

PREAMBLE

Weather and climate are the integral parts of the agricultural production system that are reflected in the dependence of the economy and food grain output on monsoon activity year after year. Weather is an important component not only for crop production but also for horticultural crops, livestock, fisheries, forestry and other areas such as transport, storage and marketing of agricultural products. The Agricultural Meteorology Division, India Meteorological Department has made considerable progress in the field of operational agrometeorology and also contributed significant services to the farmers of the nation; however, in order to keep pace with the increasing demand for foodgrain production including impacts of climatic risk and climatic variability on crop yields there is need to work with renewed vigour to face complex challenges of weather and climate and to harness benevolent weather for the welfare of the farmers, consumers and other stakeholders in the food-supply chain.

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Vision

Ensure issuance of crop and location specific agromet advisories for the farmers even up to village level through technological innovations by establishing world class operational agrometeorological advisory services.

Our Mission

- Harness of the Agromet Advisory Services by providing a very special kind of inputs to the farmer as advisories that can make a tremendous difference to the agriculture production by taking the advantage of benevolent weather and minimize the adverse impact of malevolent weather.
- Harness the beneficial effects of favorable weather conditions on agriculture and minimize the adverse effects of unfavourable and extreme weather events on crop production even at village level.

Focus

To accomplish the vision and the mission of the Agromet Advisory Services , Agricultural Meteorology Division, IMD will use the skills developed in operational, experimental and theoretical aspects of meteorology by effectively integrating and deploying them for the purpose of making the agriculture production system more robust. The future thrust will be for the development of agrometeorology as a catalyst in enhancing agricultural production which will be primarily oriented to operational agromet services, including research, training and dissemination and extension. It is determined to continuously strive hard to transform the existing Agromet Service System into a vibrant Agromet Service Innovation System. Thus the vision & mision of Agromet Service will be oriented in the following manner:

- 1.To provide quantitative assessment of local climatological information to scientific and farming community.
- 2.To evolve technologies with clear application in evolving farming strategies for the benefit of the poor dryland farmer as well as the progressive commercial farmer through multi-disciplinary research and outreach.
- 3.To provide regular agrometeorological advisories to farmers based on the location specific medium range weather forecasts for crop and location specific AAS to farmers at block level with village level advisory.

4. To disseminate weather based agromet advisory on line to the farmers in block/taluka/village level for efficient farm management.
5. To provide weather based adaptation strategies under climate change, climate variability and climate risk management.

Harnessing of Agrometeorological Services in the country by 2020

Weather and climate themselves have been constantly changing throwing new challenges in harnessing the natural resources towards achieving sustainable agricultural production. The scope and purpose of operational agrometeorology is to apply relevant meteorological skill to help the farmers to make the most efficient use of physical environment with the prime aim of improving agricultural production both in quality and quantity. Scientific knowledge keeps on advancing through innovations brought out by new developments in observations, measurement and communication technologies along with technological changes in the farming practices. Significant changes have come about by way of addition of new tools for observation (from manual to satellite data collection) and analysis (from slide rules to super computer). The vision 2020 for agrometeorological services has been evolved and mentioned below indicating the major thrust areas to be achieved in the next one decade by streamlining our activities.

1. Weather/ Agrometeorological Forecast

- Development of precise and accurate weather forecast at block/tehsil/village level in addition to extended range weather forecast at fortnight, month and seasonal scale for its application in agriculture.
- Issuance of forecast for different agrometeorological parameters like soil moisture, aridity, growing degree days, leaf temperature, leaf wetness duration and also for prediction of pest/disease for preparation of agromet advisories.
- Development of forecasting models for advance indications of forest fire occurrence, effects of denudation on micro/macro climate for meliorative action.

2. Agroclimatic Information/Agroclimatic Characterisation/ Agroclimatic Normals

- Generation and updating of agroclimatological information for several major crop species / production system and establishment of threshold weather values in the form of manuals for all major crop species within the next ten years.

- Preparation of agroclimatic normals with reference to crop growth phases for major crop species in a digital map format at regional level to depict spatial spread of stress effects on crops in relation to aberrant weather conditions.
- Use of micro and macro agroclimatic characterization in relation to determination of time and height of ground for aerial based sprays for pest / disease affected cropped zones.
- Generation of future agroclimatic zone maps to indicate zones unsuitable with respect to major crops and updated every five years.

3. Agromet Observatory/Agromet Data

- All the Agromet Observatories including evapotranspiration stations, soil moisture etc. will be will be upgraded and data will be available to GTS on real time basis. Besides Agro-Automatic Weather Stations having sensors of soil moisture, soil temperature, leaf wetness, leaf temperature, evapotraspiration and radiation will be set up at agriculture farms in Krishi Vigyan Kendras at each district to get good exposure and provide data to partnering institution for local needs.
- All types of agromet data pertaining to weather, crop / animal growth and yield / products at the data bank in agrometeorology will be readily accessible to users.
- Large volume of data on crop phenology will archived for further analysis required for agricultural operations. Phenology atlases will be prepared.

4. Weather based Agromet Advisories

- In addition to the current agromet advisories issued to the users, weather based advisories on agricultural drought will be made available as a routine for each major crop species with reference to different phenophases, region-wise, based on current weather, synoptic conditions, satellite imageries and medium range weather forecasts. Early warning and EXPERT systems become available for all regions in the country.
- Crop-weather thresholds for every growth cycle phase of pest / disease will be readily available in quantitative terms. Based on these threshold values, early warning systems will be developed for conceivable weather situations and used with real time data for in-season agricultural operations, leading to optimum / minimum use of pesticides / insecticides.

- There is a strong need to develop suitable products for the sectors like horticultural crops, livestock, wasteland and forest fires, post harvest and storage and incorporate them in the advisory bulletins.
- Climate-fish growth and multiplication relations will be fully understood and models for preparation of weather-based advisories will be in operation.

5. Micrometeorology & Agro-Advisories

- Information on microclimate and synoptic charts will be utilized as a routine for determining control measures in plant protection.
- Macro-micro climate relations will be generated under crop-environment scenarios and also under adverse weather conditions influencing crop-animal productivity. These will be routinely used in formulating weather-based agroadvisories.

6. Involvement of Crop Growers' Association & other Private Agencies

Tie up will be made with the crop growers associations existing for important crops like tea, coffee, apple, mango, sugarcane, cotton etc. to develop suitable crop-specific advisories and also build up a mechanism to disseminate the information to the targeted growers.

7. Preparation of Agromet Products

- These will be made with complete automation of the system involving GIS platform and advanced communication system.
- An integrated and holistic approach for effective utilization of the Agro-met products will be adopted for preparation of advisories viz., pest control, fertilizer application, irrigation requirement etc

8. Popularization & Awareness Programme

- Special campaigns for popularization of AAS and awareness about availability of agro-met advisories will be carried out. Emphasis will be given for development of a mechanism by which a farmer should be able to contact agricultural scientist through internet, telephone, video conference etc. and to get agro meteorological advise on his specific problem.

9. Crop-weather diagrams/ Crop Weather Models/ Crop/ Animal yield forecasting

- Agricultural product-yield forecasts through use of dynamic simulation models became a routine activity at several institutions. Integration of these estimates will be

made for each crop species within and beyond contiguous agroclimatic regions resulting in a regional level yield forecast.

➤ Models will be made available for routine use with real time weather data to predict animal health/ productivity/ yield from functional relationships between animal – weather interactions. Items such as milk yield, poultry products, disease incidence etc. will be predicted on a routine basis for all agroclimatic regions in the country.

10. Multi-Channel Dissemination of agrmet advisories

➤ Dissemination of the advisories will be done using multi-channel systems like All India Radio, Doordarshan, Private TV, Radio channels, Mobile phone / SMS/IVR, Newspaper, Internet, Common Service Centre of Department of Information Technology, Virtual Academy / Virtual Universities / NGOs, Kisan Call Centres / Krishi Vigyan Kendra (KVK) / ICAR and other related Institutes / Agricultural Universities/ Extension network of State / Central Agriculture Department.

11. Impact of Climate Change in Agriculture

Impact of short period climatic variations and long-term climatic change on different production systems will be fully understood in quantitative terms at various spatial scales and at different scenarios. Ready reckoners or simulation programs will be made for assessing the impact if any on current year.

12. Training in Agrometeorology:

- Training in computer programming for development of crop-weather dynamic simulation models will be made a routine till the year 2015. It will become a core course with sustained practical exercises for students of agrometeorology / agroclimatology in all teaching and research institutions and they have capacity to write simulation programs.
- Extensive training programme for all those involved directly and indirectly in the advisory preparation and its application including the farmers will be chalked out.
- Need based training will be imparted to the trainers of the officers in the State and district offices. Due emphasis will be given to impart training to the user groups as well as to the trainers such as KVK, NGOs etc.
- Appropriate training will be provided to farmers through some capsule courses. Extensive training for farmers will be provided through SAU/SDA with active support from IMD.

13. Research and Development

- Pre-release cultivar experiments will be used for developing crop-weather response functions. Functional relationships between short-period weather-induced aberrations and impact on crop growth will be established in interdisciplinary mode with plant breeders, agronomists, pathologists and entomologists.
- Extensive R&D activities will be carried out to prepare crop & location specific advisories. It will include microclimatology, crop weather relationship including decision support system & crop weather models, weather based forewarning of pests and diseases, crop yield forecasting, early warning system of agricultural drought, agrometeorology and remote sensing, climate change and agriculture etc. Major thrust will be of research directly or indirectly contributing to the operational agrometeorology.

14. Remote Sensing & Agriculture

- Remote sensing imageries of crop cover of major crops will be available as a routine at regional level with information on acreage and yield estimates. These will be supplemented by ground based mapping of effects of disastrous and aberrant weather events on different crop species at regional level. Weather based advisories based on the remote sensing imagery, crop condition maps and medium range weather forecasts at regional level will be issued.
- Surface moisture maps using microwave remote sensing techniques for the country will be routinely available for use in agricultural operations. Algorithms between surface moisture and profile layer soil moisture content will be developed and used for determination of irrigation scheduling, at regional level using real time crop-weather data.
- Remote sensing imagery of crops and cropped zones affected by drought at important phenological phases of crops will be issued as a routine at periodic intervals. These will be utilized for crop contingency plans / management strategies for drought conditions based on real time weather and crop information.
- Remote sensing imageries for flooded zone will be periodically available. Crop contingency plans will be included in weather-based agro-advisories and put in operation without loss of time whenever widespread flooding of cropped will be as is observed through remote sensing techniques.

15. Development of Information Sharing System (ISS)

➤ Initiatives will be started to develop Information Sharing System (ISS) for effective dissemination of agri-climate information and thus enhancing the resilience of agricultural farmers to climate variability and long term climate change. Special attention will be given to develop content creation to suit local needs and also strengthen information flow till village level and also integration of agri – climatic information. In this endeavor Progressive Farmers will be involved to enhance the efficacy of the service. Advisories will be available to the farmer well ahead of time, enabling him to take his decision appropriately to avoid any investment and other losses.

16. Feedback information

An on-line feedback mechanism from different organizations that disseminate the advisories will be developed for providing need-based agro-advisories. Mechanisms by which a farmer can interact with his AAS providers and have access to expert advice will be set up. Participation of providers of AAS in Kisan mela and other farmer's forums will be made an integral part of the service. EXPERT SYSTEM MODELS and SOFTWARE will be available as solutions for several queries on Agrometeorological aspects in different weather situations for agricultural operations.

17. Crop Weather Insurance

Mechanisms will be developed for active participation of IMD and SDA for Crop Insurance. Active supports will be provided from IMD in crop insurance after the installation of increased observational network.

Strategy & Framework:

In order to achieve the goals as mentioned above, strong supporting programmes need to be taken up with highest priority. A 10-point following strategy would be adopted to accomplish the vision and the goals of the India Meteorological Department, to enhance efficiency and effectiveness of the operational agrometeorology with the different offices of IMD at National, Regional and local level and also with the other organizations under the collaborative mode.

a. Important milestones and strategies for implementation of the same will be implemented by India Meteorological Department (IMD) and Indian Council of Agricultural Research (ICAR) in collaboration with the different organisations in a phased manner during next one decades. A number of participating organizations like IMD, NCMRWF, Agricultural Universities, ICAR Institutes, State Department of

Agriculture, Department of Information Technology, Department of Space, M.S. Swaminathan Research Foundation, NGOs etc. will be working together under the integrated system. Inter-institutional collaboration will be further strengthened at national and international level in the field of agrometeorological activities.

b. Under the existing IAAS in the country AMFUs have already been established in different agroclimatic zones in collaboration with State Agricultural Universities (SAUs), Indian Council of Agricultural Research (ICAR) and Indian Institute of Technologies (IITs). As it will not be possible for these centres alone to address the objectives of the project at block level, there is a need to set up District /block/village level Agromet Units in the country.

c. Though district level medium range weather forecast is being prepared for agromet services, there is an urgent need to prepare and issue of high resolution accurate weather forecast at block/taluka/village level. Based on satellite information and relevant weather parameters models will be developed for forecasting of forest fire during hot weather season.

d. Though the agromet advisories are being disseminated to about 2.5 million farmers in the country under PPP mode using SMS and IVRs, more efforts will be made to include more agencies in this regard. All FM channels of AIR and nowcasting centres of Doordarshan under Prasar Bharati will also be partners with time. Many more such efforts will be made to disseminate the advisories at the village levels in the farming community in the country.

e. Periodic training programmes for scientists, extension workers, media persons and farmers at appropriate levels will be organized to sharpen the service. Skill improvement of Technical Officers / Nodal Officers in understanding the weather processes and their impact on crops / animals will form an integral part of HRD process. Regular updating of knowledge on crop / pest and disease simulation, GIS, use and interpretation of remote sensing data for agromet purpose is utmost important for capacity building and HRD for the officials / staff members working for AAS. Training to extension workers as well as farmers about climate change and its impact on agriculture will be emphasized through programmes and other activities.

f. Agrometeorological information is part of a continuum that begins with scientific knowledge and understanding and ends with the evaluation of the information. It is

proposed to establish National Agromet Data Centre. Weather and crop data collected and generated across various centres and agromet observatories respectively in India would be stored and made available for the research fraternity for generation of the basic and derived agromet products and crop information to be delivered to the users online.

g. In order to address climate risks and uncertainties, Climate change and variability, drought and other climate-related extremes on the quality of agromet service to be generated at the block level, it is proposed to establish a Centre for Research and Excellence in Agrometeorology (CREAM) in IMD with its counterpart at National Institute of Abiotic Stress Management (NIAM), Deemed University, Indian Council of Agricultural Research, Baramati, Malegaon, Maharashtra which will primarily look after the application of R & D in agrometeorology in operational agrometeorological services rendered by IMD.

h. IMD will insist all the agricultural universities to develop human resource in agricultural meteorology not only in post graduate level but also at diploma and certificate level

i. Initiative will be taken to create agromet cells at all national level crop based research institutes

j. Special emphasis will be given for indigenous development of instrumentations (all types of weather sensors).



Government of India
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Agricultural Meteorology Division