

Climate Champion Program update: workshops, media and awards by Sarah Cole

Despite a tough year on-farm for most of the Climate Champion participants, with it being either too wet in the east or too dry in the west, they have all been busy with program activities.



Photo: Econnect Communication

Brad McElroy shows farmers in the Climate Champion program a surge irrigation system at his property in Padthaway, South Australia. Almost 30 Climate Champion participants gathered in Adelaide in February for the 2011 national conference. The three-day conference included farm tours, workshops, climate and farming systems speakers and planning for this year's activities.


The program was launched in March 2010. Since then, many farmers taking part in the Climate Champion program have been talking to the media. They have shared their stories, practices and ideas with ABC Country Hour and Bush Telegraph program audiences, in newsletters, in rural magazines (Stock Journal, Farming Ahead, Rural Women's Network), on the web (ABC news and Get Farming Australia, the Archibull Prize blog), industry publications (Australasian Beekeeper, Grains Research & Development Corporation and Sugar Research & Development Corporation updates), and local papers. Email sarah@econnect.com.au for a full media report.

They have also been presenting to farmers and other members of the public at field days, demonstrations, conferences, festivals, and Q & A-style panels.

Some of the farmers have received accolades: Robert Quirk placed second for Farm Industry Leader of the Year, Matthew Pitt was elected president of the Tasmanian Landcare Association, David Bruer's wine won two trophies at the Australia/NZ Organic Wine Show, and Lynne Strong won the National Landcare Primary Producers Award as well as a Carbon Cocky Award.

Researchers have been in touch with participants about trials on their farms, studying nature-based farming practices, sharing rainfall records and looking at how farmers access weather information. Other state agency, regional Bureau, and initiative leaders have also made contact with participants.

The Climate Champion participants are now planning activities for 2011—and it looks like an eventful second year for the program and farmers. The program's national workshop was held in South Australia in February, which included farm tours and guest speakers.

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MANAGING
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Photo: Econnect Communication

Anthony Gordon crops wheat, barley, canola, chick peas, field peas and lupins in Forbes, New South Wales

What's new on Climate Kelpie?

by Tom Dixon

This month on Climate Kelpie, we have added a page of handy links to climate and weather sites courtesy of Susan Carn, a farmer taking part in the Climate Champion program.

Susan Carn's profile is available on Climate Kelpie and she has also shared some excellent websites with us. She's broken these down into how often she visits the sites—daily, weekly, monthly, and, as she likes to call it, 'anytime' reading.

Susan is a great fan of the Bureau of Meteorology's Water and The Land site. She finds the 'recent drought report' and '3-month rainfall outlook' particularly useful as they give both observations of the past 12 months of rainfall data and an outlook for the immediate future. Other weather sites she recommends include the National Oceanic and Atmospheric Administration (from the US) and forecasts from Australian Weather News, which allows you to view very specific forecasts by clicking on your region.

In addition to weather sites, Susan likes to browse through longer-term forecast sites to find out about the Indian Ocean Dipole (for example, on the Japan Agency for Marine-Earth Science and Technology's site), the Southern Oscillation Index (on the Queensland Government's Long Paddock site) and the El Niño Southern Oscillation (on the Bureau's site).



Susan's favourite site that she's discovered recently is the Department of Primary Industry Victoria's Climate Dogs. It uses clever animations to show how weather systems in southern Australia work, and Susan thinks it's a really simple way to explain a complex subject.

Also new on the Climate Kelpie website are more farmer profiles from the Climate Champion program.

Andrew Carmichael grows grains and legumes on his farm in Coolamon, New South Wales. Andrew describes how he tackles the challenges of a variable climate by using simple techniques such as monitoring soil moisture and managing input costs through soil health, such as rotating field peas into his crop to minimise nitrogen use.

Also profiled is Anthony Gordon who runs a family farm and manages a much larger cropping enterprise in Forbes, in central-west New South Wales. Anthony describes the benefits of using a moisture-retention system to retain water in situ where the crop is and how making sowing decisions on soil moisture has been key in his climate risk management strategy.

Visit Climate Kelpie at <www.climatekelpie.com.au>



An award-winning partnership: with your cows, the landscape and the community

by Sarah Cole

Lynne Strong's enthusiasm for nurturing her farming landscape has come to the attention of other farmers and her community—and garnered her dairy a slew of awards.

'Winning the National Landcare Primary Producer of the Year award has really given me a platform to expand on my passion', says Lynne Strong. 'I want to get out there and talk far and wide about what farmers are doing as environmental stewards of their land.'



Lynne Strong of Clover Hill Dairies at Jamberoo, New South Wales

Lynne Strong, from Jamberoo, New South Wales, farms Clover Hill Dairies with her husband Michael and son Nick. Their dairy farm won the National Landcare Woolworths Primary Producer of the Year award in 2010. The Strongs were eligible to enter the national competition after taking first place in the 2009 New South Wales Landcare Heroes Primary Producers Award.

'We were encouraged by our catchment management group to enter the New South Wales Land Care Primary Producers Award, and we were very excited to win that award.'

National Landcare Awards celebrate the work of individuals and groups from around Australia who are making a significant contribution to the environment.

The awards are just a part of how the Strongs have been recognised for their commitment to sustainable environmental practices. They recently won a Carbon Cocky Award, presented at the Carbon Farming Conference and Expo in Dubbo.

Lynne's winning farming strategies are also driven by being prepared for and managing variations in the climate. Lynne is taking part in the Climate Champion program.

'Our focus is to produce more milk using fewer resources and to generate less waste', Lynne says. 'We want to optimise the productivity of our landscape and our cows. We see our business as a partnership between our cows, our landscape, our farm team and our community.'

The Strongs have done extensive tree planting on their property. This not only created shelterbelts of vegetation to protect their cows, but established corridors for wildlife.

They also fenced off waterways on their property from the cows. 'That, of course, improved the health of our waterways and reduced the erosion near the banks of the creeks', Lynne says. Water quality has also increased since they fenced off the creeks.

The Strongs have also built concrete laneways through the rainforest for their cows. 'The cows travel a lot quicker on the laneways, which means their manure stays on the paddocks instead of being on the laneways and then eventually ending up in the waterways.'

These changes, for Lynne, are not just about being more profitable. 'If you don't invest in your landscape, you can't possibly be sustainable. Farm businesses have so many elements, it's important to get everything working in harmony.'

'When that happens, the economics come together, and productivity and profit allows you to reinvest in the landscape and your business.'

Part of a major change in the Strongs' business was a move to recycling or reusing most of the water they use in their dairy.

'This has helped us to become one of Australia's most water efficient dairy farms, producing 125,000 litres of milk per megalitre of captured water, which is 35 times the industry average.'

The Strongs have also created nutrient maps of their paddocks using soil testing, optimised their pasture growth, and bred cows that are more efficient at converting pasture to milk.

Lynne is also passionate about fostering relationships between rural providers and urban consumers. 'Farmers have lots of great stories to tell. My work in the community tells me they have a thirst for knowledge about farmers and farming practices. It's imperative to find new ways to bring the two together, share stories, improve understanding and work through potential issues.'

Other people recognise Lynne's passion too—in December last year, Lynne's volunteer contributions to her community were celebrated. New South Wales' Rural Women's Network named her a 'Hidden Treasure' and Casella Wines awarded Lynne a scholarship as a part of their 2010 Rural Women's Award.

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Project updates

The following table lists our current projects.

Project title	Time	Summary of research objectives	Progress to date	Research contact
Improving seasonal forecasts for south-west Western Australia	2008–11	Increase the accuracy and value of seasonal forecasts for farmers in south-west Western Australia.	Improved forecasting skill at using the Indian Ocean as a climate driver has been developed and is being implemented as part of POAMA model development. The Agricultural Production Systems Simulator modelling work has shown the trade-off between sowing date and frost risk. This indicates that frost forecasts may be of value in areas where there are only small losses in yield potential with delayed sowing, and where there is a high frost risk.	Dr Senthold Asseng CSIRO Senthold.Asseng@csiro.au 08 9333 6615
Critical thresholds and climate change impacts / adaptation in horticulture	2009–11	Understand the critical temperature thresholds for specific horticultural crops and production regions in Australia. Identify commodities and/or regions which will be significantly impacted by increasing temperatures. Assess the impacts and resilience of production systems and/or regions, and identify adaptation strategies to address these impacts.	Information on temperature thresholds for all crops and regions tested during the study are being assessed to identify adaptation strategies to cope with the predicted longer-term higher temperatures. These adaptation strategies will complete the project, with the final report due in early 2011.	Peter Deuter Department of Employment, Economic Development and Innovation (DEEDI) peter.deuter@deedi.qld.gov.au 07 5466 2233
Extremes, climate modes and reanalysis-based approaches to climate resilience	2008–11	Using the latest atmospheric reconstructions of the last century of worldwide weather, find ways to help manage climate risk of extreme weather events in Australian agriculture. Options include adaptation, insurance, seasonal forecasting and future strategic projections for heatwaves, hail and other exceptional circumstances.	The project has converted available climate information for Australia from the 20th Century/ACRE projects into a user-friendly climate website. The site now gives access to seasonal forecasting of hail potential for key agricultural regions in north-eastern Australia. Upon completion of the project in June 2011, the site will deliver probability forecasts of hail or heat stress and suggest suitable weather insurance procedures.	Dr Peter Best University of Southern Queensland cindualpk@bigpond.com 07 3844 1777
Assessing and managing heat stress in cereals	2008–13	Investigate the meteorology and climatology of spring heat events on the southern grains wheatbelt. Develop a risk management package for growers.	During 2010, heat chambers were used to heat wheat at six different growth stages—from stem elongation, flowering through to grain fill, to early grain ripening. The aim was to explore the impact of heat events at different times of the year. A single day where wheat was exposed to 35°C reduced yields by about 25% or 1 t/ha, compared to untreated controls. The team is also analysing weather patterns that give rise to these events to determine whether there are clear trends in these extreme events as part of the development of risk management strategies.	Dr Peter Hayman South Australian Research and Development Institute peter.hayman@sa.gov.au 08 8303 9729
Teleconnections between climate drivers and regional climate, and model representation of these links	2010–13	Improve Australia's dynamical forecasting by investigating the connection between several weather systems, including the Southern Oscillation Index, Indian Ocean Dipole, Madden-Julian Oscillation, subtropical ridge and Southern Annular Mode.	Recent work has identified the cut-off low as the most important weather system for growing-season rainfall in south-east Australia. Diagnostic software has been developed that can automatically recognise cut-off lows in data and models, allowing a comparison of observed and modelled cut-off lows. Cold fronts are also an important source of rainfall. An automatic recognition system for these weather systems is being developed and tested. A comparison of observed and modelled synoptic weather system behaviour can help indicate areas for dynamical model improvement in the way remote climate drivers influence local weather.	Dr Peter McIntosh Centre for Australian Weather and Climate Research Peter.McIntosh@csiro.au 03 6232 5390

Project title	Time	Summary of research objectives	Progress to date	Research contact
Improving forecast accuracy through improved ocean initialisation	2010–13	Improve predictions of conditions in the Indian Ocean and ultimately predictions of regional climate for western, southern and eastern Australia.	The project has compiled deviations of Indian Ocean temperature to understand the performance of the Indian Ocean Dipole and its correlation with weather events. The skill of POAMA-2 against the available climate record, in the context of the Indian Ocean Dipole, is being assessed to determine the next priority areas for model development.	Dr Oscar Alves Centre for Australian Weather and Climate Research O.Alves@bom.gov.au 03 9669 4835
Improving multi-week predictions	2009–12	Improve POAMA's weather predictions 2–8 weeks ahead to make them more useful to agriculture and water management industries.	Initial assessment of the multi-week forecast skill for Australian rainfall and temperature has been completed with the POAMA-1.5 hindcast (where past events are modelled and outputs compared against actual results). A strategy is being developed to deliver these multi-week forecasts routinely. Work is also underway to determine the main modes of predictability on multi-week timescales, the ability of dynamical modelling to predict heatwaves and the influence of the Southern Annular Mode on the multi-week timescale.	Dr Debbie Hudson Centre for Australian Weather and Climate Research D.Hudson@bom.gov.au 03 9669 4796
Understanding frost risk in a variable and changing climate	2010–12	Improve understanding of the variability and changing nature of frost risk at both seasonal and decadal scales for the southern regions of Australia, and implications for the wine and grain industries.	The project has sourced hourly, three hourly and daily climate data from the Bureau of Meteorology (Bureau) and is analysing these data to link synoptic patterns with frost occurrences. This covers 62 weather stations south of the 30 degree southern latitude such as Wagga Wagga, Horsham, Albany and Lamerloo. Three alternative indices for synoptic characteristics are being analysed to link frost events to synoptic conditions for each weather station.	Dr Steven Crimp CSIRO Steven.Crimp@csiro.au 02 6242 1649
Climate drivers and synoptic features – New South Wales, Northern Territory and Tasmania	2010–13	Improve understanding of the links between climate drivers and synoptic features. Describe the climate drivers for the remaining states/territories (NSW, NT and Tasmania) and provide examples of key synoptic features from the Bureau's record of key weather events.	The climate drivers for NSW, NT and Tas have been analysed, recorded and are being loaded onto the Climate Kelpie website Additional examples and enhancements to the climate driver descriptions for the other states have also been completed and are being uploaded.	Ceri Lovitt Bureau of Meteorology C.Lovitt@bom.gov.au 03 9669 4859
Multi-week forecasting products (Water and The Land website)	2010–13	Using multi-week forecasts identified under the 'Improving multi-week predictions' project, make new forecasting products available on the Bureau's Water and The Land (WATL) website. The products will be tested by farmers participating in Managing Climate Variability's Climate Champion program.	The project is developing draft climate products for discussion and review by Climate Champion participants over the next four months. The Bureau intends to use inflation of variance techniques to give realistic model spread, and hence make possible a realistic 'high' and 'low' forecast, and/or a range. The Bureau are also scaling the results using observed data, giving an 'Australian Water Availability Project (AWAP)-like' high-resolution grid of real-world-comparable forecast values.	Dr Andrew Watkins Bureau of Meteorology A.Watkins@bom.gov.au 03 9669 4360
Understanding frost and heat stress extremes in the WA wheatbelt	2010–13	Quantify the extremes and impact of frost and heat stress on the WA wheatbelt. Link with the frost and heat stress projects underway in SA and Vic to improve understanding of frost and heat stress across southern Australia.	Risk of frost has been found to be significantly affected when there are large monthly or seasonal temperature deviations during a particularly warm or cold season. Further analysis of weather patterns and heatwaves is underway so that climate risk management strategies for WA can be developed.	Dr Ian Foster Department of Agriculture and Food, Western Australia Ian.Foster@agric.wa.gov.au 08 9368 3333

Managing climate risk, one region at a time

by Robbie Mitchell

Australian farmers will soon have a greater understanding and appreciation of the variability of their local climate, and how the risks associated with it need to be planned for and managed on a region-by-region basis.

Starting in 2011, a team from Newcastle University will be collecting over 100 years of climate data from all of the Bureau of Meteorology's regional weather stations. The climate data will be analysed for variability and trends, and packaged into region-specific climate products. The products will then be freely available on the Climate Kelpie website for farmers to use when developing their own climate risk management strategy.

'By collating climate information from key agricultural climate stations across Australia, this project will place the changing nature of Australia's variable climate, for each region, into context', says chief investigator Dr Anthony Kiem. 'This is very important as farmers start to appreciate how their local climate has varied in the past, has changed more recently and how the risks associated with this variability needs to be planned for at a farm scale.'

A detailed assessment for the cereals and horticulture industries has demonstrated that, until 2030, coping with and responding to climate variability is of much higher importance than dealing with the projected man-made impacts of climate change.

'People are talking about the risks of man-made climate change, but the risks associated with natural climate variability are just

as, if not more, important—especially in the near future and particularly at the farm-scale. Unfortunately, managing climate variability has been somewhat lost in the conversation around managing climate-related risk', says Dr Kiem.

'This project will highlight the need for climate forecasts that are regionally-specific and of practical use.'

The major challenges for the project will be collecting data from all of the Bureau of Meteorology's regional weather stations scattered through all major growing regions of Australia, and deciding which climate products will be of most use to farmers. To help with this process, Dr Kiem has enlisted the help of end users: farmers and Climate Champion program participants.

So just what are the potential new products?

From feedback so far, Dr Kiem and his co-chief investigator, Dr Danielle Verdon-Kidd, have already found that most farmers are comfortable with probabilities and statistics, but the way that the information is recorded and packaged is not very useful to them. An example of this is a forecast saying that there is going to be a 60 per cent chance of above-average rainfall for the month.

'This is not very useful to farmers because they want to know how much more than the average they will receive and what the likely rainfall chances are for the other 40 per cent of the time—for example, average, below average, or a lot less than average', says Dr Kiem.

Dr Kiem says that knowing what products will be useful to Australian farmers to answer these questions is the 'major challenge.'

'We would love to please all farmers and offer all products but because we only have a year, we will focus on about five main climate products that we have asked farmers and Climate Champion participants to prioritise for us', Dr Kiem says.

Products that are being considered could deliver climate information such as:

- critical temperatures for when crops can be planted or will stop growing
- optimal finishing conditions
- number of frost days per season
- growing season rainfall



Dr Danielle Verdon-Kidd, School of Environmental and Life Sciences, University of Newcastle

Dr Anthony Kiem, School of Environmental and Life Sciences, University of Newcastle

The aim of new products is to move away from averages, to focus on trends and quantifying variability.

'It's the extremes that people are most worried about', says Dr Kiem.

'The problem with climate risk management at the moment is there is too much focus on averages rather than the variability surrounding them. We already know the average, but we want to know how often you don't get the average. And if you don't get the average, how far away from the average is it?

'If you are in an area where 8 seasons out of 10 you are receiving well below average rainfall, then to manage that risk is totally different to getting at least your average rainfall 8 seasons out of 10', says Dr Kiem.

Colin Creighton, Science Manager of Managing Climate Variability, notes the imperative for agriculture to get away from the concept of averages. He says: 'As this last season has shown, it is the extremes of wet and dry that we need to be able to manage. Maximising profits in good times and minimising losses in the bad times are the imperatives of climate risk management.'

Dr Kiem says he is still looking for input from farmers round Australia as to what climate products will be of most use to them. He has asked for interested readers to contact him with any suggestions.

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Climate-analyser app

for Australia's next-generation farmers

by Alison Binney

David Freebairn has a simple vision. He wants to be able to give farmers what they want—climate data that will support risk management and decision-making by either reducing uncertainty or offer insight into the level of uncertainty.



Dr David Freebairn, RPS Brisbane

Developments in information communication technologies, such as Internet and mobile telephone applications, are driving Dr Freebairn's vision for a more refined and simple application (app) for farmers. He is currently working on a new climate-analyser app that, he says, will 'build on a series of current, but ageing tools' and become an integral part of a farmer's decision-making process.

The new app will be more accessible than current tools and use real-time weather information. Dr Freebairn says the idea is to develop and implement applications now that will be relevant for the next generation of farmers across Australia.

Gadget-savvy farmers will drive project's impetus

'The current tools are often difficult to use and update, have limited forecasting options and are not really customisable', says Dr Freebairn.

Dr Freebairn says a high adoption rate by farmers of new smartphone technologies will 'torpedo' the project forward, and increase farmers' access to better information.

According to Dr Freebairn, the crunch question that any farmer should be able to get an answer to with the new climate-analyser app is: 'What are the chances of getting either X-amount of rain, X-degrees of temperature or X-heat sum degree days between any two dates?'

'The new app needs to be able to answer many questions because the users [farmers and farm advisers] will have many different perspectives and situations', says Dr Freebairn. For example, a farmer's tactical decision needs to also fit with the future market conditions and personal preferences.

With the proposed new app, forecasts will be based on historical weather records and then adjusted based on proven forecast systems such as HowOften? and HowWet?. The application of experimental approaches, such as the Predictive Ocean Atmosphere Model for Australia, will also be explored.

The results will then be delivered in various digital formats such as tabulated data, plain text or graphic illustrations, and will include other derived variables such as soil water, nitrogen mineralisation, frost risk, flowering date and possibly disease risk.

In order to best estimate future expectations, we can use recent weather data to gauge the system's status. This can then be combined with a prediction of the future which is made up of long-term probabilities (climatology) and forecasts.

Outcome of future event = current condition + future event		
Recent event →	Now (a decision point) →	Future event
Recent climate history <ul style="list-style-type: none"> - Rainfall - Temperature - Soil type - Prev. crop 	Derived status <ul style="list-style-type: none"> - Soil water - Nutrition - Disease - Weeds - Supported by <u>observation</u> 	Distribution of future conditions <ul style="list-style-type: none"> - "Climatology" - Forecast indices - POAMA forecasts

Computer applications quicker and more objective

Dr Freebairn considers discipline and objectivity to be good practice in managing risk, and these are things that computer applications can provide quickly.

'While we can flick through books with 50 years of rainfall records, computers make the task of exploring probabilities of rain, temperature and derived variables simple and fast. Using this objective risk assessment is a good discipline and helps us get out of the trap of being too optimistic or pessimistic based on recent weather', he says.

'Computer-based applications allow for many "what ifs" to be explored without any risks being taken. The easier the model or decision-support tool is to use, the more chance it has of being used.'

Dr Freebairn sees the potential role of the new climate-analyser app as greatly improving farmers' capacity to manage risk and uncertainty, at the same time as providing a more productive space for farmers to access probabilities and manage climate variability.


'What challenges farm decision-making is uncertainty—uncertainty in weather, markets and outcomes of many agronomic practices', he says.

'In all cases, ready access to information on current conditions and future probabilities should be available to enrich decision-making.'

The new climate-analyser app will bring together the best-of-the-best current tools available which farmers already use for informing their decisions. These include: Rainman StreamFlow, potential-yield calculators, Whopper Cropper and others as featured on the Climate Kelpie website.

While Dr Freebairn cannot say exactly what shape or design the new app will take, he says algorithms from existing software would be important for the success of the new climate-analyser prototype, plus access to the best data available from the Bureau of Meteorology.

The new climate-analyser app is projected to be available in 2012 on the Climate Kelpie website as well as packaged as an app for smart phones. There will also be provisions in place to cater for some more traditional paper-based users. The farmers taking part in the Climate Champion program will test the new application, and user manuals and training support will be developed to support the adoption process.

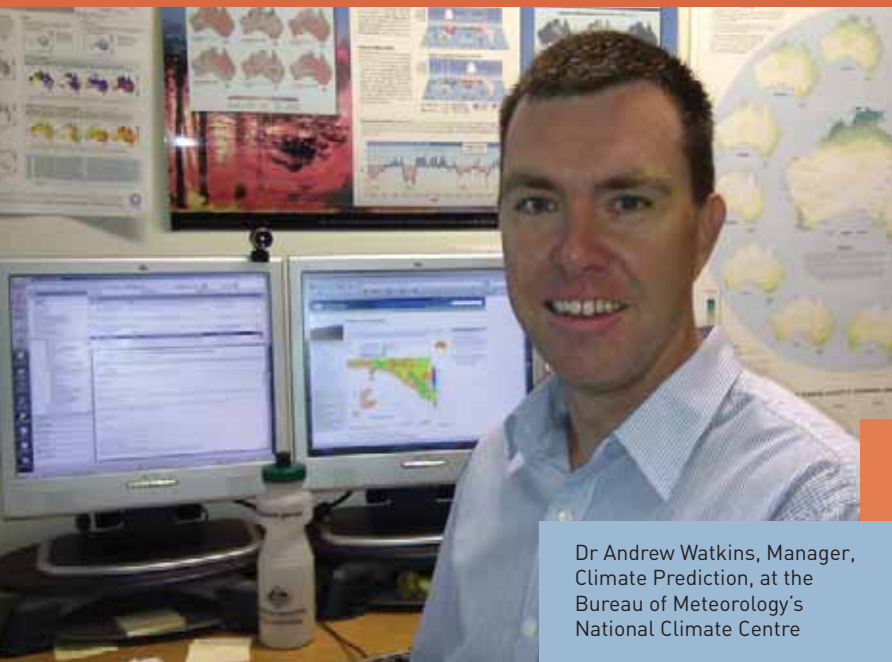
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Dr Freebairn says computer-based applications allow for many 'what ifs' to be explored without any risks being taken. Farmers need an app that can answer the question: What are the chances of getting either X-amount of rain, X-degrees of temperature or X-heat sum degree days between any two dates?

POAMA: the dynamism of dynamical modelling

Latest advances in dynamical forecasting are promising

by Alison Binney



Dr Andrew Watkins, Manager, Climate Prediction, at the Bureau of Meteorology's National Climate Centre

Advances in the skill of dynamical modelling systems are so promising that scientists worldwide have dubbed these climate models as the inevitable 'multi-week and seasonal prediction tool' of the future.

Australia's Managing Climate Variability program has been investing in projects aimed at improving models that use physics to simulate the atmosphere and the ocean (called dynamical models), rather than rely on observations of historical climate records (statistical models), with a view to expediting climate forecasting for Australian agriculture. Recent results highlight substantial progress in this work.

The main investment point for improving dynamical modelling skill has been in the Predictive Ocean Atmosphere Model for Australia (POAMA). POAMA is a state-of-the-art, multi-week to seasonal dynamical forecast model. It was developed by scientists at the CSIRO and Bureau of Meteorology (Bureau). POAMA is part of the Australian Community Climate and Earth-System Simulator modelling system, which is also used for weather forecasting and climate change projections.

A recent study looking at how POAMA results could be applied to farm management in south-west Western Australia demonstrated the potential for dynamical seasonal outlooks, where significant farm profits were made by varying decisions based upon the outlooks. While such profits cannot be guaranteed every year at every location, the study highlights how using a skilful model will put agriculture ahead.

Colin Creighton says the emerging power of dynamical models is increasingly apparent.

'Dynamical model-based climate forecasts are able to provide outlooks in the timeframes suited to many on-farm climate related decisions, such as predicting two to eight weeks ahead when the autumn break of rain is likely, so that grain growers can prepare to sow their crop in a timely manner; or, likely soil moisture during the growing season as part of determining whether to top-dress or not,' he said.

'The POAMA model correctly tipped the 2010 La Niña several months in advance. And indeed, picked it during autumn, which traditionally is the hardest period for models to forecast from because the oceans and atmosphere typically 'decouple' at this time. That's a great achievement', says Dr Watkins

A key focus of the POAMA model is the provision of intra-seasonal or multi-week forecasts. These provide more detail on timescales of weeks—a timescale that has been difficult to address in the past, as it sits between weather forecasting, which relies upon very accurate regional initial conditions to extrapolate a forecast out a few days, and seasonal outlooks, which use larger-scale climate drivers to determine how the average weather conditions may be changed (e.g. generally wetter and cooler when driven by La Niña).

For the five years from 2009 to 2013, Managing Climate Variability is contributing in excess of \$6 million, matched by the Bureau and CSIRO, to improving dynamical modelling-based climate forecasting.

This includes both improving the physics of the national models such as POAMA, and investigating the potential skill and usability of a range of products on timescales from weeks to seasons.

Dynamical forecasting will be used by the Bureau to predict both weather and climate, and a range of farmer-oriented information products will become available on the Bureau's Water and The Land website.

Dynamical modelling: achieved and planned milestones

Dr Andrew Watkins, from the Bureau's National Climate Centre, says the most significant achievement to date has been the skilful forecasts for El Niño and La Niña.

'The POAMA model correctly tipped the 2010 La Niña several months in advance. And indeed, picked it during autumn, which traditionally is the hardest period for models to forecast from because the oceans and atmosphere typically 'decouple' at this time. That's a great achievement. It also correctly forecast the 2009-10 El Niño well before it arrived in the equatorial Pacific', Dr Watkins notes.

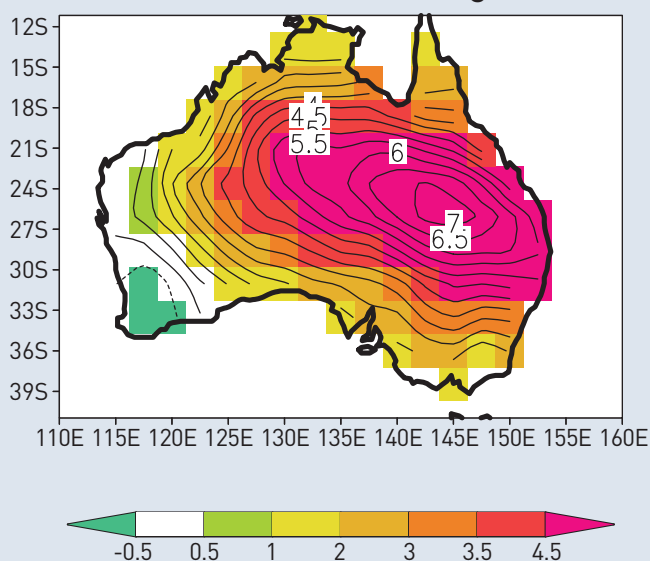
Multi-model ensembles: the 'wide-angle' view

One of the ways ahead for dynamical modelling which appears to have a number of advantages is that of multi-model ensembles.

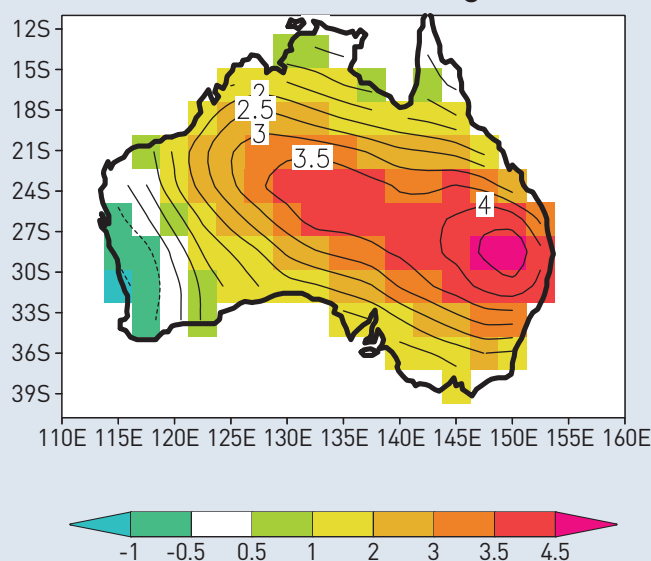
Multi-model ensembles combine the outputs of several dynamical models, which results in a higher level of reliability, and potentially skill, compared to using one model alone.

'In essence, it's a bit like the weather forecasts for rainfall on the WATL [Water and The Land] website, which is a multi-model ensemble, but using weather forecast models rather than climate models. This approach has proven to be successful, and many farmers now use this with a high level of confidence', says Dr Watkins.

a) Observed: 15-28 Aug 2009



b) POAMA: 15-28 Aug 2009



Example of a POAMA multi-week forecast: maximum temperature anomalies averaged over the fortnight of the 15-28 August 2009 from a) observed, and b) forecasted by POAMA-1.5 (forecast issued 15 August 2009)

Looking toward next year and advances in the POAMA model, Dr Watkins says the next version of the model, POAMA-2, will be operational in early 2011, and will provide outlooks for the El Niño - Southern Oscillation (ENSO) up to eight months ahead. He envisages that improvements will mean more realistic and usable probabilities from the model.

'The work done with POAMA-2 will feed into the development of the new POAMA-3. POAMA-3 will have new bells and whistles, including increased resolution with more regional detail that we've long been waiting for, and we should see a further improvement again in its capability', Dr Watkins says.

Scientists will continue verifying their models over large scales of time and space. Dr Watkins says: 'We have to be careful not to overemphasise skill at one single location, as that may occur by chance. However, the larger scales you go to, the greater the confidence we have, and the more likely that you will be getting a true assessment of the model's worth.'

The Bureau will assess the POAMA-2 hindcasts (forecasts replicated using data back to 1960) to test how well the model may have performed over this period, and will also have ongoing independent forecast verification as the model is run in real-time.

'A single model on its own doesn't really know anything about other possibilities beyond those that it can simulate—it has a somewhat blinkered view of the world. In contrast, a multi-model ensemble has the wide-angle lens.'

By having POAMA, Australia is a player in the wider multi-model ensemble game, which will not only provide benefit to Australian scientists through access to other models, but it will in turn benefit POAMA as we learn why other models perform differently to our own.

'Rainfall and temperature outlooks from multi-model ensembles are still some way off, but their potential is exciting', Dr Watkins notes.

ENSO outlooks from the POAMA model can be viewed at: <www.bom.gov.au/climate/coupled_model/poama.shtml>

Experimental multi-model ensemble results, which include POAMA, are available from the APEC Climate Centre (APCCC); see: <www.apcc21.net/climate/climate01_01.php>

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Future climate science is about managing the variability now

2011 is the tenth operational year for Managing Climate Variability—and it will not be without big challenges.

In our involvement in climate science to date, we have been able to harness advances in climate science at a national and international level. We have formed valuable partnerships with policymakers, climate scientists and agricultural scientists to ensure Australian farmers benefit from our investments.

What characterises Managing Climate Variability is the two-way street in which climate science is delivered to farmers and that farmers are given the means to influence the direction of climate science.

However, the need for more reliable climate risk management information and tools is more pressing now than it was when Managing Climate Variability was conceived in the early 1990s. Even though farmers are more sophisticated in their understanding of our variable climate and have many more technologies to assist their management decisions, there is still much more that can be done to help them.

Farmers want forecasts and management technologies that help them make wise decisions, not lucky ones. Our scientists need to have the necessary resources to improve forecasting skills. Forging mutually advantageous relationships between farmers and scientists continues to be the best way to maximise gains in managing climate variability.

One of our biggest success stories has been the improvement made in multi-week dynamical forecasting skills that is now possible with the Predictive Ocean Atmosphere Model for Australia (POAMA). Tests results published in December 2010 have shown that the POAMA model was more than 70 per cent accurate in predicting whether growing season rainfall was above or below average.

Managing Climate Variability has been focusing its investment on POAMA to improve dynamical modelling of multi-week forecasts from seven days to eight weeks.

But it is important to note that there is a balance and a trade-off between the amount of resources that should be spent on studies predicting the climate in 20 or 50 years' time and resources for managing climate variability now. The tools, techniques, research expertise and networks of researchers and farmers that we have developed form the foundation for much of the applied research and development on future management and adaptation to climate change.

We believe that providing better information and tools to help farmers to better adapt to our variable climate, be it wet or dry years, will also help them to be more resilient to climate change. Despite the importance of climate change, it is logical that being able to adapt to extremes of climate now will provide farmers with the necessary skills to be sustainable in the future, whatever the reality might be.

As a farmer and the chair of Managing Climate Variability, I believe that we have achieved much in the past and have the capacity to deliver even greater advances in the future, particularly in providing more accurate short- and medium-term forecasts so that farmers have the knowledge to make more informed decisions.

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**Grains
Research &
Development
Corporation**



Australian Government

**Department of Agriculture,
Fisheries and Forestry**

**Rural Industries Research and
Development Corporation**

**Sugar Research and
Development Corporation**

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For more information on Managing Climate Variability, visit www.managingclimate.gov.au

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