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# Editorial

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## Special Issue on Weather, Climate, and Farmers

Decision-making in agricultural production is a complex process in which many risks need to be considered for an informed decision to be made. In many parts of the world, weather and climate are one of the biggest production risks and uncertainty factors impacting on agricultural systems performance and management. Farmers around the world, especially those in the developing countries, have been trying to adapt to the variable weather and climate conditions through various risk-management strategies. Improved weather and climate information, supplied to the farming community in a timely manner, can greatly assist the farmers in their operational decisions.

This Special Supplement of Meteorological Applications would not have been possible without the active contribution of all the members of the Expert Team on Weather, Climate and Farmers of the Commission for Agricultural Meteorology (CAgM) of the World Meteorological Organization and the members of the COST718 programme, especially the Management Committee and Chairperson Giampiero Maracchi.

The key to farmers' coping strategies with weather and climate risks is preparedness. Many agrometeorological tools and methodologies can effectively contribute to preparedness from both the strategic and tactical perspectives. Agroclimatic analysis and agroclimatic zoning based on the use of long-term climate, soils, and crop data in a Geographic Information Systems (GIS) framework permit strategic planning in terms of the choice of appropriate crops/cropping systems and crop varieties to fit the agroclimatic conditions of the region. During the cropping season, tactical planning can be facilitated through the availability of early warning systems, which allow farming communities to act in sufficient time to reduce the impact of extreme weather and climate events on farm productivity. Effective dissemination and communication strategies can play a very important role here. This special supplement highlights some of these key issues faced by the farmers. The collection of the papers presented in this supplement comes from individual contributions made at the meeting of the CAgM Expert Team on Weather, Climate and Farmers held in Geneva from 15 to 18 November 2004 in which a number of experts from COST Action 718 participated.

The supplement begins with the paper *Weather, Climate and Farmers: An Overview* (Stone and Meinke) in which challenges in linking meteorological and climatological information with the wide range of farming decisions are addressed. The authors cite case studies, which show that it is particularly important for those key farm decisions that are amenable to weather and climate information, to be identified clearly so that weather and climate information can be better tailored to suit farming decisions. A participatory approach provides farmers with ownership of the processes associated with development of weather and climate information and facilitates advances to be made in linking climate and weather information and forecasts to farm decisions. The authors argue that for the uptake of weather and climate information by farmers to be successful, appropriate interdisciplinary systems to connect climate, weather and agronomic information, especially including forecasting systems with farm management are needed. Climate change is an issue that is causing concern for farming communities around the world and the authors recommend that climate change scenario and trend information should be provided to the farmers, especially in regions that are vulnerable to climate change.

The paper *Dissemination and Communication of Agrometeorological Information—Global Perspectives* (Sivakumar) presents a brief perspective on the current needs for agrometeorological information and services and compares needs with current practices in the dissemination and communication of agrometeorological information by the National Meteorological and Hydrological Services (NMHSs) in different regions of the world. Lack of adequate interaction with the user community in assessing the appropriate dissemination and communication procedures that can enhance the value of the agrometeorological information and services was pointed out as a major gap. Opportunities and challenges in the dissemination and communication of agrometeorological information by the NMHSs were presented with suitable examples which emphasise that continued improvements are necessary to make agrometeorological information more accessible and useful to the user community.

The article *United States Department of Agriculture's Weather and Climate Information System for Operational Applications in Agriculture* (Motha and Stefanski) provides some successful applications of climate and weather information and how this information is communicated between this agrometeorological service and farmers using the example of the work of the Joint Agricultural Weather Facility of the United States Department of Agriculture. The agricultural weather applications or products are grouped into tactical (short-term) and strategic (long-term) products. Examples of tactical products discussed include the "Weekly Weather and Crop Bulletin" routine and special crop-weather assessments, and a Regional Weather Network in Mississippi. Strategic products discussed include the U.S. Drought Monitor and the use of weather information in the monthly World Agricultural Supply and Demand Estimates process.

In their paper on the *World Agrometeorological Information Service* (WAMIS), Stefanski and Sivakumar describe the different developments that led to the establishment of WAMIS, a dedicated web server on which countries and organisations can place their agrometeorological bulletins and advisories. Provision of such a central location for agrometeorological information enables users to evaluate quickly and easily the various bulletins, and to gain insight into improving their own bulletins. As these bulletins represent the expert knowledge of the individual countries, they provide the possibility to assess extreme events and disasters in a historical perspective especially when an archive of bulletins are present. The tools and resources section of WAMIS provides users with additional papers, links to software tools, Internet links, and other resources to help improve their agrometeorological bulletins, advisories and services.

The paper *Weather and Climate Monitoring for Food Risk Management* (Maracchi) shows the importance of the application of meteorology to agriculture in addressing the problems of food precariousness, particularly in arid and semi-arid areas of the world. Food insecurity represents one of the main indicators of the poverty level of a country and can breed a strong dependence on foreign aid with a strong slowdown of the national economy. The characterisation of climate and the identification of anomalies, the monitoring of weather conditions and their influence on crops, short and medium range weather forecasts, and long-term climate predictions, are among the most powerful tools to predict crises due to the absence or delay of rainfall season, in as short a time as possible. This paper presents a review of the different tools and some operational products.

In their paper on *The Activities of the German Weather Service (DWD) in the Field of Agroclimatology,* Friesland and Löpmeier describe the activities of DWD covering the use of data extending over 40 years from many meteorological stations in agrometeorological models. Output from these models permits better planning, risk assessment, objective evaluation of the current situation, and even for a test of the models used. Current applications concern crop microclimate, including soil, evapotranspiration and volatilisation, plant protection, phenology, and product quality, with examples such as the frequency of extreme soil frost, optimum harvest conditions, plant water stress on different soils, and the frequency of high pest incidence. Much of the agroclimatic model information is directly usable by farmers, for example, in the removal of plastic cover from spring crops, determination of soil conditions for plant water use, tractability, herbicide effectiveness, germination, nutrient washout, and harvest. The information on forest fire index, extreme season assessment (for compensation payments), and trend analysis is of interest to policy makers. Information on the use of risk levels for plant pathogens is useful to both farmers and extension services.

The article *Impact Assessment Study of Climate Change on Agricultural Zoning* (Junior et al.) described the initiation of an official program of agricultural zoning in Brazil to define planting calendars for rice, beans, corn, soybean, wheat, sorghum, cotton, coffee and fruits. The agricultural zoning is based on the integration of crop growth models, climate and soil databases, decision analysis techniques, and geo-processing tools. The importance of agriculture for the Brazilian economy requires impact assessment studies not only for seasonal climate variations but also for climate change. This paper assesses the specific impacts of potential climate change, as indicated by IPCC scenarios in 2001, in the agricultural zoning of coffee and corn, applying the methodology used by the Brazilian Department of Agriculture. It was shown that suitability for grain production will decrease more rapidly in regions with sandy soils than in regions with clay or medium soils as the temperature increases.

Apart from the general issues on weather, climate, and farmers, which the different papers above cover, the specific issue of agrometeorological support for fruit production was dealt with by Susnik et al. in their paper on *Agrometeorological Support of Fruit Production: Application in SW Slovenia.* Fruit growing in Slovenia has become one of the more important agricultural production branches over the last two decades and the Slovenian Agrometeorological Information System (SAgMIS) was developed to assist fruit growers in Slovenia. Transfer of actual and forcasted agrometeorological data to the end users has been quick and accurate, with the last version of mobile data dissemination in testing use. The paper describes a case study of water use by irrigated peach trees in the plantation orchards of lower Vipava valley during 1996 to 2004 and shows the benefits offered by SAgMIS.



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In the paper *The Agroclimatic Analysis at Farm Scale* (Orlandini et al.), research has been performed in a hilly area of Tuscany region, where the geo-topographical factors strongly affect the spatial distribution of temperature, is described. The results were discussed in order to evaluate their application to define the structure of an agrometeorological monitoring network connected to GIS and integrated with simulation models for the elaboration of agrometeorological warnings and advisories. The presence of hills and secondary and principal valleys affects the distribution of thermal patterns, which can be analyzed according to the specific characteristics of station positions. It was pointed out that the analysis of determination coefficients can be a very important method to evaluate both the correct weather station positioning in representative location of the whole farm or territory and the definition of the minimum monitoring period to assess with good precision the climatic characteristics of the area.

It is clear that there are many opportunities to provide improved weather and climate services to the farming community. Examples of more general decisions that can be aided by targeted climate forecast systems include tactical crop management options, agricultural commodity marketing, and policy decisions about future agricultural land use. Additionally, farm management needs to be seen within a wider context; decisions made at a point (farm) in the landscape have wider implications. Hence, environmental and societal risks such as run-off, drainage, erosion, salinity, nutrient and pesticide movements, health impacts, and employment implications also need to be considered and quantified. This requires the ability to consider multi-goal objectives through the evaluation of alternative action outcomes. In this context, use of systems simulation in combination with weather and climate forecasting is now being applied in some countries and this can be a very worthwhile tool that can provide objective information on which to base such decisions.

The papers presented in this supplement illustrate the applications of weather and climate information for farmers. Once again, we thank all the authors for their contributions and the reviewers for their efforts in editing and improving the manuscripts.



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