Perspectives from Regional Association VI (Europe)

Zoltan Dunkel and Adriana Marica
Hungarian Meteorological Service, National Meteorological Administration
Budapest, Hungary, and Bucharest, Romania

Abstract

This report summarizes the results found in the questionnaire (Table 1). The questionnaire was circulated among the Commission for Agricultural Meteorology (CAgM) members of Regional Association VI (RA-VI) of Europe and volunteers in agrometeorology. It is concluded that the application of agrometeorological information, advice, and support issued by the meteorological community for the agricultural, horticultural, forestry, and including the fishery users, depends on the tradition and economical environment. Improvement of operational agrometeorological services needs better technology and better business policy. The Internet seems to be a developing tool for information dissemination. The decision makers are interested in monitoring the agricultural campaign to help the farmers in difficult years or with agroclimatological information for agriculture planning. The decision makers concerns are extreme events causing damages to agricultural systems or to the environment; such as hurricanes, extreme droughts, floods, frost, strong winds, and intense rainfall. For delivery to farmers, the information should be punctual, succinct, and coherent given the possible choices they have, and written in comprehensible agricultural technical language.

1. Does the Meteorological Service of your country have an independent Agrometeorological Service Unit?	
2. Who are the major customers for agrometeorological services in your country?	
3. What kind of operational agrometeorological services are provided by the NMHS in your country?	
a) Issuing regular agrometeorological bulletins and advisories	Yes/No
b) Issuing early warnings/alerts as appropriate	Yes/No
c) Helping with strategic studies e.g., agroecological zoning	Yes/No
d) Assessment of the impact of extreme events e.g., floods, cyclones etc.,	Yes/No
e) Others - please specify	
4. Five major types of agrometeorological services were identified at the International Workshop on Agrometeorology for the 21st Century held in Accra, Ghana in 1999. Please identify which of the operational services below are provided by the Meteorological Service in your country?	
a) Services to help reduce the impact of natural disasters, including pests and diseases	Yes/No
b) Early warning and monitoring systems	Yes/No
c) Short- and medium-range weather forecasting for agriculture	Yes/No
d) Climate prediction/forecasting for agriculture	Yes/No
e) Services to help reduce the contributions of agricultural production to global warming/cooling(?)	Yes/No
5. Identify the shortcomings and limitations in the following aspects of your work:	
a) current availability of data,	
b) analytical tools;	
c) methods of provision of operational agrometeorological services?	
6. Do you work with agricultural research and extension services in your country?	Yes/No
If yes, please indicate the frequency of your interactions with agricultural research and extension services	Daily/Weekly/Monthly/Yearly/Irregular
7. Are you aware of the new requirements from the following International Conventions and Agreements?	
a) United Nations Framework Convention on Climate Change (UNFCCC);	
b) The United Nations Convention to Combat Desertification (UNCCD);	
c) Convention on Biological Diversity; d) World Food Summit Plan of Action	
8. In your view, what additional methods and tools could help improve the operational agrometeorological services in your country? Please list in order of priority (most important as (a) and least important as (e)!	
9. What strategy should be employed to build the capacity of your service to strengthen operational agrometeorological services in your country?	
10. Please give the contact name(s), address, and e-mail address concerning the 'agrometeorological activity' in your country!	

Table 1. The circulated questionnaire.

Introduction

The Regional Association VI consists of 49 countries. Every European country is a member of the Association and a few countries from the Near East also belong to the RA-VI. Only parts of two countries (Russian Federation and Kazakhstan) belong to the RA-VI. These two countries are members of RA-VI and RA-II, simultaneously. The position of the World Meteorological Organization (WMO) Regional Associations is shown in Figure 1. The basic goal of the current survey was to collect as much information as possible from not only the members of the national meteorological services but also specialists involved in agrometeorology. WMO is the global organization of the National Meteorological and Hydrological Services (NMHSs) that is responsible for meteorology. We wanted to find a connection within the framework of NMHSs as well as anywhere else we could find agrometeorological activity. Unfortunately, not every member nation has nominated a representative for the CAgM. Thus, we have no starting contact point in these few countries.

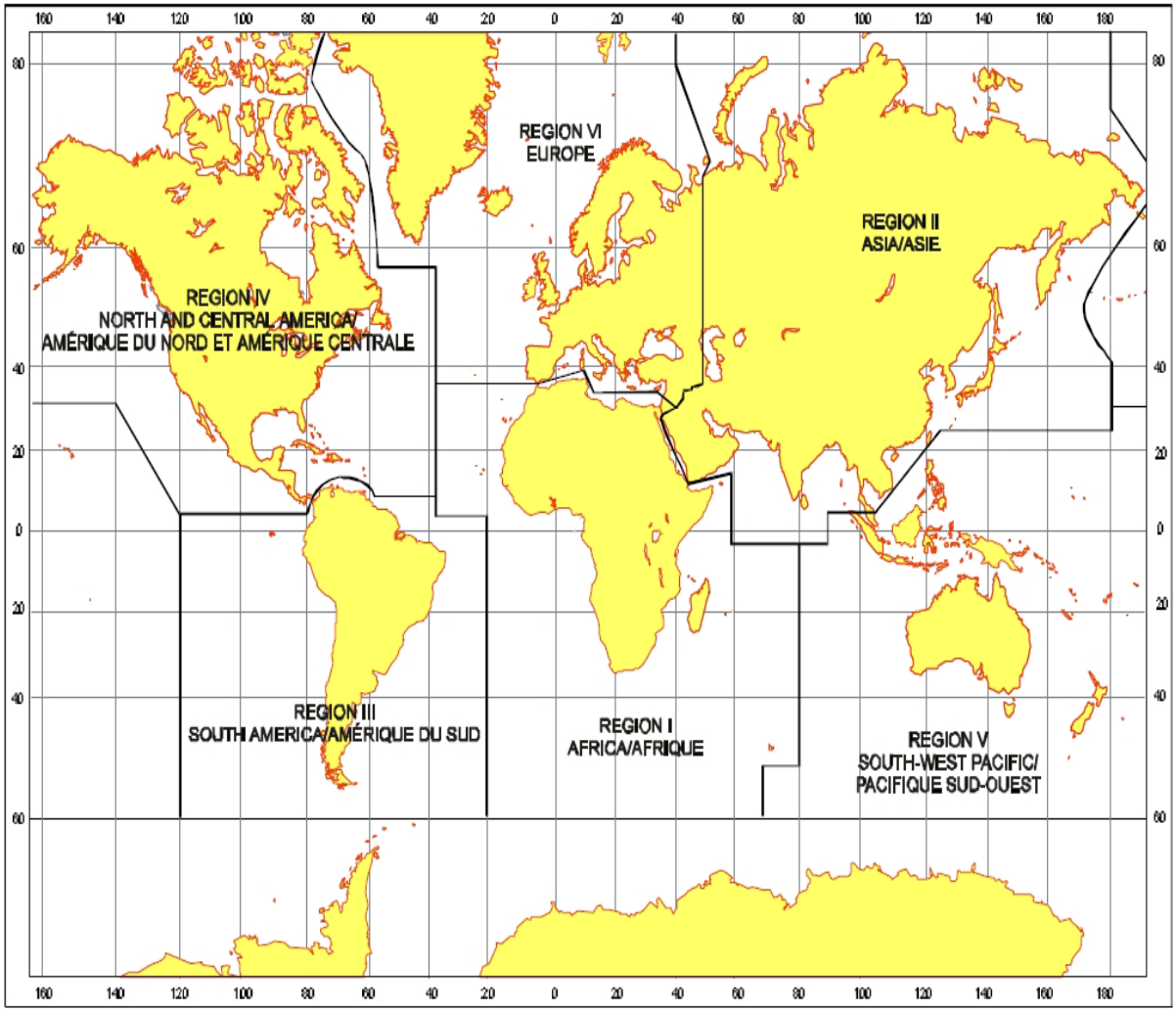

Figure 1. The Regional Association of the World Meteorological Organization.

Table 2 shows the members of RA-VI. Table 3 shows the countries that have no nominations for CAgM. In some cases, a country may not have a nomination for CAgM, but we are well informed about its agrometeorological activity because we have a good relationship with agrometeorological experts in other agencies, i.e., in Cooperation in the Field of Scientific and Technical Research COST Action 718, a European framework for the coordination of

nationally funded research. . There were two portions to the present survey. The first one was an earlier circulated questionnaire used for the Barbados workshop (Dunkel 2002). Three years ago, useful information was submitted, but we were not able to process the material in every detail because they were so voluminous. We have also used data from that questionnaire in this analysis.

Albania	Georgia	Netherlands, The
Armenia	Germany	Norway
Austria	Greece	Poland
Azerbaijan	Hungary	Portugal
Belarus	Iceland	Romania
Belgium	Ireland	Russian Federation
Bosnia and Herzegovina	Israel	Serbia and Montenegro
Bulgaria	Italy	Slovakia
Croatia	Jordan	Slovenia
Cyprus	Kazakhstan	Spain
Czech Republic	Latvia	Sweden
Denmark	Lebanon	Switzerland
Estonia	Lithuania	Syrian Arab Republic
Finland	Luxembourg	Turkey
France	Malta	Ukraine
Former Yugoslav	Moldova, Republic of	United Kingdom
Rep of Macedonia	Monaco	

Table 2. The Members of Regional Association VI.

Azerbaijan	FYROM	Moldova
Belgium	Iceland	Monaco
Bosnia and Herzegovina	Lebanon	
Estonia	Luxembourg	

Table 3. The countries of Regional Association VI, no nomination for CAgM.

The Barbados questionnaire had 13 questions circulated in the RA-VI region as well as in the other regions. The original questionnaire suggested by the WMO Division for Agricultural Meteorology was a little modified. The targeted audience was representatives of the experts in agrometeorology. As is the case of any questionnaire, it is always difficult to find the appropriate channel to get useful information. To collect as much information the National Representatives in the Region, the members of RA-VI Working Group on Agricultural Meteorology, and the members of the COST Action 718 were asked questions formally and informally as well. We received 31 answers from 30 countries and a response from the editor of the Monitoring of Agriculture with Remote Sensing (MARS) Bulletin.

The Region has 49 members. Thus, we received answers from more than 60 percent of the survey recipients. The evaluation of the answers was not an easy task because of the diverse type of responses. The people were asked to submit a few examples as well. The total amount of the submitted materials totaled more than 500 pages. This paper would like to evaluate the state-of-the-art agrometeorological bulletins for the entire RA-VI. However, we can cover the part of the Region that provided detailed information from the questionnaire.

The second portion of the survey was another questionnaire that was circulated among the same organizations and specialists. We were able to collect information from 33 countries, 85 percent of the represented countries in CAgM, and 67 percent of the whole RA-VI. Figure 2 shows the territorial distribution of the non-answering countries, and it shows that, from the point of view of territorial representation, we reported much better coverage of the Region. No information was available before the meeting from Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Estonia, the form Yugoslav Republic of Macedonia (FYROM), Georgia, Iceland, Jordan, Latvia, Lebanon, Lithuania, Luxembourg, Republic of Moldavia, Monaco, and Syrian Arab Republic.

Figure 2. The non-responding countries are marked with dark color.

Table 3 lists the questions of the circulated questionnaire. As is usually the case in every questionnaire, it is not easy to formulate the questions to ensure adequate response by everyone. Taking into consideration the problems of the questions, we can conclude a few common features of the agrometeorological activity in RA-VI.

Preliminary Conclusions

Before trying to summarize the answers, we would like to set forth a philosophical question. Why do we need an applied science? Why do we need agrometeorology? If we would like to answer the question, it could promote the evaluation of the collected information. What is agrometeorology? Is it a supplementary service? Has it social or economical necessity or anything else? In very general or very simplifying terms, the answer we can give is that the basic goal of agrometeorology is to increase the quantity of yield, improve the quality, and reduce the environmental damage.

In most of the RA-VI, i.e., the European Union (EU), the basic problem is not increasing the quantity of the yield, but overproduction. The EU which consists of 15 members, increased to 25 members after May 1, 2004 (Figure 3). The EU dealt with the biggest enlargement in its history.

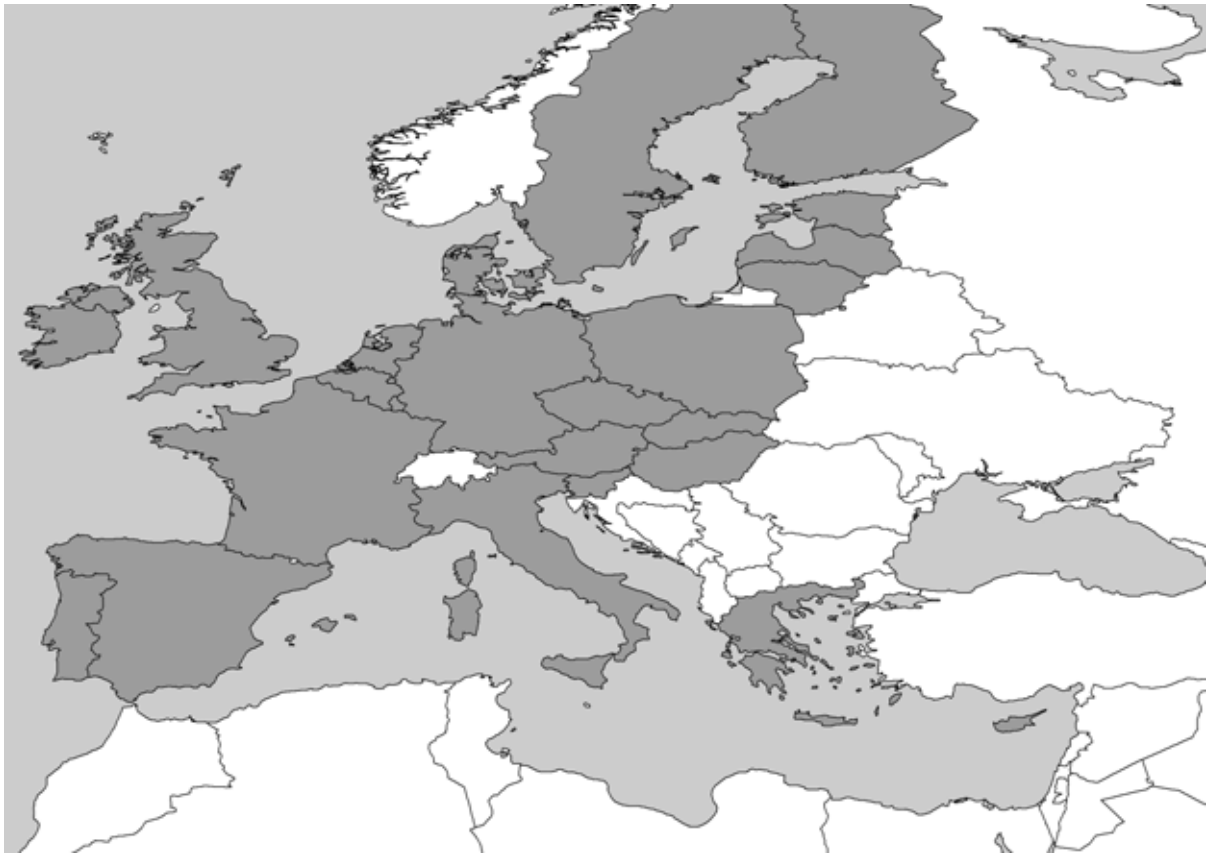

Figure 3. Members of the European Union after May 1, 2004.

When we try to evaluate the state-of-the-art of agrometeorology in RA-VI, we have to take into consideration, the present and near future political situation in the Region. The history of the EU (Common Market) started in 1958 with six members. The first enlargement was in 1973 when three new members were added to the organization. This was followed by one new member in 1981 and two new members in 1986. After 1995, the number of members reached 15 with three new countries. The Union harmonizes the countries activities. In case of the agricultural policy and activity, every country should follow the common agricultural policy (CAP). From the point of view of agricultural meteorology, if we would like to have an impression about the agrometeorological activity of the Union, we have to follow the work of Ispra Institute of Joint Research Centre. The details are shown in a separate paper of the present volume. We will only summarize the reports of national meteorological/hydrometeorological institutes.

Because there is no lack of food and overproduction exists, the national communities are generally not interested in a system that can promote the quantity of the food production. On the other hand, there is a very strict and difficult subsidization system (CAP) in the European Union that should be followed by farmers, and there is strict environmental protection which would minimize the environmental damage. Agricultural meteorology could be helpful in the optimization of the use of chemicals, herbicides, and irrigation water. From the point of view of the national and traditional organizations, agricultural meteorology is not in a favorable

position because many activities of insurance and pesticide companies exist which have got their own agrometeorological services.

Many companies sell the chemicals together with automatic weather stations and computer programs to help the farmers. We have no information either on quality or quantity of these services or systems. The other permanent problem of the meteorological data user community is the commercialization of meteorological data (as outlined in WMO Resolution 40 of Cg-XII).

Results of the Questionnaire

The answer for the first question, independent agrometeorological unit, was a little surprising. We received 33 answers. Twenty countries reported having operated an independent agrometeorological unit, and only 13 countries responded having no independent unit. In a few cases, it was reported that few people deal with the agrometeorological service in the frame of other organizational units, mainly as a part of the commercial, forecast, or climate units.

The answers for the "major customers" question were not surprising. Every response put the farmers and the extension services in the first place. Almost everybody mentioned the research institution as users. In many countries the biggest users cited were the public administration and the government. In a few countries, the last two listed were the major customers of the national agrometeorological service.

Concerning the third question on agrometeorological services almost everybody answered that agrometeorological bulletins exist. It is a traditional tool of information dissemination. Taking into consideration the relatively low cost involved in its preparation, only a few services think that it would be better to stop its publication. A very detailed evaluation of the state-of-the-art agrometeorological bulletins was carried out during the Barbados Workshop (Sivakumar, 2001). A few examples of the types of bulletins are also presented here. For the real user, a direct immediate service would be the most useful. Many services have got direct information transmission, which is the Internet. Every national meteorological service has its own homepage. The complete list of the NMHSs can be found in the WMO's homepage with a direct link to every website. Nearly all users have access to web sites with direct access to at least the basic meteorological information, and to the basic weather forecast.

Of course many of the meteorological websites are not directly organized for agrometeorological purposes, but we can assume that every meteorological website can be used for agrometeorological goals. For example, if someone searches for a weather forecast to organize an agricultural activity, we can consider it as agrometeorological use. We show here only three types (or possible categories) of websites. The first one is the simple national meteorological service's homepage. The Bulgarian website is also shown. The second category (but maybe it is unique in Europe) is the direct agrometeorological homepage from Germany, and the third one is a plant protection institution's homepage showing agrometeorological information (as the Norwegian institute does):

http://www.meteo.bg
http://www.agrarmet.de
http://www.vips.planterorsk.no

In the third case, the homepage includes a public portion and a subscriber portion.

The answers in the three first questions of the "five major types" block were homogeneous. Practically everyone answered that they would like to use the agrometeorological information to reduce the impact of natural disasters. It plays a role in the early warning and, of course, its main tool is the main-, short-, and medium-range forecast. The majority uses some climate prediction, but many countries reported that there are no case studies for climate prediction. The situation is opposite in the case of the reduction of the contributions to global warming. The majority saw that their activity has no connection with the global warming problems.

Most respondents mentioned that the main shortcomings and limitations of the agrometeorological services are the availability of data, unsuitable methods, and lack of well-developed analytical tools. As it was mentioned earlier, there exists a contradiction between national meteorological services and the users concerning data availability. In many countries, the state government does not totally support the work of the national meteorological service and the meteorological service should follow some commercial activity. One branch of the commercial activity is the selling of meteorological data. The national meteorological services, in general, do not want to open the data archives for the agrometeorologist or agricultural users as they would like as much income as possible or would like to pay for the service/information/data.

During the agrometeorological bulletin survey, it was realized that the cooperation with agricultural research and extension services highly depends on the organization and the basic task of the national meteorological services. The majority reported that they have connections and interaction with agricultural institutions; only a few respondents stated that there is practically no connection.

The responses were weak regarding connections with the great international organizations. The answers were strongly affirmative in the case of United Nations Framework Convention on Climate Change (UNFCCC) and United Nations Convention to Combat Desertification (UNCCD) (desertification). A majority submitted "yes" in the case of Convention on Biological Diversity (CBD), but many reported "no." A minority reported "yes" for the World Food Summit Plan of Action. The reason may be very simple. These global problems are not relevant for most of the European agrometeorological services.

It is always difficult to discover any relevant suggestions on how to improve the service. It was a common opinion of the reporters that it is important to modernize the monitoring system, use GIS, build into the system as many tools of the remote sensing techniques as possible, and to upgrade the computer-based management. All respondents mentioned the application of agrometeorological models, the new dissemination system, the use of SMS, and the Internet as useful for disseminating information.

We think the main purpose of any similar survey is to find a good suggestion for the common problem, i.e., in our case to find a strategy to strengthen operational services. For the question on "strategy" there was no answer. Only a tactical approach was given. The general opinion was that the agrometeorological information could be useful only in combination with other services. Agrometeorology could be useful as an auxiliary system, but it can not work alone.

If we would like to outline the type of the agrometeorological service summarizing the given answers, we can conclude that two different types of structures exist in Europe. The first category is where the national meteorological service has no agrometeorological activity, but in the country, other service systems exist. A good example is Italy where the national meteorological service has no connection with agrometeorological activity, but on a regional level (not a WMO Region), we find very strong services. Every region has its own service and issue agrometeorological bulletins. An ideal situation is found in Germany, where the national service has its own research and operational network within the federation system.

National Examples

The position and organization of agrometeorological information systems changes from country to country. It would be very difficult to outline any common European feature of the agrometeorological system. Instead of searching for common lessons, we show a few examples extracting the most interesting part of submitted reports. The authors apologize if not every responding country is presented here.

As mentioned, we can identify some basic examples of the organization of the agrometeorological information system. The first is the countrywide national service belonging to the national meteorological service. The second example could be the more or less independent structure, not organized on the base of the organizational structure of the national institute.

Before the information era, the central element of the agrometeorological information distribution was the bulletin. We concluded that the agrometeorological bulletin can not compete with the more efficient distribution media; materials are the same notwithstanding the media. Many national meteorological services in many countries issue local or regional bulletins.

France

In France, the delivery of a bulletin depends on its frequency of use. If the bulletin includes climate data (temperature, rainfall) or agroclimatological data (potential evapotranspiration, degree days, etc.), the purpose of this bulletin is to assess the impact of the meteorological parameters of previous months on one or many crops, and the dissemination is on a monthly basis. If the bulletin includes meteorological forecast, the purpose for the end-user (generally farmers) is to manage their work in the coming hours or days. The bulletins are updated about five times daily.

For departmental weather forecasting, France is divided into 95 administrative departments. These forecasts are accessible on answering machines and provide specialized information in agrometeorology adapted to the cultures of the department, including information over the previous days along with agronomical advice (pest and disease, irrigation, etc.). They are generally set up thanks to the collaboration of the Departmental Center of METEO-France and the Departmental Chambers of Agriculture and/or Services of the Protection of the Plants.

The METEO-France (videotext) provides weather forecasts on each department, for the 7 coming days. These forecasts are updated four times a day. From the METEO-France, the user can obtain the departmental forecast by fax. This means that access to information used

now by the farmers will be doubtless gradually abandoned for the benefit of the Internet in the next few years. To refine the meteorological forecasts at the local level, France has been divided into 700 homogeneous zones from the forecasting point of view. There are about 5 to 10 zones per department. The farmers can reach these very accurate, local forecasts elaborated by the Departmental Centre of METEO-France, by step 3 hours. They are valid up to 36 hours, and updated at least six times per day (ATMOGRAMME). This service represents a true tactical decision-making tool for the farmers, since it helps realize savings on chemical amounts and irrigation. ATMOFAX is a service of METEO-France, making it possible for the farmers to obtain by telefax the ATMOGRAMME of their zone of interest as soon as possible upon request. This service can be accessible through an organization of farmers such as the cooperatives and the Chambers of Agriculture. Upon request, each group member obtains an access code that allows connection to the fax server of METEO-France. In the same phone call, the farmer can obtain its ATMOGRAMME as well as the number of ATMOGRAMME consumed since the beginning of their subscription.

This service can be supplemented by the access to the weather reports (up to 7 days) worked out by the Departmental Centre of METEO-France. This bulletin is provided by fax to each farmer by the headquarters of the farmers group.

Another example is the Ministry of Agriculture bulletin about the state of crops at the national level elaborated with maps of rainfall, outputs of a water balance model, and output of Incident Support & Operational Planning (ISOP). This information is posted on the Internet by METEO-France on a monthly basis. Since 1997, an integrated system called ISOP has been developed between three French participants: the Ministry of Agriculture (through its Department of Statistics, SCEES), the Institute for Agronomical Research (INRA), and the national meteorological service. The purpose is to produce reliable estimations of the forage production, in order to give objective information to the Ministry of Agriculture to estimate real production losses in the case of local or global drought. Estimated from a national survey, input data are various and multiple, including spatialized daily meteorological parameters, percentages of soil types, nitrogen status, and amounts and frequency of mowing or grazing. The STICS crop model is applied to three kinds of grassland: permanent, temporary, and pure legumes. The results are available for 200 regions of forage production (RFP) and synthesized in alert maps and temporal graphs for selected drought-stricken areas.

The model is part of the multi-crop simulator STICS and simulates the evolution of grass above ground dry matter and water and nitrogen balances. The STICS crop model needs daily meteorological parameters (temperatures, rain, global radiation, and PET). These data should be available for the reference period (1982 to 1996) and also for the current year to provide real-time outputs with a short delay. The management practices for mowing frequency and nitrogen supply are estimated from a national survey (8800 fields surveyed in autumn 1998) for the 182 (out of 200) RFPs with representative grassland surface (more than 7000 hectares). The results were translated into direct inputs for the STICS crop model: values of thermal time between mowing, number of mowings, amounts of nitrogen supply during winter and spring, and initial nitrogen indices. To take into account the different soil types on which the grasslands are to be found, the EU (1/1.000.000) soil map is used to provide soil map units where only predominant soils are listed. These soils are then characterized by their water capacity and nitrogen mineralization properties per layer and introduced in the system.

Concerning the climate information, METEO-France has developed a service allowing a simple access to the climate data of the stations managed by the service. This service called COLCHIQUE is intended for the professional users needing climate data occasionally or on a regular basis. The technical institutes, the plant health and agricultural-alimentary companies, and research centers, frequently need climate data to refine their studies, compute crop models or pest and disease models, or estimate crop productions. COLCHIQUE allows the acquisition of a meteorological data-set less than 2 days after measurement, from about 150 synoptic stations of METEO-France and approximately 1,000 automatic stations. Observations of temperature, wind, pressure, and moisture are accessible on a daily, 10-day, or monthly basis and also elaborated products like deviation or ratio-to-normal water-content assessment.

For example, the agricultural institute involved in the sugarbeet study collects the meteorological and agrometeorological data of the METEO-France database using COLCHIQUE. It presents a specific bulletin each month taking into account the agroclimatic conditions. Agricultural technicians of the Chambers of Agriculture or cooperatives in the north of France, in cooperation with the technical institute involved in the sugarbeet study, provide detailed information for the bulletin. All agrometeorological services provided by METEO-France are also available on the Internet.

The bulletins disseminated by answering machines, Minitel, fax, and Internet can be evaluated based on the number of end-users and requests. At the departmental level, there are a lot of meetings between the end-users and the delegate of METEO-France to define the needs and evaluate the feedback of new services. Sometimes, the Commercial Services of METEO-France conduct national surveys to assess the impact of services. It is possible to evaluate if a farmer has realized savings on the chemical or irrigation amounts when he or she has taken into account meteorological information. But, it is difficult to estimate the economic value and also the real environmental benefit at a national level. For that, the Ministry of Agriculture would have to do a survey in partnership with the Ministry of Environment and METEO-France.

To estimate and monitor the risk of severe drought and determine the most affected areas, maps on agrometeorological parameters such as potential water balance or state of available water, are produced on a regular basis or upon request. This information is completed with other data like the levels of the water tables and compared with the statistical values. For more than 20 years in the southeast of France, studies and experiments have been performed to monitor and prevent forest fires. This activity is a core mission. The drought indices calculated by METEO-France are communicated to the Civil Protection Agency from June to September. The indices are calculated with meteorological data of ground network with meteorological forecasts. This information is spatially improved using remote sensing (surface temperature and vegetation index from NOAA-Advanced Very High Resolution Radiometer [AVHRR]). The Météoflash message informs the farmer by telefax of the arrival on its zone of a weather phenomenon which can affect the cultures, the cattle, the materials, and the program of work. The warning message concerns the phenomena such as storm, strong rain, frost, very strong frost, strong heat, etc. This service is available by subscription through the departmental centre of METEO-France.

Modern techniques such as remote sensing data (surface temperature and NDVI from NOAA-AVHRR) are used by METEO-France to improve forest fires bulletins. Simulation models are used by agricultural institutes (Chambers of Agriculture, technical institutes,

cooperatives, etc.). Interactions between Soil, Biosphere, and Atmosphere (ISBA) is a soil-vegetation-atmosphere transfer (SVAT) scheme developed at the National Centre for Meteorological Research (CNRM) at METEO-France which is used to model the exchange of heat, mass, and momentum between the land or water surface and the overlying atmosphere. The model is used in so-called stand-alone mode for development, and in coupled-mode in which the model supplies the lower boundary conditions to atmospheric numerical weather prediction models or the upper boundary conditions for distributed hydrological models. ISBA is currently coupled to the METEO-France operational numerical weather prediction model (ARPEGE), the METEO-France climate model or GCM (ARPEGE-climate), the non-hydrostatic meso-scale atmospheric model Meso-NH, and the distributed macro-scale hydrological model MODCOU. The purpose is to do an operational service in hydrology and agrometeorology using ISBA linked to MODCOU with interpolated meteorological data in input. The use of GIS is increasing in France. A lot of organizations involved in agriculture and in agrometeorology use GIS to define agricultural potentialities to define polluted areas.

AgriQuest (http://www.agri-quest.com) is an Internet agricultural monitoring service developed by a private agency that provides real-time nationwide mapping and monitoring of vegetation conditions calculated with NOAA-AVHRR data. More than any other economic sector, the food and agriculture industries are affected by climatic risks. Among the various methods available for anticipating variations in productivity, remote sensing offers a wide range of simple techniques tested and proven over the past twenty years by numerous national and international organizations. For agricultural monitoring, AgriQuest provides weekly maps and charts that help end-users make objective, real-time analyses of crop potential from sowing time to harvest.

Germany

The German Meteorological Service (Deutsche Wetterdienst or DWD) has its own agrometeorological unit. It consists of seven regional branches (Figure 4). The agrometeorological service does research in the interrelations between weather and agriculture and presents the findings to the farmer by the agrometeorological advisory service. In Offenbach, where the centre of DWD is located, is the central business unit. Braunschweig has the agrometeorological research. Schleswig (Schleswig-Holstein, Mecklenburg-Vorpommern, Niedersachsen, Bremen, and Hamburg), Halle (Thüringen, Sachsen-Anhalt, Sachsen, Brandenburg, and Berlin), Geisenheim (Hessen, Rheinland-Pfalz, Saarland, and Nordrhein-Westfalen), and Weihenstephan (Bayern, Baden-Württemberg) supply the information (federal states of Germany in parenthesis).

Every agrometeorological regional unit supplies agrometeorological information and advice to a few federal states of Germany. Meaning, not every federal state has its own agrometeorological institute. Deutscher Wetterdienst (DWD) has a business unit called Landwirtschaft, meaning it deals with agrometeorology. The agrometeorological service does not work alone; in some cases, regional agricultural chambers (or research) give contributions to the more biological parts of text (in advisories). Bulletins cover the previous weekly and monthly period as well as daily forecasts and advisories. The main users of the information are farmers, vegetable growers, horticulturalists, vine growers, extension service, and agricultural chambers. They are reached by telephone, answering machine, and fax. There is a service of DWD for forestry: http://www.dwd.de/services/gflw/lw_home.html.

Figure 4. The agrometeorological units of DWD (Germany), and the regions belonging to the centers.

The remote sensing or GIS is not directly used for agrometeorological information service at DWD. Simulation models are used for agrometeorological topics (crop and soil conditions, harvest conditions and quality, pests and diseases, etc.). Telephone service (renewed daily) is limited by time (2- to 3-minute advisories). The daily, regional weatherfax consists of one page with results of the most interesting topics for the season. Second-order important information is not given to the farmer. Limitations include the personnel available to produce the regional texts and fax sheets, although the models run automatically that create the morning tables.

Italy

There are various types of agrometeorological information distributors in Italy. The results of the survey indicate that the role of the national meteorological service could be negligible in supplying agrometeorological information. The standard meteorological forecast is in the hands of the national services. In the case of EU, the basis of every standard weather prediction is the various types of forecasts issued by the European Centre for Weather Forecasts (ECMF), which is mainly the organization of the national meteorological services of the EU and a few other countries (Switzerland, Turkey, and Norway). The list gives the

main servers supplying the users with agrometeorological information in the Italian regions. As we can see in the list, there are various types of website supporters. The agrometeorological centers are shown in Figure 5.

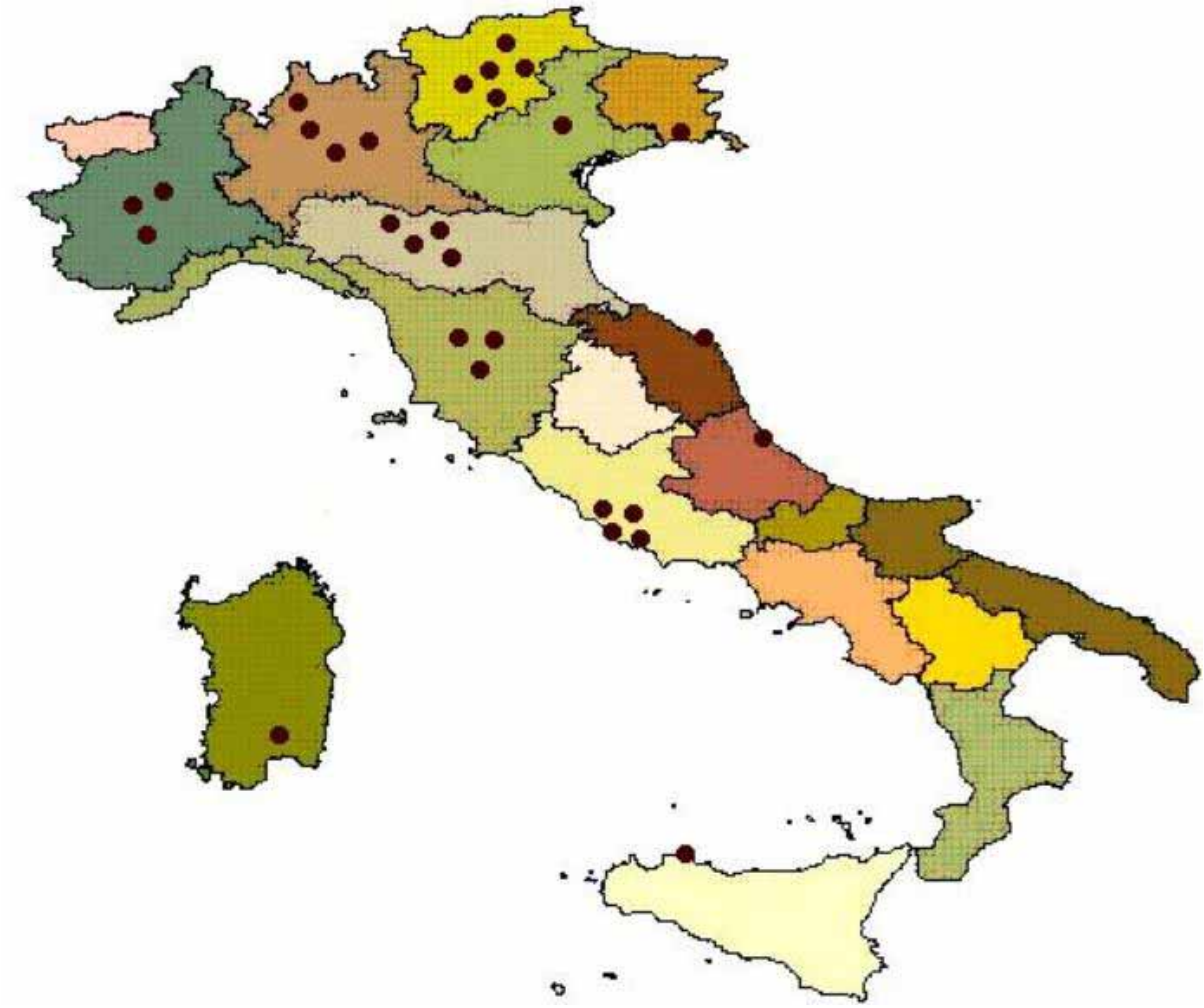

Figure 5. The regional centers in Italy where agrometeorological information is used.

The Italian regions and the agrometeorological information distributors are:

LIGURIA

Centro Meteo Idrologico della Regione Liguria, (http://www.cmirl.ge.infn.it/index.html),
Assonautica (Ass.Nazi. per la Nautica da Diporto Sezione Provinciale di Savona):
(http://www.infocomm.it/AptPalme/Puntometeo.htm)
Tele Liguria Sud, (http://www.itsyn.it/meteo/prev.htm)

PIEMONTE

Società Meteorologica Subalpina, (http://www.comune.torino.it/meteo/)
Regione Piemonte – Dir. Reg. servizi tecnici di prevenzione, (http://www.regione.piemonte.it/meteo/boll.shtml)
LRC Cuneo (http://www.lrcser.it/retecivica/meteo/)

LOMBARDIA

Centro Geofisico Prealpino (http://www.astrogeo.va.it/prevmete.htm)
Centro Nivometeorologico della Regione Lombardia di Bormio (http://www.novanet.it/vvol/meteo/)
Brescia on Line (http://bresciamagazine.numerica.it/meteo/)
Centro Rilevamento Ambientale (CRA) Comune di Sirmione (http://gardanet.it/turismo/sirmione/meteo/)

TRENTINO ALTO ADIGE

Centro Sperimentale Valanghe e Difesa Idrogeologica di Arabba (http://www.sunrise.it/csvdi/csvdi_it.html)
Servizio Prevenzione Calamità Pubbliche Provincia Autonoma di Trento (http://www.provincia.tn.it/meteo/)

Centro Agrometeorologico Provinciale (S.Michele all'Adige) (http://www.ismaa.it/html/ita/meteo.html)
Provincia Autonoma di Bolzano-Ufficio idrografico, (http://www.provincia.bz.it/hydro/index_i.htm)
DolomitiSuperski (http://www.DolomitiSuperski.com/page04it.html)

FRIULI VENEZIA GIULIA

Centro Meteorologico Regionale (http://193.207.118.99/ita.htm)

VENETO

Regione del Veneto -CSIM Centro Sperimentale Idrologia e Meteorologia Regione (http://www.campiello.it/csim_teolo/csim.html)

EMILIA ROMAGNA

Servizion Meteorologico Regionale-CINECA (http://www.cineca.it/meteo/)
ARPA - Servizio Meteorologico dell'Emilia Romagna, (http://www.arpamet.regione.emilia-romagna.it/default.htm)
Regione Emilia Romagna (http://www.regione.emilia-romagna.it/meteo/)
Università di Modena-Osservatorio Geofisico (http://rainbow.unimo.it/it/boll/)

TOSCANA

La.M.M.A. Laboratorio per la Meteorologia e la Modellistica Ambientale-Regione Toscana (http://www.lamma.rete.toscana.it/)
ARSIA-Servizio Agrometeorologico della Regione Toscana (http://www.arsia.toscana.it/meteo/hpmeteo1.htm)
IGT-Istituto Geofisico Toscano-Il Meteo (http://www.igt.it/meteo/)

MARCHE

Meteo Marche a cura dell'A.S.S.A.M (http://www.agricoop.it/meteom.htm)

ABRUZZO

Internet: Previsioni meteo Abruzzo (http://www.iternet.it/meteo/pma.html)

SARDEGNA

SAR-Servizio Agrometeorologico Regionale per la Sardegna (http://www.sar.sardegna.it/)

SICILIA

Telecolor (http://www.telecolor.it/tempo.htm)

ALTRI-ENEL Ricerca

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Testata Giornalistica Regionale TGR RAI (http://www.tin.it/tgr/meteo/meteoit.htm)
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Televideo RAI (http://www2.telematica.it/televideo/index.html)
Bollettino Agrometeorologico Nazionale UCEA (http://www.inea.it/ucca/bollettino/

Russia

In the Russian Federation, many regions (Oblast) issue their own agrometeorological bulletins. The structure follows the format of the traditional meteorological/agrometeorological bulletins. New technique plant-growth models and GIS are used, but the commercial services provide mainly special meteorological information to farmers and organizations. At the university, they work on models for crop growth and forecasts for pests and diseases. The phenological observation is an important part of the activity but because of its relatively difficult needs, very few services maintain phenological networks and observations.

Due to the significant number of survey responses, it was impossible to review the system submitted for every country in the present survey. We wanted to give an outline of how the agrometeorological works in RA-VI, mainly in Europe. We acknowledge all contributions, especially the services and bulletins mentioned in each national summary. For more details regarding specific countries, the readers are referred to the names and e-mail addresses of the contributors.

Summary

In evaluating the submitted responses, it was very difficult to find any common lesson. We can conclude that the application of agrometeorological information, advice, and support issued by the meteorological community for the agricultural, horticultural, forestry, and fishery users depend on the traditions and economical environment. The biggest problem for the agrometeorological community is that there is no feedback from the real users, and there is an information gap between the producers and users. The lesson of our survey is that much information is out of the scope of the national services. General opinion was that the improvement of operational agrometeorological services needs both better technology and business policy.

In order to organize/reorganize or simply improve the agrometeorological service, we have to follow at least two basic positions. In the first position, we can speak about passive information transmission because we have no influence on the user. In the second position, we could be active in transferring the information to the user's contact point, and then the user can select what information is useful for their daily working practice. First, the users of a service could be various groups with different needs in information, so there should be the opportunity to prepare various kinds of services. In this case, it is more appropriate to talk about agrometeorological information systems. Secondly, the service evokes the idea of a printed document in a traditional approach, but to reach the targeted group, in many cases, it is necessary to use other means such as radio broadcasting or television. The best solution seems to be the internet or direct information transmission such as fax or sms.

Because the Internet is a developing tool of information dissemination, a general summary is shown in Figure 6, following Maracchi (2002). The first step is to define the targeted group to be reach. The main groups we can identify are: 1) the decision makers and the extension services for agriculture and the environment, 2) the farmers, and 3) the businessmen.

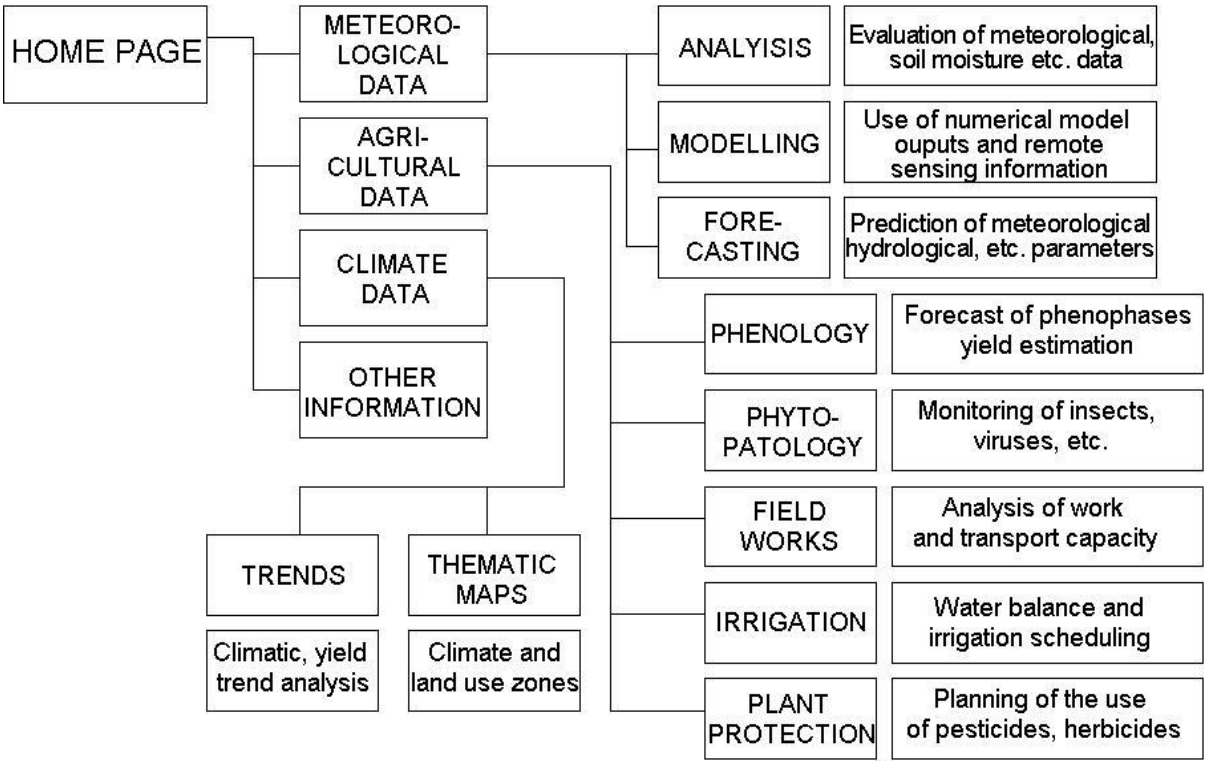

Figure 6. The structure of the agrometeorological homepage or information system.

The decision makers are interested in monitoring the agricultural campaign to help the farmers in difficult years or in the agroclimatological information for agriculture planning (Maracchi 2002, Thysen and Hocevar, 2004). They would know in advance the production estimates of the main crops, generally at a level of aggregation corresponding to the administrative subdivision of the country. The preparation of this type of information needs the conversion of meteorological data into crop yields in a format that could be compared with past statistical data. To compute the production, we can state how far we are from the average yields of each area as well as the evaluation of the acreage of the crop.

The decision makers concerns focus on extreme events causing damages to agricultural systems or to the environment; such as hurricanes, extreme droughts, floods, frost, strong winds, and intense rainfall. In these cases, the decision makers would need to know the area affected and the intensity of the phenomena.

The farmers' interests include knowing first, the characteristics of the season ahead of time in order to plan where to plant the crops. (At one time, this was not part of the forecast, but now the progress in knowledge of the seasonal climate together with the earth observation of sea surface temperature from space, makes it possible). And, secondly, during the season, using the information to make a decision in terms of crop management, planting, or not planting, spraying or not spraying, irrigate or not irrigating, and determining how much water is needed.

The farmers should receive the information punctually, and it should succinctly and coherently explain (in technical terms) the options they have. For example, it is not important to state the temperature or rainfall amount, but it is essential to communicate whether the farmers should plant or not.

In preparing advice, agrometeorologists should keep in mind the following issues: 1) what options the farmers have in relation to the information delivered; 2) the accuracy in terms of time and space of the information; 3) how to translate the meteorological or climate information into crop-management information; and 4) how to estimate the value of the advice.

List of Contributors

Many thanks to the colleagues listed below for their cooperation and materials:

ALBANIA	Mr. Petrit ZORBA	aspetal@yahoo.com
		agrometeoalb@yahoo.com
AUSTRIA	Mr. Hartwig DOBESCH	h.dobesch@zamg.ac.at
BELGIUM	Mr. Robert OGER	oger@cragx.fgov.be
	Mr. Piet CREEMERS	piet.creemers@ping.be
BULGARIA	Mr. Vesselin ALEXANDROV	vesselin.alexandrov@meteo.bg
	Mr. Valentin KAZANDIJEV	valentin.kazandijev@meteo.bg
CROATIA	Mr- Branko GELO	gelo@cirus.dhz.hr
CYPRUS	Mr. Stelios PASHIARDIS	stelios.pashiardis@cytanet.co.cy
CZECH REPUBLIC	Mr. Jaroslav VALTER	valter@chmi.cz
	Mr. Lubomir COUFAL	coufal@chmi.cz
DENMARK	Mr. Michael STEFFENSEN	mist@dmi.dk
	Mr. Iver THYSSEN	iver.thysen@agrsci.dk
FINLAND	Ms. Lea LESKINEN	lea.leskinen@fmi.fi
	Mr. Ari VENÄLÄINEN	ari.venalainen@fmi.fi
FRANCE	Ms. Victorine PERARNAUD	victorine.perarnaud@meteo.fr
GEMANY	Mr. Udo GÄRTNER	udo.gartner@dwd.de
	Mr. Hans FRIESLAND	hans.friesland@dwd.de
GREECE	Mr. Alexander ECONOMOU	a.economou@hnms.gr
	Mr. Nicolas DALEZIOS	dalezios@uth.gr
HUNGARY	Mr. Gabor KIS KOVACS	kkg@met.hu
	Mr. Zoltán DUNKEL	dunkel.z@met.hu
IRELAND	Mr. Denis FITZGERALD	denis.fitzgerald@met.ie
ISRAEL	Ms. Talia HOROVITZ	htalia@ims.gov.il
	Ms. Ora KARNI	karnio@ims.gov.il
ITALY	Mr. Giampiero MARACCHI	g.maracchi@ibimet.cnr.it
	Ms. Federica ROSSI	f.rossi@ibimet.cnr.it
	Mr. Simone ORLANDINI	simone.orlandini@unifi.it
	Mr. Antonio BRUNETTI	ucea@ucea.it
KAZAKHSTAN	Ms. Yelena ANTIPOVA	agro@meteo.kz
MALTA	Mr. Francis GAUCI	francis.gauci@maltairport.com
The NETHERLANDS	Mr. Cornelius J. STIGTER	kees.stigter@wur.nl,
	Mr. Marcel MOLENDIJK	cjstigter@usa.net
	Mr. Cornelis van DIEPEN	marcel.molendijk@knmi.nl
		c.a.vandiepen@alterra.wag-ur.nl
NORWAY	Ms. Bente HERSTAD	bente.herstad@planteforsk.no
	Mr. Tor Hakon SIVERTSEN	tor.sivertsen@planteforsk.no
POLAND	Mr. Jan ZIELINSKI	jan_zielinski@imgw.pl
	Mr. Andrzej DOROSZEWSKI	ador@iung.pulawy.pl
	Ms. Malgorzata KEPINSKAKASPARZAK	dyr_imgw@rose.man.poznan.pl
PORTUGAL	Mr. Fernando Quintas RIBEIRO	fernando.ribeiro@meteo.pt
	Ms. Rita GUERREIRO	rita.guerreiro@meteo.pt
ROMANIA	Ms. Adriana MARICA	adriana.marica@meteo.inmh.ro
	Mr. Gheorge STANCALIE	gheorghe.stancalie@meteo.inmh.ro
RUSSIAN FEDERATION	Mr. Alexandrov D. KLESCHENKO	cxm@obninsk.ru or cxm@meteo-ru
SERBIA & MONTENEGRO	Mr. Momcilo ZIVKOVIC	mzivkovic@hidmet.sr.gov.yu
SLOVAKIA	Ms. Olga BRASLAVSKA	olga.braslavska@mail.shmu.sk
	Mr. Miroslav ONDRAS	miroslav.ondras@mail.shmu.sk
SLOVENIA	Mr. Iztok MATAJC	iztok.matajc@rzs-hm.si
	Ms. Andreja SUSNIK	andreja.susnik@rzs-hm.si
SPAIN	Mr. Antonio MESTRE BARCELO	amestre@inm.es
SWEDEN	Mr. Roland SIGVALD	roland.sigvald@evp.slu.se
	Mr. Gunlög WENNERBERG	gunlog.wennerberg@smhi.se
SWITZERLAND	Mr. Daniel K. KEUERLEBER-BURK	daniel.keuerleber@meteoswiss.ch
	Mr. Jakob BRÄNDLI	jakob.braendli@meteoswiss.ch
TURKEY	Mr. Halil KÜTAHYA	infor@meteor.gov.tr
UKRAINE	Mr. Sergiy ZORIN	ems@zorin.kiev.ua
	Ms. Oksana BOGOLUBOVA	office@meteo.com.ua
UNITED KINGDOM	Ms. Ruth PATTON	ruth.patton@metoffice.uk
	Mr. Ian BARRIE	ian.barrie@adas.co.uk

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