The Parliament of the Commonwealth of Australia

# Seasonal forecasting in Australia

House of Representatives
Standing Committee on Industry, Science and Innovation

November 2009
Canberra

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# Foreword

Many of Australia's economically important industries such as tourism and agriculture are crucially dependent on long-term meteorological forecasting, otherwise known as seasonal forecasting. This presents significant challenges as Australia is a vast continent with a diverse range of climatic conditions. The Committee's inquiry examined a number of these challenges and found that Australia needs to invest in resources and people to increase the reliability of seasonal forecasting for the benefit of individuals, businesses and emergency services.

Not only is seasonal forecasting essential for our agricultural industries, but for tourism and water management, the planning of large infrastructure projects and emergency services. In these industries, and others, information on long term weather forecasts influences a wide range of management decisions. For example, grain producers need to know about seasonal rainfall and the likelihood of frost. Less obvious examples include energy authorities needing to plan for extra energy loads during heat waves and the construction industry in North Queensland factoring in wet season down time. Emergency services rely on seasonal forecasting to plan for bushfires, floods and cyclones. Advanced warning of possible extreme events allows for strategic planning and preparation.

Australia once led the world in research and development in climate and weather forecasting but sadly has fallen behind in the last couple of decades. One of the major causes for the decline is the increasing reliance on supercomputing capability. Australia's supercomputing capacity has not kept up with comparable countries. New supercomputers that have just been provided to the Bureau of Meteorology and the Australian National University will not make up the shortfall. Limited computing capacity is hampering Australia's research efforts and our ability to attract top quality researchers.

Another concern is the reduction to the Bureau's staffing levels which is impeding its effectiveness and jeopardising long-term sustainability. Recruitment needs to be increased, employment conditions reviewed, career pathways encouraged and secure tenure provided to attract and retain more high-calibre personnel.

Another contributing factor to the falling standard of our weather forecasting is the quantity and quality of data coming from the network of weather stations across the country. Forecasting depends

on accurate, long term, observational data. The integrity of current data is being threatened by a number of factors: many existing weather stations are suffering the effects of age, resource cuts have lead to a decrease in qualified observational staff and there are significant gaps between weather stations across the continent. Additionally, there is concern that some weather stations could be better placed. More weather stations are required to improve the amount and integrity of the data being collected.

Challenges facing long-term seasonal forecasters include Australia's position in the Southern Hemisphere Indo-Pacific Region and the number of variables which need to be included in simulations.  Much of the work done in the Northern Hemisphere is not useful to Australia's weather sensitive industries. Variables such as the El Niño effect and the Indian Ocean Dipole provide an abundance of data that must be incorporated into any reliable forecasting model. Other variables include particulates or aerosols like smoke from agriculture, deforestation, industry and volcanoes. Currently the effect of many of these variables on Australia's climate and weather patterns is not fully understood and more research on their impact is required.

Australia is a large land mass and long term forecasting needs to be tailored to regional needs to be useful and effective. Seasonal forecasts are only useful if the data is translated into meaningful information for end users. A number of State Governments are taking the lead in this regard, matching data to stakeholder requirements and producing a range of products that enable end users to gain maximum benefit from the Bureau's long-term weather forecasts.

Despite the difficulties identified by the inquiry, Australia is doing some impressive work in the research field, not only by the Bureau of Meteorology and CSIRO, but by State Government agencies and universities. However, the lack of a nationally coordinated research agenda and some reluctance to share information is hampering progress. The establishment of an institute of meteorological science to facilitate an ongoing partnership between the relevant research bodies will go someway to helping Australia make up lost ground and regain its place as a leader in long-term meteorological forecasting.

It is hoped the measures outlined in this report will boost Australia's capacity to provide suitable and meaningful seasonal forecasting products.

**Maria Vamvakinou MP**
**Chair**

# Membership of the Committee

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| **Chair** | Ms Maria Vamvakinou MP |
| **Deputy Chair** | Hon Fran Bailey MP |

**Members**

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| Mr James Bidgood MP (until 22/10/09) | Mr Michael Johnson MP |
| Mr Nick Champion MP | Mr Rowan Ramsey MP |
| Mr Darren Cheeseman MP | Ms Amanda Rishworth MP |
| Dr Dennis Jensen MP | Mr Mike Symon MP |

# Committee Secretariat

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| **Secretary** | Mr Russell Chafer |
| **Inquiry Secretary** | Mr Anthony Overs |
| **Research Officer** | Dr Narelle McGlusky |

# Terms of reference

The inquiry will 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 neighbouring countries; and

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

# List of abbreviations and acronyms

| | |
|---|---|
| 4DVAR | Four-dimensional variational data assimilation |
| AAO | Antarctic Oscillation |
| AAS | Australian Academy of Science |
| ACCESS | Australian Community Climate and Earth System Simulator |
| ACRA | Atmospheric Circulation Reconstructions of the Earth |
| AMOS | Australian Meteorological and Oceanographic Society |
| APSFarm | Agricultural Production Systems Farm |
| APSIM | Agricultural Production Systems Simulator |
| APSRU | Agricultural Production Systems Research Unit |
| BoM or the Bureau | Bureau of Meteorology |
| CAWCR | Centre for Australian Weather and climate Research |
| CCS | Climate and Carbon Sciences Program |
| CCSM | Community Climate System Model |
| COAG | Council of Australian Governments |
| CPSU | Community and Public Sector Union |
| CRC | Cooperative Research Centre |
| CSIRO | Australian Commonwealth Scientific and Research Organisation |

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|---|---|
| DAF | Western Australian Department of Agriculture and Food |
| DAFF | Department of Agriculture Fisheries and Forestry |
| DEC | Western Australian Department of Environment and Conservation |
| DERM | Queensland Department of Environment and Resource Management |
| ENSO | El Niño – Southern Oscillation |
| FESA | Fire and Emergency Services of Western Australia |
| IOCI | Indian Ocean Climate Initiative |
| IOD | Indian Ocean Dipole |
| IPCC | Intergovernmental Panel on Climate Change |
| IRI | International Research Institute for Climate and Society |
| LWA | Land and Water Australia |
| MJO | Madden Julian Oscillation |
| NCI | National Computer Infrastructure |
| PDO | Pacific Decadal Oscillation |
| POAMA | Predictive Ocean Atmosphere Model for Australia |
| PWS | Public Weather Service (UK) |
| QCCCE | Queensland Climate Change Centre of Excellence |
| R&D | Research and Development |
| SAFF | South Australian Farmers Federation |
| SAM | Southern Annular Mode |
| SILO | An internet website that provides a source of meteorological and agricultural data |
| SOI | Southern Oscillation Index |

SPOTA-1    Seasonal Pacific Ocean Temperature Analysis

UK            United Kingdom

UKMO       United Kingdom Meteorological Office

WAFF        Western Australian Farmers Federation

WRF          Weather Research and Forecasting Model

WRMS        Weather Risk Management Services Pty Ltd

# List of recommendations

## 3    Long-term forecasting models

### Recommendation 1

The Committee recommends that CSIRO and the Bureau of Meteorology provide to the Australian Government a report with detailed explanatory information as to why a particular dynamic forecasting model or system was chosen for use in Australia. The report should be completed by the end of 2010.

### Recommendation 2

The Committee recommends that weather and climate variables and influences, for example, particulates, be identified, thoroughly examined to assess their degree of impact on our weather and climate, and incorporated into forecasting models as necessary. Priority areas for incorporating these variables should be published.

### Recommendation 3

The Committee recommends that the Australian Government increase funding for research into the effects of weather and climate variables such as El Nino and Indian Ocean Dipole that impact on Australia's forecasting abilities.

### Recommendation 4

The Committee recommends that the Australian Government conduct a short review to determine what supercomputing facilities are required by CSIRO and the Bureau of Meteorology to conduct crucial forecasting operations and research. Any additional funding to increase supercomputing capacity should be made available as a priority so that all model research, development and application can be undertaken in Australia.

### Recommendation 5

The Committee recommends that the Australian Government undertake an audit of weather stations that contribute data to forecasting models, to ensure that they comply with World Meteorological Organization guidelines. All necessary actions should be taken to ensure that all stations comply.

### Recommendation 6

The Committee recommends that the Australian Government budgets for the purchase, installation and maintenance of additional weather stations in critical areas around the country. There should be broad consultation to consider the number of new stations needed and their placement.

## 4   Other issues

### Recommendation 7

The Committee recommends that the Bureau of Meteorology employment conditions be reviewed and that a more secure tenure be provided to relevant staff, including increasing contracts from three years to five years.

### Recommendation 8

The Committee recommends that the Australian Government establish an institute of meteorological science to develop an ongoing partnership between relevant research bodies and implement a coordinated research agenda.