Perspectives from Regional Association II (Asia)

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Abstract

Agricultural meteorology is one of the most important fields of applied meteorology. Every year, widespread damages are caused to the agricultural sector mainly by weather-related impacts. In recent years, large parts of Asia have suffered from drought spells, frequent floods, heat extremes, and many other severe phenomena. In order to assess agrometeorological activities and strengthen operational agrometeorological services in Regional Association (RA-II) countries, a questionnaire was sent to all member countries of the region via e-mail. Most of the countries provided information indicating that they did have agrometeorological services that produce agrometeorological information and these products were disseminated to the end users. In Qatar and Bahrain, agrometeorological activities are conducted within the Ministry of Agriculture. However, in other countries like Japan and Vietnam, such operations are managed jointly by the Ministry of Agriculture and a meteorological organization. In Iran, the agrometeorological department is in the Iranian National Meteorological Service.

The survey revealed that a few countries including Russia, Japan, Mongolia, and China operate agrometeorological activities in both the private and governmental sectors. Details of the agrometeorological stations, nature of data collected, crops observed, and the various services provided in different countries in RA-II have been given with suitable examples. Progress is being made in the region in using new technologies in agrometeorology for the purpose of providing better services for users. The means of transferring agrometeorological data and statistics and operational agrometeorological services to users vary and these are described with suitable examples. Several recommendations for Operational Agrometeorological Services in World Meteorological Organization (WMO) Regions have been made. Activities of the Agricultural Meteorology Department in the Islamic Republic (I.R.) of Iran are described as an example of operational services provided at the national level.

Introduction

Regional Association II (Asia) is the biggest of the six WMO regions (Figure 1).

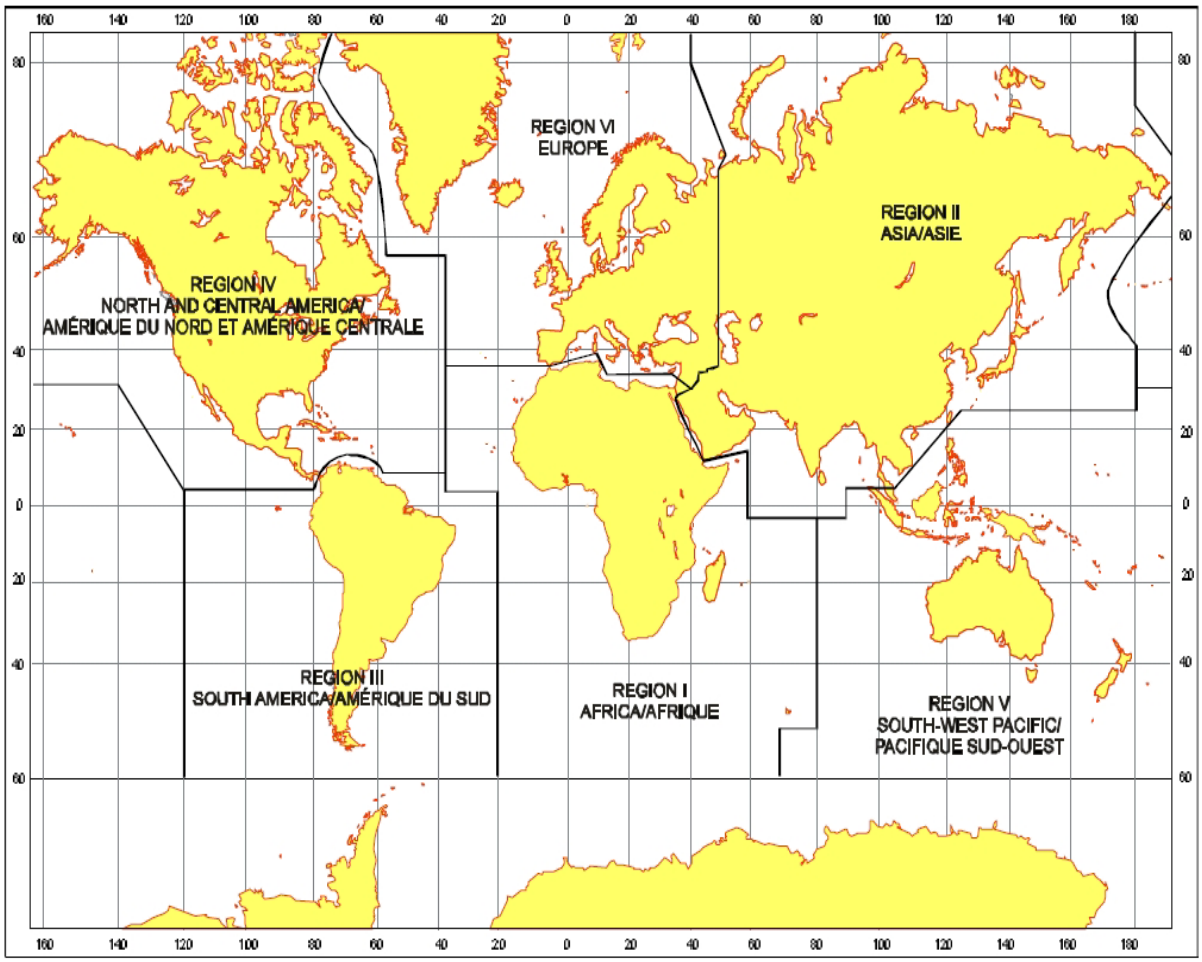

Figure 1: The six WMO meteorological regions.

The countries in RA-II are: Afghanistan, Islamic State of Mongolia, Bahrain, Myanmar, Bangladesh, Nepal, Cambodia, Oman, China, Pakistan, Democratic Peoples Republic of Korea, Qatar, Hong Kong, Republic of Korea, India, Republic of Yemen, Islamic Republic of Iran, Russian Federation, Iraq, Saudi Arabia, Japan, Sri Lanka, Kazakhstan, Tajikistan, Kuwait, Turkmenistan, Peoples Democratic Republic of Lao, United Arab Emirates, Macao, Uzbekistan, Maldives, Socialist Republic of Vietnam.

Regional Association II covers a vast expanse of the Indian Ocean and part of the Pacific Ocean and contains a large and diverse range of ecosystems, including desert, forests, rivers, lakes, and seas. The desert extends from east to west encompassing central and western Asia. Each country has a different climate regime.

Compared to other WMO regions, the Asian region includes the highest mountains, the rainiest areas, and the driest deserts, with their associated variation in culture and biodiversity. Over the long period of human occupation in the region, exploitation of natural resources, urbanization, industrialization, and economic development have led to land degradation and environmental pollution. Climate change and climate variations also represent future stress.

Current Status of Agricultural Meteorology Activities in Regional Association II

In order to assess agrometeorological activities and strengthen operational agrometeorological services in RA-II countries, a questionnaire was sent to all member countries of the region via e-mail. Because of the shortness of the time for preparing this paper, we have received only a few replies. The replies have been reviewed and prepared for consideration in this workshop. Also, we used some information from this questionnaire and other questionnaires that we had before.

The first question pertains to the availability of agrometeorological services, date of establishment, and service provider. Most of the countries provided information indicating that they did have agrometeorological services that produce agrometeorological information and these products were disseminated to the end users.

The first country in RA-II that initiated agrometeorological operations was the Republic of Kazakhstan, which started its activities in 1922. Later, India in 1945, China in 1953, Vietnam in 1960, and Iran in 1978 joined this activity. The last country to begin a service was Bangladesh, which started its operations in 1986.

Affiliation of agrometeorological departments in RA-II is very different. For instance, in Qatar and Bahrain, agrometeorological activities are conducted within the Ministry of Agriculture. However, in other countries like Japan and Vietnam, such operations are managed jointly by the Ministry of Agriculture and a meteorological organization. In Iran, the agrometeorological department is in the Iranian National Meteorological Service.

The survey revealed that a few countries including Russia, Japan, Mongolia, and China operate agrometeorological activities in both the private and governmental sectors. In other countries, such as Iran, the government is solely responsible for agrometeorology.

Results obtained from the replies indicate that horticulture, fisheries, animal husbandry, forestry, and crop production activities are the primary sectors receiving information from the agrometeorological services of member countries. Some countries such as Bangladesh focus only in the farming sector exclusively; while Japan, Nepal, Vietnam, and Thailand have a wider scope, serving all the above-mentioned sectors.

The survey revealed that in Bangladesh, Nepal, Kazakhstan, and Laos there are no agrometeorological stations. They only record data at agricultural centers and provide it to users. Agrometeorological observation in these countries depends on specific case requirements.

The number of agrometeorological stations in each country varies widely, as shown in Figure 2. In Vietnam, about 15 agrometeorological stations are classified as essential and the remaining are subsidiary stations. In Uzbekistan, two stations out of five are considered specialized agrometeorological stations and three other stations are called operational subdivision.

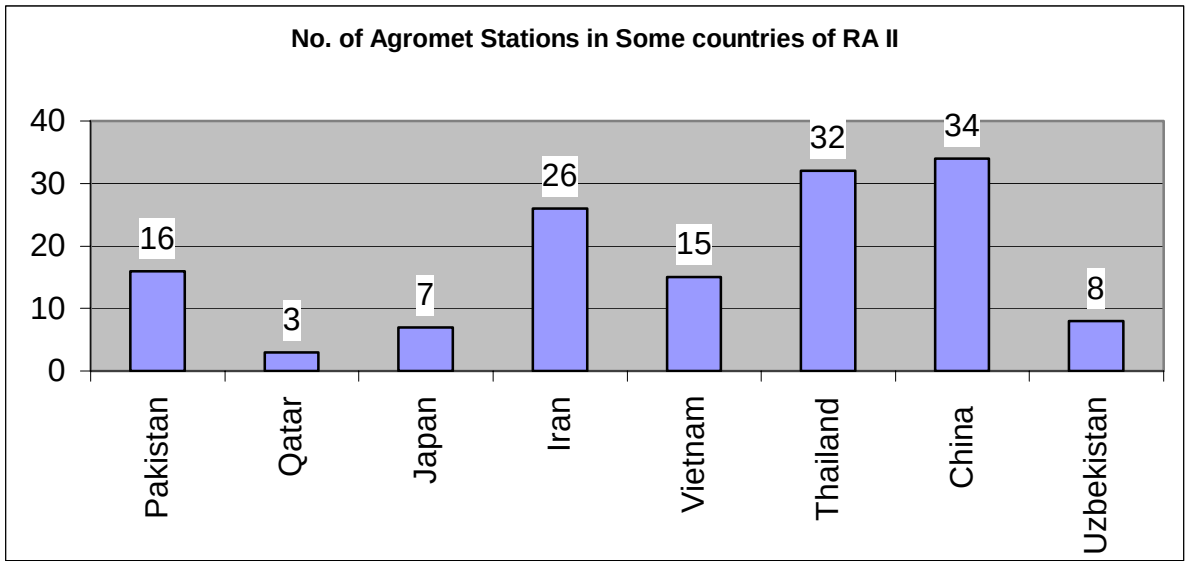

Figure 2: Number of agrometeorological stations in RA-II countries.

The Republic of South Korea owns one main and nine supplementary agrometeorological stations. In Japan, there are seven stations in total for this purpose. In India, there are some agrometeorological stations that conduct study and research activities in four different regions, namely Pune, Rahur, Anand, and Bangalore.

There are two agrometeorological stations in Mongolia, which observe parameters on wheat and potatoes and six other stations perform activities related to cattle, sheep, and goat.

There are 50 stations in China that study meteorological parameters for field crops, gardening, forestry, and pasture.

Regarding the kind of observation, most of the countries make biometrical measurements and soil and phenological observations in addition to climatological observations. However, only a few members, like Korea, do one or at most two kinds of observations mentioned in the questionnaire.

Regarding agrometeorological bulletins, most countries, including China, Korea, Mongolia, Bahrain, and Pakistan, produce agrometeorological data and information such as 10-day or monthly and growth-season bulletins. Moreover, other countries produce various bulletins in different periods. For example, in the I.R. of Iran, all the climatic, phenological, biometrical, and soil data are produced in weekly, 10-day, monthly, and seasonal bulletins, and also specific reports are issued regularly.

Agrometeorological weather forecasts are one of the most important items focused in these bulletins. In this context, short- and long-term forecasts bear particular importance in bulletins, which are widely applied by users.

Short-term predictions are used in cultivating operations such as the suitable date for applying pesticides, irrigation, and date of planting in different short-term periods.

Long-term predictions, provided based on statistical methods, are also issued by Bangladesh, Nepal, and Laos. These kinds of predictions lack agrometeorological forecasts and they

suffice only for weather predictions with a lead-time of 48 hours. In addition to weather predictions, some countries have agrometeorological forecasts that may include some piece of advice for operational agrometeorological services. It should be noted that sectorial requirements of some users upon request might be met through preparation of special bulletins giving the probability index in the forecast. Such special cases are among additional obligations of these services. The agrometeorological forecasts depend on the variety of vegetation and climate of each country.

Considering the climatic variations in different countries in Asia, most of the existing cultivated crops in the world are grown in this region. Regarding the fact that each cultivated crop has a prominent role in the country, the agricultural meteorology related to that specific crop is studied and included in the bulletin provided for the crop.

Wheat is the main agricultural crop studied and observed in Bangladesh, Iran, India, and China. Parameters related to rice are observed in South Korea, Uzbekistan, Iran, Thailand, India, China, and Laos.

The survey indicates that fruit trees are the other orchard plants being observed and studied from an agrometeorological point of view. Vegetables such as tomatoes, cucumbers, flowers, potatoes, grapes, barley, maize, oily plants, and other cultivated orchard plants are among other cases that are considered for study and research in this field. Some advice on individual crops is provided in this regard for users.

Farmers are the primary users of agrometeorological information. In some countries, such as Mongolia, China, and Russia, cattle breeders and the private sector also use agrometeorological data.

All the countries in the region have agricultural meteorological data banks, including phenological observations for different cultivated plants and data for soils and climate. These data are classified to be processed by users.

In some countries, the applied analyzed data are available. Data quality controls based on standards are regularly accomplished.

The period of climatological data is from 4 to 25 years in different countries. In some countries, climatic information covers a period longer than 70 years, but data on soil and plants usually cover short statistical periods. Information in databases is recorded on paper. However, data files are usually offered on electronic copies for the users.

Agricultural meteorological statistics and data including general information and bulletins for agricultural meteorology are offered free of charge in all countries. In India and Iran, agricultural meteorological data and statistics are free of charge only for the researchers and scholars. Other users are expected to pay related charges based on approved tariffs.

In Kazakhstan, some costs for giving agricultural meteorological data and statistics and bulletins for operational agrometeorological services are also received from private sector applicants. Governmental sectors receive agricultural meteorological data and statistics free of charge.

In most of the countries in the region, users of agricultural meteorological data, statistics, and their products such as bulletins are connected to governmental sectors. Farmers do not receive the information directly through the yearbooks, but receive it through the Ministries of Agriculture and Natural Resources, Forests, and Pastures and Animal Husbandry.

In South Korea, Uzbekistan, and Mongolia the meteorological services, in addition to providing data for agricultural ministries, offer the information directly to the farmers.

In Kazakhstan, Iran, Thailand, and India, in addition to related agricultural ministries and organizations in the government, these data are transmitted to the large industrial and cultivation companies. Sometimes specific bulletins for operational agrometeorology are provided to these users. In all of the countries, researchers, TV broadcasters, and print media organizations are considered as the important and essential users.

The means of transferring agricultural meteorological data and statistics and operational agrometeorological services to users vary. In some countries, such data are disseminated on line and via establishing direct communication links; while in others, data are provided in print and mailed to the users.

In Bangladesh, Nepal, and Laos, data are printed and sent to the users; while in Qatar, Japan, Vietnam, Uzbekistan, Kazakhstan, Iran, Thailand, China, and Mongolia, the agrometeorological data and bulletins are provided in the form of hard copy and electronic data files. In most countries of the region, time-critical news and information are broadcast publicly, particularly to farmers through mass media.

Mongolia, China, India, Thailand, Iran, and Uzbekistan have a mass media system to disseminate necessary data during the growth period. One of the most important duties of National Meteorological Services (NMSs) is early warning to mitigate the impacts of natural disasters. In agrometeorological operations, these types of warnings can play a crucial role in improving the farm operations and lead to a better financial situation for farmers.

All of the countries are trying to do more operational services for agriculture. Services such as early warning of weather disasters, untimely extremes, and plant pest and disease forecasting are the most frequent services reported.

Early warnings, the most important operational service, are prepared in the form of notifications and announcements by NMSs in all the countries. These are given to the authorities in the agrometeorological division to adopt measures for mitigation of natural disaster impacts.

In some countries, these warnings, in addition to NMSs, are made by other organizations. For instance, in Qatar, early warnings are announced by the Agricultural and Water Resources Division. In Vietnam, the Ministry of Agriculture is responsible for early warnings. In South Korea, a joint committee comprising of South Korean NMHS and the National Institute of Agriculture, Science, and Technology makes them. In Laos, a joint committee makes the early warnings for users, relevant organizations from the weather prediction division, and flood prediction and warnings sector. In some of the above-mentioned countries, there are defined systems to consider these early warning issues to apply methods to mitigate the natural disaster consequences.

The survey shows progress in using new technologies in agrometeorology for the purpose of providing better services for users. Vietnam uses GIS and modeling methods. While Bangladesh, Nepal, South Korea, and Laos do not yet use them. Japan uses GIS and modeling in its prediction and crop-growth measurements function. Uzbekistan uses satellite data in agrometeorology to monitor area under cultivation. Kazakhstan uses GIS and modeling for grains prediction in agrometeorology. Mongolia, India, and Thailand use various software facilities to make agrometeorological data operational.

Evaluation of the effectiveness of agrometeorological information and bulletins on agriculture indicates that the products serve gardening and field crops most effectively.

Analyzing feedback of services from the countries by categories shows a high effectiveness rate as follows:

A) Gardening and field crops:
- 60 percent in Qatar and Vietnam;
- 90 percent in South Korea;
- 75 percent in Kazakhstan;
- 50 percent in Iran; and,
- 80 percent in India and China.

B) Horticulture:
- 25 percent in Qatar;
- 10 percent in Vietnam, Kazakhstan, and South Korea; and,
- 20 percent in Iran and India.

C) Forestry:
- 10 percent in Vietnam, Iran, and India.

D) Animal husbandry:
- 5 percent in Qatar;
- 10 percent in Vietnam and China;
- 15 percent in Kazakhstan; and,
- 30 percent in Mongolia.

E) Fisheries:
- 10 percent in Vietnam.

Analysis of the results indicate that most activities in the regional countries happen in farming and other activities like horticulture, fishery, and animal husbandry and they vary depending on different countries. In addition, there might be other activities of little importance as well.

The major problem of most countries is the long distance between the place of producing data and the place of application. This distance mostly causes delay in receiving and decreasing efficiency of the data.

Recommendations for Operational Agrometeorological Services in WMO Regions

Basically, in developing countries, most of the agrometeorological activities are concentrated on producing data. Application of the data in agricultural practices is less important. For instance, data of phenological phases and biometrical measurements of crops are collected in agrometeorological stations; however, they are rarely used in decision making and executive actions. What are the main reasons?

The following are some major reasons:

1. Experts of many disciplines in the agricultural ministry are not familiar with applications of agrometeorological data in agricultural practices like planting, protecting, and harvesting steps of the gardening and field crops. Disciplines like animal husbandry, fishery, and plant protection use agrometeorological data and information inadequately. In this regard, FAO can play an effective role in countries which NMHSs and Agricultural Ministries are distinct sections, because agricultural experts have little information about the application of agrometeorological data. Perhaps, regional, joint training courses and workshops with the cooperation of WMO would be useful in promoting application of agrometeorological data.
2. There is not a pronounced plan for agrometeorological activities. For making agrometeorological data applicable and advancing agrometeorological stations in most of developing countries, requests of end users were not taken into consideration. This is more obvious in countries where NMHSs and agricultural departments are distinct. In some countries where agricultural and meteorological activities are located in one ministry, problems of coordination are less. However, it seems this is a major problem in most of the countries. One solution is the establishment of joint committees between NMHSs and agricultural department staff.
3. There is no defined feedback for assessment of the applicability of operational agrometeorological data in various disciplines of agriculture. Feedback can promote required reforms of operational services of agrometeorology.
4. There are shortages in experimental instruments for agrometeorological activities like soil moisture tools in most of the transition countries. There is no specific program for processing an application; data are only being archived.
5. Little attention is given to agrometeorological research and studies like estimating yield, chilling, relationship between meteorological parameters and growth and geographic distribution of field crops, and long-term predictions in various strategic and tactical parts of agriculture.
6. We do not have distinct studies about the effects and roles of agrometeorology in increasing agricultural production and food security of nations. Does agrometeorology basically play any role in increasing agricultural production? What will happen to yield prospect if agrometeorological services are removed? Replies to these questions can justify the importance and the value and funding of countries in these fields.
7. The role of extension should be highlighted in making agrometeorological activities operational and agrometeorological knowledge more important. In most countries, agrometeorological data are not sent on time to the end user. In most of the countries, agrometeorological information is published in newspapers and broadcast via TV and radio and there is less direct dissemination to farmers through bulletins and warnings.
8. Most farmers are not familiar with agrometeorology and its products and services.
9. Many agrometeorological products/services are not understandable to farmers because of their complexity.

10. Some agrometeorologists do not have a good understanding of the actual meteorological information/services needed by farmers.
11. Farmers getting to know meteorology do not believe in the usefulness of agrometeorological information for increasing and protecting yields.
12. Because of lack of suitable, fast, and extensive transmission methods, the potential users receive useful information with too much delay; even the most accurate data, when expired, are not useful to anyone.

Agricultural Meteorology Department in I.R. of Iran

Agricultural meteorology is one of the sub-administrations of the general Department of Meteorology. The network of stations provides meteorological data for agricultural and/or biological purposes and makes other meteorological observations under the programs of agrometeorological research centers and other relevant organizations. There are 26 agricultural meteorological stations at the present.

Each agricultural meteorological station is located at experimental stations or research institutes for agriculture or horticulture.

At each agricultural meteorological station, the observing program includes the standard climatological observations, observations of physical environment, and observations of the biological environment.

Agricultural meteorological departments have a specialized staff of two Master of Science experts. This department also has suitable scientific relations with educational and research organizations, especially the Ministry of Agriculture and the Karaj Agricultural College of Science & Meteorology higher-training institute as well.

Main Activities of the Agrometeorology Department of Islamic Republic of Iran Meteorological Organization (IRIMO)

1) Monthly Agrometeorological Bulletins

The results of biometric measurements and phenologic observations for different crops of the agricultural meteorology research stations are provided in the form of monthly bulletins and sent to the agricultural meteorology department. This information is kept in the information center for users. In addition to sending the information in electronic form, a hard copy of the bulletins is sent to the agricultural meteorology department as well.

In addition to this information, there are meteorological parameter observations and temperatures at different depths of soil.

Each year, every station dispatches 12 monthly bulletins for any crop, and a growth-season bulletin at the end of the season.

2) Weekly Agrometeorological Bulletins
This information includes crop phenologic data, climatic information, weekly growing-degree days, and growing-degree days from sowing time to date, which are sent to the agricultural meteorology department.

Every year, agricultural meteorological research stations send 52 pages of weekly agricultural meteorology information to be inserted in the weekly meteorological organization bulletins.

3) Ten-Day Agrometeorological Bulletins

Ten-day Agrometeorological Bulletins are sent at the end of each decade of months via the Switching System. During the year, every station sends 36 sheets of 10-day information for certain crops, which is then kept in the information center of the meteorological organization.

Future Plans of IRIMO for Strengthening Operational Agrometeorological Services

There is a need to:

- Increase the number of agrometeorological stations in the major agricultural regions;
- Improve the number of crops and fruit trees under examination in agrometeorological stations all over Iran;
- Provide a concise agrometeorological database, including phonological and climatologically data;
- Establish stronger scientific relations between the agrometeorological department and international organizations; and,
- Enhance the extension in agrometeorology through the right type of intermediaries.

Plans for Enhancement of Operational Services of Agrometeorology

- All the countries have a strategic plan for more applied agrometeorological services.

Recommendations of Regional Association II NMSs for Strengthening Operational Agrometeorological Services

The following recommendations are made to strengthen operational agrometeorological services in Regional Association II:

- Developing agrometeorological forecasting centers;
- Developing forest meteorology, predicting yield/biomass before planting;
- Studying sand movement or desertification elements;
- Using AMS for measuring climatic elements and soil moisture;
- Measuring evapotranspiration;
- Establishing the domestic infrastructure of a flux measurement network;
- Developing agrometeorological models for crop growth and development and evaluate agromet environment using agromet advice model "AMBER";
- Integrating agrometeorological information services;
- Collaborating with the World Agrometeorological Information System (WAMIS);
- Cooperating with the International Society of Agricultural Meteorology (INSAM);
- Strengthening agrometeorology networks including station density, fine equipment, and capacity building;
- Providing more detailed agrometeorology information; and,
- Developing the infrastructure of the information network to transfer agrometeorological information to farmers more easily and faster.