



Australian Government
Bureau of Meteorology

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In reply please quote

Committee Secretary
Standing Committee on Primary Industries and Resources
House of Representatives
PO Box 6021
Parliament House
CANBERRA ACT 2600

Dear Committee Secretary,

Submission by the Bureau of Meteorology to the inquiry into the role of government in assisting Australian farmers to adapt to the impacts of climate change

The Bureau of Meteorology welcomes the opportunity to provide its views on the key role that it might play in assisting Australian farmers to adapt to the impacts of climate change. The Bureau has long historical links with agriculture and views the sector as one of its most important stakeholder groups. Many Bureau products and services are targeted at farmers and will be important tools to help farmers not only mitigate the negative impacts of climate change on their industry but also to optimise future productivity under what may become a very different climatic regime.

This submission outlines key areas of the Bureau of Meteorology's activities that are relevant to the Inquiry's Terms of Reference.

Key Points

- Maintenance of the Australian Climate Record is important for climate change monitoring and the development of adaptation strategies.
- High quality climate information, provided from the Bureau of Meteorology climate monitoring network informs adaptation efforts.
- The impacts of climate change on agriculture will be largely felt through weather and near term climate variability. The interaction of climate variability with the longer term trends will likely see more extremes such as heatwaves and droughts.
- The Bureau of Meteorology is focussing effort on improving the accuracy and reliability of seasonal forecasts to assist farmers in managing the effects of near term climate variability.
- Improvements in longer term climate projections in Australia will depend on the success of combined CSIRO and Bureau of Meteorology efforts in developing the Australian

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Community Climate and Earth Systems Simulator (ACCESS), a complex high-performance climate and climate change model.

- The Bureau of Meteorology is putting considerable effort towards improving the online accessibility of its data.
- The Bureau of Meteorology has many established partnerships with agencies that work directly with farmers and natural resource managers in making climate information more relevant, including through extension efforts that help relate information directly to farming needs.
- The Bureau of Meteorology has been active in the communication of climate change information to farmers through a number of new partnerships as well as through regular interactions with the farming community.

Response to Terms of Reference

1. Current and prospective adaptations to the impacts of climate change on agriculture and the potential impacts on downstream processing.

For effective decision making and risk management the agricultural sector, and indeed all weather and climate sensitive sectors of the Australian community, need accurate and reliable information about the state of the climate, how climate has changed in the past, and how it may further change into the future.

The Bureau of Meteorology maintains a network of high quality stations recording a wide range of meteorological variables that together constitute Australia's climate record. Many locations are representative of agriculturally-significant or sensitive areas. In addition to recording on at least a daily basis the standard variables of rainfall, temperature and wind, many stations also record other variables important to agriculture such as evaporation, hail, frost and dust. Maintaining this network to the exacting standards required for monitoring climate variability and change is a challenging task, made more so by the more specific demands of adaptation. In particular, the increasing trend towards the use of automatic recording equipment requires careful management so as not to compromise the climate record, which has been established primarily on recordings made by human operators.

A sound quality assurance process is required to ensure that the data collected are reliable, complete and homogeneous. It is vital that assessments of climate change are made against the highest quality information possible, to which end the Bureau is developing improved, more efficient systems for the quality assurance of the data it collects. Finally the data must be organised in an archiving system to which there is ready access.

The Australian climate record managed by the Bureau of Meteorology is a critical national asset. The data and analysis products derived from the climate record underpin our understanding of climate variability and change across Australia, and support our ability to adapt over time. Maintaining the climate record is an Australian Government priority.

It is important that farmers and natural resource managers recognise that the trend in the base state of the climate (for example, the long term global warming trend of around +0.1°C per decade) may not be the most relevant aspect of climate change for developing appropriate adaptation practices.

The impacts of climate change on agriculture (at least initially) will be largely felt through the overlay of climate variability on the longer term trends, in some cases leading to more frequent extreme events. Heatwaves and droughts, for example, are likely to be more intense. Such events might be characterised by the outcomes already experienced in recent droughts, which have seen record high temperatures compounding the impacts of persistent rainfall deficiencies.

Paradoxically, other parts of the country have seen record rainfall and flood events. Effective early warning systems are a key requirement for managing these extremes and, along with high quality monitoring systems, will generally enhance resilience throughout the farming sector.

The Bureau of Meteorology is currently the national provider of climate data, climate analyses and short term (seasonal) climate predictions. These information services equip farmers to manage their enterprises more effectively in a varying and changing climate. The Bureau of Meteorology's National Climate Centre (NCC) provides a comprehensive seasonal outlook service, currently based upon a statistical model that relates observed fluctuations in Indian Ocean and Pacific Ocean temperatures to subsequent Australian rainfall patterns. This model has demonstrated moderate skill and reliability over time, however climate change is altering ocean temperatures, and hence the underlying relationships with rainfall over Australia. In other words, the past relationships may be less informative of climate variations in the future.

In conjunction with the Centre for Australian Weather and Climate Research (CAWCR)¹, the NCC is working to enhance its seasonal climate forecasting capabilities by shifting to dynamical modelling techniques. Such climate models are based upon physics and dynamics rather than on statistics, and are capable of incorporating the effects of climate change into a prediction. The Bureau of Meteorology is strongly committed to the development and maintenance of a sound, scientifically based operational forecasting service that can translate the meteorological output from climate models into information that is useful to farmers and the agricultural industry as a whole. Working closely with agricultural scientists as well practitioners will be critical to this outcome.

Such a dynamical model based service would enhance the agricultural community's capacity to manage in a varying and changing climate, and in particular improve its preparedness for extreme seasons and events. There is a high expectation by scientists that dynamical seasonal forecasts will perform consistently better than statistically based forecasts. There is also some optimism that increased knowledge of what drives climate variability on longer time scales will eventually lead to a measure of predictability out to a decade or more.

Beyond seasonal to decadal timescales, one must rely on projections of climate change that will be determined not only by the current state of climate and forces internal to the climate system but also by additional forcing from increased concentrations of greenhouse gases in the atmosphere. Such projections, based on various greenhouse gas concentration scenarios, include estimates of changes in the frequency of heat stress, droughts and flooding events that might point, for example, to systematic reductions in crop yields and livestock productivity beyond impacts that would follow from changes in the mean state alone. For instance, the intensity of rainfall (e.g. the amount that falls on a day when it rains), particularly in the tropics and the southeast, is forecast to increase in all scenarios, suggesting increased rates of erosion and flood frequency. Correspondingly, the number of dry days is also projected to increase, especially in the central and western regions, suggesting that periods between rain events will become longer. The risk of hail is also projected to increase along Australia's east coast, including large parts of the eastern Murray Darling Basin.

Further research is needed to improve the confidence in the projections of climate change. The ACCESS project is central to the Bureau's plans for modelling of future climate variability and change. ACCESS will ultimately provide stakeholders with data and information to drive their own agriculture, water management, and natural resource management models.

In late 2006 senior researchers from the Bureau of Meteorology and CSIRO defined Australia's climate change knowledge gaps and research priorities. Of particular note was the need to improve the simulations of the earth's climate system by advancing to new generation climate

¹ A collaboration between CSIRO and the Bureau of Meteorology

models that not only contain the physics of the atmosphere, oceans and cryosphere (as done in earlier generation models), but also the physics and/or chemistry of interrelated aspects such as the biosphere and radiatively active gases. Such improvements would also include a full carbon cycle, covering the terrestrial (including full vegetation model), ocean and atmosphere systems.

It is intended that the climate projections for Australia from the ACCESS model be included in an online database. Such a database would in addition provide information from the climate models developed in several other major research institutes around the world, enabling better assessments of likely future climate than can be derived from using one model alone. Such a future climate database will be critical to adaptation planning for the longer term by all primary industry and natural resource managers. An equivalent detailed database has already been developed for the United States.

The Climate Projections OnLine (CPOL) database, which would be managed by the Bureau of Meteorology in collaboration with the CSIRO, would also be a major resource to support actions identified by the National Climate Change Adaptation Framework, in addition to recommendations by the Prime Minister's Science, Engineering and Innovation Council (PMSEIC) Independent Working Group report on *Climate change in Australia: Regional impacts and adaptation*.

The climate projections database containing detailed assessments of possible future climate for periods up to, and possibly beyond, 2100 would interface with the Bureau's existing historical database, thus providing a seamless record of the climate of Australia from the past through the present and for several climate change scenarios into the future.

Such a wealth of information about climate available in the one location, delivered in relatively simple formats, and via easy to use tools could be readily mined by researchers and practitioners alike to inform decision making across a wide range of weather and climate sensitive sectors.

The role of government in:

- **augmenting the shift towards farming practices which promote resilience in the farm sector in the face of climate change;**

The Bureau of Meteorology has considerable expertise on climate variability and change to support assessments of appropriate farming practices in a changing climate. As noted, it has the ability to provide high quality historical and contemporary data and data from future projections of climate to inform longer term strategic planning.

In addition, the Bureau of Meteorology provides seasonal outlook information, which can inform farmers and natural resource managers in their tactical decision making and planning. Planning and preparedness in farming in the face of a changing climate can be significantly improved by judicious adaptation on shorter time scales. Research and development efforts to lift the skill of such outlooks need to be an ongoing national priority for responding to the impacts of climate change.

- **promoting research, extension and training which assists the farm sector to better adapt to climate change.**

The Bureau of Meteorology, as part of the National Agriculture & Climate Change Action Plan (NACCAP), and with assistance from Land and Water Australia's Managing Climate Variability research and development program, has been working with the agricultural community in documenting and assessing the potential consequences of climate change and variability for agriculture. Several workshops in a number of mainland states have sought to equip farmers with information about long term impacts of climate change and the cascading

effects through to shorter timescales, including the likely increase in the frequencies and intensities of extreme events.

While this initial round of workshops was limited in number, feedback supported their value for informing both farmers and the Bureau of Meteorology in what information could be provided and what was needed, respectively. For example, projections for 2030 and 2070, while important, are mostly too far into the future for many farmers to plan adaptation strategies. Projections over a 10-year timescale were deemed far more relevant to farmer and natural resource manager planning horizons, and would better guide actions.

Bureau of Meteorology officers also attend field days meeting one-on-one with farmers, speaking at agricultural conferences, and also communicating with the farming community via the mass media.

- **The role of rural research and development in assisting farmers to adapt to the impacts of climate change.**

The Bureau of Meteorology has collaborated frequently with research and extension agencies that work directly with farmers and natural resource managers. Some examples of the outcomes of some of these partnerships include, but are not limited to:

Water and the Land: <http://www.bom.gov.au/watl/index.shtml>

National Agriculture & Climate change Action Plan:
http://www.bcg.org.au/cb_pages/Communicating_Climate_Change.php

National Agricultural Monitoring System: <http://www.nams.gov.au/>

Australian Water Availability Project: <http://www.bom.gov.au/jsp/awap/>

Australian Community Climate and Earth-System Simulator:
<http://www.accessimulator.org.au/index.html>

Indian Ocean Climate Initiative: <http://www.iooi.org.au/index.html>

South-East Australian Climate Initiative: <http://www.seaci.org/index.html>

These projects have thus far provided a number of avenues to Bureau of Meteorology information that is of direct use to farmers. The Bureau will continue to explore options for partnerships of this nature in support of research into agricultural practices best suited to a future climate.

Yours sincerely,



(NEVILLE SMITH)
Acting Director of Meteorology

9 April 2009