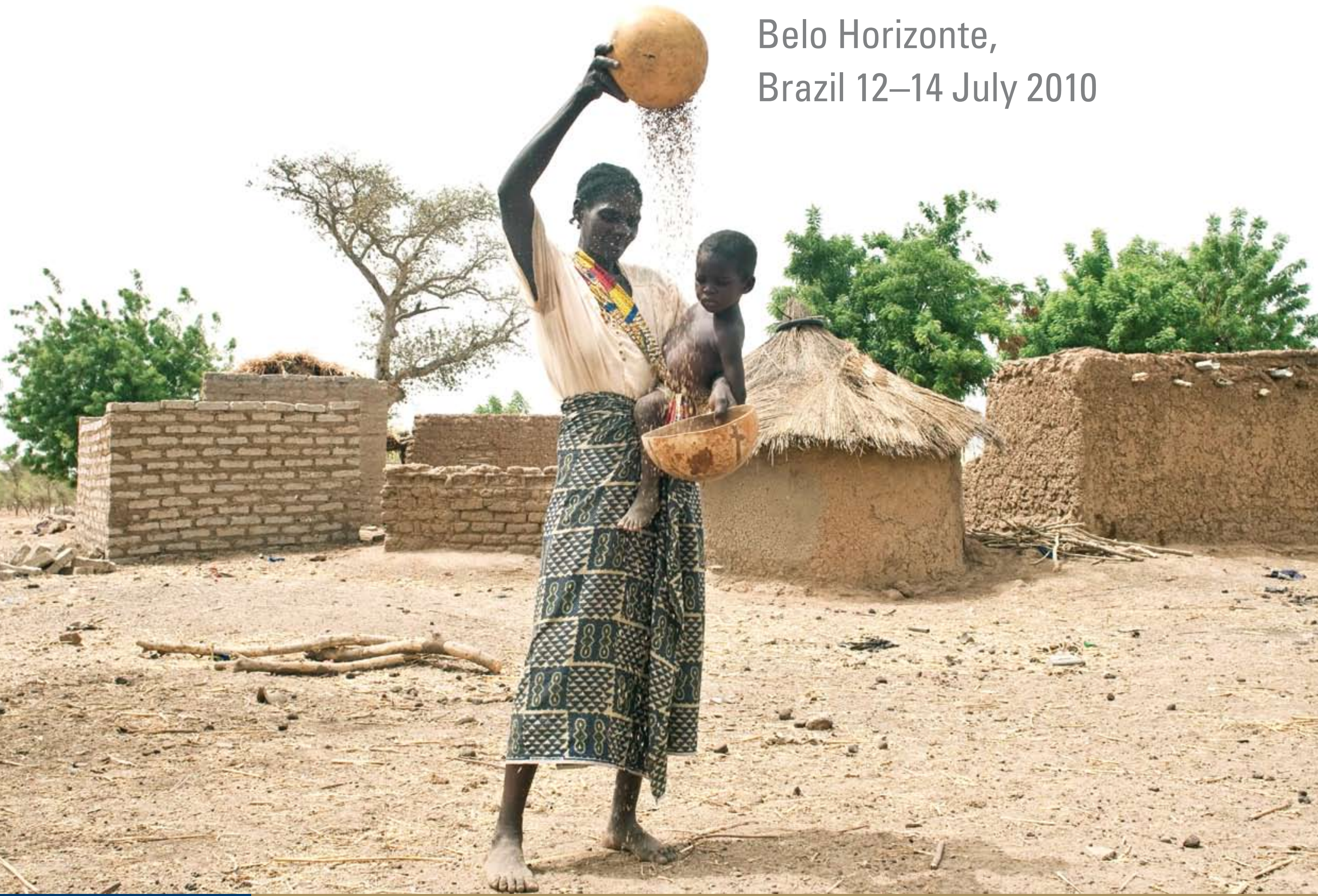
ABSTRACTS

International Workshop on Addressing the Livelihood Crisis of Farmers: Weather and Climate Services

Belo Horizonte,
Brazil 12–14 July 2010



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NOTE TO PARTICIPANTS

In addition to the papers listed in the Conference Programme, there will be posters that will be displayed during the Conference.

An abstract volume comprising abstracts of all presentations as well as posters will be available during the Conference.

Abstracts of the International Workshop on Addressing the Livelihood Crisis of Farmers: Weather and Climate Services

Belo Horizonte, Brazil, 12-14 July 2010

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PREFACE

The International Workshop on Addressing the Livelihood Crisis of Farmers: Weather and Climate Services is taking place at a time when there is a growing concern about livelihoods of over 500 million smallholder farmers around the world coupled with the increasing climate variability and future climate change. The world population is projected to grow from 6.5 billion today to 8.3 billion in 2030 and nearly 9.2 billion in 2050. All of that growth will be concentrated in developing countries. Global food production will therefore need to increase by more than 50% by 2030, and should nearly double by 2050. In 2010, FAO expects the cereal stocks-to-utilization ratio to be nearly 24%, which is the highest since 2003. Cereal production for developing countries is forecasted to decrease slightly by 0.8 percent in 2010. Agriculture's share of Official Development Assistance fell from 19% in 1980 to about 5% today.

The frequency and intensity of natural disasters including floods, droughts, tropical cyclones, wild fires etc., have been rising in the recent years. In 2008, Cyclone Nargis and Typhoon Fengshen caused significant damage to lives and property and 2009 was the fifth warmest year since the beginning of routine temperature recording. Also, the first decade of the 21st Century (2000-2009) was warmer than 1990s and is considered the warmest decade on record. Climate change is very probably contributing to increasingly frequent weather extremes and ensuing natural catastrophes.

Added to the impacts of increasing natural disasters on agriculture, prices for fertilizer, seeds and animal feed have risen by 98, 72 and 60 percent, respectively since 2006. Small subsistence farmers in developing countries are always particularly hard-hit by soaring input prices. After months of rising prices, governments in the developing countries had to draw on their budget reserves and households on their savings.

In order to address the livelihood crisis of farmers, there is an urgent need to increase productivity on their farms. This can only be accomplished through most efficient use of the three natural resources, soil, crop and climate, important for agricultural productivity. The agriculture and water resources sectors are probably the primary users of weather, climate and water information. In many countries, the National Meteorological and Hydrological Services (NMHSs), in partnership with academic and private sector service providers, provide a wide range of information and advisory services, including the following: historical climate data and products; current information (weather, climate, air quality, streamflow, etc.); weather, climate, air quality, and river forecasts; warning services (for all forms of meteorological, hydrological and oceanographic hazards); projections and scenarios of future human-induced climate change; and scientific advice and investigations.

But the challenge is that there is a lack of awareness in the farming community in the developing countries, in particular the least developed countries, of the available and potential weather and climate services. In addition there is a lack of capacity and specialized competency in NMHSs of developing countries to deliver timely and relevant services in order to better meet the needs of the farming community.

Projections of climate change and climate variability have generated a growing sense of urgency for continued but closer collaboration between the farming community and NMHSs. This collaborative process must move forward more aggressively, with effective risk management, to maximize the benefits of weather, climate and water information in the agricultural sector. There is a need for routine engagement by NMHSs of end-users and stakeholders in the development of products and services; improved communication and coordination in the development, use, assessment and improvement of these products; the development of a policy promoting free, unrestricted and timely exchange of data and information to foster stronger linkages with the farming sector; and the development of partnerships between climate and water scientists to improve water management and water use efficiency in order to deal more effectively with weather- and climate-related events such as droughts and floods.

It is with this background that WMO and the Instituto Nacional de Meteorologia (INMET), Brazil, are organizing, jointly with several co-sponsors, this international workshop from 12 to 14 July 2010 in Belo Horizonte, Brazil, in conjunction with the 15th Session of the Commission for Agricultural Meteorology of WMO.

Specific Objectives of the Workshop

- To identify and assess the weather and climate risks and uncertainties in different regions of the world which affect the livelihoods of farmers e.g. extreme climatic events (droughts, floods, cyclonic systems, temperature and wind disturbances etc.), climate variability and climate change, lack of timely information on weather and climate risks and uncertainties etc.,

- To review and summarize various weather and climate services for the farming community such as timely weather and climate forecasts to facilitate on-farm operational decisions, agrometeorological monitoring and forecasts for pests and disease control, agrometeorological adaptation strategies to cope with climate change, agroclimatic zoning for crop planning etc.,

- To evaluate the current means of communication of various weather and climate services to the farming community in different regions of the world and suggest the ways and means to implement new and/or appropriate tools for dissemination of the weather and climate products and services, especially in regions where farmers are most vulnerable to the vagaries of weather and climate extremes,

- To review climate change risk management in adapting strategic plans to reduce the potential impacts of climate change for farmers;

- To review, through appropriate case studies, the use of weather risk insurance strategies and schemes to reduce the vulnerability of the farming communities to weather and climate risks;

- To obtain feedback from farmers from different regions of the world on the extent to which current weather and climate services assist them in coping with various weather and climate risks and enhance the productivity of crops on their farms;

- To discuss and recommend suitable policy options to enhance weather and climate services for the farming community in different parts of the world; and

- To present these recommendations at the ensuing session of the Commission for Agricultural Meteorology of WMO for the provision of improved and weather and climate services to the farming community by the NMHSs.

The International Workshop is organized in 10 sessions (including the opening session, the special symposium on climate change adaptation, and the farmer's forum) during which 25 invited papers are presented addressing the different specific objectives of the Workshop.

This volume includes the abstracts of the invited papers and several posters that will be displayed during the Conference. The Sponsors of the Conference would like to thank all of the authors for their efforts and for their cooperation in bringing out this volume in time.

SESSION II

Livelihood Crisis of Farmers – Regional Perspectives, with Particular Reference to Weather and Climate Risks and Uncertainties

Chairman: Carlo Scaramella
Rapporteur: Peter Gibba

LIVELIHOOD CRISIS OF FARMERS – OVERVIEW

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Abstract

Livelihoods of farming communities are largely dependent on their assets (natural, social, financial and human). They earn their livelihood from resources such as climate (water, solar energy, and heat), land, crops, trees, livestock, inputs, labour, finance, social relationships, knowledge and information. They are exposed to risks and uncertainties related to the variability of climate, and associated threats such as decrease in crop and livestock production, plant and animal diseases, uncertainty in commodity prices, inability to adopt new technologies, scarcity of inputs and challenges in credit access.

Efforts to address livelihood crises of farmers should seek to protect and build resilience in order to reduce vulnerability to external shocks. Within this context, National Hydro-Meteorological Services (NHMSs) must play a key role by providing tailored climate information to allow rural farming communities to better cope with climate shocks.

NHMS can adopt three direct approaches: (i) assess the resource base providing information about the livelihood zones, livelihood profiles and their vulnerability to impacts of weather and climate; (ii) provision of tailored climate and weather information to rural households, community networks and institutions to guide pro-active decision making to sustain agricultural production and maintain livelihoods; and (iii) supporting climate-based information systems (e.g. early warning systems, crop insurance) to enable timely response to livelihood crisis (food, market, financial etc.) and avoid/moderate secondary risks closely linked to climate related perturbations. All these interventions yield strengthened risk coping strategies and positive livelihood outcomes through an integrated approach aimed at tackling rural poverty, food insecurity and climate change.

This paper seeks to highlight the livelihood crisis of farmers especially in under developed countries of the world as well as provide an overview of concepts and experiences of linking weather and climate services and bottom-up livelihood approaches to prevent and/or moderate livelihood crisis of rural communities. Among the challenges rural farmers face with respect to climate information include: intra-seasonal and inter-annual distribution of rainfall and temperature (including extreme variations), language/terminology, communication channels, capacities, stakeholder awareness, tailored forecasts, further forecasted parameters, key relationships, lack of data, spatial distribution and challenges of timely issuance climate forecasts. Building capacities in NMHSs and their partners (such as agricultural extension and agronomic research) are crucial to making available weather and climate information to match the demands of rural farming communities. The paper also proposes some measures to be taken by the NMHSs to reduce the livelihood crisis of farmers. They include the strengthening of agro-meteorological monitoring in rural areas, data archival and management, data analysis, seasonal forecasts for rural livelihoods, new tools and methods for the assessment of production potential, vulnerability and impact. Institutional networking and building social capital are essential to facilitate easy flow of need based agro-meteorological information to the end-users and feedback to service providers.

LIVELIHOOD CRISIS OF FARMERS IN AFRICA – ADAPTATION TO UNCERTAINTY DUE TO CLIMATE AND OTHER CHANGES

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Abstract

Livelihoods are about 'making a living' so as to provide among other things enough food. They are about people and their use of available resources to cope with risks and uncertainties while utilising new emerging opportunities. Throughout Africa they are linked with household food security but survival is not simple. In Africa, the most vulnerable people (approximately 325 million people) are those living in dry lands which cover about 43% of Africa's land surface. Food security is a function of factors such as population dynamics; biophysical (including climate) change; land ownership and use, agricultural markets, trade and investment policies, and political stability and socialization. Indicators for food security include availability of food, access to food according to subsistence agriculture and purchasing power, and product utilisation including kind, quantity, quality and nutritional value of available foodstuff. They can be compared by using either a 'Livelihood Vulnerability Index', which considers exposure, sensitivity and adaptive capacity of communities or a 'Sustainable Livelihoods Framework', which characterises the various contributions from human, natural, social, physical and financial capital. The latter also covers debt and credit structures and the necessary infrastructure. A number of assessments have been carried out in various African countries and are ongoing using the World Food Programme Food Security and Vulnerability Analysis and Monitoring Systems. The adaptation solutions can be divided according to various agro-ecological zones and for each of these into the following main categories: natural resource management, type of farmer (income classes and position/role in society, land owner, labourer, share cropper, subsistence farmer, farmer and trader, creditor or in debt), markets, and institutional opportunities (including financial markets). Examples from various regions on the African continent that highlight each of these areas of adaptation will be discussed. Some natural resource management opportunities are in the identification of alternative cropping, soil and water conservation and improvement techniques for transitional zones. This can be particularly useful in marginal or otherwise endangered areas where there is a high risk for crop production with low yields and many crop failures, whereas alternative farming systems (such as mixed cropping and livestock or even in other seasons) can be identified and introduced to improve livelihoods. Changes in land use patterns can also be due to land scarcity and decreasing farm size such that farmers need to diversify the crops grown, as has happened on the slopes of Mount Kilimanjaro. Similarly, complementary integrated land uses in the Atlas Mountains in Morocco provide sustainable livelihoods by using a combination of irrigated terraces and runoff agriculture to adapt to the changing climate and restrict degradation. Another example is in a Sahelian village, in northern Burkina Faso. The people have increased their climate independence by engaging in diverse agricultural activities including mats, horticultural products and small stock rearing for sale on the local market. Institutional opportunities can be driven by the local community or by government interventions. For example, the establishment of fishing co-operatives in Angola provide a voluntary mutual self-help system of better use of common resources for the benefit of all. In semi-arid Tanzania, risk mapping was used to identify and gain insight into common interest and availability of natural resources which play a vital role for the livelihoods. The interaction between environmental factors and natural, human and social capital was gender specific along the lines of

traditional roles in the community. However, financial and livelihood strategies were of concern to both men and women. Thus it can be seen that there are possible interventions that address the livelihood crises in Africa. Agrometeorological services need to be developed and implemented as a matter of policy to assist extension to transfer these interventions from one area or country to other similar agro-ecological zones.

PUBLIC METEOROLOGICAL SERVICE DELIVERY AND DISASTER RISK MANAGEMENT FOR THE FARMING COMMUNITY OF CHINA

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Abstract

For long, the rural areas have always been the important but difficult targets for information outreach for meteorological disaster prevention and preparedness across the country. And the rural areas are the weakest linkages in getting messages across in disaster prevention and mitigation. The insufficient coverage of telecommunication plus poor knowledge of farmers about meteorological disasters often led to heavier losses of lives and properties before, in and after the predicted extreme events took place. It seems imperative to tackle the so-called “last- mile bottleneck” problem in outreaching the disaster early warning messages to local farmers in the remote countryside. This thrust has been highly attended by governments at all levels.

With untiring efforts made in recent years, some significant progress is very much noticeable in building up a meteorological information delivery system in China’s rural areas. The grass-root weather bureaus have gradually set up local weather information dissemination networks that combine the indigenous repercussion instruments (e.g. Gongs & drums), loudspeakers with modern means of communication like automatic alarming devices, electronic display screens, mobile-phone SMS messages, telephones, TV and radio broadcasts. Basically, the farmers can stay informed about weather at home. According to incomplete statistics, the SMS users are 91 million, about 30 percent of which are farmers. Up to 80,000 wired loudspeakers and over 43,000 electronic display screens already exist in villages across the broad rural areas. The short-wave marine weather radio stations have been set up along the vast coastal lines, which are targeted to fishermen operating at sea. So far, the total number of voluntary weather information deliverers exceeds 375,000 across the vast countryside. Furthermore, the meteorological establishments in 34 provinces (including autonomous regions, municipalities and cities with independent development plans) have opened respective Agromet websites. 270 cities and 1,300 counties have also opened the Agromet web-pages targeted to local users. A satisfaction survey made in 2009 showed the satisfaction rate was 89.1% in rural areas, and 85.6% in urban areas. It is also found that SMS messages, the wired loudspeakers and TV are the dominant sources of the meteorological information for farmers at present stage.

Meanwhile, Disaster risk reduction and management has been highlighted in government agendas. Public awareness in rural areas on disaster prevention and mitigation was significantly enhanced. The survey on historical disaster was conducted and the real time collection system on disaster information has been put into operation. Risk mapping and analysis based on GIS and other emerging technologies provide a solid basis for on-farm decisions and adaptation to climate change. Financial risk transfer—Agriculture Insurance mechanism has been operated on a trial manner and catastrophe risk insurance for farmers on typhoon, flood etc. will be initiated in the near future.

LIVELIHOOD CRISIS OF FARMERS – PERSPECTIVES FROM NORTH AMERICA, CENTRAL AMERICA AND THE CARIBBEAN WITH PARTICULAR REFERENCE TO WEATHER AND CLIMATE RISKS AND UNCERTAINTIES

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Abstract

In recent decades, numerous weather- and climate-related natural disasters have impacted RA-IV, repeatedly demonstrating how vulnerable local agriculture is to extreme episodic events. Given this recent history, and expectations that the frequency and intensity of these episodic events will increase with climate change, it is becoming increasingly important for farmers to proactively manage weather and climate risks to agriculture to protect their livelihoods. Some farmers in RA-IV already apply various strategies to help reduce weather and climate risks and uncertainties, including farming in multiple locations, diversifying crops and varieties, seeking alternative sources of income, and purchasing crop insurance. Such efforts often help farmers maintain a more stable income while also protecting and preserving the productivity of the land. Other farmers, however, have failed to implement basic risk management strategies despite the clear benefits. Reasons for these failures can be attributed to inadequate farmer education and training, a lack of tools to help facilitate the practical application of risk management concepts, and poor communications between the agrometeorological and farming communities. The agrometeorological community can help overcome these obstacles by building upon existing efforts that have successfully educated farmers about weather and climate risks to agriculture and have equipped farmers with the data, tools, and applications necessary to manage these risks. Farmer input is critical to preparing effective educational and training materials and developing user-friendly risk management tools. The agrometeorological community should solicit input from farmers regularly to ensure that farmers are obtaining the information necessary to effectively manage weather and climate risks to agriculture.

LIVELIHOOD CRISIS OF FARMERS – PERSPECTIVES FROM THE AUSTRALIA AND THE SOUTH – WEST PACIFIC WITH PARTICULAR REFERENCE TO WEATHER AND CLIMATE RISKS AND UNCERTAINTIES

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Abstract

Australia and the South-West Pacific are greatly impacted by high levels of climate variability. The large inter-annual variations in this region's climate lead to either occasionally excessive rainfall or periodic drought occurrence. These climatic processes are inherent to driving variations in soil moisture which is critically important to agricultural systems in the region. The 2002/03 drought in Australia reduced growth in Australian GDP by one per cent (or $8billion AUS) due to the hugely negative impact on agricultural sectors (Gallant et al., 2010). The El Niño-Southern Oscillation (ENSO) is a dominant climate driver in the region so that major dry and wet years are associated with extreme phases of ENSO (El Niño and La Niña, respectively) (McBride and Nicholls, 1983; Stone et al., 1996). Additional influences include the Southern Annular Mode, the sub-tropical ridge, and the Indian Ocean Dipole (e.g. Hendon et al., 2007; Williams and Stone, 2009). Furthermore, some of the inter-annual variability and decadal variability is shown to be influenced or driven by decadal-scale fluctuations in ocean-atmosphere systems such as the Pacific Decadal Oscillation (PDO) and Interdecadal Pacific Oscillation (IPO). Additionally, the region is being subject to long-term shifts in rainfall and temperature (e.g. frost frequency).

Nelson and Kokic (2004) show that in many regions of Australia, crop yields and pasture growth fluctuate with low and highly variable rainfall and that sandy soils in many regions provide little stored soil moisture to sustain crop growth when in-crop rainfall is low. Additionally, sensitivity of farm incomes to high climate variability can be "compounded by low diversity of farm income sources and, for some regions, a low reliance on off-farm income". Conversely, regions with the least sensitivity in crop-farm incomes to climate variability include central and southern parts of the Western Australian wheat belt, and the south eastern cropping regions from the Yorke Peninsular of South Australia to central Victoria to the Riverina District of New South Wales. In New Zealand, key areas of climate/drought risk exist in the east of both the main islands. The main factor in soil moisture deficit is the major mountain 'backbone' which cuts across the predominant westerly flow (Salinger and Mullan, 1999). In some parts of New Zealand (e.g. northern parts of the South Island) farmers believe lack of reliable rainfall in both summer and winter, which is related to the El Niño/Southern Oscillation, is by far the biggest challenge. Issues related to climate variability in Fiji and other southwest Pacific nations are also provided.

LIVELIHOOD CRISIS OF FARMERS – PERSPECTIVES FROM EUROPE WITH PARTICULAR REFERENCE TO WEATHER AND CLIMATE RISKS AND UNCERTAINTIES

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Abstract

Farming is a priority to European economy. Europe is both a major exporter and the world's largest importer of food, mainly from developing countries. Agrifood sector is the third largest employer in the European Union, and is at the same time a provider of plentiful supply of safe food and of guaranties to the survival of countryside as places to live, work and visit.
Different wealth and diversity characterize agriculture in the EU's 27 Member States, but environmental issues and climate hazards are common problems.
EU Agricultural Income went down 11.6% in 2009, and strategies are planned to face globalization, pressure on resources, ageing and exit from the crisis.
Three priorities are at the heart of Europe 2020:
– Smart growth – developing an economy based on knowledge and innovation.
– Sustainable growth – promoting a more resource efficient, greener and more competitive economy.
– Inclusive growth – fostering a high-employment economy delivering economic, social and territorial cohesion.
EU agricultural policy is constantly evolving. 50 years ago, the emphasis was on providing enough food for a Europe emerging from a decade of war-induced shortages. Subsidizing production on a large scale and buying up surpluses in the interests of food security are now largely a thing of the past. EU policy aims now to enable producers of all forms of food - from crops and livestock to fruit and vegetables or wine – to ensure that farming and preservation of the environment go together. Agricultural practices and production processes are now considered in a much wider context – that of achieving real sustainability in a wide sense and responding directly to the concerns of the consumers of Europe. Agriculture must cope with new pressures, as: environmental new demands; changes in rural policy; rise of non-food production, landscape management, biodiversity and conservation issues. Also impacts on European agriculture come as a result of international agreements, such as WTO, the Kyoto protocol and the Convention on Biological Diversity.
CAP (the Common Agricultural Policy) helps develop the economic and social fabric of rural communities and plays a vital role in confronting new challenges such as climate change, water management, bio-energy and biodiversity. Through responses to the new economic, social, environmental, climate-related and technological challenges facing our society, the CAP can contribute more to developing intelligent, sustainable and inclusive growth.
Constantly identifying ways of improvement of the agricultural chains, and looking for new windows of opportunity may help the process to face weather and climate risks: innovation in technologies, ICT resources, planning sustainable use of the energy and water resource are at the basis of growth strategies and to support to farmers. The promotion of internationally competitive, quality foodstuffs, innovation in farming and food processing, as well as rural development, including the diversification of rural economies is looked for . Consumers have become much more quality-conscious, so voluntary EU labels help them make educated choices. There are labels for foodstuffs with a clear geographic origin, for food made with traditional ingredients or using traditional methods, and for organic food. Quality is an issue for every farmer and, also under this vision, appropriate strategies dealing with reducing uncertainties due to weather and climate changes must be addressed. Agrometeorology is a strongly supporting discipline for a farming more environmentally friendly and wider uses of its instruments and tools at national and regional levels is foreseen and suggested.

SESSION III

Weather and Climate Services for the Farming Community

Chairman: Byong Lee
Rapporteur: Adrian Trotman

SHORT, MEDIUM AND EXTENDED RANGE WEATHER FORECASTS FOR THE FARMING COMMUNITY

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Abstract

In different parts of the world farming practices are conditioned to the normal weather variability of the region relying heavily on biological adaptations of crops as well as availability of natural resources to supplement natural adaptability. In the case of modern agriculture technological interventions are resorted to, thereby adding a significant cost factor to productivity. Weather prediction provides the basis for selecting the best option as well as gives a lead-time to mobilize resources. Both these virtues make weather prediction a natural ingredient of modern agriculture.

There are various shades and connotations to what we imply as weather prediction. In some cases it is forecasting of different physical parameters for the entire period of forecast validity. In others it is a distribution of probability over the range of expected values. In certain others it may simply refer to a long period average which in real world would actually be manifested through a range of variations. Users need to understand the scientific limitations behind such approaches and also to make sense out of these predictions in individual decision-making.

It is possible to give reasonably reliable forecasts by persisting with current weather and using climatological knowledge for the next 24 hours or so. Beyond that numerical methods are essential which require observational information on several atmospheric parameters, which are linked to the weather outcome in a causative manner. The most important aspect of this is that numerical methods are highly computer intensive and have different approaches for different lengths of validity. Pure atmospheric numerical models running for the entire globe can at most serve up to 7 and 10 days for forecasting local weather depending on whether one is in the tropical region or mid-latitudes respectively. This is called the domain of short and medium range, the short range being only up to 2-3 days that is tractable by child regional models also deriving its data from a mother global model. Smaller size domains enable higher resolution and more detailing at a relatively less computing cost. However, most modeling centers are now running global models at high resolution thereby slowly eliminating the need to install several types of models.

But one needs to go beyond the information derivable from purely atmospheric variables when we go beyond 10 days or so. This is because sea surface temperatures tend to change beyond this time and affect atmospheric circulation through transfer of heat, momentum and moisture between the ocean and atmosphere. Thus Ocean-Atmosphere coupled models are used for extended range forecasts which although principally can extend up to a season but are rarely reliable beyond 15 days in a deterministic mode. Beyond 15 days the predictions are only averages over weeks or months.

Farming practices that tend to benefit most from extended range forecasts are – determination of sowing dates and initiating water conservation, because both these have to be planned sufficiently in advance. Medium range predictions are typically used to schedule irrigation, apply fertilizers and pesticides, and determine dates of harvest and storage. Short range predictions are typically more accurate and can be relied for warnings against disaster occurrences like hailstorms, squalls, flooding etc. Likelihood of false warnings in the case of short-range forecasts is the least. The most important aspect of receiving multi range predictions is that it gives an opportunity to telescopically review decisions and to check for consistency in the predictions, which in turn can be regarded as some measure of reliability.

Statistical depiction of model performance in terms of its success rate of determination of a certain occurrence or its non-occurrence and of the misses and false hits is essential to judge the reliability of predictions. These normally accompany model predictions in a routine

manner to indicate the model usability. More advanced assessments tend to derive estimates of conditional reliability, i.e. reliability levels under various circumstances.
The overall impact of a weather service in terms of management of farming risks can only be realized if appropriate steps are taken to bring the information to the concerned user without any delay. This is a challenging task for developing economies and the less technologically privileged areas of the world.

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SEASONAL TO INTER-ANNUAL CLIMATE FORECASTS AND THEIR APPLICATIONS IN AGRICULTURE

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Abstract

Interaction between the atmosphere and underlying oceans provides the basis for probabilistic forecasts of climate conditions at a seasonal lead-time. The ability to anticipate climate fluctuations and their impact on agriculture months in advance should, in principle, enable several opportunities to manage risk. Within an enabling environment, it offers the farmer opportunity to adopt improved technology, intensify production, replenish soil nutrients and invest in more profitable enterprises when conditions are favorable; and to more effectively protect families and farms against the long-term consequences of adverse extremes. More effective systematic use of advance information about climate and its impacts on agriculture may also offer opportunities to improve management of input and credit supply, production volatility (through food trade and strategic grain reserves), food crises and insurance – in ways that reduce risk and increase opportunities at the farm level. Seasonal climate forecasts have been the subject of more research than other types and time scales of climate information for agriculture. The resulting literature provides evidence of latent demand and potential for farmers to use seasonal forecast information. It also reveals that several common constraints have so far limited the widespread use and benefit from available seasonal forecast information among smallholder farmers. Those constraints that reflect inadequate information products, policies or institutional process can potentially be overcome. Institutional processes that give farmers a genuine voice in the design of climate information products and services are crucial for improving salience. However, widespread experience suggests several technically feasible avenues for improving the salience of seasonal forecast information for farmers. As a starting point, seasonal forecasts should: (a) be downscaled onto available stations or projected onto high-resolution, gridded, merged satellite-station data; (b) include relevant and predictable information about "weather-within-climate" such as the number of rain days; (c) express uncertainty in transparent probabilistic terms, including the full forecast and climatological distributions; and (d) be packaged with historic observations and hindcasts of the forecast variables. Probabilistic forecasts of agricultural impacts (e.g., crop or forage yields), updated through the growing season, would serve multiple climate risk management interventions involving a range of decision makers. Six institutional and policy changes are suggested that will enhance the benefits of seasonal forecasting to agriculture in many contexts. The first is to mainstream climate information, including seasonal forecasting, into agricultural research and development strategy. The second, closely-related challenge is to develop capacity to use and effectively demand climate information, perhaps beginning with champions within national agricultural research systems. Third, the agricultural sector and particularly farmers must be given a greater degree of ownership and an effective voice in climate information products and services. Fourth, climate services should target and foster coordination among an expanded set of applications of seasonal forecast information, such as coordinating input and credit supply, food crisis management, trade, and agricultural insurance. Fifth, in many cases national meteorological services need to be realigned, resourced and trained as providers of services for development and as participants in the development process. Finally, meteorological data should be treated by national policy as a free public good and a resource for sustainable development across sectors. While these changes are likely to be more challenging than the technical issues related to climate information, they are not intractable. The surge of activity surrounding seasonal forecasting in SSA following the 1997/98 El Niño has waned in recent years, but emerging initiatives, such as the Global

Framework for Climate Services, ClimDev-Africa and the CGIAR's new program on Climate Change, Agriculture and Food Security (CCAFS), seem poised to re-invigorate interest in seasonal forecast information services for agriculture.

AGROMETEOROLOGICAL MONITORING AND FORECASTS FOR PEST AND DISEASE CONTROL

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Abstract

Agrometeorological models represent very powerful tools to improve the activity of growers. Based on meteorological variables they simulate the dynamics of agricultural systems (crop growth, water balance, disease and insect development, etc.), producing a wide range of information available to the farmers. They can use this information to improve their decision making, by integrating their experience and knowledge with objective data obtained by the application of models.

The management of crop protection against pest and disease represents one of the most important fields for the operational application of agrometeorological models. Most of the biological phases of insect and fungus cycles are strongly related to the meteorological conditions, and so they can be considered as one of the main driving factors responsible for the different incidence of attacks during the vegetative seasons. The use of algorithms taking into account the relationship among crop, pathogen or insect and weather variables, allows to simulate the level and trend of risk. The produced output of the models can be used to assist the growers to determine when and how to manage crop protection techniques. The use of simulation models to realise decision support systems, can further increase the potential benefit to the farmer's activity, allowing to condense the available knowledge and to create a particular mix with the intuition, the experience and the knowledge of the technicians.

At present many conditions are favourable for the development of new simulation models and particularly for their operational application to support farmer activity. The widening of biological knowledge can provide the modellers with new information that can be implemented in new simulators or used to improve the structure of existing ones. Computer science and telecommunications are two of the most important points allowing to apply more complex models, also based on agrometeorological data measured and transmitted in real time to the computer centre. Information can also be disseminated to the users exploiting the new possibilities made available by internet, mobile phone, etc. The use of weather forecast data, as well as seasonal climate forecast, to feed agrometeorological models increases the possibility of using model outputs to support farmers' activity.

By considering field conditions, other favourable considerations can be emphasised: the relevant level of real and potential crop losses with annual changes and the high level of pesticide utilisation. This means that both in developed and developing countries P&D are responsible of an high percentage of yield losses (about 25% for the developed countries and 50% for the other ones), in spite of the high amount of pesticide applied during the growing season to protect the crops.

AGROCLIMATIC ZONING FOR CROP PLANNING

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Abstract

In the established scenarios based on the current agricultural management systems and the climate patterns that affect crop development and production, a new source of uncertainty must be taken into account, i.e. the temperature and water availability scenarios resulting from climate changes and/or global warming. Despite abundant discussion and a multitude of studies presented indicating the future scenarios related to global warming and the current modifications, very little is known as a fact, especially how crops respond to a new thermal regime, the physiological and metabolic adaptations, the consequent modifications to which crops will be subjected. An important procedure is the establishment of public policies for agricultural development based on climatic characteristics. In that sense, agricultural zoning followed by Agro-ecological Zoning, based on the climatic and soil potential of a region and its climatic associated risks are highly relevant. It is also important to mention that the agro-ecological zoning might provide complementary information about the climatic risk such as: high or low temperatures, drought or excess rainfall, thus indicating the climatic risk and the feasibility of crop success.

The study of agricultural zoning or agro climatic suitability, followed by agro environmental zoning, comprises the determination, within a certain defined area, of the potential of agricultural use of crops in relation to their climate demands and of how much support the climate can offer in terms of temperature and water supply. It also includes evaluation of climatic risks associated with frost, water deficit, drought or high temperatures. The climate is generally the first element taken into account as it is considered a stability factor, although seasonal variations and the climate variability are also to be considered.

Despite being relatively work intensive, this methodology of crop zoning is efficient for qualitative climate comparison between the several regions of the globe to study agricultural zoning. Also, a better degree of refinement is reached when this methodology and the climate indices are compared with weather indices of crop response in order to obtain the bioclimatic indexes for the referred crop. The widely known and widely used methodology in macro-agroclimatic zoning is the following:

1) Data collection and preparation of basic climatic charts representative of the region (average air temperature; annual and coldest month potential evapotranspiration, among others);

2) Calculation of Water Balance for the determination of the following parameters: actual evapotranspiration; water deficit and surplus based on water balance parameters according to crop-soil relations;

3) Survey of climatic demands of the crop – values estimated based on climate-crop qualification.

A region may be classified for the growth of a plant, in one of three following categories:

Adequate – when macroclimate conditions are normally favorable to commercial base use;

Restricted – when climate conditions present restrictions which frequently undermine certain phases of the crop. There might be some limitation, not too severe, in terms of temperature and/or water supply;

Inadequate – when climatic characteristics are not adequate for commercial use. In this case, there are serious limitations in terms of temperature and water supply. Besides the overall achievement of crop suitability in function of climate constraints and crop requirements, the crop planning should also enhance the major factors involved in crop development and production as described above, or for instance risks of frost, dry spell, and water surplus or meteorological and agronomical drought. Furthermore a consistent and dynamical procedure must be carried on to provide farmers and extension service communities with on-

line weather data to better understand crop behavior and the success or fail in the expected crop yield. This paper aims to provide scientific information about agroclimatic zoning and crop planning based on FAO and by the Agronomic Institute (IAC). A complementary analysis for coping the process of climatic risks and crop development is introduced, considering also a dynamical procedure to follow-up weather variables and a monitoring system to ensure a better food security policy and crop yield estimates, considering the climate change scenarios.

CLIMATE SERVICES FOR THE FARMING SECTOR

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Abstract

In the last 50 years the world population has more than doubled – from 3 billion in 1959 to 6.7 billion in 2009 and the economically active population in the less developed regions of Africa, Asia (excluding Japan), Latin America and the Caribbean plus Melanesia, Micronesia and Polynesia grew from 1.38 billion in 1980 to 2.59 billion in 2009. A large majority of the economically active population in the less developed regions is engaged in subsistence agriculture. Irregular and unpredictable rainfall patterns; increasing frequency of heavy rainfall; increased incidence of storms and prolonged droughts are impacting food production. While the nature of the impacts is location specific, the adaptive capacity of people and ecosystems determine the extent of damage that is caused. Over the next two decades, the world will need 17 per cent more water for agriculture and the total water use will increase by 40 per cent.

The need for efficient climate services for the farming sector is greater than ever before. The key elements of climate services for the farming sector include acquisition and wider dissemination of data and products; assisting farmers in coping with current climatic risks; advancing knowledge base for adaptation; assisting in the intensification of food production systems; enabling institutions and policy support; and partnerships and capacity enhancement. Each of these elements is described with suitable examples. It is important to integrate climate services for the farming sector into sustainable development planning at the national and regional levels.

SESSION IV

Provision of Weather and Climate Services to Farming Community

Chairman: Ray Motha
Rapporteur: Nelly Riama

MEETING FARMERS NEEDS FOR AGROMETEOROLOGICAL SERVICES - OVERVIEW AND CASE STUDIES

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Abstract

Meeting the needs for agrometeorological services, including agroclimatological services, in the livelihood of farmers is the focus of this paper. Some historical aspects are dealt with in the introduction, particularly regarding the definition and scope of agrometeorology. What has recently been said about such services is quoted, including examples from Cuba and South Africa. Much was already reported by us on the context of farmers' needs for agrometeorological services. We therefore use now some recent reviews of this context in which we recognize that of our own approaches. These reviews deal with the existing situation in Africa, Asia and Latin America from angles of water/fertility/markets (Africa), traditional, conventional/intensive and organic farming (Asia) and operational frameworks that provide agrometeorological information to farmers, extension services and other stakeholders with some emphasis on internet information (Latin America). Examples from Australia, India and South Africa strengthen the arguments in these reviews. The future is subsequently dealt with from the point of view of agroforestry and communication in agrometeorology as connecting principles for these reviews. Targeted capacity building initiatives are an essential component of the communication process. Farmer/Climate Field Schools appear to have large potentials here. These are the ultimate new educational commitments with which new agrometeorological services are established.

In these participative approaches the understanding of farmers' needs can be extended and used to redress and improve the existing situations earlier described, using these agrometeorological services. The remainder of the paper deals with case studies to illustrate some of the best examples of agrometeorological services.

ROVING SEMINARS FOR FARMERS ON WEATHER, CLIMATE AND AGRICULTURE IN WEST AFRICA: MEANS FOR ADAPTATION TO CLIMATE VARIABILITY AND CLIMATE CHANGE

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Abstract

The development of agriculture in the semi-arid areas of Western Africa evolves in the context of extreme variability of climatic factors. The variability of precipitation is regarded as one of the causes which threatens the sources of revenue in the semi-arid zones. The rural households rely on various strategies to cope with these risks while trying to satisfy their needs for consumption by an adequate exploitation of natural and human resources.

Weather and the climate represent the independent risk factors having an impact on the agricultural production and the natural stock management in West Africa. Extreme conditions of weather and climate, such as droughts, floods, or the shocks of temperature often compromise in a considerable way the sustainable agricultural development in West Africa. Factors like climate variability and climate change make individual farms vulnerable, as well as the rural communities as a whole, with effects especially on food safety in West Africa.

The supply of weather and climate information can provide early warning events and lead to better economic, social, and environmental outcomes for farmers. However, forecasts constitute only one of the risk management tools.

More effective approaches with the supply of weather and climate information require a more participative multidisciplinary approach, involving institutions, adequate disciplines, and farmers. Many initiatives were carried out in this aspect among which is assistance to the rural world whose activities consist primarily with sensitizing/training of the peasants, and the development of agrometeorological products intended for authorities and rural producers.

Rowing Seminars on Weather, Climate and Agriculture and Farmers for the peasants in West Africa constitute a means of sensitizing and training of the populations concerned with weather, climate and agriculture.

The main objective of these seminars is "to ensure the independence of agriculture, through a supported assistance, for an effective management of the risks related on weather and climate, by a rational use of the natural resources within the framework of agricultural production".

The first two phases of these seminars were carried out in West Africa, with the support of the Spanish State Agency for Meteorology and with the technical support of World Meteorological Organization (WMO), in 5 countries for the first phase and 11 countries for the second phase. The seminars - ten per country - made it possible to help the peasants to become aware of the effects of the climatic phenomena and their impacts on their daily activities. At the end of the seminars, farmers could better understand weather, climate variability and climate change and could reinforce their capability to adapt and manage their resources. The seminars represented also an occasion to discuss indicators and traditional knowledge on the aforementioned phenomena and their forecasts by the peasant at the local level.

ROVING SEMINARS FOR FARMERS ON WEATHER AND CLIMATE: INDIA AND SRI LANKA

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Abstract

Weather and climate are some of the biggest risk factors impacting on farming performance and management. At present the farmers and their farming systems world over are experiencing multi-faceted challenges of climate change and variability. These challenges require wise and well informed decisions supported by appropriate services that provide targeted weather and climate information which include strategic and tactical crop management options. It is with this background that the World Meteorological Organisation (WMO) is promoting the organization of a series of one-day roving seminars on “Weather-Climate and Farmers (WCFs)”.

11 one-day seminars, 9 in India during 2007-08 and 2 in Sri Lanka during December, 2009, were organized bringing together farmers of 2-3 villages to a centralized location. These villages and farmers were selected in such a way that the villages represent as much possible of geographical area as possible with regard to weather and crops. Also, gender equality, age, equal proportion of different farm holdings is followed. The representatives of NMHSs, local agricultural extension services, agricultural research stations of agricultural universities participated as resource personnel. Enough care and caution was taken to make lectures more interactive and promote a dialogue with farmers. The lectures delivered ranged from introduction to weather and climate to climate risk management and drought alerts. To make seminars more informative, rexin-banners, pamphlets containing information in local language on weather related topics like “Specific quotations on influence of weather on crops; golden tips for weather risk management; important precautions on how to use weather as non-monetary input in all farm operations starting from sowing to harvest; protection of crops from floods; weather related precautions for chemical spraying etc.” were displayed at the venues of the seminars.

Ninety per cent of the 1800 farmers who participated in the seminars held in India and Sri Lanka expressed alike that these seminars are extremely useful to become self-reliant in dealing with weather and climate issues on their farms. An agrometeorological service “Murthy’s Daily Weather and Agriculture (MDWA)” proved successful to secure farmer self reliance through helping them better informed about effective weather/climate risk management by sustainable use of natural resources for agricultural production. By following MDWA, 25.2 per cent of 450 farmers who participated in an evaluation study in India expressed that they were able to reduce the cost of cultivation of their crops by 19 per cent. Also, 54.1 per cent of farmers believed strongly that they were not only able to reduce the cost of cultivation of their crops but also got good quality produce. However, they were unable to quantify the benefit in terms of money. Similarly, during the spot evaluation of seminars in Sri Lanka it was revealed by all farmers that the MDWA was found to provide sound, appropriate, efficient and enduring climate service to farmers and requested for popularization of the MDWA.

TRAINING OF TRAINERS ON WEATHER AND CLIMATE INFORMATION AND PRODUCTS FOR AGRICULTURAL EXTENSION SERVICES IN ETHIOPIA

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Abstract

Ethiopian agriculture has been particularly affected by drought which has persistently affected the country since the early 1970s along with a low level of technology. Helping Ethiopian farmers improve the productivity of agriculture on their farms is an urgent priority. In this context, weather and climate are some of the biggest risk factors impacting on farming performance and management in Ethiopia. Extreme weather and climate events such as severe droughts, floods, or temperature shocks often strongly impede sustainable farming development. Factors such as climate variability and change contribute to the vulnerability of individual farms, as well as on whole rural communities. This also particularly impacts the food security in the country. Agricultural extension personnel play an important intermediary role between developers of agrometeorological products (national weather services, universities, research institutes) and farmers. A key reason for low level use of agro-meteorological services in African countries is often the lack of effective liaison between the institutions providing information and relevant advisories and those responsible for their transfer to the farming community. This is compounded by insufficient education and training of the user community, including the farm advisory services that provide specific agricultural advice from general weather information.

It is against this background that WMO proposed a project of the training of trainers on weather and climate information and products for the Agricultural Extension Services in Ethiopia to familiarize Agricultural Extension services in use of weather and climate information and their applications in operational farm management. This proposal was sent to the Rockefeller Foundation and was accepted and funded in December 2009. The objective of the project is support the National Meteorological Agency of Ethiopia (NMAE) to engage with and provide training to agricultural extension agents and agricultural experts and to assist them to provide better practical knowledge of agro-meteorological services and applications to farmers in order to improve farming practices and increase or secure agricultural production.

Following this, seminars will be held in each chosen district that will bring together the Agricultural Extension Workers with local farmers to give the Extension Officers “hands on experience” in transferring Weather and Climate Information to the community, obtain input and feedback from the farming community on specific issues they need assistance with in relation to weather and climate, their information needs and also to commence the ongoing engagement of the farmers in the project. Towards the end of the project phase, a survey of other delivery channels to disseminate climate information for small holder farmers in Ethiopia such as SMS messages through cell phones, local radio, etc will be undertaken and the preliminary results will be given in the final report on the project. An implementation plan was developed during the first half of 2010.

NEW TOOLS FOR DISSEMINATING WEATHER AND CLIMATE PRODUCTS AND SERVICES

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Abstract

Advanced ICTs such as information networks, databases, simulation models, tools for GIS, remote sensing for agrometeorology are an imperative in strengthening national agrometeorological services, particularly in light of climate change and variability. Sharing of resources including IT and human resources available among countries is a promising solution to impending food and water security problems that confront member countries, where limited IT resources are the most critical barrier in improving operational agrometeorological services.

In addition, the increasing importance of agrometeorological data, such as surface vegetation and soil moisture from agronomy sectors, is receiving more public recognition. There is a growing interest in understanding the predictability of weather and climate forecasts using NWP models because the atmosphere-biosphere interactions. Agrometeorological information sharing among member countries thus emerges as one of the most vital and dynamic ingredients for strengthening national weather services not only for sustainable agriculture, but also for enhanced accuracy of weather/climate forecasts in the future. The provision of both data/information and computer resources for models, tools, and products for operational services, specialized or dedicated resource frameworks has great potential for facilitating resource sharing among CAgM member countries, which could be able to make better use of remotely located resources for agrometeorological services at the national/ regional level, especially when providing interactive forecast-based agrometeorological services simply using the Internet or mobile phones.

Given an advanced resource sharing environment together with legacy technology for high-performance computing, large-scale diverse data and analysis servers, an IT framework is needed for end-users that allows for interactive remote operation of their service development and deployment based on NWP forecasts. Specific interfaces will enable interactive operation for region-specific applications that require and provide non-meteorological information from diverse sources such as crop models at the operational level. The ideal system would consist of 1) servers for simulation models, databases, and system analysis, 2) high-speed network frame, 3) web service interfaces for simulation models with near-real-time DB access, 4) multi-tiered interface architecture in a distributed computing environment and 5) wireless communications. The system should be capable of handling diverse data sources, formats, contents from synoptic data, forecasts, prognosis, adaptation data, crop simulation models, resource management, and farm management among others. It must also accommodate derived products such as detailed climate change scenarios and regional food demand/production predictions. WAMIS needs highly elaborated data handling and distribution mechanisms, including metadata, because it comprises a wide variety of contents in different formats depending on the provider or data manipulation process. While WMO Information System (WIS) evolves to provide a single entry point for any data request, CAgM is trying to extend its service to member countries under the WIS umbrella by implementing WAMIS into a Grid portal to facilitate the sharing of computer resources for improving operational agrometeorology services. Since operational agrometeorology requires diverse data and information from different disciplines for better services, future information systems for agrometeorology should also consider accommodating diverse communications technologies for information and resource dissemination.

SESSION V

Climate Change Adaptation - A Special Symposium

Chairman: Mama Konate
Rapporteur: Flaviana Hilario

REDUCING POTENTIAL IMPACTS OF CLIMATE CHANGE ON FARMERS

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Abstract

Climate scenarios indicate a future warming of the mean global surface temperature of between 1 and 5°C during the 21st century{Best estimate for low scenario (B1) is 1.8° C (likely range is 1.1° C to 2.9° C), and for high scenario (A1FI) is 4.0° C (likely range is 2.4°C to 6.4° C)}, with most warming occurring in the higher latitudes of the continental land areas of the North Hemisphere, with less over continental areas of the Southern Hemisphere. At the same time frost days decrease dramatically over North America, southern South America, all of Europe and Asia, except South Asia, southern Africa and Australia with an increase in the length of the growing season. Similarly heat wave conditions increase significantly in many areas. Coupled with warming, scenarios indicate significant drying of climates in the Mediterranean basin and subtropical latitudes of both hemispheres, whilst climates become wetter in a narrow equatorial zone and higher latitudes of the Northern Hemisphere. This translates to a significant increase in dry days over southern Europe and the Mediterranean, subtropical areas of USA and Mexico, Brazil, Argentina, Chile, southern Africa and Australia, and decreases in dry days over the Russian Federation and Mongolia. These changes will pose significant impacts on the livelihoods of farmers, with a variety of adaptation measures required to adapt to the future climates.

In view of the long inertia of environmental and climate change it will not be possible to stop current warming trends rapidly. Adaptation to change is thus the only viable strategy to enable agriculture to manage change. To adjust to a warming climate strategies involved include changes in crops and cultivars, use of more disease, pest and salt tolerant varieties, and the introduction of higher yielding and earlier maturing cultivars in cold regions. Other strategies include altered fertilizer and pesticide/insecticide applications, change of planting dates and development of adaptive management strategies at the farm level. For livestock production breeding will be required for greater environmental tolerance and productivity, increases in stores of forages for adverse climatic periods, improved pasture and grazing management including stocking rates and rotations. As well an increase in forages used to graze animals together with introduction of native grass species, increased average per hectare and community support for supplementary feed production will all be required. Crop and livestock insurance will be an essential strategy to manage change together with the raising awareness of vulnerable populations to negative impacts through education and outreach. The support and services of the World Meteorological Organizations Commission for Agricultural Meteorology will be essential especially to subsistence food production in least developed countries and small island states.

WATER MANAGEMENT STRATEGIES FOR CLIMATE CHANGE ADAPTATION

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Abstract

Climate change is expected to increase both the severity and duration of extreme events, threatening food security for millions of poor people around the world. Farmers are particularly vulnerable to climate variability. Thus, to reduce vulnerability and improve livelihood, adaptation strategies have to be implemented at farm level. Agriculture is the main source of incoming to farmers and as so any strategy to improve livelihood and reduce vulnerability at farm level has to deal with agriculture. Climate change is and will be changing the geography of production in Brazil. It means that some areas will not be able to produce certain types of crop anymore, which will have to be cropped in other regions. Besides this, in some areas farmers will have to change their system from rainfed to irrigated agriculture, which will demand more water from an already stressed system. It means that conflicts for water can arise. To adequately propose strategies on irrigation for climate change adaptation, the watershed response to that driven force has to be better understood. What hydrologic process will be affected and in what magnitude? Will the water available in the watersheds be enough to support the new water demand pattern? What kind of adaptation strategies on irrigation basins can be developed to respond the impacts of climate change and to cope with people vulnerability? In irrigated areas, dams are one of most important adaptation strategies for climate change. Small multi-purpose reservoirs are a widely used form of infrastructure for the provision of water. They supply water for domestic use, livestock watering, small scale irrigation, and other beneficial uses. One problem, however, is that several reservoirs around the world are functioning sub-optimally and/or are falling into disrepair. It indicates that actions have to be taken in other to maintain these infrastructures in a way they can serve as an adaptation. Adding to this, it is important to highlight that studies have to be taken in other areas to assess the impact that a new small reservoirs will have in the watershed behavior avoiding the water conflicts. Most of the food production will continue to come from rainfed agriculture. Those areas are much more vulnerable to the effects of climate change. When people cannot migrate from rainfed to irrigated agriculture, soil and water conservation are the main adaptation strategies. No-till farming, for instance, contributes to enhanced residual soil moisture reducing the negative effects of the driest periods on crop production. In the irrigated agriculture efforts are necessary to increase water use efficiency and adopt appropriate farming techniques, like changing planting and harvesting times, erosion control, etc. As food security is inextricably linked with access to water, the river basin is an appropriate scale to develop adaptation strategies to cope with the effects of climate change. It is important to emphasize that any adaptation strategy has to take into account the basin and its diversity. Groups will be affected differently by different strategies and so the implementation of the adaptation requires a partnership between civil society, the private sector and government that balances power and actions at different levels of authority. These points cannot be over-emphasized, as past experience demonstrates that top-down solutions pursued in isolation are likely to fail. To implement the adaptation is very difficult without first gathering insights from, and disseminating information to, economically and culturally diverse stakeholder groups.

VULNERABILITY, DISASTERS AND SOCIAL PROTECTION ASPECTS OF CLIMATE CHANGE ADAPTATION

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Abstract

Climate change is a vulnerability and risk multiplier for over one billion people who today already suffer from hunger, as well as for hundred millions more living their precarious lives and livelihoods in the margins of the mainstream economy. According to IPCC, many countries and communities are already experiencing more unpredictable rainfall patterns, increasing climate extreme events (storms, droughts), and accelerated land degradation and soil erosion processes (IPCC, 2007). Also in view of this, according to recent projections, by 2050 the number of people at risk of hunger will increase by 10 to 20 percent as compared to a no-climate-change scenario (Parry et al., 2009). Interestingly, these estimates may actually not take into full account the possible interactions between climate change and other factors of instability and drivers of food insecurity. For example, as extreme climate events become the "new normal", resource scarcity issues may also intensify, with impact on prices of staple food commodities, increasing conflicts over scarce resources, growing urbanization, migration and displacements (Evans, 2009).

The World Food Programme (WFP) is the frontline humanitarian agency of the UN system. WFP works with and supports those people who have the fewest assets, capacities and opportunities, people and communities living in the most marginal and disaster prone areas, the most exposed to the risk of hunger and food insecurity as well as to impacts of climate change. As part of climate adaptation, WFP is advocating for approaches and strategies that link the objective of enhancing food availability (to be achieved through improvements in production and agricultural techniques) with increased risk reduction, as well as enhanced access to food and nutrition security for the most vulnerable and at risk people, to be achieved through strengthened safety nets and social protection frameworks and services. In other words, efforts to adapt agriculture and increase food availability must be complemented with stepped-up efforts in disaster risk reduction and resilience building among vulnerable communities, as well as with stronger public policy protection frameworks for the most vulnerable and at risk (WFP et al. 2009).

Climate science, vulnerability analysis, disaster risk reduction and social protection are therefore part of a "policy continuum" in climate adaptation, of which the concept of enhanced social protection is a key element. This is in line with the search for a paradigm shift in development thinking towards more equitable, inclusive and sustainable models. There is growing recognition today that social protection, if designed appropriately, can be a powerful instrument to build resilience to climate change and create livelihoods opportunities for the most vulnerable, for instance by allowing poor farmers access investment opportunities that they would otherwise miss, and benefit from any technological advances from which they would otherwise be excluded (Parry et al. 2009). Particularly productive safety nets, which involve participation in natural resource management activities that create community and household assets, can play an important role in pro-poor adaptation (Davies et al. 2008).

As for many other interventions that aim at increasing resilience to climate hazards, social protection schemes also depend on reliable, down-scaled and up-to-date weather and climate information. Building on that information and linking it with data on vulnerability and food (in)security, WFP is helping countries and regional institutions enhance their food security capacities and frameworks, for instance through vulnerability assessments, early warning systems, crop and food security monitoring systems, and innovative risk transfer

mechanism. Nevertheless, climate change requires urgently stepped-up capacities as well as a range of innovative tools allowing Governments and communities to strengthen their own risk management frameworks and mechanisms. WFP is prioritizing support to the GFCS and collaboration with the climate science community with a view to contributing to the common effort of strengthening protection frameworks, services and capacities in support of the most vulnerable.

Session VI

Risk Management and Weather Risk Insurance Strategies and Schemes

Chairman: Jim Salinger
Rapporteur: Elijah Mukhala

WEATHER INDEX BASED CROP INSURANCE IN INDIA

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Abstract

The yield index based crop insurance in India, presently under the title 'National Agricultural Insurance Scheme (NAIS), is the flagship crop insurance programme, annually insuring about 25 million farmers with an area of over 35 million hectares and available for almost all seasonal and annual crops for which there exists historical yield data of 10 years at sub-district level. NAIS, despite well suited for Indian conditions, suffers from some key problems. These include basis risk (insurance unit being too large), delay in receiving yield estimates leading to delay in settlement of indemnities, non-coverage of pre-sowing & post-harvest losses, huge infrastructure and manpower required to estimate yields (irrespective of yield loss), etc. The government is expected to introduce a 'modified' version of NAIS which is expected to overcome some of the shortcomings of existing NAIS, as a pilot programme from the latter half of 2010.

In any case keeping in mind the challenges with yield index insurance, India started piloting 'rainfall (weather) index' based insurance since 2003. The government from 2007 started providing subsidies in premium, and is being tested as a substitute for NAIS. At present Agriculture Insurance Company of India (AIC), an entity created at the behest of the Government in 2003 and the largest market player in India with over 80 percent market share, has insured nearly 2 million farmers during 2009-10 (April to March) with acreage of 2.7 million hectares for a sum insured of approx. US $ 870 million for a premium income of US $ 80 million. At present the programme covers over 35 crops and is piloted in about 10 percent of the areas in the country.

One key advantage of the weather index based crop insurance is that the payouts could be made faster, besides the fact that the insurance contract is more transparent and the transaction costs are lower. Because weather index insurance uses objective, publicly available data it is less susceptible to moral hazard (IRI, 2009).

AIC through weather index based crop insurance, introduced a location-specific (sub-district) and crop-specific pilot based on rainfall outputs for the Kharif (June to October) season, and a composite weather parameters like rise in temperature, un-seasonal rainfall, humidity, frost risks, etc. during the Rabi season (winter). Indian Agricultural Research Institute (IARI) is providing the know-how to AIC to design weather risk insurance products on 'Crop Growth Simulation Modelling' platform. AIC has been using various components of weather parameters; an illustration of it is shown below in Table:

Table: Weather Index Parameters

S.No	Weather Parameter	Components
1	Rainfall	Deficit rainfall, Consecutive Dry Days (CDD), Number of Rainy Days, Excess rainfall, Consecutive Wet Days (CWD)
2	Temperature	Max. Temperature (heat), Min. Temperature (frost), Mean Temperature, Hourly Chilling units
3	Relative Humidity	High Humidity and low Humidity
4	Wind Speed	High Wind Speed
5	Disease proxy	Combination of Weather parameters like rainfall, temperature & humidity

AIC has found weather risk index-based insurance to be specifically useful for insuring crops that do not have adequate historical yield. Many of these crops do not lend themselves to 'individual-based insurance' due to either low value or high complexity. Weather risk index-based insurance, thus, can be part of an insurance program in which it is combined with an area yield index-based insurance. That is, in a double-trigger relationship, weather risk index-based insurance provides a trigger to release early payout with a provision that these will be further adjusted against final yield estimates. Additionally, weather risk index-based insurance can be an ideal alternative for protecting a large portfolio at the macro level against drought or floods.

Weather Risk Insurance – Challenges

The two biggest weaknesses and challenges of the present weather risk index-based insurance product are (i) designing a proxy weather risk index with predictive capability to realistically measure crop losses and (ii) basis risk. Basis risk results if the actual experience of weather risk (rainfall) in the neighbourhood significantly differ from the data recorded at the weather station. The two aspects lead to compounding of the problem: both may lead to no payout despite the occurrence of damages at an individual farm, or these may trigger a payout when loss did not occur. The combined effect of the two challenges represents a significant barrier to the scale up of the product. Nevertheless, weather risk index-based insurance performs well on data accuracy, transparency and quick claims settlement, which are very attractive to both farmers and the reinsurance market.

Recently the government conducted an evaluation study on the utility of weather index based crop insurance, covering about 1000 farmers across six States. The study focused on 16 parameters, covering (i) product design; (ii) convenience in buying; (iii) adequacy of risk coverage; (iv) reliability of weather data; (v) weather station density, etc. The study brought out many positive features and also identified areas where further work is necessary. The study revealed that as much as 80.8 percent of the respondents were not satisfied with weather station density or location of weather station. Similarly 56.5 percent were not satisfied with convenience in buying weather insurance and mechanism for grievance redress. On the positive side, only 16.8 percent and 17.3 percent were not satisfied with regard to 'weather data reliability' and 'protection against crop losses and climate change'.

The study by and large supported the use of weather index based crop insurance as a tool for risk mitigation. However, both the government and the insurers have to work on a certain areas to improve the utility value of the insurance mechanism. An estimate done by AIC puts the requirement of about 8,000 weather stations and 32,000 rain gauges across the country to effectively use weather insurance as an important risk mitigation tool. Financial literacy of farmers and capacity building of stakeholders has also been identified as the key area. In addition to these constraints, premium calculation, frequency of payout, data calibration and subsidy are also aspects that need to be addressed for effective diffusion of weather risk index-based insurance.

Index based insurance is here to stay, and is the way forward in many developing nations. Best results could be obtained by careful design of the index and use of a combination of indices (multiple triggers) to capture the key production risks in agriculture.

WEATHER RISK INSURANCE FOR SMALL FARMERS IN MALAWI

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Abstract

Agriculture in Malawi is dominated by smallholder agriculture and the main crop is maize which is the staple food. Maize is very weather sensitive crop and requires a series of inputs across the growing. The main issues that affect the agricultural economy and livelihoods in Malawi are rainfall risk (i.e. food insecurity), depletion of the soil, low levels or lack of credit, and limited access to inputs.

In Malawi, there are weather risk insurance programs at the micro and macro level (Hess 2007). At the farm level, weather-based index insurance can provide for more stable income streams and could provide a way to protect peoples' livelihoods and improve their access to finance. In 2005, an index-based weather insurance program at the smallholder level was initiated as 900 groundnut farmers in Malawi bought weather insurance to increase their ability to manage drought risk and increase their access credit for inputs. The National Smallholder Farmer Association of Malawi, in conjunction with the Insurance Association of Malawi and World Bank, designed an index-based weather insurance contract that would give farmers a payout if the rainfall needed for groundnut production in four pilot areas was insufficient for groundnut production.

Based on the success of the 2005 pilot, a second pilot was developed in 2006 with 2500 farmers securing weather insurance-linked crop production loans for groundnut and hybrid maize. These pilot projects noted that more weathers stations are required so that farmers in more locations can access insurance and two new automatic weather stations were installed and investment were out into developing quality controlled historical data at these sites. In 2006/2007, these new stations allowed more farmers to access weather insurance and input financing.

At the macro-level, a nationwide maize production index for the entire country could be developed to form the basis of an index-based insurance policy. A Malawi Maize Production Index (MMPI) has been proposed which is the weighted average of farmer maize indexes measured at weather stations located throughout the country, with each station's contribution weighted by the corresponding average or expected maize production in that location. Since the MMPI is an objective index and there is good quality of weather data available from the Malawi Meteorological Office, this index could used in the weather risk market.

POTENTIAL FOR WEATHER INDEX INSURANCE FOR RISK MANAGEMENT

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Abstract

Risk is inherent in agriculture. Input prices may increase out of reach, crops may be destroyed by drought or pest outbreaks, selling prices may plummet, and harvests may rot in poor storage facilities. The type and severity of the risks confronting farmers are particularly burdensome to small-scale farmers in the developing world. But, many risks can be managed. Farmers, rural communities, financial service providers, input suppliers, private insurers and relief agencies each have strategies for coping with chronic and catastrophic risk.

In recent years, an increasing number of pilot programmes have tested an innovative idea in managing covariate risk in agriculture: index insurance. Weather index-based insurance is a financial product linked to an index highly correlated to local yields. Indemnifications are triggered by pre-specified patterns of the index, as opposed to actual yields, reducing the occurrence of moral hazard and adverse selection and eliminating the need for in-field assessments. In addition, because the insurance product is based on an independently verifiable index, it can also be reinsured, allowing insurance companies to transfer part of their risk to international markets.

The Weather Risk Management Facility, a joint undertaking of IFAD and WFP, reviewed recent experiences with index insurance programmes around the world, analysing the key actors, products, and their successes and challenges. These pilot programmes have demonstrated the great potential of index insurance as a risk-management tool. They suggest that index insurance could not only provide an additional effective, market-mediated solution to promote agricultural development, but it could also make disaster relief more effective. As such, index insurance can benefit clients beyond agricultural producers: governments, relief agencies, financial service providers, input suppliers, businesses, agricultural processors, food companies, farmers' organizations and producers' associations could all use index insurance.

While the potential benefits of index insurance are great, implementation can be difficult. Small producers often do not understand the benefits of insurance – and often cannot afford it. The cost of premiums, especially in major scaling up, can be daunting, putting insurance out of the reach of those who need it most. The many hurdles indicate that important public goods need to be in place, and a facilitating role played by non-profit organizations, donors, and others, in order to launch index insurance in most regions. Without such an infrastructure, private insurers are unlikely to break into the sector.

The Potential for Scale and Sustainability in Weather Index Insurance report identifies eight principles to help index insurance reach scale and sustainability: (1) Create a proposition of real value to the insured, and offer insurance as part of a wider package of services; (2) Build the capacity and ownership of implementation stakeholders; (3) Increase client awareness of index insurance products; (4) Graft onto existing, efficient delivery channels, engaging the private sector from the beginning; (5) Access international risk-transfer markets; (6) Improve the infrastructure and quality of weather data; (7) Promote enabling legal and regulatory frameworks; and (8) Monitor and evaluate products to promote continuous improvement.

While not a panacea for poverty, nor the sole solution for at-risk producers, index insurance shows great promise as a tool to reduce the severe effects of weather-related phenomena on people who depend on agricultural production for their livelihoods. Index insurance seems to be more effective when part of a larger package of risk management strategies and services. Given the consequences of global climate change, index insurance may also play a role in

supporting adaptation strategies in developing countries. To be successful, index insurance will require public and private investment, as well as willingness to measure success objectively and adjust strategies accordingly.

Session VII

Farmers Forum on Improving Weather and Climate Services for the Farming Community

Chairman: Michele Bernardi
Rapporteur: Mduduzi Gamedze

CLIMATE AND WEATHER AS NON- MONETARY INPUTS IN AGRICULTURE

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Abstract

Agriculture is the culture of Asia because more than 64% of total Asian population depend on agriculture either directly or indirectly. However, vast majority of the population of Asia is in the scourges of malnutrition and hunger. Therefore, food for all has been the main goal for development planning in Asia in general and India, Pakisthan, Bangladesh, Indonesia, Myanmar, Srilanka and Vietnam in particular.
Agriculture is the most weather and climate dependent in Asia because the economic yield of crops viz., cereals, pulses, oilseeds, commercial crops etc., grown in Asia are strongly governed by influences of South West and North East Monsoons. Farmers look at the sky all through the day, week, month and year round to know what is in store for him pertaining to weather. Then, he starts any agricultural operations in his cropping fields based on his own assessment combined with traditional knowledge he gained from his father, forefather and also the information available from news papers, radio, television etc. Virtually, all agricultural operations viz., land preparation, sowing of seeds, weeding, irrigation, application of fertilizers and pesticides, harvesting, transportation , storage, marketing etc., depend on weather and climate.Wather/climate are non-monetary inputs in all the agricultural operations because better knowledge of weather and climate could assist the farmers in making more effective use of resources such as labour, capital, water, etc. Examples: A)If rain is forecast in the next few hours and farmer takes a decision to postpone the application of fertilizer as top dressing he can save US$ 100 per hectare. If he does not have the information on weather then what all the fertilizer (5 bags of urea per hectare) he applies gets washed away in rain water. B) Similarly, if rain occurs in 6-12 hours after the application of insecticide or pesticide then US$ 40 he spent on chemical and labour per hectare goes not only as sheer waste but also the residue of the chemical contaminates his drinking water in the near by pond as the seepage and run off water enters the pond and the health of his fish spoils. C) On the same analogy, if the paddy crop is harvested and kept for sun drying in the field itself for the next 3-4 days then if rain occurs the farmers incurs a huge loss of US$ 1500 per hectare because the grain sprouts on the harvested crop itself. Like this all agricultural operations in Asia are totally climate / weather dependent.

Millions of farmers across Asia are finding it hard to come to terms with the deteriorating conditions in agricultural sector marked by rising cost of cultivation, the gross inadequate irrigation facilities, depleting ground water resources, mounting debts in the face of high cost private lending, sharp fall in institutional credit flow, un-remunerative prices for agricultural produce and continuous drought. So, for scores of debt ridden small and marginal farmers, there appears to be no respite from the techniques that are already available. The sufferings are unending. The agrarian crisis is gripping the Asia. The farmers are caught in the vicious circle of mounting debts and failed crops due weather related disasters like drought, untimely rains, hot and desiccating winds, hail storms, floods etc.

So, there is an urgent need to take up farmer friendly initiatives through better access to weather knowledge that will serve as a **non-monetary** input. It is strongly believed among the farmers that weather/climate information definitely improve the living conditions of the population of Asia in general and farmers in particular.

IMPROVING WEATHER AND CLIMATE INFORMATION FOR THE FARMING COMMUNITY – PERSPECTIVES FROM SOUTH-WEST PACIFIC

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Abstract

Farming in a country with the highest year to year rainfall variability means that managing climatic risk is one of the major management issues and using the best information is paramount. Since the 1960s, an understanding of weather, climate science and forecasting has been an advantage to the Plant family farming and grazing business on the Darling Downs in South East Queensland. Every decision, whether about short term production or longer term strategy, has an element of climate risk in it and utilising a range of the best climate forecasting sources is important to help advise decision-making.

The value of weather and seasonal forecasting data has been recognised by the farming community in Australia for decades. Now climate change science and related policies are recognised as having critical relevance to farm businesses and the industry as a whole. Australia was low in organic carbon even prior to farming, and some farming practices have driven it lower. With the right encouragement farmers can lift their soil carbon for the benefit of the planet and farm productivity. Over five generations of family farming, the declining farm terms of trade has been witnessed and various strategies have been utilised to address profitability. Appropriate policy providing realistic value for carbon would help address the farming financial crisis and reduce greenhouse gas emissions significantly enough in the short term to provide the community with time for other mitigation strategies to progress. This would require leadership not seen on the world stage to date.

Not only do we need better weather and climate forecasts and decision tools to assist in farm productivity there is an urgent need to address the broader downstream issues including food and water security, sustainable population and social impacts.

Session VIII

Enhancing Weather and Climate Services for Farmers - Policy Options

Chairman: Avinash Tyagi
Rapporteur: Robert Stefanski

POLICY OPTIONS FOR COPING WITH AGROMETEOROLOGICAL RISKS AND UNCERTAINTIES

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Abstract

Only 70 years ago, Brazil was an essentially agricultural country. Rural population prevailed, corresponding to 70% of a total of 42 million people. The economy primary relied on coffee as the main product (70% of the exchange revenue). But the post-war scenario was signaling towards industrialization, which delayed to occur; however, urbanization and high birth rates were impressive: Brazilian population today is around 192 million people and only 18% of them live in rural areas. This urbanization speed, unprecedented in the world in peacetime, led to an intense use of natural resources to meet the new demand for cheap food for a low-income population. Replacing forests by crops and pastures was regarded by society as a beneficial measure.

Thus, the depletion of good and fertile soils of the south-central region, previously covered by native forests, besides the pressure of the new generations of farmers for land, created a new cycle of expansion of the agricultural border towards Central Brazil (Cerrados) and Amazon, mainly from 1970.

Productivity was the prevailing paradigm, still under the influence of the Green Revolution, aimed at meeting the increasing demand for food and energy, which was stressed by the globalization process. The low profitability of the agricultural activity is recognized worldwide, which explains many losses in the conservation of natural resources. It must be highlighted that 80% of Brazilian rural properties are small, generate low income and, frequently present negative returns.

Commitment with the new paradigm of sustainability and the cry of society for preservation and conservation draw the attention to a highly important process, the recovery of degraded areas, which are more vulnerable to bad weather. It is necessary to include this recovery in the agenda of the new paradigm of sustainability. In Brazil, for example, it is estimated that 60 million hectares are used for pasture. In the state of Minas Gerais the figure is 25 million hectares. In both cases, it is estimated that 50% of these lands are characterized as degraded. The present challenge is: how to transform immense degraded areas (CO_2 emitters) into bases for a sustainable production process (CO_2 captors)?

There are alternatives besides the expensive and predictable agricultural subsidies used in large scale by rich countries, but impracticable for poor countries. First of all, improved concepts of integrated production systems should be adopted, instead of the mere single use of new technologies. Therefore, after the No-tillage system (widely employed today in mechanized agriculture), the Crop/ Cattle Raising (pasture) Integration started to be used in the same planting season. For example, maize can be planted along with forage grass. After the harvest of grains, a new and rich pasture remains installed. Recently, especially in the state of Minas Gerais, projects including the forest component have been developed. Thus, a set formed by Crop/Cattle Raising/ Forest has been created. This system has been successfully diffused in Minas Gerais, through a program coordinated by the Secretary of Agriculture and supported by some institutions, related with rural extension, research and academic services. Hundreds of extensions technicians have already been trained, hundreds of UDs (Units of Demonstration) have been installed for small farmers; research projects and academic theses have been developed. This is a strategy to support the diffusion of the Crop/Cattle Raising and Forest Integration System, which is viable under tropical and subtropical conditions. Besides the economic and social results, several relevant environmental services are offered to society by the producers who adopt this system, especially the recovery of areas in environmental deterioration process and the replacement

of the traditional cultivation system by this highly sustainable integrated intercropping system. The following environmental gains are evident:

- Carbon sequestration with reduced emission of greenhouse gases;
- Elimination of deforestation and consequent protection of biodiversity;
- Increased efficiency in the use of machinery, equipment with reduced use of fossil fuels;
- Recovery of quality and productivity of the soil
- Increased Reduction of soil erosion, siltation and contamination of springs, rivers and water reservoirs;
- Reduced evaporation of soil water;
- Lower incidence of pests, diseases and weeds, with decreased pesticide use;
- Diversification of production and minimization of climate and market risks;
- Animal welfare due to mild micro-climate generated by the forest component;
- Cycling of nutrients, increased organic matter and enrichment of the soil micro fauna.

This new strategy to revert environmental degradation has the potential to:

- Expand food supply and improve farmers' income;
- Increase income through the provision of articulated environmental services, simultaneously protecting air, water, soil and biodiversity;
- Transform rural producers into protagonists of a virtuous process in search of sustainability.

In summary, the ILPF – Integração Lavoura, Pecuária e Floresta (Crop, Cattle Raising and Forest Integration) represents a new paradigm because it reestablishes most functions of a natural system, improving sustainable productive capacity. Besides technical mobilization and technological development, there must be adjustments in the following instruments:

- Rural credit and insurance
- Payment for environmental services

ENSURING GLOBAL FRAMEWORK FOR CLIMATE SERVICES (GFCS) FOR FARMING COMMUNITIES AROUND THE WORLD

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Abstract

One of the major outcomes of the World Climate Conference-3 (WCC-3) held in 2009 was the agreement of participating countries and organizations to develop the Global Framework for Climate Services (GFCS). Specifically, the GFCS calls for strengthening climate services information systems by taking advantage of enhanced national and international climate service arrangements in the delivery of products and for improving climate user interface mechanisms that are focused on building linkages and integrating information, at all levels, between the providers and users of climate services. It also calls for more efficient capacity building process through education, training, and strengthened communication system.

With regards to farming communities, the WCC-3 had identified the need to reduce the risk of crop failure and to ensure resilience of agronomic and horticultural systems for feed, food, fibre, and fuel production. Hence, there is an urgent need to develop an improved understanding of the complex interactions between climate and agricultural systems and to implement production systems that can adapt to climate variation and climate extremes, especially in the developing countries.

GFCS envisions enhancing the contribution of climate information to land management, agriculture and food security by addressing several issues. The first is to improve risk evaluation and information delivery. An intensive effort is needed on the use of climate forecasts to reduce the risks to crop and animal production, especially in areas where the risks are greatest. Such efforts should include the development of effective dissemination tools for timely provision of authentic information for decision-makers. Climate information should hence be relevant and actionable to meet the needs of end users, such as contingent planning to adapt monsoon variations, drought proofing, crop insurance etc.

Secondly, new and innovative models of cooperation and partnerships are needed among several groups including WMO, FAO, NMHSs, the Consultative Group for International Agricultural Research (CGIAR), National Agricultural Research Systems and Extension Services, national entities dealing with agriculture, food security and policy issues, the United Nations Convention to Combat Desertification (UNCCD) and Soil Conservation Services. Linkages between producers of climate information and applications and various end users have to be enhanced through appropriate mechanisms such as awareness raising, capacity-building for intermediaries as well as end users, and the strengthening of institutional partnerships, especially in the developing countries that are more vulnerable to climate change effects.

The next issue to be addressed is to have improved adaptation strategies in place to ensure resilient agricultural systems. Adaptation strategies to cope with climate variation and extreme events will have to be developed and transferred in a timely manner so that their adoption helps in reducing and managing risk. Lastly, there is an urgent need for climate change mitigation for agricultural systems. It is important to recognize that agriculture is also part of the solution to mitigate climate change and hence adequate investments at national, regional and global level are required as a matter of urgency to reduce greenhouse gas emissions, while ensuring increased agricultural productivity and overall environmental sustainability.

Poster Abstracts

DELIVERING AGROMETEOROLOGICAL DATA AND PRODUCTS TO FARMERS ON THE WEB: A TECHNO-ECONOMIC ANALYSIS OF THE NETWORK RELATED TO AGRITEMPO SYSTEM

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Abstract

This paper aims to describe the techno-economic network that generated the Agrometeorológico Monitoring System - Agritempo. This system, developed by Embrapa Informatics for Agriculture in partnership with the State University of Campinas – Unicamp, articulates a network of over 40 institutions to integrate data from more than 1000 weather stations in order to offer agrometeorological products for Brazilian territory openly at the Internet.

Meteorological networks for sharing data for study and research are practices that date back to the eighteenth century. In nineteenth-century Europe, collaborative initiatives to collect large amounts of weather data grew, linked to an effort of institutionalization of activities. At this time, the development of systematic meteorological observations began to be of interest to the National States designed to improve agricultural practices, respond to health issues, generate public warnings about storms and meet military needs (Fleming, 1998). The development of collaborative actions to exchange of meteorological data involves issues related to standardization of observation procedures, standardization of data (format and units), managing activities of team members and establishing mechanisms of communication between individuals (Edwards, 2004). Thus, the generation of new agrometeorological knowledge and information (or products) involves the management of administrative and organizational issues as well as operative questions, regarding equipment and/ or procedures.

This study has a qualitative nature and aims to map and analyze the flow of information and knowledge within this network as well as the governance mechanisms established, emphasizing management procedures and intra and inter-organizational mechanisms. The conceptual approach is based on the Actor-Network Theory (Callon et al, 1995; Latour, 2005) to understand the process of building a technological product such as Agritempo system. Callon (1992) employs the techno-economic network concept by which several types of actors establish heterogeneous relations in order to share expertise, data, information, financial resources and also to define rules of conduct and zones of influence.

The use of the term "network" refers to a flexible and adaptative form of coordination of the actors (such as public and private laboratories and research centers, technical organisms, financial institutions, users and public authorities) and the adjective "techno-economic", in turn, indicates that a network is not limited to actors who constitute it: there is a process of generation and circulation of intermediaries among them. The intermediaries can have different natures like written documents, skills, technical objects or money.

An information system like Agritempo would be described as an intermediate – an "technical object" - generated by a techno-economic network involving research institutions, federal and state government agencies (Secretaries of Provinces and Ministries, among others) and private companies. Considering that Agritempo received an average of 400.000 annual visits on the last three years (2007, 2008, 2009) it can be considered a network-generated innovation.

The preliminary results of this work are: a contextual analysis of the scientific field of Agrometeorology and the mapping of the techno-economic network as well as the flow of agrometeorological data and information among the actors and the system.

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THE INTERTROPICAL FRONT AND RAINFALL VARIABILITY IN SAHEL

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Abstract

Human activity planning, in particular agriculture and energy generation, requires climate outlook with sufficient leading time, 5 to 10 years ahead, so it can be beneficial for society. This need is highly apparent in the Sahel, a latitudinal land strip of about 300 to 400km wide, subject to north-south Sahara Desert border displacement, with consequent social and economical disturbances for countries from Senegal and Mauritania to Eritrea. The advance and retreat of the desert are repetitive in decadal time scale and are associated with the positioning of the Intertropical Front (ITF). The hypothesis formulated here is that the Pacific Ocean, and its Pacific Decadal Oscillation (PDO), be one the main internal global climate system controllers in the decadal time scale and that PDO may explain an expressive part of the Sahel climate variability and may be used for decadal climate forecasting of this region. The El Niño-Southern Oscillation (ENSO) impacts on the Sahel rainfall anomalies for the period July-September were analyzed assembling the El Niño and La Niña events in the PDO cold and warm phases separately. The period of the analysis was 1950-1999. The data were taken from the Earth System Research Lab (ESRL/PSD/NOAA) website. The rainfall data are from a gridded dataset 0.5°x0.5° lat/long resolution prepared by the University of Delaware. The ENSO events used for the composites are listed in a table found in the CPC/NCEP/NOAA website. Only the ENSO events that persisted throughout the wet season, that is July-September (Jul-Sep), were considered. It was found that the El Niño events in both cold (CP) and warm (WP) phases of PDO produced droughts in the Sahel in general, allowing the Sahara southern border to expand southward. The La Niña events of PDO WP were related to below normal rainfall in Western Sahel but slightly over in Eastern Sahel. The CP La Niña events, on the other hand, were associated with rainfall above normal in the Sahel, suggesting that the ITF reached a more northward position with consequent retreat of the Sahara southern border. Since PDO has entered a new cold phase in 1999, it is expected that ENSO rainfall impacts in Sahel be similar to the ones of its previous cold phase roughly within the next 20 years…. if PDO is a real physical oscillation!

BASIC ANALYSIS TO DEVELOP WEATHER AND CLIMATE SERVICES FOR THE FARMING COMMUNITY OF SOUTH OF CORDOBA - ARGENTINA

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Abstract

Climatic change and climate variability poses a threat of major disruption to agricultural production in central Argentina affecting crops yield and production, the agricultural systems and the local and national economy. Farmers' capacity to deal with climate variability and extreme events could be enhanced by including climate services in their decision process. The study proposed to investigate farmer's perceptions and needs for climate information and services, and how they incorporate them into their decision process. The region of analysis comprises the southern portion of Cordoba province in the sub humid region of the Pampas, which accounts for 22% of the national agricultural production. Production systems in the region are mostly rainfed and extremely weather dependent. Four places were selected for the analysis located in different ecosystems. The methodology consisted in an ethnographic survey involving individual interviews, focal group's discussions and semi-structured household interviews with open and close questions. Results indicate that most of the farmers have access to some kind of climate service or information and from different sources, mainly radio, TV and newspapers. Less than 30% of the farmers used at least once a seasonal climate forecast, but they express concern about the forecast application because they are not tailored to their specific needs or regions, not available on time or not easy to understand. Also, they remark that to be effective the climate forecasts should be available at least one month before the beginning of the cropping season. Depending on the location, farmers indicated that floods, droughts, hailstorms and anomalous frosts are the main extreme events affecting yield and production. As an influence on their management decisions, respondents identified climate information as one of the main factors to be considered. When asked about the decisions that they could change in response to a climate forecast, planting date and cultivar were indicated in most of the cases. A close relationship between farm size and the use of climate information was found as farmers who owned bigger productive units are the ones who consult more information. Also, relationship was found between the use of climate services and the age of the farmers and education level. The results of the research were useful to identified farmer's needs of climate information and also to understand the importance of local perceptions, beliefs and knowledge of the farmers about the climate, as a previous step to provide improved weather and climate services.

THE CLIMATIC HYDROLOGICAL BALANCE FOR THE RIO DOCE BASIN – MG - BRAZIL

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Abstract

In the paper the spatial and temporal precipitation pattern at the Rio Doce Basin was analyzed. The basin drainage area extends approximately between 18º and 20º S, occupying an area of 83,400 Km^2, predominantly in the east-west direction and corresponding to an extension of 875 Km of the river. Human occupation in the Rio Doce valley was oriented eastwards at the time of the mining cycle (second half of the XVIII century) and in opposite direction during the agricultural cycle (second half of the XIX century)[1]. Today, there are two hundred and thirty small towns along the valley, which economies are mainly structured in mining, eucalyptus and coffee plantation, steel manufactures, hydroelectric powers, exploration of gems, livestock, sugarcane and family farming. The activities in the basin, there and now, resulted in increasing demand of its complex water courses. As a consequence a large environmental degradation is observed on the region. This study is a reference to the planning of water resources, minimizing the effects of eventual climatic risks during the dry and rainy seasons.

The analysis indicated that the precipitation pattern shows an eastward displacement along the year, starting from the rainy season. Its determined by dynamic atmospheric mechanisms such as the Bolivian High (AB), the frontal systems and the South Atlantic Convergence Zone at the western part, which is enhanced by the topography; the South Atlantic Subtropical High (SASH) and the northeastern trough (NT), both related to strong subsidence, promote clear weather conditions which induce subsidence in Minas Gerais State, affecting the basin area. Under these circumstances, the atmosphere is strongly stable, resulting in dry periods during the wet season, known as "veranicos". They can last for a long period of time causing drought events which can start the dry season earlier than expected.[2]

The basin has severe distribution deficits, as indicated by the climatic Thornwaite-Matter (1955) hydrological balance, calculated from a decendial (every ten days) dataset deriving from the historical time series from ten INMET(Brazilian National Meteorological Institute) weather stations for the period 1980 to 2002. The field capacity of 100 mm was assumed for this region. It is observed that the entire basin present a dry season predominantly between April and September, determined by the atmospheric large scale dynamics. However the deficit and the excess variables present different occurrence periods, due to topographic features. As you move eastwards, the number of ten day periods that characterize the dry season increases. The western part of the basin shows short dry

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seasons, lasting from the 2nd decendio of April to the 2nd of October. At the central region of the basin the deficit lasts as much as twenty one decendios, between the 1st decendio of *April and the 3rd of October. In both regions the "veranico" is observed in February. At the* eastern portion of the basin, despite the closeness of the coastal region, it is observed the longest deficit period, which lasts for thirty three decendios, however, starting around the 2nd decendio of December until the 1st of November.

QUANTIFYING FINANCIALLY THE IMPACTS OF CLIMATE VARIABILITY IN RAIN FED AGRICULTURE IN NORTHEAST BRAZIL

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Abstract

In recent decades the impacts of climatic variability in economic activities and other activities of society have been the objects of attention of many researchers. This study examines the relationship between tropical climate variability and rain fed agriculture (beans and maize crops) Ceará State quantifying their financial losses and gains, associated the climatic events of the cycle El Niño-Southern Oscillation and the dipole of the Sea Surface Temperature (SST) in the Tropical Atlantic during 1952-2000. Was used to analysis data of production, yield, and price and aggregated value of the beans and maize crops. The results showed that, on average, in years of La Niña and Neutral, except when La Niña is associated with the positive dipole of SST anomalies occur for positive production, income and a surplus of value (of about U.S.$ 31 and 28 million) of these crops. While in El Nino years, there are negative anomalies of these variables, the Ceará State and its rainfed agricultural systems lose around U.S.$ 23 and 16 million. Climate indices (SST anomalies in December) in the regions of Niño3, SST dipole in the areas north and south Atlantic Tropical can be used in simple methods, with multiple linear regressions, with the potential to predict these variables in the following year. Studies using this approach can help governments, decision makers and farmers to take appropriate action when the imminence of a condition similar to oceanic SST in the tropical Pacific and Atlantic oceans in future years.

HYDROMETEOROLOGICAL MONITORING SYSTEMS AS SUPPORT FOR DECISION-MAKING IN THE MANAGEMENT OF CONFLICTS BETWEEN USERS OF WATER IN MICRO BASINS IN THE STATE OF ESPÍRITO SANTO, BRAZIL

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Abstract

This paper studies the hydrometeorological monitoring to assist in the decision making process for the management of conflicts over water use in micro basins in the State of Espirito Santo, Brazil. Whether in light of possible climate change impacts or due to human action, many municipalities in the Northwest region of the state are already facing a crisis of water supply for use in agriculture and other sectors of society. With a proposal for public participation and other sectors of state civil society seeks to disseminate information of good water conditions for the development of local agricultural production system for this situation that due to global warming is likely to get worse.

One of the main problems linked to agricultural production in the state are the effects of regional climate vulnerability. The year 2007, specifically the months of May, June, July and August, was marked by the occurrence of low rainfall in the state. The predominance of anticyclonic circulation in the central region of Brazil during this period inhibited the formation of rain clouds, causing strong stability and preventing the progress of frontal systems. The accumulated rainfall in the mountainous region was on average 70% below the climatological normal from the region. In the municipality of Mucurici, upstate, cumulative totals for the period May to August were approximately 83% below the historical average (Nobrega, et al., 2007). This occurred again in 2008, causing a severe water shortage affecting the public water supply in many cities and causing an increase in conflicts between water users in different river basins, especially among farmers irrigating, exacerbating existing conflicts over water use to point of mutual threats of death (Valory, 2010).

With this worsening situation and the direct initiative of the State Public Ministry, in September 2008 created the Permanent Forum on State Water Resources comprising representatives from various sectors linked to the government and private initiative, aimed at restoring the watersheds of the State with proposed actions for the short, medium and long term (Valory, 2010), which emphasize the development of Terms of Adjustment of Conduct - TACs, integrating farmers, municipalities, environmental agencies and other institutions involved with a cause..

Direct Actions of State Forum Standing Water Resources

Within the context presented in the introduction, we adopted a participative methodological approach aimed at integrating the various institutions with local water users, especially farmers irrigating, seeking the management of shared water resources until the legal instruments of management are implemented in Sub Basins. Upon completion of the public meetings and meetings of the Interinstitutional Committee, the TAC was established with the proposals of producers and local institutions that was presented at public hearings in communities.

Meteorology to support decision-making

The information produced by the Hydrometeorological Monitoring System in the State of Espírito Santo/Brazil is taken into account, in the decisions of the Permanent Forum State Water Resources to promote proper management of conflicts over water use in the state. Such a system could be developed and coordinated by INCAPER. For this, the following steps need to be implemented:

1. Collecting and processing information from meteorological and hydrological stations of the study area (Meteorological Marilandia (automatic) and rainfall stations of Colatina and Cavalinho);
2. Systematic preparation of maps of water balance and deviations to indicate the regional water availability;
3. Disclosure of this information in order to incorporate guidelines for sustainable use of natural resources, especially water resources, in areas that present conflicts for the use of water for agricultural activities and other;
4. Reconciliation of the use of this information with projects and environmental restoration programs, which are being developed in the state of Espírito Santo, Brasil.

To achieve these goals, the training of technicians responsible for developing the institutional actions of the Conflict Management Group of the Water Use is proposed for distributing a “package” of multimedia information to be submitted through the Internet site INCAPER (http://hidrometeorologia.incaper.es.gov.br).

Being a methodology to aid decision making and support the actions of the Forum is not yet possible to explain a discussion of the results to be achieved. However, some past initiatives, such as monitoring the rainfall of Mesorregião Southern Bahia (D'Angiolella, et al., 2009) allowed the monitoring of water availability for crops and the development of the Climate Monitoring Program Real Time Northeast Region - PROCLIMA (CPTEC, 2010) produced good results and continue to provide information. However, these initiatives did not cover the region of interest - the state of Espirito Santo and acted specifically focused on the availability of water for agriculture without involving the subject water resources, specifically.

Implementing this initiative will facilitate the monitoring of the volumes of rain and diversions, according to the annual and monthly climate fluctuation, allowing decision making to assist the State Water Resources Forum Standing on the actions for dealing with conflicts over water use in sub basins in the State of Espírito Santo/Brasil.

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INFLUENCE OF CLIMATE CHANGE IN THE CULTURE OF MAIZE EASTERN AMAZON-PARÁ-BRAZIL

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Abstract

The latest IPCC report (Summary for Policymakers - International Panel on Climate Change, 2007) shows that climate change resulting from human activities is already occurring on a global scale and the impacts in several areas of human activity will serious and require urgent action that could lead to techniques for mitigation and adaptation. Whereas the models adopted by IPCC (2007) indicates that the temperature should increase over the next 100 years, considering the year 1990 as reference, between 1.4 º C to 5.8 ° C, this scenario in fact complements the earlier studies (IPCC 1997), when an estimated increase in temperature of 0.05 º C per decade, provide for an increase in precipitation of 0.5 to 1% per decade until the late twentieth century (Marengo, et al. 2007; IPCC 2007). Among economic activities certainly agriculture is more dependent on climatic factors. At this point, fits into the maize (Zea mays L.) which is considered a key species used in the world, providing products widely used for human and animal food and raw materials for industry, mainly in terms of quantity and nature of the reserves accumulated in the grains. Depending on its multiplicity of applications both in food and in animal diet, the corn takes relevant socioeconomic role, and forms itself into indispensable raw material for various agro-industrial complexes (Fancellil; Golden Neto, 2000). The area considered in the study was in the eastern Amazon, State of Pará (PA). The weather data were represented by historical data (1960-1990) and Future (2070-2100) where we used the maximum and minimum daily temperatures (º C), precipitation (mm) and solar radiation (MJ.m-2.dia -1.) Simulations of long-term productivity of maize were conducted in the sub-routine "seasonal" Support System for Agrotechnology Transfer (DSSAT), Version 4.0.2.0 (Hoogenboom, 2004), which allows the simulation cycles crops for several years considered in the series of meteorological data and, considering the balance of soil water and CO_2 fertilization. Considering the prospects of global climate changes and their impacts on agriculture, this study aims to evaluate possible impacts of climate on current conditions and projections of global warming on productivity of maize in the State of Para, from scenario (A2) and (B2). The potential of climate change on agricultural production in the state of Para can be assessed as negative, due to the fact that, even under optimum nutrient management and the results of this study indicate a reduction in the average potential productivity of maize, 9% (B2) and 20% (A2) of the current values (4755 kg / ha). More studies, both field experiments, such modeling should be conducted to fully understand the mechanisms wrapped in crop responses to climate change.

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INFLUENCE OF CLIMATE CHANGE IN THE CULTURE OF MAIZE IN THE STATE OF MARANHÃO, BRAZIL

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Abstract

Recent studies show that concentrations of greenhouse gases in the atmosphere have been increasing since the Industrial Revolution. In turn, that increase in gas comes from human activities, mainly burning fossil fuels, deforestation and burning of forests. Thus attributed to these factors, the responsibility for global warming. Besides temperature, precipitation has also undergone changes due to these practices and climate projections for this century indicate the possibility of grave consequences for humanity (Marengo, et al. 2007; IPCC, 2007). Among the economic activities, of course, agriculture is more dependent on climatic factors. Thus, the 'state of the art' current converges to a unique challenge that is to elucidate, in terms of farming and environmental impacts on climate change at different scales of time and space, and the possible effects on vegetation and life on the planet. We are thus faced with the urgent needs of comparative studies aiming to characterize the physiological and adaptive cultivated and native species to climate change, to better understand the adverse human impacts on the planet. Brazil is the third largest producer, surpassed only by the United States and China. The area sown in Brazil varies in volume from 14 million hectares, producing approximately 50 million tons, giving a yield of 3.5 tons / ha (CONAB, 2009). Simulations of long-term productivity of maize were conducted in the sub-routine "seasonal" Support System for Agrotechnology Transfer (DSSAT), Version 4.0.2.0 (Hoogenboom, 2004), which allows the simulation cycles crops for several years considered in the series of meteorological data and, considering the balance of soil water and CO2 fertilization. Considering the prospects of global climate change and its impacts on agriculture, this study aims to evaluate possible impacts of climate on current conditions and projections of global warming on productivity of maize in Maranhao state, from scenario (A2) and (B2). The potential of climate change on agricultural production in the state of Maranhao can be assessed as negative, due to the fact that, even under optimum nutrient management and the results of this study indicate a reduction in the average potential productivity of maize 5% (B2) and 16% (A2) of the current values (4681 Kg/ha). More studies, both field experiments, such modeling should be conducted to fully understand the mechanisms wrapped in crop responses to climate change.

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