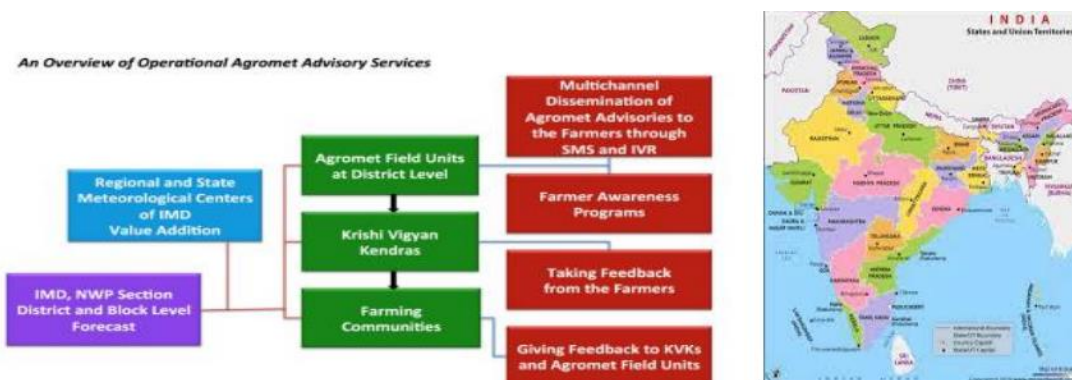


Agromet Services in South Asia

India

India The Agromet Advisory Services of the India Meteorological Department (IMD) in the Ministry of Earth Sciences is providing location and crop specific actionable weather and climate services and products that link in available technologies, best practices and go the last mile to reach all farmers in the country. The Agromet Advisory Services have now been established at district as well as block levels in India. These Services meet the real-time needs of farmers and contribute to weather-based crop/livestock management strategies and operations dedicated to enhancing crop production and food security. They are making a tremendous difference in agricultural production by assisting farmers in taking the advantage of benevolent weather and in minimizing the adverse impact of malevolent weather. Today, IMD is implementing operational agrometeorological schemes across the country under a six-tier structure ranging from top-level policy planning body in Delhi to Krishi Vigyan Kendras at district level. All of the information is geared to help farmers maximize output and avert crop damage or loss. The Agromet Advisory Services also has an end-user group feedback mechanism to help the district level forecasters to tailor their services further. In a survey conducted by the National Council of Applied Economic Research (NCAER), 93% of farmers responding agreed that numerical weather prediction were reliable, and asserting that they used the information in making decisions during different farming stages, from sowing to harvesting. The economic benefit has been estimated at US\$ 7.575 billion per year and is extrapolated to rise to US\$ 32 billion if the entire farming community in the country were to use Agromet Advisory Services in their agricultural activities.



Agromet Advisory Services use multi-channel dissemination channels including mass media, group awareness campaigns and individual contacts in order to reach more farmers. Around 43 million farmers are currently subscribed to the SMS advisories, but there is still a need for greater dissemination and to convince farmers of the sustainability of the positive impacts observed in the long term. A participatory, cross-disciplinary approach is taken to deliver climate and weather information and enhance awareness in these user groups. organized these group awareness campaigns in different parts of the country. Farmers receive informative brochures and pamphlets outlining weather-based farming guidelines; information on crop management practices in the district; about pests and diseases, severe weather conditions, crops that can be grown under stress conditions and contingency plans; and on the District Agromet Bulletin – all in local languages. To further improve the relevance of these services, local-level Agromet Advisory Services have been proposed. Highresolution weather forecasts at local level is being used to develop this services. These local-level forecasts have shown incremental benefits of up to 13% over district-based advisories. The weather forecast and warnings have enhanced livelihood security for the rural community. Meghdoot, a joint initiative of India Meteorological Department(IMD), Indian Institute of Tropical Meteorology(IITM) and

Indian Council of Agricultural Research(ICAR) and Research centres of AICRP on Agrometeorology aims to deliver critical information to farmers through a simple and easy to use mobile application. Damini Lightning apps is developed by IITM,Pune and ESSO. The apps is monitoring all lightning activity which are happening in specifically for all India and alert you if lightning is happening near users by GPS notification under 20KM and 40 KM



Visit to Farmer Field



**Farmer Awareness
Programme**



Feedback from Farmers

Afghanistan

Afghanistan

Currently with the World Bank support, early action plan on weather and climate is being developed and expected to be completed by 2021. It is expected to manage and update the current areas and extending to remote areas like district. At present there is no proper institutional arrangements in developing agromet advisories. In spite of its presence in agriculture and meteorology departments, the agromet advisories is not truly going to farmer but only to the central part of communication system having ICT facilities.

Scientists with the USGS Agro-Meteorology (Agromet) Project assisted the Afghan Government in collecting and analyzing agricultural and meteorological data in relation to crop production, irrigation, water supply, energy, and aviation.

Key aspects of the program involved in establishing a country-wide network of meteorological data-collecting stations and creating an extensive national database for the analysis of meteorological, hydrological, and agricultural information.

As part of the project, more than 100 agromet observation stations were installed throughout Afghanistan. These stations enable acquisition of current, valid agromet data that are essential for modeling and forecasting crop yields.

Accurate agromet data are also important for assessing Afghanistan's water supply and demand, estimating snow melt and water runoff, gauging the need for irrigation and hydropower, and validating satellite data.

Furthermore, continuous monitoring of key weather parameters can provide the earliest indications of potential crop failures and subsequent food shortages.

Agro-meteorological stations across Afghanistan are providing farmers vital information on climatic and soil conditions, enabling them to grow and irrigate their crops more effectively.

Five newly installed stations, supported by On-Farm Water Management Project (OFWMP) under the Ministry of Agriculture, Irrigation, and Livestock, are providing more reliable, timely information through an automated system.

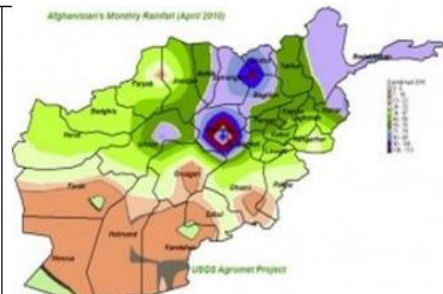
OFWMP, which works to improve agricultural productivity by enhancing the efficiency of water use, is supported by a \$25 million grant from the Afghanistan Reconstruction Trust Fund.

Agromet project participants also helped in establishing an operational crop yield forecasting system (primarily for wheat) as well as a national monitoring and early warning system for droughts and floods.

They helped to train nearly 200 people, including many individuals from the Afghan Meteorological Authority and various Afghan ministries, in agro and hydrometeorological techniques and tools.



With Afghan colleagues, USGS team members were also involved in publishing regular and timely agrometeorological reports, seasonal analyses, and special bulletins, and disseminating these documents among national and international agencies and NGOs



The automated stations are connected to satellites and automatically relay the recorded information through Internet to the administrator's website on an hourly basis.

Bangladesh

Bangladesh

Newly and emerging Bangladesh Agromet Advisory Service System and the active involvement with the World Bank funded project on Agromet Advisory Services (AAS) project from inception is doing exceedingly well. Number of important activities like preparation of AAS bulletins (district, national levels), special advisories under extreme events and dissemination and also sharing of information among different committees including National Agromet Committee, different organisations including Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), etc. during preparation of advisories are significant progress in this regard. BAMIS PORTAL (www.bamis.gov.bd) was developed under this project. All the weather forecasts are available and the same is displayed in BAMIS portal. Agromet Advisory Services bulletins (district, national levels), are prepared in collaboration with Bangladesh Meteorological Department (BMD), & Bangladesh Water Development Board (BWDB).. At present 43 weather observatories are functioning well and the same is used in agromet advisory system. Bangladesh will shortly open agromet course in two leading Agricultural Universities (Bangladesh Agricultural University (BAU) and Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU). Sub-seasonal forecast is being used under experimental mode in issuing advisories during flash flood and cyclone.



At present 30000 farmers were selected from the 15000 farmers' organisations, developed the infrastructure at district and upazila level by providing instruments (TABS rain gauge, kiosk, weather board, agromet room) including focal persons at different districts and upazilas in Bangladesh. Different information generated based on the data received from BMD and BWDB and through BAMIS PORTAL are disseminated to the farmers and also Sub-Assistant Agricultural Officers who used to visit the 12 farmer groups once a week and also SMS agromet advisories are communicated to farmers through BAMIS PORTAL. In Bangladesh agriculture production system is highly vulnerable to extreme weather events. Almost every year there is considerable loss of crops in some parts of the country. Recently a number of agrometeorological information and products are generated under the assistance of World Bank for providing sensible advisories at right time and right areas to save the loss of crop and ultimately contribute food security in the country.

Management of Extreme Events

Flash flood Guidance system

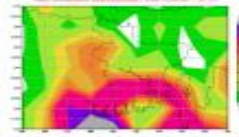
- Rainfall threshold analysis in flash flood pilot areas

- Establishment of Real Time rainfall station in Sylhet and Cox's Bazar

Web based flash flood guidance and dissemination system development
Uses WRF 3 days and ECMWF 10

Flood Forecasting and Warning Center (FFWC) of the Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources (MoWR) and Department of Agriculture Extension (DAE), Ministry of Agriculture will jointly issue flood forecast & Agromet Advisories under flood like situations

Drought monitoring is being made by using Standard Precipitation Index (SPI) at weekly and monthly basis



Station Code	01-01-2012	02-01-2012	03-01-2012	04-01-2012	05-01-2012	06-01-2012	07-01-2012
01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
07	0.0	0.0	0.0	0.0	0.0	0.0	0.0
08	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Flash Flood Advisory

Flash Flood Warning 01-07-2012 to 07-01-2012

Flash Flood Warning 01-08-2012 to 08-01-2012

Flash Flood Warning 01-09-2012 to 09-01-2012

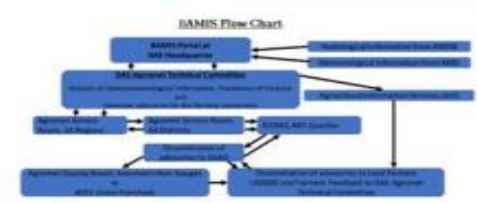
Flash Flood Warning 01-10-2012 to 10-01-2012

Flash Flood Warning 01-11-2012 to 11-01-2012

Flash Flood Warning 01-12-2012 to 12-01-2012

Flash Flood Warning 01-01-2013 to 01-01-2013

TRAINING MANUAL



Modes of Communication of Agromet Advisories



- Bangladesh Agro-Meteorological Information portal is a dynamic web portal developed under Agro-Meteorological Information Systems Development Project (Component C:BWCSR), DAE with a view to disseminate agro-meteorological services and other related information to the different users especially to the farmers in Bangladesh. Meteorological data from Bangladesh Meteorological Department and hydrological data from Bangladesh Water Development Board are accumulated in BAMIS portal. After being translated and validated by the DAE Agromet Technical Committee the information are disseminated at present to the 30000 lead farmers. It is linked with other relevant stakeholders. Also DAE officials and farmers are also connected. Bangladesh Agro-Meteorological Information portal includes:
 - Weather and Climate information across Bangladesh
 - Updated 64 districts agromet advisories twice in a week and one national agromet advisory once in a week.
 - Agromet information in respect of crop, weather sensitivities on crops, pests and diseases information and its linkages with weather along with control measures, Crop Weather Calendars etc.
 - Development of Agro-Meteorological products including satellite products to help different users to make tactical & strategic decisions.
 - Dissemination of agro-meteorological and hydrological information, forecasts and agromet advisories through different modes to the farmers through Department of Agricultural Extension and Agriculture Information Service.
 - Information on extreme events
 - Special Agromet Advisory Services for livestock, poultry and fishery
 - Feedback from farmers

Maldives

Agro-Meteorology in Maldives

Maldives is low lying island and at present Maldives is not giving any agromet services. but the services is the priority for Govt of the country and would be addressed in future and more stress would be given to capacity building

Climate Information users and utilization of information in Maldives

Relationship with climate information users

There is a framework for cooperation with the following user sectors.

Agriculture, Water management, Disaster Risk Reduction, Energy resources, Health and welfare, Transportation

Method of provision of climate information

- E-mail, TV and/or radio

Efforts/activities to enhance the utilization of climate information

- - User Workshops
- - Publicity and educational activities

Information on severe weather events to news papers (not on the web)



Maldives Meteorological Services

Myanmar

Myanmar

Agromet Advisory project is operating in the country from 1982 under the Division of Meteorology & Hydrology. Primarily weather forecast is provided under this project and disseminates the same along with the advisories and bulletin to the users with the help Department of Agriculture. Though the agromet bulletins are issued but truly that does not contain agromet advisories Seasonal weather forecast is used and supported by RIMES, in producing the agromet bulletin where some advisories for farmers are given, However, these are on experimental mode but working and exploring to prepare advisories under World Bank project. Mobile application is also a part of dissemination process. During 2015-18, this project was supported by RIMES especially on early warning system in some pilot areas initially in dry zone of the country. Besides, World Bank also supports the country under the broad areas like agroecological mapping, weather monitoring & forecasting, capacity building, agromet services. There is need in upgradation of agromet advisory services. and encourage and assist in agrometeorological research and its publication which will ultimately help in Agromet Advisory Services (AAS) in the country and hence is need of the hour. The research in agrometeorology is very limited in spite of the presence of agricultural universities in the country.



Nepal

Nepal

The subject of Agromet Advisory Services was not taken into consideration till 2012 in Nepal. During 2013-14, a number of discussions were made to implement the operational agromet advisory services and finally in 2015, with the World Bank assistance, agromet advisory services started in the country by joint collaboration between Nepal Agricultural Research Council (NARC) and Department of Hydrology & Meteorology. Using weather forecast along with the past weather and crop status; these services were started for 26 districts in the country. AAS bulletins are issued on provincial level using the 72 hours forecast on every Friday and aiming to prepare in district level and local level agromet advisories in future. Agromet advisories are disseminated by the Agriculture Information Centre, central agency for dissemination of information in Nepal. Dissemination is done through SMS, mobile apps and radio. Roving seminars in 26 districts for capacity building of the farmers were arranged for popularisation and awareness of the agromet advisory services. Short- and long-term plans for the improvement of operational Agromet Advisory Services have been formulated. More attention needs to pay as climate is changing in Nepal along with capacity building on use of ICT technology and remote sensing application in agrometeorology, use of artificial intelligence, district and seasonal forecast. Weather insurance. PPP is not so strong in Nepal. Smart agriculture, AWS in Hill station, climate change adaptation programme are being encouraged.

The Agriculture Management Information System (AMIS)

The Agriculture Management Information System (AMIS) is implemented by the Ministry of Agricultural Development (MoAD) on four sub components mentioned below.

1. Infrastructure
2. Agro/climate-Info Products
3. Agro-Info dissemination and
4. Capacity Building
5. Support for PMU, M&E and Outreach

Objective of AMIS

The prime objective of this component is to provide critical and timely agro-climate and weather information to farmers in order to increase productivity and reduce losses from meteorological and hydrological hazards. Other objectives are bulleted as below.

At present farmers in Nepal have shown confidence and appreciate the information generated by the meteorological and hydrological fusion products for agriculture in Nepal. Some good studies made in Nepal in this regard. PPCR project has been completed and further initiatives were taken up for further continuation of the project. There is need for more AWS in the country especially to the hill stations and also the importance of the same to the weather-based insurance in the country. Moreover, the AAS should be farmer's friendly as the farmers are not literate enough to adopt these services. In respect of data sharing, research on crop weather relationship, effect of weather on pest & disease etc.



- 1) Provide a mechanism to deliver timely relevant agro climate and weather information under early warning system and deals as agriculture decision support tools to farmers, and other stakeholders.
- 2) Provide open data access for information and web portals.
- 3) Build ICT assisted communication opportunities to strengthen the voice of the farmers on agricultural issues.
- 4) Diminish the impacts of extreme climate related events.
- 5) Protect lives & assets.
- 6) Support agriculture livelihoods

Different Activities under AMIS



Roving Seminar



Crop Simulation Modelling Training



Dissemination through Call Centre



Mobile SIM Distribution



Kisan Call Centre



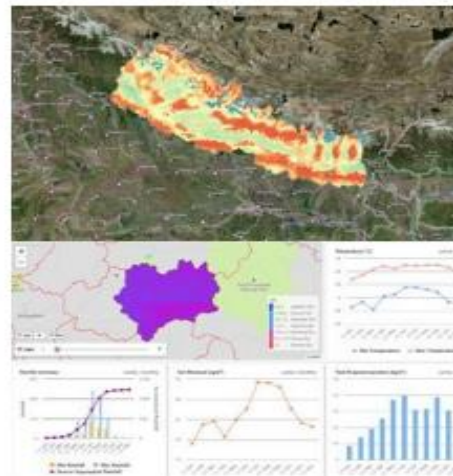
GIS Training

Drought monitoring and early warning system in Nepal

The Ministry of Agricultural Development (MoAD), Government of Nepal and the International Center for Integrated Mountain Development (ICIMOD) join hands to develop the drought monitoring and early warning system for Nepal.

The system incorporates suitable earth observation datasets and land surface and climatic models to produce key drought indices to inform on the agricultural drought condition in Nepal

The agricultural drought information system allows the user to visualize drought indicators aggregated at district level along the growing season of key cereal crops in Nepal.



Pakistan

Pakistan

National Agromet Centre has established five Regional Agromet Centers (RAMCs) in the major agriculture plains of the country, where the major crops are monitored thoroughly on agrometeorological grounds and at the end of each season a comprehensive document (Crop Report) is produced on regular basis. These RAMCs are located at Rawalpindi (Potohar), Faisalabad (Central Punjab), Usta Muhammad (Eastern Baluchistan), Quetta (Northern Baluchistan) and Tandojam (Lower Sindh). Crop reports mainly portray the post analysis study based on impact of weather on particular crop in the relevant area.

Agromet Centres issues weekly Agromet Advisory Service bulletins which covers the post analysis outcome (including the data tables, figures/maps and a comprehensive discussion portion) based on all the important Agromet data for the past week collected mainly from a network of 34 agromet stations throughout Pakistan (working under National Agromet Centre NAMC, Islamabad) besides meteorological network of PMD.

The agromet data being utilized comprise of all the important meteorological and agriculture related elements like air temperatures, soil temperature, rainfall, air humidity, cloud cover, growing degree days, general weather pattern, crop condition report including phenological report etc. Besides this, a comprehensive farmers advisory is also included which covers the general forecast for the coming week along with crop specific as well as animal care suggestions.

Besides, following bulletins & reports are also issued.

Decadal Bulletins

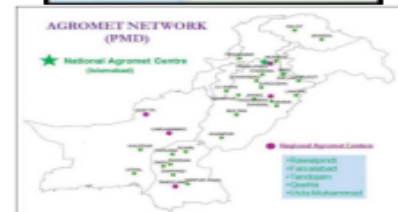
Monthly Bulletins

Crop Calendar & Harvest Calendar

Below are the types of information included in a typical agromet advisory bulletin prepared by the PMD:

- Advisories on dates of sowing/planting and the suitability of carrying out intercultural operations.
- District specific weather forecast in quantitative term, for the next 10 days for rainfall, cloud, maximum/minimum temperature, wind speed/direction and relative humidity, including warning of hazardous weather likely to cause stress on standing crops and suggestions on how to protect them.
- Information on soil moisture status and guidance for application of irrigation, fertilizer and herbicides, etc.
- Warnings of major pests and diseases of principal crops and advice on plant protection measures.
- Manipulation of crop microclimates, e.g. shading, mulching, other surface modifications, shelter belt, frost protection etc. to protect crops under stress.

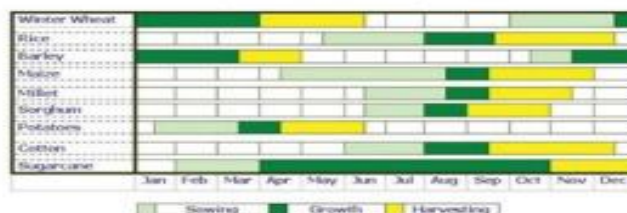
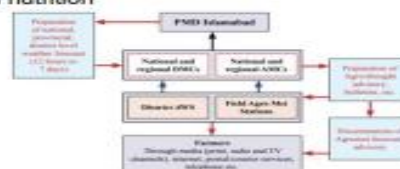
- Advisory on the judicious management of land, water and farm inputs, particularly pesticides, herbicides and fertilizers. Advisories for livestock on health, shelter and nutrition



Timely dissemination of agrometeorological information online and through mass media is part of a process that empower the farmers with scientific knowledge and to take appropriate action for enhancing agricultural production. SohniDharti is the first agricultural TV channel of Pakistan that provides information relating to agriculture and rural development (<http://www.sohnidharti.tv/>).

A TV channel and an FM radio station are also being set up in the public sector to educate farmers about modern farming technology suiting their needs.

The Internet is a new and cost-effective technology that can provide research and technological development information in an accurate and timely manner. Additionally, the Internet is also effectively used to offer training modules to agrometeorologists and help them improve the quality of their products. Besides, through the National Agromet Centre agromet bulletins are disseminated. There are few other agencies providing bulletins through their websites or radio services.



Sri Lanka

Sri Lanka

Agrometeorological network was started in 1973 with the guidance and donations given by United Nations Development Programme (UNDP) as a result of it, so many agrometeorological stations were established island wide under certain institutions such as coconut research, rubber research, agriculture research, paddy research and tea research at the beginning. Data are continuously received from all stations and those data are quality controlled and processed by agromet division other than this we supply data for academic purpose research and other relevant projects

Though Agromet Division established in Meteorological Department in 1976, agromet advisory services for the farmers on agroecological zones in selected parts of the country was started in 2009 by joint collaboration between Meteorological Department & Agriculture Department. However, still the agromet advisories are not easily understood by the farmers. Recently under Green Climate Fund (GCF) fund from UNDP, agromet advisories are prepared based on seasonal forecast at agroecological zones in three river basins in the country. Dry land area is very vulnerable to extreme events and climate variability and climate change. RIMES is supporting agromet services by sharing the seasonal forecast also. The agromet bulletins are prepared on national level and disseminated to the different stake holders in provincial and national level. Working on drought monitoring as well as on weather insurance and other sectors. RIMES and Irrigation Department, Government of Sri Lanka jointly started working on agromet advisory system. Successful initiative at pilot scale in northern Sri Lanka is being made by International Water Management Institute (IWMI), insurance company and local agrarian Govt. of Sri Lanka in issuing demand driven agromet advisories in local language. However, farmers' demand is that agromet advisories should be consistent and regular in nature. Under World Food Programme, initiatives have been taken on last mile services through development and maintenance of agromet portal in Sri Lanka where the national bulletins at agroecological zone are uploaded. At present there is no provision for uploading local AAS bulletins and still the correct and timely information is not reaching to the farmer in Sri Lanka.

