

Climate Services: An efficient adaptation strategy to impending climate change in Indian Agriculture

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Climate change affects all three aspects of food security: availability, access and absorption. Climate change has about 4–9% impact on agriculture each year. As agriculture contributes 15% to India's GDP, climate change presumably causes about 1.5% loss in GDP. Adaptation has become a national priority for many countries, where this supply of seamless climate services containing advisories for farm and livestock operation is disseminated well in advance of the impending weather, and is playing a pivotal role in the management of climate risks in agriculture. These services are critical to improving decision-making in climate-sensitive sectors like agriculture. Wise use of climate services can help to make better-informed policy, institutional and community decisions that reduce related risks and enhance opportunities, improve the efficient use of limited resources and increase crop and livestock production. Climate services have demonstrably led to improved agricultural and food security outcomes and benefits for stakeholders in the sector across the globe.

Keywords: Adaptation, Climate change, Climate services, Food security, Risks

CLIMATE services can be defined as decision-making support tools developed based on a process of transforming climate information into relevant advisory services that assist decision-making by individuals and organizations of society. Climate services include the provisions of relevant weather and climate information, as well as a variety of advisory services to help decision-makers understand and act on that information—all within a suitable institutional environment. These services typically provide end-user products in the form of tools, products, websites, or bulletins.

Climate information is factual data i.e. climate information describes data on temperature, rainfall, wind, humidity, sunshine hours, and other factors. Climate service is a decision aid that assists individuals and organizations in society to make improved ex-ante decision-making. They rely on a vast amount of climate data and information. However, data is only one component of climate services,

which also include the translation and application of pertinent information to assist society in managing the risks and opportunities associated with climate variability and change. To be successful, any climate service must have a clear problem focus, be based on high-quality observations, and consider climate across multiple time scales. Global Framework for Climate Services (GFCS) envisions enabling better management of the risks of climate variability, change and adaptation to climate change, through the development and incorporation of science-based climate information and prediction into planning, policy and practice on the global, regional and national scale.

Importance of Climate Services in Agriculture

- Based on available climate information, a climate service provides tailored, salient, and usable advisories for policymakers and vulnerable communities.

- Customized climate services in agriculture aim to provide a comprehensive range of advice on climate, its effects on crops, livestock, and fisheries, as well as management practices to be used to prevent, reduce, or manage risks.
- By assisting with decision-making under uncertainty, climate services facilitate and guide early action and preparedness. Reliable access and delivery systems are also required for service.
- Climate services meet the real-time needs of farmers and contribute to weather-based crop/livestock management strategies and operations dedicated to enhancing crop/livestock production and food security.
- Such services can aid in the development of ecologically sustainable and economically viable agricultural systems, as well as the improvement of production and quality; the

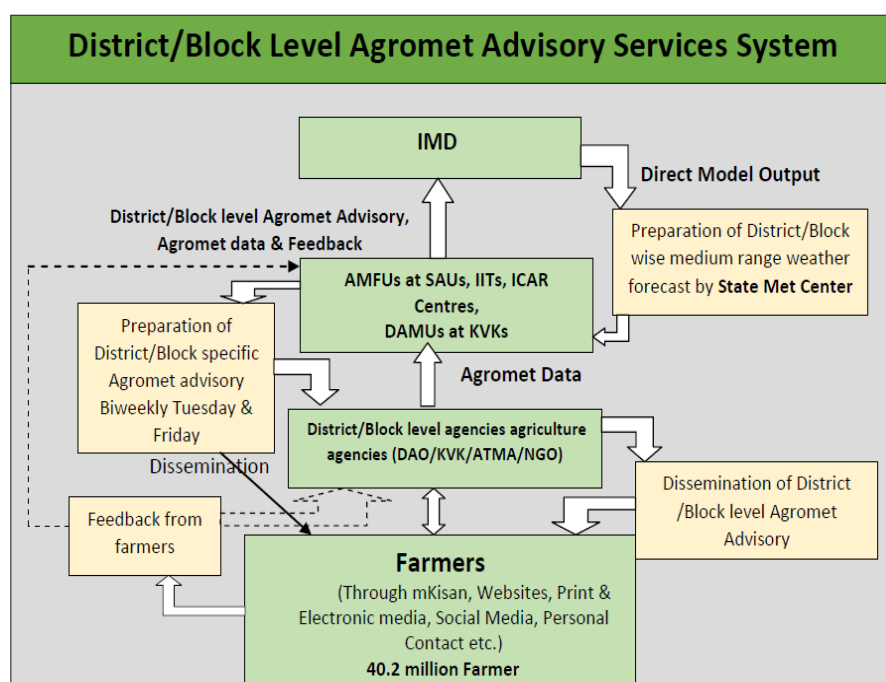
reduction of losses and risks; the reduction of costs; the increase of efficiency in the use of water, labour, and energy; the conservation of natural resources; and the reduction of pollution caused by agricultural chemicals or other agents that contribute to environmental degradation.

- Weather-related agricultural operations such as cultivar selection, sowing, transplanting dates, irrigation scheduling, disease and pest outbreaks as well as intercultural operations, harvest and post-harvest operations, can be anticipated and planned with these services.
- Advisory for livestock on health, shelter, nutrition and disease management.
- National Council of Applied Economic Research (NCAER) has estimated the economic benefit of these services in 2009 at ₹50,000 crores per year is extrapolated to rise to ₹211,000 crores, if the entire farming community in the country were to apply Agromet information to their agricultural activity.

Climate Services in India: How they are organized by IMD

Agrometeorological Advisory Service (AAS) is being provided to farmers at the district level by Indian Meteorological Department (IMD), Ministry of Earth Sciences (MoES) through a network of 130 Agro-Met Field Units (AMFUs) located in each Agro Climatic Zone (ACZ) under Gramin Krishi Mausam Sewa (GKMS) scheme as a step towards contributing to weather information-based crop/livestock management strategies and operations dedicated for enhancing crop production and food security. These agromet advisories are prepared and disseminated by AMFUs twice a week (Tuesday and Friday) covering 668 districts. Currently, 4.3 crore farmers are receiving SMS advisory on their mobile phones through mKisan portal (AAS Division, New Delhi and Agrimet Division, Pune, 2020).

At the district level, the AAS



Process of preparation of Agromet Bulletin (Source: IMD, New Delhi)

bulletin contains observed weather information from the previous five days in tabular format, as well as district-specific weather forecasts in quantitative terms for the next five days for weather parameters such as rainfall, cloud, maximum and minimum temperature, wind speed/direction, and relative humidity, as well as a forewarning of hazardous weather events (cyclone, hailstorm, heat/cold waves, drought, and flood etc) likely to cause stress on standing crop and suggestions to protect the crop from them. Based on forecast values, the weather summary for the next 5 days is kept in the bulletin.

AAS is divided into four sections: meteorological (weather forecasting), agricultural (determining how weather forecasts affect farming), extension (two-way communication with users), and information dissemination (media, IT and others). All of the information is intended to assist farmers in maximising output and avoiding crop damage or loss.

Beneficiaries: 21.69 million farmers are benefitted directly.

Sector covered: Crops, fruits, vegetables, livestock, water supplies for irrigation, and efficient use of chemicals.

Impact: Decreased cultivation costs overall by up to 25%, and increased net returns of farmers

up to 83%. The economic benefit is estimated at \$7.575 billion per year.

Delivery of climate services—covering the last mile

It is crucial to ensure that the final advisory product is communicated efficiently and effectively. In order to ensure that vulnerable communities receive the climate services intended for them, it is necessary to assess the delivery channels. The format should be adapted to local needs and preferences. For example, to keep farmers informed of current farm operations, a radio alert should be sent when they are available to hear it, in their native language, and at a convenient time for them. In addition to community perceptions, localized climate services take into account traditional knowledge of the community, livelihood practices, gender, and reliable communication channels. Decentralized climate service facilitates community participation and strengthens two-way feedback. To deliver end-to-end climate information products and services across all levels of government, an FAO project in the Philippines has shown strong decentralized partnerships between meteorological services and departments of agriculture, research institutes, and provincial, municipal, and village authorities.

The meteorological services must work closely with the intermediary user institutions to add value. Combined with traditionally proven media (e.g. rural radio, farmers' associations, social networks and trusted local NGOs), information and communication technologies (ICT) offer increasing prospects to reach farmers with relevant climate services. In India, this was accomplished by sending SMS and voice recordings in local languages to farmers' mobile phones. Agro Meteorological Field Units (AMFUs) disseminated advisory bulletins to farmers in their respective zones through a variety of communication channels, including mass media (newspapers, television or radio), and cellular phones (voicemail and SMS) and the Internet. A total of 2.5 million farmers in 16 states have access to SMS services, and 30,000 farmers in five states have access to voicemails via an Interactive Voice Response System.

To ensure that climate services are tailored to meet their needs, participatory action research tools have proven invaluable. Farmers in the Kaffrine project, for example, proposed new and more effective ways to reach women farmers, such as SMS messages sent to their children's cell phones in the local Wolof language. Ugandan farmers in some areas were provided climate information in local languages by their children, who learned about it in school and then brought their families (including their mothers) together to discuss it at home, as part of a project there. The alerts were also communicated through religious organizations and women's savings groups. Similarly, farmers surveyed by India's Integrated Agrometeorological Advisory Service (IAAS), the world's largest of its kind, suggested that agrometeorological bulletin boards in the local language be posted at strategic outposts throughout their villages, where they could be read as the farmers went about their daily activities.

Other potential emerging alternatives, according to the literature, include customized

mobile applications, web-based interactive platforms, voice mails and SMS, SHGs, and partnerships with other intermediaries, such as media communication professionals, NGOs, community-based organizations, and women's associations, to serve as the missing link between communities at risk and forecasters. Priorities for climate service providers should include the following:

- To begin, user communities should be involved and work to bridge communication gaps.
- Second, institutional and technological capacity should be developed, with a focus on frameworks that allow for a better user interface.
- Third, they should think about decentralizing climate services to be more responsive to user needs, with feedback and dissemination options.
- Finally, they should make a concerted effort to integrate advocacy and policy decision-making.

Contextualizing advisory to the local context

For any national program to be successful, end-user participation in the assessment of their climate service needs is a prerequisite. Climate service requirements are highly context-dependent, varying from village to village. An effective ex-ante assessment of farmer climate service needs using tailored participatory action research tools to match services to local end-user needs ahead of project design, can be seen in examples from the Indo-Gangetic plains of India and Kaffrine, Senegal, which target women farmers. A mapping of farmer adaptation and climate service needs in every target region or sector is required. Identifying end-user needs also entails valuing local information sources. The community should be asked to identify any information gaps or needs that they have noticed. Following the identification of end-users context-specific climate service needs, their ongoing participation in the production, delivery, and

evaluation of climate services is critical to ensure that delivered climate services meet identified needs. This is the role of the User Interface Platform, one of the most critical components of the GFCS.

Climate knowledge and services are highly limited to small farmers because they are not tailored to community needs or are not translated into the local language. Two factors, in particular, contribute to this information gap as reported by FAO in 2019:

- Farmers require local agrometeorological information that accurately depicts the farming environment, which is frequently lacking.
- Due to a lack of access to local extension staff and farming communities, integrating meteorological and local knowledge is difficult.

On the downside, CCAFS points out that forecast categories do not include necessary threshold information for specific decisions and are susceptible to misinterpretation. There is ambiguity about forecast accuracy and uncertainty, and there is a lack of decision-relevant information beyond seasonal average precipitation or temperature.

To address this last mile gap, FAO launched Farmer Field Schools in 1989 as a platform for farmer education and empowerment (FFS). FFSs now cover over 90 countries with between 4 lakh and 1 million farmers using FFS annually. Another innovative initiative, Forecast-based Financing (FbF), a WFP initiative uses climate forecasts to trigger community-level actions to reduce disaster risks and impacts. The WFP facilitates dialogue between information producers and users and a key role in tailoring and transmitting information to all stakeholders is played by extension services and other knowledge intermediaries, who also provide feedback on the validity of information and products developed by using a mix of ICTs, such as mobile apps, radio, and television.

Implications for further scaling up of climate services

1. Addressing the salience challenge

- Climate and agricultural organizations and farmers need institutional arrangements and investments in capacity at multiple levels that support sustained interaction.
- Relevant to farm decision-making at a local scale.
- With a range of lead times, a seamless suite of the forecast, advisory and early warning products enables farmers to manage evolving risks throughout the season.

2. Addressing the legitimacy challenge

- Climate services are more likely to be adopted if farmers have a say in their design and production.
- It is possible that combining meteorological data with local indigenous knowledge will increase trust as well as local relevancy and use.

3. Addressing the access challenge

- An effective way to share historical and seasonal climate information is through face-to-face conversations between farmers and service providers.
- It is possible to reach a large number of farmers with relevant information using ICTs and other communication channels, which opens up new possibilities.
- Co-production processes, in which end-users are always involved in the development of

climate services, should replace top-down pushes of information to users.

4. Addressing the equity challenge

- The inclusion of women and other socially marginalized groups in the design and delivery of climate services for rural communities can be improved by proactively targeting these groups in the first place.

5. There is a need for systematic monitoring and evaluation of socio-economic benefits associated with climate services. In order to facilitate cross-country learning and sharing, this body of knowledge will need to be consolidated and managed.

6. Climate services must be prepared at the most grassroots level possible (block-level) for increased uptake and utilization by the farming community in order to address more crop and location-specific needs of farmers and to take into account the wide variations in weather within the districts.

7. Impact outlooks and management alternatives addressing local needs should be considered by agriculture extension and community-based organisations, as well as communicating information and receiving feedback.

SUMMARY

Climate services are gaining attraction around the world as an important part of the climate adaptation agenda. The provision of accurate and locally relevant climate services is a critical building block in improving community's resilience

to climate change. As part of a new initiative, the Global Framework for Climate Services (GFCS), several countries are working to improve their capacity to provide these services so that they can prepare for the future of climate change. Through the Agro-Meteorological Advisory Service (AAS) programme of the Indian Meteorology Department (IMD), farmers have been providing weather-based, crop-focused agrometeorological advisories at the district level for several years. While climate services for farmers have improved significantly, a large body of research suggests that the availability of information is insufficient to assist unreached and marginal farmers in rural areas. Climate information must be translated into actionable advisories for farmers based on their specific location. It is necessary to link climatic information with available technologies and best farming practices. Small farmers require customized, location-specific, and crop-specific actionable information. Climate services are important steps toward assisting vulnerable populations and sectors in adapting to today's and future climate. The ability of climate services to address risks and opportunities at relevant time scales with appropriate solutions informed by high-quality data will determine their success.

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