimental effects of increasing

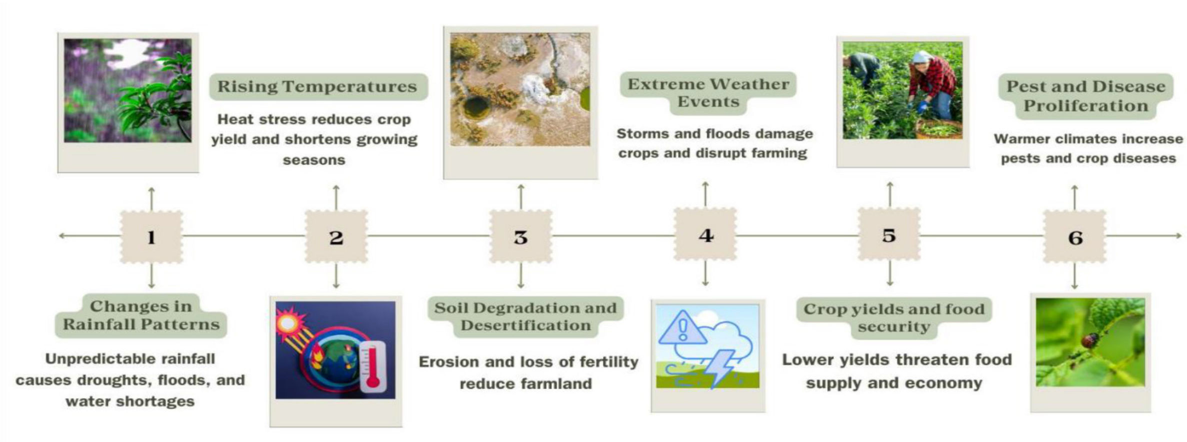

Fig. 1: Interrelationship between agriculture and climate change

temperature and erratic rainfall with high intensity (Zheng *et al*., 2024). Numerous significant variables, including air temperature and carbon levels, precipitation volumes and patterns, related salinity, and the buildup of poisons in soil. It has been demonstrated that rising temperatures globally lead to significant variations in different hydrological parameters including but not limited to evapotranspiration, runoff, ground water and soil moisture. The estimate suggests that agricultural yields may fall back down by 5-10% as temperatures increase in the future, for every degree Celsius. Plants must finish their growing cycle faster in warmer climates (Bibi and Rahman, 2024). Temperature and rainfall have a significant impact on crop productivity, which fluctuates greatly because of interannual climate variability. Global yields are predicted to decline, with significant losses anticipated, particularly in tropical areas. Temperature and rainfall variations are recognized as the primary factors that directly affect crop growth and development among a wide range of meteorological variables. By altering the physiological and biochemical characteristics of crops, these stresses significantly contribute to a bigger reduction in yields (Praveenkumar *et al*., 2024).

Observed changes in adverse weather conditions

Over the last few years, dramatic changes in adverse weather conditions have been reported across the world and have been straight contributors to distortion in agricultural systems. For instance, heavy downpour during the harvest season leads to waterlogging and spoilage of crops, whereas long drought periods can stunt the growth of crops because of inadequate soil moisture. Besides, frost events that occur during unusual seasons may damage or destroy sensitive crops such as fruit trees and vegetables (Skendzic *et al*., 2021). The continued increase in global temperatures is a significant threat to agriculture since greenhouse gas emissions continue to push the temperature of the globe upward. High temperatures accelerate the rate of evaporation of soil moisture, thus lowering the availability of water for crops and resulting in increased irrigation and delayed flower and fruit development. In addition, some areas that are now suitable for farming may eventually be unsuitable for traditional farming under warmer temperature, requiring farmers to adapt to new crops or completely abandon farming (Huong *et al*., 2019).

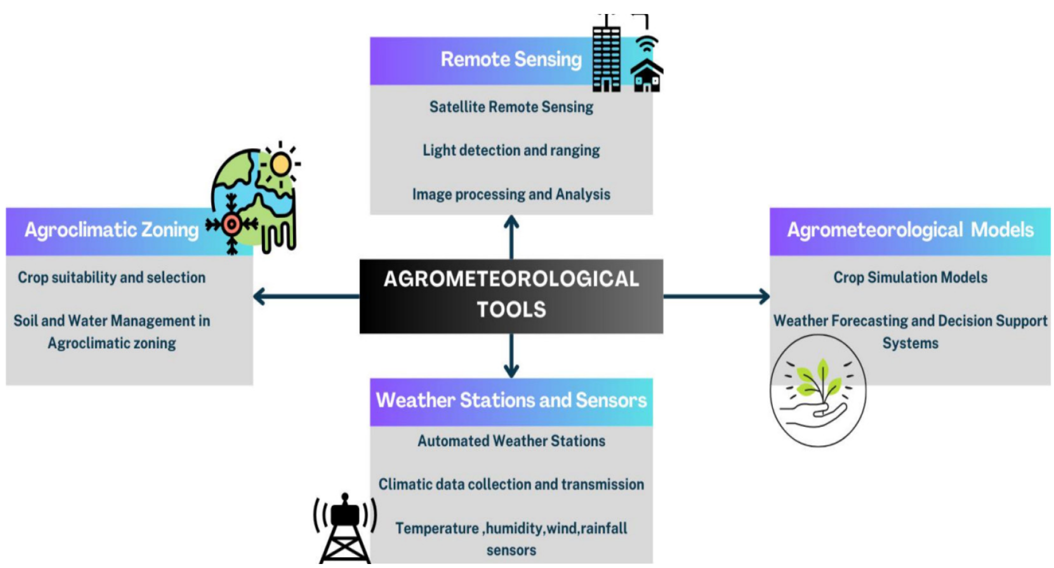

Fig. 2: Agrometeorological tools for climate change and agroclimatic management

TOOLS OF AGROMETEOROLOGY USED IN COMBATING CLIMATE CHANGE AND AGROCLIMATIC CONDITIONS

Agrometeorology is actually an integration of advanced tools and techniques that should assist farmers as well as the decision-maker to adapt to climate change and reduce impacts on agriculture. These tools avail crucial data or insights helpful for better planning and resource management as well as in preparations for disaster, as seen later in the discussion on major agrometeorology tools (Nannewar *et al*., 2023). The use of various agrometeorological techniques for climate change and agroclimatic management is explained in (Fig. 2), which shows how these tools provide vital data or insights useful for improved planning, resource management, and disaster preparation.

Remote sensing

One of the revolutionary techniques of agrometeorology is remote sensing, with an entire satellite and aerial imaging system used to monitor and analyze vast environmental and agricultural conditions. The information regarding parameters such as vegetative health, soil moisture, land use, and atmospheric condition is captured with the help of a remote sensing technology, offering vital information required for agricultural planning and disaster management. It thereby tracks soil moisture as an important factor enhancing the growth of crops and helps farmers in scheduling the irrigation, therefore saving more water (Soussi *et al*., 2024). Remote sensing facilitates monitoring onsets and the progressions of drought and floods, so that near real-time information may be available in connection with weather patterns and precipitation events, thus allowing for timely provision of warnings relating to possible disasters and improving efficiency in recovery actions. The strength lies in the use of the technology to give an holistic perspective of agricultural landscapes in mostly ground-infrastructure constrained regions that further develops precision farming and large-scale informed decision-making (Aryal *et al*., 2020). The most appropriate option for predicting crop production is satellite-derived remotely sensed data due to its multispectral information and repeatability. Numerous studies have used satellite-derived vegetation indices (VIs), such as the enhanced vegetation index (EVI), normalized difference vegetation index (NDVI), and near-infrared reflectance of vegetation (NIRv), to estimate agricultural production (Jhajharia, 2025). The change in the seasonal patterns of the vegetated surfaces as seen by remote sensing data is known as land surface phenology (Pokhariyal *et al*., 2024).

Agroclimatic zoning

Agroclimatic zoning is the systematic classification of different regions according to soil, climatic and ecological characteristics. It facilitates farmers to grow crops according to climatic conditions of a particular area, helps in agricultural infrastructure planning and development, optimizing resource use and building resistance against extreme effects of agroclimatic conditions (Nannewar *et al*., 2023). Agroclimatic zoning ensures sustainability in agriculture and maintaining crop productivity in particular areas. For example, farmers choose for growing crops such as millets, sorghum in dry climatic conditions; rice in areas having high rainfall intensity, fruit crops such as apple in cold regions. Such zoning also enables development of specific storage conditions, irrigation systems and transport networks which are specific needs of that particular agroclimatic zone (Zheng *et al.,* 2024).

Agrometeorological models

Agrometeorological models play a vital role in yield forecasting. Simulations predict yields based on both real-time and forecasted weather conditions to make plans regarding food security and formulate supply chain management and market forecasts. These models provide forecasts of crop pests and disease outbreaks by applying weather data input, which has enabled farmers to start preventive measures even before the arrival of the event, thus further reducing crop loses (Aryal *et al*., 2020). Long-term analysis of climate provides through these models is essential when it comes to understanding how particular future climate will affect agriculture as a whole and therefore helps policymaker design relevant adaptation and mitigation strategies to address these changes appropriately and ensure sustenance in agro-practice (Nannewar *et al*., 2023). Crop growth models offer a special chance to add data from field trials since they take into consideration how different factors affect yield. Numerous studies and farmer-level field tests have been carried out in India, documented in published works, and are accessible for model testing (Guhan *et al*., 2024).

Weather stations and sensors

The two most crucial pieces of equipment on the ground are weather stations and sensors, which provide real-time meteorological data from the ground and help manage and control the local agroclimatic conditions. A farmer may make data-driven decisions about improving crop production and developing plans to mitigate risks caused by climate change thanks to the precision agriculture and disaster prevention capabilities of all these equipment. Temperatures, humidity, rainfall, wind speeds, and radiant solar radiation intensities are among the parameters that environmental stations measure (Aryal *et al*., 2020). Besides, weather stations can predict those conditions that would be favorable to pest and disease outbreaks by observing the temperature and humidity levels. Many of the present-day weather stations are integrated with the IoT and it can analyze the data and share the updates through the mobile application or cloud platforms. Weather stations and sensors close the gap between global meteorological forecasts and localized needs of farmers by ensuring they have information that enables them to effectively respond to climate challenges and enhance agricultural productivity (Soussi *et al*., 2024).

CASE STUDIES

India's agrometeorological advisory services (AAS)

The Agrometeorological Advisory Services were initially established by the India Meteorological Department in 1988 with the aim of enabling farm-level decisions based on weather data. AAS is now coupled with mobile advisory, SMS-based service, as well as direct online access, enabling the farmer to access real-time location-based information even directly in their field (Rathore et *al*., 2025). The Agrometeorological Advisory Services (AAS) were established due to the increasing vulnerability of agriculture to weather extremes and unpredictable changes in climatic conditions. The Indian farmers faced extreme issues in the 1980s because of the erratic monsoonic season, droughts, floods, and some climatic factors, which often resulted in crop failures and led to great economic losses. Thus, the Indian government came to realize that the farmers were devoid of information on crucial weather forecasts. AAS was developed in response to this (Ratiya *et al*., 2022). Under the "Gramin Krishi Mausam Sewa (GKMS)" program, IMD currently provides weather forecast-based District/ Block level Agromet Advisory Services (AAS) for the benefit of farmers nationwide in partnership with ICAR, SAUs, and other organizations. Every Tuesday and Friday, 130 Agromet Field Units (AMFUs), which are co-located with SAUs, ICAR, Indian Institutes of Technology (IITs), and approximately 3100 blocks, prepare the agromet advisories for all of the nation's agriculturally significant districts. Additionally, 199 District Agromet Units (DAMUs) are established within the premises of Krishi Vigyan Kendras (KVKs) of ICAR (Singh *et al*., 2023).

Benefits and disadvantages of AAS

The purpose of AAS is to counsel the farming community on the implementation of appropriate management techniques in their farming operations, such as crop harvesting, fertilizer application, plant protection measures, irrigation scheduling, variety selection, and sowing, depending on predicted and actual weather conditions. By maximizing the benefits of favorable weather and reducing the effects of unfavorable weather, AAS offers farmers highly specific inputs in the form of advisories that can significantly impact agricultural output (Ratiya *et al*., 2022). The most important advantage of Agrometeorological Advisory Services is that it provides site-specific weather-based advisories designed for the needs of the farmer. These advisories give information, which is localized; for example, best time for planting, allowing the farmer to plant crops when the weather conditions are favorable and at the same time minimize risks of crop failure. From the weather pattern analysis, the system can predict the likelihood of pest and disease outbreaks, allowing farmers to implement preventive measures early (Nannewar *et al*., 2023). There are many obstacles and restrictions that keep AAS from becoming fully effective. The majority of farmers still face obstacles to basic literacy, especially those who reside in rural and isolated locations, despite the rapid growth of digital platforms and mobile services. They can be unable of comprehending or interpreting weather advisories, which reduces the service's usefulness (Ratiya *et al*., 2022).

CHALLENGES IN THE AGROMETEOROLOGICAL SECTOR

Despite its promise to transform farming practices, agrometeorology faces many challenges that hinder its adoption and effectiveness. Many challenges together limit the potential impact of agrometeorology in improving productivity, sustainability, and resilience in agriculture. Data gaps, lack of farmer awareness, inadequate infrastructure, and resource limitations are the main issues faced by the agrometeorological sector (Fig. 3).

Data gaps and infrastructural deficiencies

Perhaps one of the biggest limitations that agrometeorology is faced with is the lack of availability and accessibility of localized high-quality meteorological data. Such information is quite vital to agrometeorological systems since they need weather information that can be very site-specific in terms of accuracy (Rickards and Howden, 2012). Weather stations available in the villages are few, old, and not well maintained, which adversely affects meteorological data reliability and accuracy. Without an adequate network of weather stations, the farmers cannot receive localized weather updates and warnings about such critical events as storms,

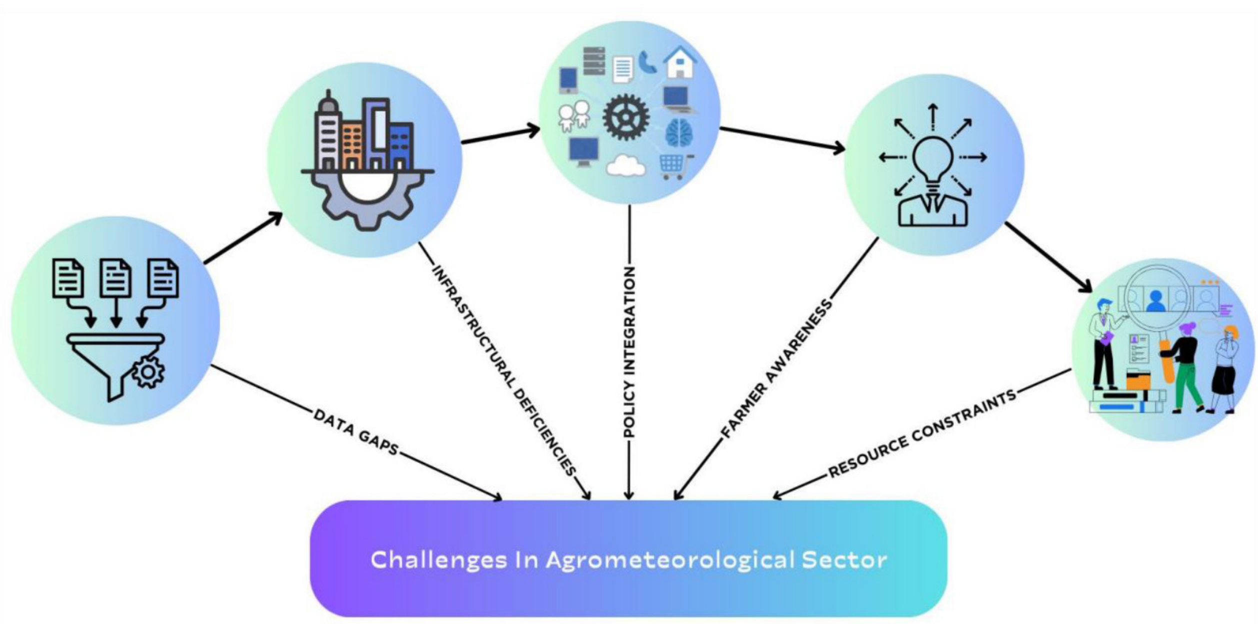

Fig. 3: Various challenges in sector of Agrometeorology

Table 2: Various government policies supporting agrometeorology

S. No.	Scheme name	Launch date	Key objectives	Achievements/Details
1	Pradhan Mantri Fasal Bima Yojana (PMFBY)	2016	Affordable crop insurance to cover non-preventable natural risks from pre-sowing to post-harvest	Insured 5549.40 lakh farmer applications since 2016-17. Rs. 1,50,589.10 crores paid as claims
2	Namo Drone Didi	2024-2025	Provides drones to 15,000 Women Self-Help Groups (SHGs) for rental services in agriculture	Central financial assistance of up to 80% (maximum Rs. 8 lakh). Additional income of Rs. 1 lakh per annum for SHGs
3	Rashtriya Krishi Vikas Yojana (RKVY-DPR)	Ongoing	Focuses on creating pre- and post-harvest infrastructure in agriculture and allied sectors	Since 2019-20, 1524 Agri-startups have been funded with Rs. 106.25 crore in grants
4	Rainfed Area Development (RAD)	2014-15	Promotes Integrated Farming Systems (IFS)	Rs. 1673.58 crore released, covering 7.13 lakh hectares
5	Per Drop More Crop (PDMC)	2015-16	Improves water-use efficiency via micro-irrigation (drip/sprinkler systems).	Covered 78 lakh hectares from 2015-2023
6	Micro Irrigation Fund (MIF)	Ongoing	Expands micro-irrigation through NABARD loans	Loans worth Rs. 4710.96 crore approved; Rs. 2812.24 crore disbursed to states
7	Sub-Mission on Agricultural Mechanization (SMAM)	Apr-14	Enhances farm mechanization and supports small farmers via custom hiring centers and hi-tech hubs	Distributed over 15.75 lakh agricultural machines and established 23,472 custom hiring centers. Drone technology promotion includes funding Rs. 138.82 crore

droughts, or temperature extremes that make decisions on the crop management, irrigation, and pest control (Juhola *et al*., 2017).

Farmer awareness and resource constraints

An important barrier to the successful implementation of agrometeorology is the lack of general awareness and understanding of agrometeorological tools among farmers. Several farmers, especially the smallholder farmers, do not know what the advisory and decision-support tools based on weather information can benefit them or how they can be used properly (Rickards and Howden, 2012). In most areas of the world, the barriers facing scale-up are largely financial and technical. Establishing a weather monitoring network is capital intensive as it also entails sourcing necessary technologies like sensors and satellite data, as well as building the models used in making the prediction. Furthermore, maintenance and upgrade of the infrastructure is continuously funded, which is a problem in resource-poor environments (Zheng *et al*., 2024).

Policy integration

Agrometeorology is supported by a number of government policies, as listed in (Table 2). Policy integration makes agrometeorology be considered as an independent initiative rather than being a core element of holistic agricultural planning. This lack of integration of policy leads to heterogeneous efforts and waste of tools in this sector. Without the full support of policy, necessary funding, infrastructure, and coordination at the institutional level may not be available for the large-scale promotion of agrometeorological services. Therefore, aligning agrometeorology with national agricultural policies is very crucial to ensuring that these systems will be scaled and integrated into farming practices and adequately supported by adequate resources (Barrett *et al*., 2023).

USE OF ARTIFICIAL INTELLIGENCE (AI) IN AGROMETEOROLOGY

The growing global population and food demand have made the necessity of attaining more productivity on less space using effective agricultural techniques inevitable. AI is being integrated into the agricultural society every day, and the devices utilizing AI enhance the present state of the farming sector. By providing them with the best guidance on water management, crop rotation, timely harvesting, the type of crop to be grown, optimal planting, pest attacks, and nutrition management, AI-based agricultural applications and solutions have been developed to assist farmers in practicing precise and regulated farming (Zougmore *et al*., 2021). The agrometeorological sector also benefits greatly from artificial intelligence, which is included into weather forecasting systems, drones, remote sensing, soil and crop health monitoring systems, and AI robotics in agriculture (Fig. 4).

Weather forecasting using AI

Farming is the activity that is dependent on weather patterns to grow and harvest crops. Climate change and pollution

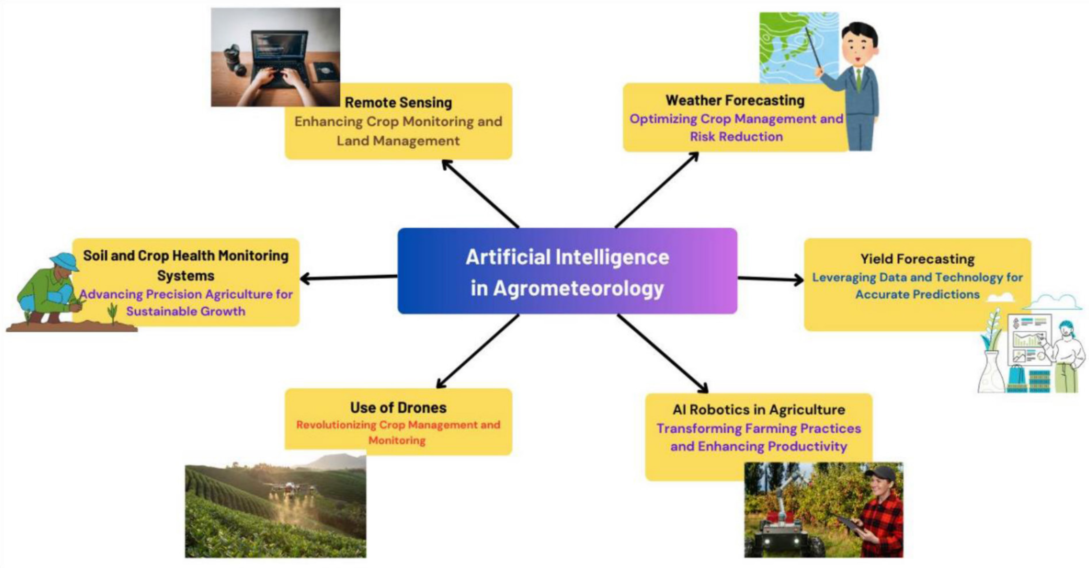

Fig. 4: Role of artificial intelligence in advancing agrometeorology

have made it challenging with changed weather conditions rather than the traditional manners of changing the seasons. Advanced weather forecasting systems are one of the tools artificial intelligence can provide to mitigate such problems (Nannewar *et al*., 2023). The combination of real-time satellite data, historical climate records, and machine learning algorithms provides detailed analysis on the complexity of the weather pattern. AI models are able to process vast volumes of data in rapid speeds while discovering trends for more accurate, highly localized weather forecasting. In-depth forecasts regarding rainfalls, temperature variations, humidity, and potential natural disasters are delivered to the farmer. It has aided them in choosing crucial activities like sowing seeds, when to irrigate fields or apply fertilizers. AI-backed weather forecasting allows farmers to minimize risks, thus cutting down crop losses and increasing yield in agriculture in general (Juhola *et al*., 2017).

Soil and crop health monitoring system

One of the main reasons crop quality and yield vary so greatly is the underperformance of soil. AI-powered soil and crop health monitoring systems have changed the face of agriculture. They work on the information collected by sensors, drones, and satellite images, which would then help to determine the properties of soil, including nutritional composition, pH content, moisture, and texture (Zougmore *et al*., 2021). Crop water demand, water management, and electricity generation all depend on drought prediction. In the hydrological cycle, rainfall data is crucial for predicting and calculating drought. Rainfall data sets derived from reanalysis and satellite products are another method that is available worldwide at both temporal and spatial scales (Suliman, 2024). It also monitors crop health since it can detect the first signs of diseases or infestation by pests so that the farmer prevents them. An AI tool can detect specific pests such as locusts, grasshoppers, or aphids based on the patterns of the images being correlated with the environmental factors. The system will send a real-time alert based on the infestation to farmers, which is very common through mobile applications. The alert information comes with details on the type of pest and how worse the infestation is, together with some recommendations of proper measure to put in control (Soussi *et al*., 2024). Using weather factors to create an accurate forewarning model can help reduce pest outbreaks and increase agricultural output. For agricultural disease and crop pest population dynamics, researchers have created weather-based forecasting models. Therefore, accurate crop pest prediction can assist farmers in determining how much pesticide to apply to the soil, preserving the soil's quality (Naranammal and Priya, 2024).

AI robotics in agriculture

The integration of robotics with artificial intelligence in farming has altered the model of conducting farm operations. Robots with artificial intelligence are released to perform manual processes, in which they work very efficiently with great precision and consistency. These are all fitted with complex sensors, cameras, and higher versions of machine learning, such as navigating fields looking for crops or similar tasks to be done automatically (Juhola *et al*., 2017). Crop harvesting is one of the major applications of these machines, which may work faster and more efficiently than human laborers. Take strawberries and delicate crops being harvested without damage by the robots themselves, which would set them at the ideal quality. Also, reduced physical burden on agricultural workers makes it a safer and more sustainable environment for farming (Soussi *et al*., 2024).

Crop health monitoring using drones

The use of drones in monitoring crop health reduces time and labor consumption in field inspection, improves on accuracy and efficiency, detect moisture stress, pest damage, nutrient lacking in plants and soil. It enhances decision making of farmers and boosts general productivity in agriculture by providing real-time data as well as actionable insights (Pais *et al*., 2020).

CONCLUSION AND FUTURE ASPECTS

Agrometeorology can be summed up as a crucial intersection of meteorological science and agriculture. In order to address climate-related concerns, it is crucial to introduce adaptation techniques and methods to the farmers' domain. Using the Center of Early Warning and Climate-Resilient Agriculture, agrometeorology addresses the effects of extreme weather events and resource limitations in connection to climate change. Using technologies like remote sensing, agroclimatic zoning, and sophisticated models, this research focuses on how agrometeorology might lessen the negative consequences of climate change on farming. Indian case examples will illustrate the usefulness and revolutionary potential of agrometeorological services in creating climate-smart, sustainable agricultural systems. There are many obstacles to integration, including missing data, inadequate infrastructure, and a lack of knowledge among farmers about using AI technology that could revolutionize precision farming. This emphasizes how to increase agricultural resilience to a changing climate by using a multidisciplinary approach along with suitable, strong policies and technologies.

Inclusion of AI in agrometeorology: Use of Artificial Intelligence empowers agrometeorological models by providing real time decisions on pest control, irrigation and monitoring of crop health.

Use of digital platforms: To enable the farmers for the use of agrometeorological models digital platforms such as mobile applications are required; which also provide weather forecasting information and early warnings regarding extreme weather events.

Better data infrastructure: Installation of local weather stations is one of the ways in which data collection can be improved in real-time for better prediction accuracy and farmer-oriented advisories.

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