Australian Government

Department of Agriculture, Fisheries and Forestry

Submission to

Inquiry into Meteorological Forecasting

For the Parliament of Australia House of Representatives Standing Committee on Industry, Science and Innovation

April 2009

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Terms of Reference
The Industry, Science and Innovation Committee is to inquire into and report on long-term meteorological forecasting with particular reference to:

- The efficacy of current climate modelling methods and techniques and long-term meteorological prediction systems;

- Innovation in long-term meteorological forecasting methods and technology;

- The impact of accurate measurement of inter-seasonal climate variability on decision-making processes for agricultural production and other sectors such as tourism;

- Potential benefits and applications for emergency response to natural disasters, such as bushfire, flood, cyclone, hail, and tsunami, in Australia and in neighboring countries; and

- Strategies, systems and research overseas that could contribute to Australia's innovation in this area.

Terminology

In the context of this submission, several terms need to be clarified. There are three main types of forecasts which span from tomorrow into the distant future. They are weather forecasts, long-term meteorological forecasts and climate change forecasts.

All of these forecasts convey information about environmental phenomena such as temperature, rainfall, atmospheric pressure, humidity, wind speed, and so on, but at different scales.

"*Weather forecasts*" typically cover the time span from one to seven or more days. Weather forecasts include prediction of individual weather events like cold fronts and storms.

"*Long-term meteorological forecasts*" cover the time interval from weeks to years. Farmers often refer to "seasonal forecasting" in place of "long-term meteorological forecasting", but the meaning is similar. Long-term meteorological forecasts typically predict the state of the weather in monthly or seasonal time scales and can include information about whether the season will be wetter or drier than normal.

"*Climate change forecasts*" cover the time interval from decades onward. Climate change forecasts typically predict gross changes in the average state of the climate at these much longer time scales.

Climate variability is a generic term which is used to describe the variations in time of environmental phenomena such as temperature, rainfall, atmospheric pressure, humidity, wind speed. Typically, climate variability relates to monthly, seasonal or annual time scales and is thus a relevant concept to long-term meteorological forecasts.

In the present context, *climate change* can be thought of as long term changes to climate variability.

Agriculture in a variable and changing climate

Agriculture, fisheries and forestry make an important contribution to Australia's economy. The combined gross value of Australia's agriculture, fisheries and forestry production was around $47.5 billion in 2007-08, or 2.3 per cent of gross domestic product (GDP). Around 60 per cent of agricultural production is exported, generating $30.8 billion in 2007-08 and making Australia one of the world's largest exporters of wheat, beef, dairy products, wine and wool.

Global food production will be required to significantly increase to feed a world population that is predicted to reach 9 billion by 2050. This will require a new wave of productivity growth that focuses on improved resource efficiency and adaptation to the unavoidable impacts of climate change. Australia can make a significant contribution to improving global food security through continued growth in agricultural productivity.

In response to this need for productivity improvements, one of the Australian Government's key initiatives for primary industries is the *Australia's Farming Future* (AFF) program. AFF provides $130 million over four years to help primary producers to adapt and respond to climate change. The initiative supports research, adaptation and adjustment activities to assist the agricultural sector to reduce its emissions and improve its adaptive capacity.

In April 2008, the Australian Government initiated a comprehensive national review of drought policy in recognition that the current Exceptional Circumstances arrangements may no longer be the most appropriate in the context of a changing climate. This review included independent investigations of the climatic, economic and social aspects of drought and drought support in Australia by the Bureau of Meteorology and CSIRO, the Productivity Commission and an expert social panel, respectively.

The review by the Bureau of Meteorology and CSIRO, *An Assessment of the Impact of Climate Change on the Nature and Frequency of Exceptional Climatic Events,* highlighted that there is inadequate knowledge about the drivers of climate variability and insufficient reliable information about the likelihood of poor or good seasons. The report stated that farmers and their suppliers need user-friendly, reliable and up-to-date location-specific information on historical climatic conditions and future climate variability. The review identified the need for research to improve climate change projections and seasonal-to-interannual forecasts, particularly with respect to specific rural sectors and a localised scale.

The draft review by the Productivity Commission, *Government Drought Support - Draft Inquiry Report,* identified the need to ensure that sufficient funding is directed to seasonal climate forecasting to improve risk management for climate variation and change.

Noting the above findings, the Primary Industries Ministerial Forum (PIMF) on 13 February 2009, agreed that improved research and development, including seasonal forecasting, should be implemented to support further development of drought reforms.

Why do farmers need long-term meteorological forecasts?
Better information about Australia's potential future climate is central to decision-making for individual enterprises and for policy planning. Understanding climate variability at seasonal timescales and having relevant long term meteorological forecasting tools will greatly assist risk management strategies at an enterprise level. There is also an increasing recognition that climate change intensifies some of the risks associated with climate variability and perhaps presents new risks.

Although the sensitivity to climate varies across Australian agricultural sectors, there are some general features of climate to which most sectors are sensitive. High rates of change and abrupt shifts in climate may exceed agricultural producers adaptive capacity. Improving farmers capacity to adapt to climatic changes both within-season and in the long-term will be crucial in determining how well they will cope with climate change.

The type of climate information required to support decision making in agricultural industries depends on whether within growing season or multiyear decisions are being considered. For example, within season decisions might include crop selection and seeding, fertiliser application, stocking and destocking of livestock, and control of pests, weeds and diseases. Longer term decisions may involve infrastructure investments (such as grain handling facilities or dams), perennial crop species, irrigation systems and farm purchases.

Problems with existing forecasting systems
The inaccuracy in the current generation of long-term meteorological forecasts is one of the greatest barriers to their wider adoption to inform management decisions amongst farmers. Current long-term meteorological forecasts are primarily based on averages taken from historical climate data. In light of the international scientific consensus that human activity is increasing atmospheric carbon emissions and enhancing global warming, scientists widely acknowledge that historical climate records are no longer adequate predictors of future climates.

The record heatwave across south-eastern Australia during February 2009 is a good example of a meteorological event occurring outside historical experience. A new approach in long-term meteorological forecasting must take account of climate change.

New forecasting technologies
Improvements in long-term meteorological forecasting systems are being driven by our growing knowledge of the Earth's climate. In recent years, there has been substantial international investment in climate change research including on understanding the drivers of climate variability and the impacts of climate on society. This new knowledge of climate drivers is being used to build new and increasingly complex models of the Earth's climate system and to develop new approaches to long-term meteorological forecasting.

In the Australian context, these new approaches to long-term meteorological forecasting incorporate knowledge about local drivers of climate such as the El Niño-Southern Oscillation (ENSO), the Indian Ocean Dipole (IOD), the Madden-Julian Oscillation (MJO) and the Southern Annular Mode (SAM). These phenomena are known to affect rainfall and other climate variables across the continent and to influence year-to-year production levels for Australian agriculture.

The Bureau of Meteorology has identified that the reliability of long term meteorological forecasts could be increased significantly by replacing the existing methods based on historical statistics with these new approaches. However, there are high costs involved in establishing and maintaining the necessary supercomputing facilities capable of running these new earth system models. The modeling effort also needs to be underpinned by focused research into improved understanding of the individual climate processes, their interaction and any effects due to climate change.

The high cost of establishing such a capacity is likely to be a significant barrier to entry by the commercial sector. Internationally, the effort to establish these new forecasting technologies is increasingly focused into a small number of national institutions with a high level of international collaboration. In the Australian context, the Bureau of Meteorology and CSIRO have established a partnership through the Centre for Australian Weather and Climate Research (CAWCR) to channel the expertise and computing capacity needed. The focus of this effort to date has largely been on short term weather forecasts and the much longer climate change forecasts. The long term meteorological forecasts (i.e. covering the period from weeks to a few years) have not been a focus of attention.

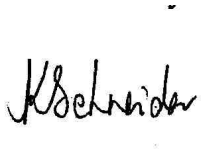
There is significant public investment required to achieve a similar effort on long term meteorological forecasts and to make these forecasts relevant to industries such as agriculture.

Risk management in agriculture

Natural disasters such as floods, bushfires and cyclones result in crop failures, damage to infrastructure and heavy financial loses. The 2008 Bureau of Meteorology-CSIRO drought exceptional circumstances report, *An Assessment of the Impact of Climate Change on the Nature and Frequency of Exceptional Climatic Events,* indicates that these events are likely to occur more frequently and with greater intensity in the future as a result of climate change. While it is not possible to prevent these natural disasters, the resultant losses can be reduced considerably through proper planning and effective preparation. As a consequence, there is growing interest in using new long term meteorological forecasts to predict the likelihood of such events in the future and integrate these predictions into a risk management framework.

Research and development strategies

Research, Development and Extension (RD&E) in primary industries is a key factor for increasing productivity and ensuring sustainability. The Australian Government is focused on improve the targeting, coordination and adoption of research that supports the competitiveness and sustainability of agriculture, fisheries and forest industries. A number of rural RD&E projects and programs coordinated by the rural Research and Development Corporations (RDCs) are focused towards assisting farmers and natural resource managers to access and use long-term meteorological forecasts. For example, the *Managing Climate Variability Research and Development Strategy* (MCVS) and its predecessor programs were created by a partnership of Rural RDCs to increase Australia's capacity to capture opportunities and manage risks related to climate variability. Over the last 15 years, the research program has broadened in focus beyond drought to climate risk management. MCVS focuses on investments which increase long term meteorological forecast accuracy and the development of associated tools that translates these forecasts into applications and build risk management strategies for primary industries and natural resource managers.



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