

Looking ahead after south-east Australia's driest year

By increasing our understanding and predictability of three large-scale climate drivers—El Niño (the Southern Oscillation), changes in Indian Ocean sea surface temperatures and the Southern Annular mode [hemispheric changes in windiness and storm activity over the Southern Ocean and Antarctica]—researchers now have a better understanding of their influence on rainfall variability in the region.



Motivated by the string of years with below-average rainfall in the southern basin region, researchers with the South Eastern Australian Climate Initiative (SEACI) have found that rainfall in south-east Australia is not only sensitive to the occurrence of El Niño in the eastern equatorial Pacific but also to patterns of sea surface temperature changes in the central Pacific.

'These findings help explain why some major El Niño events only cause mild droughts whereas some weak El Niños are associated with severe droughts,' said CSIRO research leader Dr Bryson Bates.

A research team from around the country has found that a combination of factors has led to 2006 being the third driest year in terms of rainfall for the region since 1900.

'Even though this isn't the lowest rainfall we've had, there is less water available in Murray-Darling Basin storages. This is because the impacts of below-average rainfall have been exacerbated by three factors: a temporal shift in the rainfall pattern, higher air temperatures; and low year-to-year rainfall variability since 1996,' said Bryson.

SEACI's mission is to look at future water availability for the southern Murray-Darling Basin. This work is important for decision makers involved in water planning and allocation. Researchers are projecting water availability in 2030 and 2070.

'This past decade has been different from all other decades since 1900. We haven't had a single year with above-average rainfall and have experienced record high surface temperatures.

'Are we looking at a drought or a long-term change in our climate? The answer to this question will be important for ensuring that there is a secure supply of water in the future.'

'While changes in the Southern Annular mode can account for rainfall changes in autumn, sea surface temperature variations in the Indian Ocean and Coral Sea appear to account for a larger part rainfall variability in spring,' Bryson said.

The challenge ahead is to better understand how these variations in climate drivers interact to produce changes in rainfall, temperature, wind and evaporation.

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MANAGING
CLIMATE
VARIABILITY
R & D PROGRAM

Increased seasonal forecast skill tops the list for farmers

Based on the resounding feedback we have received from farmers, the next phase of the Managing Climate Variability Program (MCV) will focus on improving the skill of seasonal climate forecasts.

The need for better skill was borne out in our recent survey, which we ran in close collaboration with the Bureau of Meteorology's National Climate Centre.

We wanted to find out what farmers need from seasonal forecast tools and information on the internet. Almost 500 farmers and farmer advisors across Australia responded to our internet survey. Most of them (82.8 per cent) use seasonal forecasting information to manage their farms. They find it easy to understand, but would like it to be more reliable (65 per cent) and more specific to their local region (41 per cent).

The majority of respondents access seasonal forecast information on the internet daily (44 per cent) or weekly (35 per cent), using broadband connections. They either read it in some detail (55 per cent) or scan it quickly (39 per cent). They prefer maps and diagrams to just text.

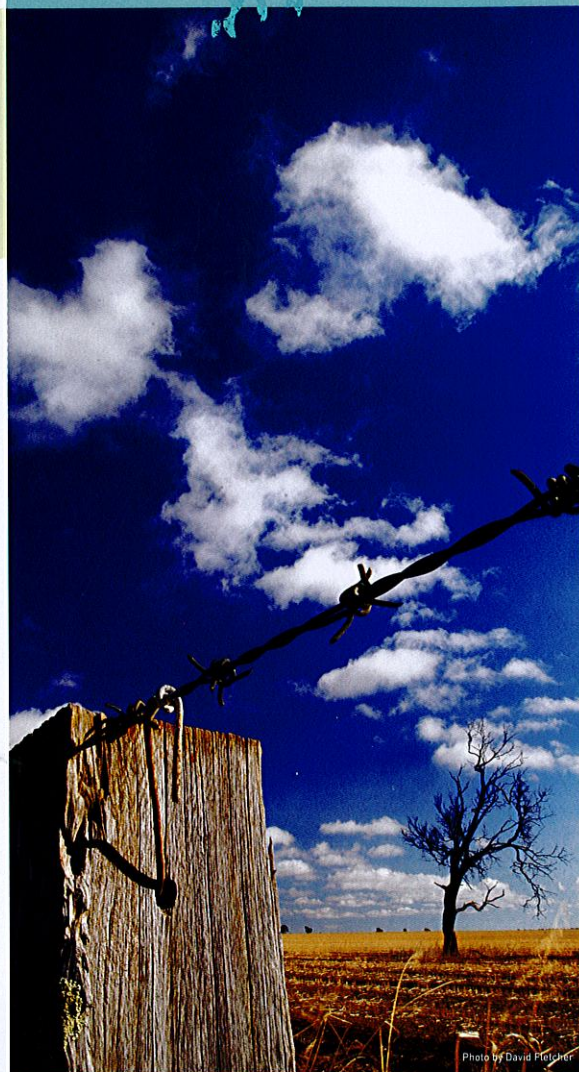
They primarily use seasonal forecast information to help them decide on the timing (59.9 per cent) and area (55.9 per cent) of seeding/planting, followed by the timing (54.7 per cent) and amount (49.9 per cent) of fertiliser, stocking/de-stocking strategies (49.3 per cent), crop/cultivar choice (48.7 per cent) and the timing of pest/weed disease management (46.4 per cent).

When asked what seasonal forecasting information was useful, the vast majority (96 per cent) of respondents indicated that amount of rainfall was important or very important, while more than half indicated that rainfall rate (59 per cent), frost (58 per cent), air temperature (56.5 per cent) and wind (55.4 per cent) were also important or very important. More than half (55 per cent) indicated that sea surface temperature was not very important.

Most respondents said they would find seasonal forecasts for the months of March, April and September the most helpful. However, there is not a specific time of the year where they feel that seasonal forecasts would not be helpful.

Most (74 per cent) respondents thought the Bureau of Meteorology's seasonal outlook, including the ENSO Wrap-up, was important or very important for their business. Most (64.3 per cent) also indicated that the Southern Oscillation Index was important or very important.

The vast majority (92 per cent) of farmers believe that the Bureau's website is an important or very important source of seasonal climate forecast information. Almost half (48.5 per cent) visit the Bureau's recently developed Water and the Land (WATL) website, which brings together forecast information for the season ahead.



We also asked farmers for feedback on products that the Bureau is considering developing to improve seasonal forecasting and the way it is explained. This information is now being used by the Bureau to develop and expand tools on WATL.

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Seasonal forecasts help NRM planning

Regional natural resource management (NRM) groups around Australia are turning to seasonal forecasts to better plan for their catchments, including strategies for tree planting, pest management, environmental flows and fire management.

They are also using seasonal forecast information to advise landholders and farmers about their practices and to recommend changes to existing land practices.

These are the findings of a survey we conducted of regional NRM bodies around Australia. We received 116 responses to our survey, covering all but 10 of the country's 56 regional NRM bodies.

The survey was part of our analysis of the needs of farmers and natural resource managers for seasonal forecasting tools and information on the internet. We worked closely with the Bureau of Meteorology throughout the process.

From the survey, we found that the majority of regional NRM bodies access seasonal forecast information on the internet (67 per cent) on a weekly (23 per cent) or monthly (26 per cent) basis. One of our survey respondents explained why seasonal forecast information was becoming more important to NRM groups:

Regional NRM groups have a number of indirect needs for climate data 1) to support landholders in managing climate variability, 2) [to influence] farmers' impacts on the success of NRM programs, and 3) to potentially integrate with various science projects.

The majority of respondents indicated that the amount (95 per cent) and intensity (78 per cent) of rainfall, air temperature (65 per cent), frost (50 per cent) and wind (55 per cent) are either important or very important to their regional NRM body. Sunshine, sea surface temperature and evapo-transpiration were rated by one-third of the respondents (28 per cent – 38 per cent) as moderately important.

But there seems to be no specific time of the year when seasonal forecasts are most helpful to NRM bodies.

Most respondents found the Bureau's Seasonal Outlook (43 per cent) and the Southern Oscillation Index (35 per cent) to be important tools for seasonal forecasting. And they largely accessed seasonal forecast information through the internet from the Bureau's website (95 per cent) and other websites (75 per cent). Almost half of our respondents access the Bureau's Water and the Land (WATL) website now and again or regularly for seasonal forecasting information. Other important sources were radio (61 per cent) and television (49 per cent).

Two-thirds of respondents indicated that they prefer to scan seasonal information on the internet quickly, while one-third said they like to read it in some detail. Only six people preferred to download the information for printing and/or reading offline. Most (91 per cent) prefer to see the information presented with maps and images, supported by text.

Most respondents would like to see more climate education products on the Bureau's website and are interested in the idea of a portal to access available climate risk management information and tools.

We are now analysing the survey information further to better inform the expansion of WATL and the MCV website. As MCV moves into a new phase, there will be more emphasis on delivering the information and tools needed by regional NRM groups for their decision making and for providing strategic advice.

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Managing agriculture in a changing climate

A report from Greenhouse 2007

Australia's agriculture industry has to deal with the short-term crisis of drought, as well as looking at the long-term implications of climate change, according to panel speakers at the recent Greenhouse 2007 conference in Sydney.

'Farmers have been adapting for years to a variable climate with new technologies, cropping systems and genetics research,' said National Farmers Federation CEO Ben Fargher. 'And we need to protect the productive base of farmers now. It's about supporting farm families and the community in going forward in the face of climate risk.'

Ian McClelland, a farmer from north-west Victoria's Birchip region, and also a panel speaker, agreed that things were tough for cropping farmers in his region, having experienced drought four years out of the past six.

'Farmers have been adapting to change forever,' he said. 'Give farmers the truth and they can find a way to deal with the change.'

McClelland said it was important for research and development (R&D) to back up farmers activities. He finds it odd that Australia spent \$2 billion on drought support and only \$1 billion on research.

'Many farmers have maximum water efficiency already in their practices. We need to create new productive systems or practices. We need new skills and management expertise so we can make the most out of our farms.'



Panel members from left to right: Ian McClelland, mixed farmer and Chair of the Birchip Cropping Group, Dr Michael Robinson, Executive Director of Land & Water Australia and Ben Fargher, CEO National Farmers Federation

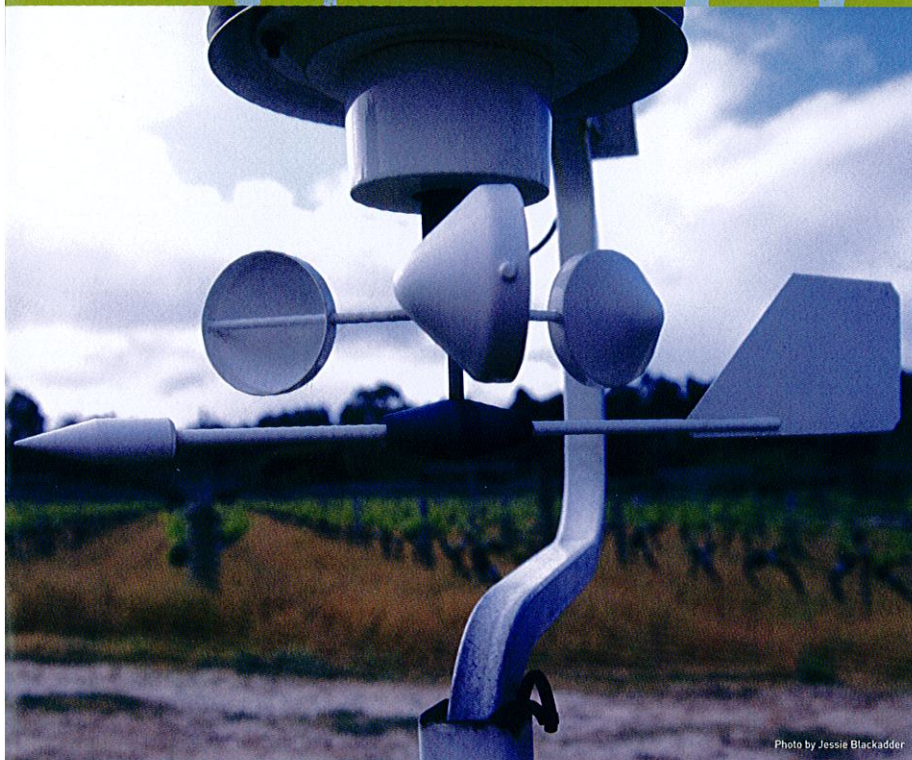
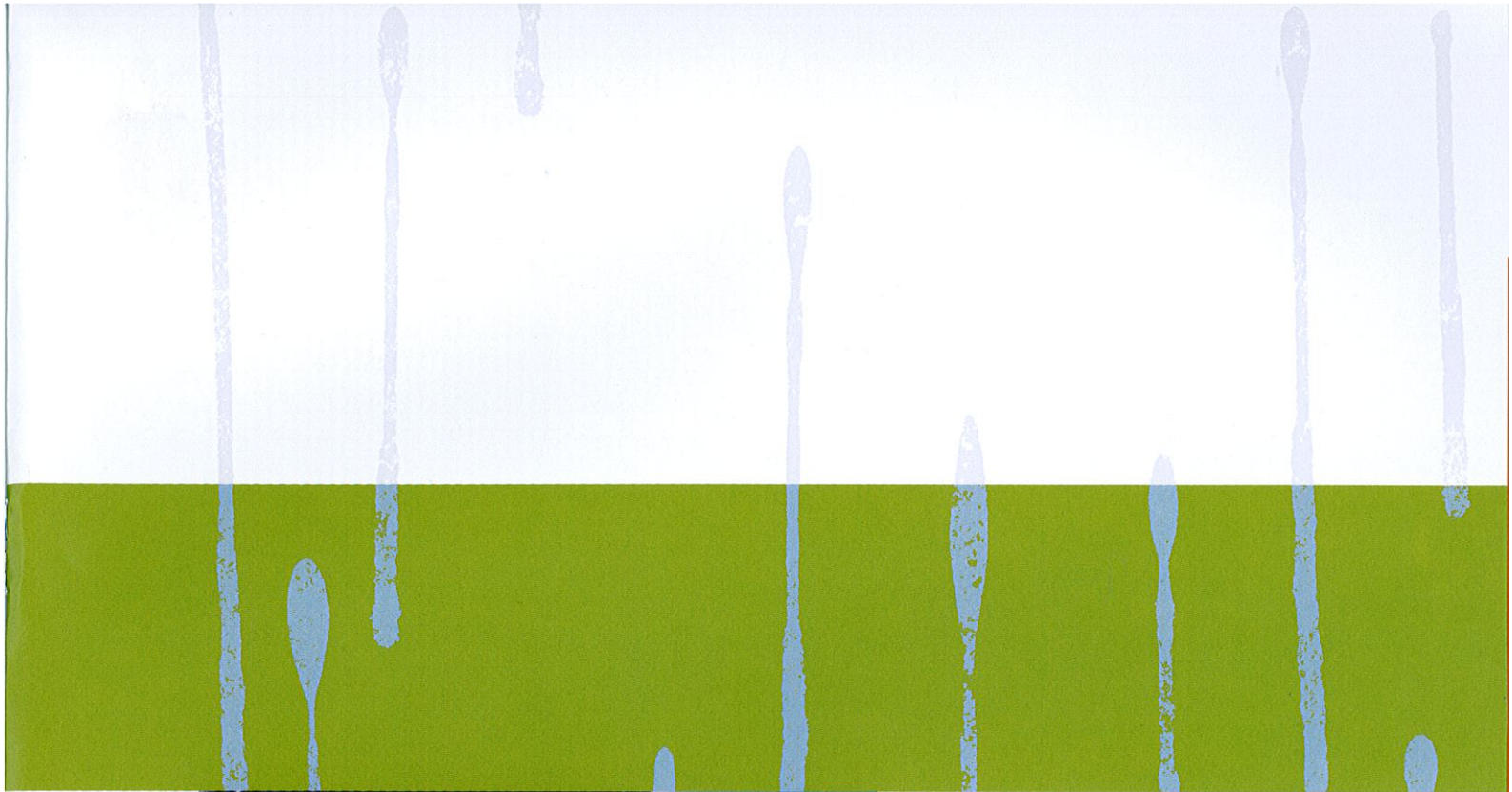


Photo by Jessie Blackadder

The third panel speaker, Dr Michael Robinson, Executive Director of Land & Water Australia, outlined his vision for Australian agriculture in 10 years time:

1. better climate change knowledge
2. more with less—for example, twice the productivity from half the water
3. sustainable production
4. supportive policies and social and institutional environments that work for primary industries and communities
5. informed, proactive and prepared agricultural industries that are continually reducing their emissions
6. relevant communication that reduces uncertainty a national climate strategy vision for primary industries

Dr Robinson elaborated on the National Climate Change Research Strategy for Primary Industries, which is currently being developed (visit www.lwa.gov.au/ccrspi). 'We are consulting with a wide range of people and organisations and welcome input from primary producers and industries about climate change,' he said.

Ben Fargher also highlighted the importance of research to underpin industry action to reduce greenhouse emissions. 'We can sequester carbon through tree planting, we can reduce methane emissions, and we can better manage our fertiliser. But there is a lot of uncertainty about their effectiveness and we need better information. We also need to be directly involved in setting up any emissions trading schemes.'

Ian McClelland said that most farmers are carbon recyclers rather than traders, but agreed farmers had a role to play in any carbon trading scheme. 'The price of carbon needs to be around \$100/tonne for any scheme to be beneficial to grain farmers,' he said. 'But sustainability is more than money in the bank. It's about prosperous farmers who live in a dynamic interesting environment and who are able to adapt to a changing world.'



Dr Cai doing what he loves

The lure of Australia's complex climate systems

More than 20 years after leaving China for Australia, and having built an international reputation as an oceanographer, Dr Wenju Cai, a member of MCV's Technical Advisory Committee, was invited back to his home country in November to advise the Chinese Government on strategies for managing water resources.

'The water problem in China is humungous,' says Dr Cai. 'The Australian experience is driven by drought and climate change and, while climate change is contributing to a rainfall reduction in northern China, the main problem is urbanisation.'

'When I left China in 1986, 96 per cent of the population were farmers. That's down to 60 per cent now and is expected to drop to 20 per cent by 2040. In the past 20 years, 450 million people have moved to the cities. That's more than the Australian population every year. As a result of this huge migration, water is already in short supply in 200 cities.'

A specialist in climate variability and its impact in Australia, Dr Cai is using his expertise to advise MCV on its R&D strategy for the next phase of the program and its research proposals. The MCV Technical Advisory Committee (see Table 1) is also responsible for reviewing final research project reports.

'Australia is interesting compared to other parts of the world. The continent is surrounded by three oceans that simultaneously influence our regional climate. These oceans don't always have the same directional influence and this makes it difficult to predict regional seasonal climate.'

'I am very fascinated by the complex climate systems in Australia. Each region is dominated each season by climate drivers which change from one season to another. It's tantalising—one factor will give you more rain but, simultaneously, two other factors may give you less rain. Just when you think you have a handle on it, climate shows that it has a life of its own.'

'The situation in 2007 attests to this point; we have an unprecedented combination of an Indian Ocean Dipole and a La Niña. The only other time we got close to this was 1967, when an Indian Ocean Dipole was accompanied by a La Niña-like condition, but not strong enough to be classified as one. We had severe drought that year.

'We should eventually be able to capture all the simultaneous influences. Because of climate change, it's hard to say when we'll have an improved model with enhanced skill. We need to develop capability in dynamical seasonal prediction which is, in fact, prediction in a changing climate. But in the next five years I expect a big improvement.'

Improving the skill of the forecast is step one for Dr Cai, and he emphasises the importance of a step two:

'We need to make it useful for farmers on the ground. I was a farmer back in China so I know how hard it is. And this year's big drought on top of a long period of dryness has made me feel that my job is more important—it is affecting people's lives.'

Dr Cai is a Stream Leader of Ocean Climate Characterization, part of CSIRO's Wealth from Oceans Flagship.

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Table 1: MCV's Technical Advisory Committee

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Dr David Bowran	Department of Agriculture and Food Western Australia, Western Australia
Dr Wenju Cai	CSIRO Marine and Atmospheric Research, Victoria
Dr Yvette Everingham	James Cook University, Queensland
Mr David Hamilton	Hamilton Consulting; Department of Primary Industries and Fisheries, Queensland
Dr Rohan Nelson	CSIRO Sustainable Ecosystems, Australian Capital Territory
Mr Sam Nelson	Bureau of Rural Sciences / Land & Water Australia, Australian Capital Territory
Mr Neil Plummer	Bureau of Meteorology, Victoria
Ms Mary Voice	Cumulus Consulting, Victoria

Climate predictions for better risk management

As our climate changes, Australia's weather will become even more variable. A key strategy to cope with climate change is to manage for variability, according to Colin Creighton, Program Coordinator of Managing Climate Variability.

'Improving seasonal forecasting skill is therefore imperative and is central to MCV's investment focus,' says Creighton.

'Tools that apply seasonal to inter-annual climate forecasts at the farm level are also an essential part of the strategy to manage climate change. They will make sure that the improved forecasts that we hope to achieve through our current investments are of value on farm.'

MCV's investment strategy is similar to that recommended by the World Meteorological Organization.

In the recent special issue of the *Australian Journal of Agricultural Research*, which focuses on 'Climate Predictions for Better Agricultural Risk Management' (Volume 58 Number 10 2007), Secretary-General of the World Meteorological Organization Michel Jarraud says, 'Ensemble predictions appear to show the most promise, but the spatial scales need to become even smaller, in order to promote field applications of these forecasts. Pilot projects demonstrating the application of such information have great potential, so direct participation by the farming communities in these pilot projects is essential to determine the actual value of forecasts and to identify the specific user needs.'

In this special issue, the preface is co-authored by Holger Meinke and Rohan Nelson.



Articles include:

- Making climate model forecasts more useful (Scott Power and colleagues)
- Constraints and opportunities in applying seasonal climate forecasts in agriculture (Andrew Ash and colleagues)
- How do probabilistic seasonal climate forecasts compare with other innovations that Australian farmers are encouraged to adopt? (Peter Hayman and colleagues)

You can read the foreword, preface and abstracts and buy the full-text articles online at www.publish.csiro.au/nid/43/issue/3729.htm



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