CliMag

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From big picture to regional relevance

Physics 'without borders' helps solve the complexity of Australia's climate drivers

by Sarah Cole

When it comes to what drives our climate and weather, much depends on large-scale changes in the earth's atmosphere and oceans that are remote to Australia.

For example, the El Niño-Southern Oscillation (ENSO) operates in the Pacific Ocean, the Indian Ocean Dipole in the Indian Ocean, and the Madden-Julian Oscillation is a pulse of cloud and rainfall that travels around the world near the equator.

What we experience is weather; climate is the averaging of these conditions over time.

From offshore drivers to regional climate effects

There are many regional differences in our climate, and much variation in how farmers make decisions based on forecasts.

However, Australia's climate drivers often affect each other, and do not conform to the boundaries of states, regions or the remit of research institutions.

Each driver's influence can interact with another's—sometimes adding together or cancelling out—which affects synoptic features (such as cloud bands or cut-off lows) at different times of year.

Australia's climate drivers

Eastern: ENSO is dominant and affects the activity of other 'smaller' drivers.

Southern/western: Influences from drivers in more southern latitudes increase.

Northern: Tropical drivers strongly influence weather and climate.

See the Climate Kelpie website for examples: www.climatekelpie.com.au

Dr David Jones, who manages climate monitoring and prediction at the National Climate Centre (Bureau of Meteorology), explains: 'Every part of Australia's climate has influence on other parts. Everywhere can be affected by a regional climate driver, but not equally. For example, we have seen a monsoon low come all the way down south, causing the January 2011 floods in northern Victoria', he says.

Capturing complexity to provide strong predictions

How these drivers interconnect gives researchers clues into the future of seasonal climate forecasting.

To account for the complexity of how they connect, a dynamical model is the only way forward—a model that uses real-time data to predict the future ocean and atmosphere conditions.

Farmers are experienced at integrating information from charts, and signals from their land, into their enterprises.

In contrast, statistical models look back at previous weather patterns to predict future weather.

Because Australia has many different drivers, scientists cannot get down to one index encompassing all those drivers to make a prediction.

[continued on page 2]

In this issue

MANAGING CLIMATE VARIABILITY R & D PROGRAM

[continued from page 1]

Fortunately, a sophisticated dynamical model called POAMA (Predictive Ocean Atmosphere Model for Australia) has been developed, and is continuously being improved.

POAMA models the physics of the atmosphere and ocean 'without borders'. Dr Debbie Hudson, senior research scientist at the Bureau of Meteorology, explains:

'When we look at the climate drivers—such as ENSO—in POAMA, our first step is to see if POAMA can capture the ENSO mechanism correctly, as well as the link between ENSO and Australian rainfall and temperature.

'We then look at how well the model can actually predict ENSO and the related regional Australian climate. This helps us to understand the strengths and weaknesses of our forecast system and work towards improving forecasts', says Dr Hudson.

Dr Jones estimates that, by moving from statistical to dynamical models, the predictive skill for rainfall has improved so much it is correct twice as often, though there remains much room for further improvement.

Linking weather systems and remote drivers

ENSO, the Indian Ocean Dipole and the Southern Annular Mode are seasonal climate drivers which influence the weather, causing wetter or drier seasons.

But these drivers are phenomena remote from Australia—how, and how much, do these drivers influence our local rain-bearing weather events?

Dr Peter McIntosh (CSIRO) is leading a research team for Managing Climate Variability to answer these questions to improve modelling of these 'teleconnections'.

See page 6 for Dr McIntosh's tips for using forecasts more effectively.

Farmers help to guide the science

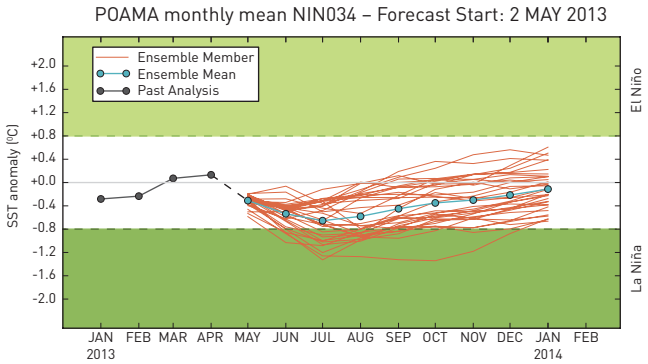
Farmers have an essential role to play in helping develop better forecasting products for Australia. Dr Jones emphasises that scientists need to keep up with the critical decision points for farmers.

'We have been working with farmers for many years, but as people adapt and get more innovative, we still need those ideas from agriculture', he says.

The biggest difference, Dr Jones says, is that people who directly experience the weather and see changes in seasons give researchers a 'useful idea of the impact and importance of the numbers on a graph'.

'Viticulture, which can be very temperature sensitive, can experience major impacts from what seems like a small number. Producers know that sensitivity.'

Dr Debbie Hudson agrees. 'End users give us background information—then we tailor our analysis, and use those suggestions in developing experimental products. People can also guide the presentation of a product', she says.



A monthly model forecast of ENSO and IOD generated by POAMA. The multiple 'runs' of the model shown give a range of possible developments for sea-surface temperature in equatorial Pacific and Indian Oceans.

Commodity/industry	Forecast needs / decision points
Cropping	Probability of spring frosts Soil temperature and temperature thresholds, October–December
Summer cropping	Autumn break [when reliable rainfall starts for winter-dominant rainfall regions] 20 mm of rain over a 4-day period from late April Probability of 25 mm of rain after sowing, 4 weeks out
Livestock	Early autumn break Extreme temperatures, 7 days out (for its effect on grains)
Pork and poultry	Heat extremes, 7 days out
Rice, cotton and horticulture	Heat units [cumulative heat a crop has experienced], 3 months out Threshold temperatures, 3 months out Forecasts for October–December
Viticulture	Rainfall in spring/winter, 3 months out

Researchers are keenly aware that their products are effective only if they are tailored and communicated well. The feedback from Climate Champion farmers on recent multi-week forecast work was a good example of that, says Dr Beverley Henry.

Dr Henry, science coordinator of Managing Climate Variability, says that 'farmers have differing capacities and perceptions of how much risk they should take. Many farmers are incredibly good at interpreting information and integrating that into their own enterprises.'

She sums up why climate risk management is so important: 'Part of what producers do is managing climate to manage income variability and reduce the risks of financial loss.

'But the other critical management aspect is managing their farm's capacity to produce, by preventing long-term resource degradation such as loss of soil health, or loss of ground cover possibly increasing the risk of erosion.'

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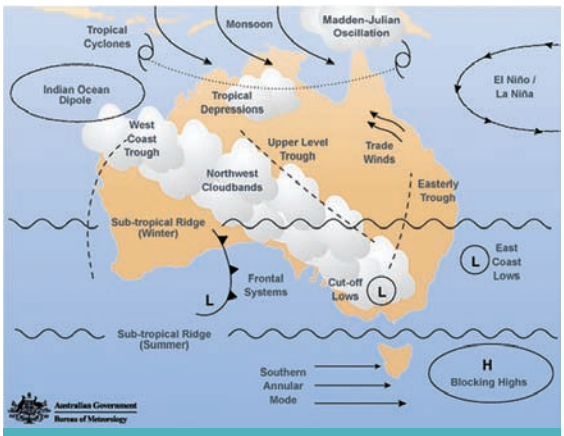


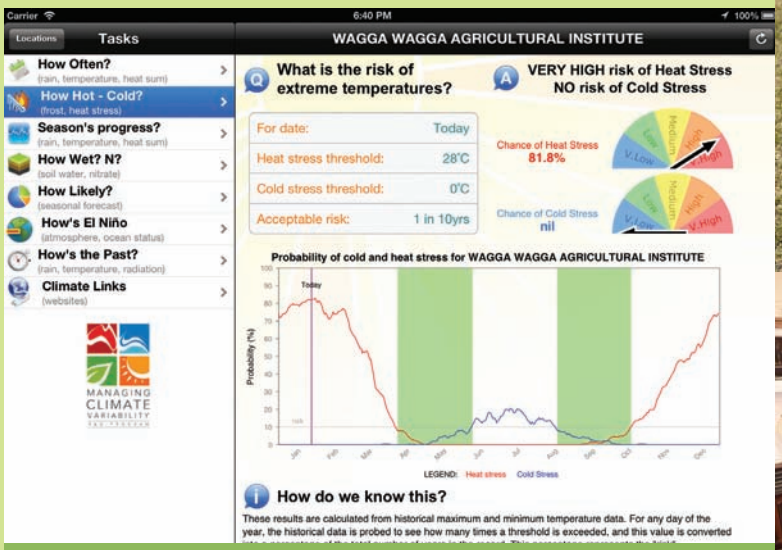
A summary of the main climate drivers and synoptic features of Australia's climate and weather

Your CliMate at your fingertips

New app answers local climate questions

by Sarah Cole

With a swipe of your finger, a new iTunes app now delivers 60 years of Bureau of Meteorology data —for your location—into the palm of your hand.



Copyright: Deanne Attard

David Freebairn (pictured left) and David McClymont developed the CliMate app, which has been downloaded onto mobile devices at least 3000 times already.

Copyright: Andrea & Mark Hannemann

Below: Andrea and Mark Hannemann (standing rear, right-hand side) shared the new CliMate app with young agriculture students while speaking about farm planning and tools for decision-making.

Answers to questions such as 'How wet?' and 'How cold?' are just a touch away on iPhone, iPad and iPod devices.

The app, Australian CliMate, delivers recent weather data and likely climate probabilities. It is the first app to 'interrogate' long-term weather statistics using a set of decision-makers' questions.

Seasonal outlooks are given, based on analysis of Pacific and Indian Ocean sea surface temperatures, and provide a measure of past skill for the forecast.

CliMate can also calculate heat sums, and estimate soil water and soil nitrate accumulation in fallows where soil water is important for cropping prospects.

'Anyone who uses probabilities of weather events in their decision-making—whether they be a grain grower, grazier or grape grower —can use the questions in CliMate', says Dr David Freebairn.

Dr Freebairn (Principal Environmental Scientist, RPS) and David McClymont (DHM Environmental Software Engineering) developed the app for Managing Climate Variability.

The app aims to help people access and understand past climate statistics and forecasts, and upcoming seasonal predictions. Since December 2012, it has been downloaded onto mobile devices at least 3000 times. The web version at <www.australianclimate.net.au> extends its use even further.

Farmers in the Climate Champion program and on Grains Research & Development Corporation regional panels helped road-test the app before its release. Climate Champion participants Andrea and Mark Hannemann, who produce crops and fat lambs in South Australia, say it is a very powerful tool for their enterprise.

'We like how it combines current data and historical data relevant to our area. For us, it's a great tool to help make decisions like crop planting and establishment, spraying and fertiliser application', Andrea says.

'The 'How's El Nino?' question explains the concept very well, and the 'How likely?' question links to current Bureau of Meteorology and Long Paddock forecasts.'

Find CliMate in the App Store by searching for 'Australian CliMate', or go to <www.australianclimate.net.au>.

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The seven key CliMate tools

1. How often? Example: What is the chance of planting rain based on an amount of rainfall over so many days?
2. How hot-cold? Example: When determining an ideal sowing date, when are cold stresses lowest for the optimum flowering time?
3. Season's progress? Example: When adjusting inputs during a crop or pasture season, how does the current season's heat sum compare with previous seasons?
4. How wet? N? Example: How much water and nitrate have I stored over the fallow?
5. How likely? Example: Based on current ENSO conditions, what is the probability that rainfall is greater than key thresholds?
6. How's El Nino? Example: What is the current ENSO status based on key atmospheric and oceanic indicators?
7. How's the Past? Example: What have been the monthly and annual temperature summaries in the past?

Project updates

The following table lists a selection of our current projects.

Project title	Time	Summary of research objectives	Progress to date	Research contact
Multi-week climate outlook products for Australia (Phase 2)	2012 –13	Produce a set of web-based tools for a multi-week rainfall forecasting service and make the tools available on the Bureau's Water and the Land website.	Phase 1 of this project produced prototype tools for multi-week forecasting (the period between 7 days and 3 months) using raw experimental data produced by POAMA-1.5. The products were trialled with Climate Champion participants. Phase 2 will continue to improve the prototype tools and develop the web interface.	**Dr Andrew Watkins** Bureau of Meteorology A.Watkins@bom.gov.au 03 9669 4360
Assessing and managing heat stress in cereals	2008 –13	Investigate the meteorology and climatology of spring heat events on the southern grains wheat belt. Develop a risk management package for growers.	In this final stage of the project, researchers are examining the likelihood of heat events at different locations and at various crop growth stages to estimate the likely damage in the current and future climates. An experiment is under way to further understand the interaction between heat and moisture stress.	**Dr Peter Hayman** South Australian Research and Development Institute peter.hayman@sa.gov.au 08 8303 9729
Predictions of heat extremes on the multi-week timescale	2012 –14	Investigate the ability, or skill, of POAMA for making predictions of extreme heat events for forecast timescales of less than 1 month.	This project started by exploring the large-scale climate drivers (specifically, the El Niño-Southern Oscillation (ENSO), the Madden-Julian Oscillation (MJO), the Southern Annular Mode (SAM) and atmospheric blocking events) that lead to episodes of extreme heat over Australia. Researchers are examining the ability of POAMA to capture and predict these drivers, as well as the link between the drivers and extreme heat. For example, in terms of ENSO, the probability of having an extremely hot week is increased across much of southern Australia in spring months during El Niño events, and POAMA is able to capture this fairly well. This work will increase our understanding of extreme heat events.	**Dr Debbie Hudson** Centre for Australian Weather and Climate Research D.Hudson@bom.gov.au 03 9669 4796
Investigate teleconnections between climate drivers and regional climate, and model representations of these links	2010 –13	Improve Australia's dynamical forecasting by investigating the connection between rain-bearing weather systems and remote climate drivers, including ENSO, IOD, MJO, subtropical ridge and SAM.	Equatorial convection has a significant effect on weather systems in mid-latitudes. Rossby waves spread energy eastwards and polewards to alter the strength of mid-latitude weather systems and, therefore, rainfall. Analysis indicates that both ENSO and the IOD influence southern Australian weather in winter and spring, via Rossby waves originating in the Indian Ocean. The mechanism appears to be more complicated than previously understood. POAMA's representation of this teleconnection pathway appears to have shifted to the east, which may help explain why skill is decreased in south-east Australia.	**Dr Peter McIntosh** Centre for Australian Weather and Climate Research Peter.Mcintosh@csiro.au 03 6232 5390
Climate analyser decision-support system tools	2010 –12	Deliver a set of next-generation, user-friendly, climate risk management tools that farmers can easily access to query weather data.	The Australian CliMate (CliMate) app was released on the iTunes app store in mid-December for iPhone, iPod and iPad. The app sources data from the Queensland Government's SILO climate data, which is an enhanced version of the Bureau of Meteorology data. Seven different analyses are available. A web version was released in March to help a broader range of users.	**Dr David Freebairn** RPS david.freebairn@rpsgroup.com.au 07 3237 8820

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.	POAMA uses sophisticated assimilation techniques to ingest oceanic observations to initialise model forecasts and create analysis estimates of the ocean state at each point in time. New ocean observations (sea surface temperature and altimeter) were included and ocean–atmosphere coupling was accounted for. We have evaluated improvements in the forecasts of the IOD and regional climate. So far, two new enhancements (coupled assimilation and direct assimilation of sea surface temperature data) will likely improve the initialisation of Indian Ocean model forecasts. Including altimeter data did not improve IOD predictions and will not be pursued. A new comprehensive 32-year ocean reanalysis is being carried out, incorporating both improvements. Hindcasts using the POAMA-2 model are being performed to assess the impact on the skill of IOD forecasts. These improvements will then be incorporated into the new POAMA-3 system.	**Dr Oscar Alves** Centre for Australian Weather and Climate Research O.Alves@bom.gov.au 03 9669 4835
Improving multi-week predictions Completed September 2012	2009 –12	Improve POAMA's weather predictions for 2–8 weeks ahead to make them more useful to agriculture and water-management industries.	This project investigated using the Bureau's seasonal forecast system, POAMA, to provide forecasts on time scales and lead-times shorter than seasonal. This would fill the prediction capability gap between weather forecasts and seasonal outlooks. POAMA shows promising skill in forecasting multi-week rainfall and temperature over Australia, and scientists now have a better understanding of the large-scale climate drivers that affect multi-week forecast skill. POAMA was upgraded to better suit multi-week forecasting. The resulting forecasts are more skilful and reliable. This upgrade also improved the reliability of seasonal forecasts. Experimental multi-week forecast products are available on the POAMA website: www.poama.bom.gov.au	**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.	Spatial analysis of frost trends—such as minimum temperatures, numbers of frosts, cold-wave duration, and frost-season length—has been completed. The proportion of events above the long-term 90th percentile has been finalised. Major synoptic drivers of frost have been analysed. A statistical model of frost frequency has been developed for the region of strongest change frequency and occurrence (i.e. southern NSW and northern Victoria). VineLOGIC has been benchmarked for 4 grape-growing locations in the Yarra Valley. The effect of climate change on budburst [the emergence of new leaves at the start of growing season] has been assessed for 4 main grape varieties grown in this region.	**Dr Steven Crimp** CSIRO Steven.Crimp@csiro.au 02 6242 1649

WA farmers battle complex seasonal variability

By Robbie Mitchell

Since 2001, Western Australian farmers—like most Australian farmers—have seen it all. Droughts, floods, frosts, unseasonal temperatures and unreliable rainfall have all conspired to undo the best laid plans set down by farmers to safeguard their business.

'Without doubt, the last decade has been among the worst in history for grain growers and livestock producers in WA', sympathises Dr David Bowran, who is the grains industry director for the Department of Agriculture and Food Western Australia (DAFWA).

'We [DAFWA] have found that extreme variability during this time can explain 70–80 per cent of variation farmers see in profits', he says.

For Dr Bowran, the question is whether extreme variability 'is simply a part of the climatic cycle, or a sign of a significant departure from the long-term mean'.

South-west WA was once considered to have reliable winter rainfall. However, the abrupt drop in rainfall during the 1970s has brought much less reliable early-season rain and fewer wet years.

'The latest analysis shows rainfall across the south-west during the critical months of May and June has declined by almost 40 per cent'.

A number of farmers have been using seasonal forecasts for a long time. However, the biggest issue was—and will be for some time, according to Dr Bowran—the reliability. 'They are sceptical of the forecasts and are reluctant to rely on them.'

The merits of seasonal forecasts

Dr Peter McIntosh, from the Centre for Australian Weather and Climate Research, understands why farmers might be sceptical.

'Forecasting for WA is complicated because there are a number of competing drivers that converge on WA. The Southern Ocean, Indian Ocean and tropics all play a part. Even the Pacific Ocean has a role to play in how much rainfall the state will receive', explains Dr McIntosh.

'Seasonal forecast models, like the Predictive Ocean Atmosphere Model for Australia (POAMA), are not as accurate in WA as they are in eastern Australia, but they are improving.

'With increased data, faster computers and better modelling techniques, seasonal forecasts are gradually improving in the same way that weather forecasts have improved over the years. The five-day weather forecast is now as accurate as a three-day forecast was 15 years ago. The seven-day weather forecast is now as accurate as a three-day forecast was 30 years ago.'

Using forecasts more effectively

Dr McIntosh has four tips for WA farmers who want to use forecasts:

1. Look at all the information and models you can get.
2. Do not weigh all the information equally. Some models and forecasts are more skilful and reliable than others. You should account for this when comparing different forecasts.
3. Look for consistency between the forecasts and models you have collected. If everything is telling you the same thing, then it's more likely to happen. If there is variation, then there is increased uncertainty.
4. Get used to the fact that no forecast is certain. The information is telling you which way to lean, not which way to jump.

'If you follow a forecast for long enough it will eventually bring you dollars. It's the same as if you went to a casino and knew a coin was biased. You may not pick the first toss, but if you keep playing you'll learn which side is weighted and can take advantage of your insider knowledge', says Dr McIntosh.

'The models are already good enough to be useful, but it takes time to understand how best to use them to influence your decisions.'

Planting for shorter, drier seasons

By John Scotney

Region: West Midlands, 2.5 hours north of Perth, Western Australia

Commodities: Wheat, barley, canola, lambs and hay

Farming area: 3200 hectares

Average rainfall: 300–650 mm per year

Seasonal forecasting is playing a far larger part in decision-making in our farm business than it was a few years ago. This is due to both an improvement in the science behind the forecasting and the increase in seasonal variability that we have seen.

In our region, we have seen a dramatic decline in autumn rainfall together with an increase in intensity of rainfall events throughout the season, plus higher temperatures and wetter summers.

Modelling by POAMA has low accuracy in our area. However, we do use it to get a picture for what may happen at a state-level to help decide our enterprise mix for the coming season.

The Bureau of Meteorology's three-monthly forecasts also have low accuracy for our region, but are used in conjunction with other models and observations in identifying a general trend.

DAFWA's statistical seasonal forecast is the forecast we find most useful. It incorporates the Southern Annular Mode and sea surface temperatures that we also look at independently when making decisions throughout the growing season.

Given the trend to drier, shorter seasons in WA, our approach is to get the crop in as early as possible. This has meant a large increase in dry sowing in order to get crop established on limited early-season rainfall events. We then use seasonal forecasts to make crop management and marketing decisions.

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Western Australia

Answering the fundamental challenges

By Simon Wallwork

Region: Corrigin, central wheat belt, 230 kilometres east of Perth, Western Australia

Commodity: Grains and cattle

Farming area: 2200 hectares

Average rainfall: 300–340 mm per year

Improved seasonal forecasting will assist farm decision-making, but fundamental challenges such as severe frost events require agronomic answers from our scientists.

It seems to me that climate change is starting to bite in central parts of the WA wheat belt.

Difficult seasonal starts, drier winters and severe frost events are challenging most farm businesses in this region. Farm equity and cash flow are being hit hard, in many cases, as production struggles to keep pace with rising farm costs.

In the 2012 season, both dry and frosty conditions produced a disappointing year for many, even though grain prices were higher than average.

We are adapting the best we can to the drier conditions —dry sowing, chemical fallow, grazing crops and lower inputs are some of the techniques we are adopting to manage the changing conditions.

Managing severe frost events is more challenging and our staple crop, wheat, is most susceptible. Frost damage has caused many farmers to reduce the area of wheat grown and increase barley, canola and oat plantings.

Improved seasonal forecasting will give farmers more confidence with their decision-making, but change in farming practices is required to adapt to climate change.

Climatic information, including weather trends, seasonal forecasting and climate predictions are important information for farmers and consultants to consider when designing adaptive farming systems.

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Manage what you can

By Peter Horwood

Region: West Mingenew, Western Australia

Commodity: Wheat, lupins, Poll Dorset rams

Farming area: 3440 hectares

Average rainfall: 400 mm per year

My approach to dealing with climate change or variability, in our area, is to break the issues into what I can control, influence or need to know, and what I can't control.

The things I can influence are soil testing, herbicide-resistance testing and cereal trials.

To know what herbicides work, spend the dollars on testing. Whether a chemical costs a lot or a little, if it is not effective then it is a waste.

We make a site available for the cereal National Variety Trials each year. The results show me the latest varieties that are coming through and how they perform in our area. I make sure the trial is a success by selecting an extremely weed-free site with some of our better soils.

The issue I have no control over is the weather.

I use the Bureau of Meteorology website on a weekly basis, and I prefer DAFWA's seasonal rainfall graphs. They plot the actual growing-season rainfall, showing decile one, five and nine probabilities.

Historically, between April and June, we have received 45 to 50 per cent of our growing-season rainfall. If rainfall is tracking below average to the end of June, the probability of the season improving in July–September is very low.

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Soil, water and extreme events

By Mary O'Callaghan

Some farmers may still be in two minds as to whether the climate is changing but, in Victoria at least, many of them are getting on with planning for and implementing change.

In 2011, almost half (47.6 per cent) of the farmers surveyed by Victorian Department of Primary Industries said they had changed their enterprise mix to manage the impact of climate change.

Farmers understand seasonal rainfall better these days, says Victorian Department of Primary Industries' Chris Sounness. 'They're more comfortable with seasonal forecasts, they're understanding the drivers of extreme events and they're making decisions accordingly.'

While most respondents said that they had heard of the El Niño-Southern Oscillation, Chris says: 'There's been a big increase in the number of farmers who now understand that it affects their local rainfall and seasons, and thus why the Southern Oscillation Index really does matter in the southern spring.'

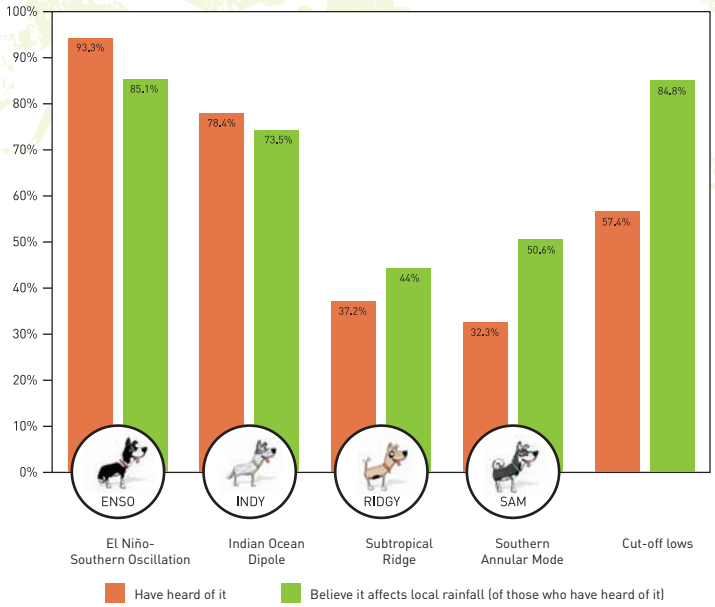
The key research gap where climate science meets agriculture is in bringing together soil science and soil-moisture risks with the climate, says Chris.

'Soil moisture and the seasonal climate outlook relate to one another. Combined, they are what a grower faces', he says. 'We need to quantify the probabilities of the two combined.'

'In autumn, you know what's in the ground, but then there's the challenge of what might fall—the seasonal risk. No-one has looked at the two together. And with all the dry springs we've had, people are realising this is a big factor here.'

Understanding more about the likelihood of extreme events occurring is another area where Chris would like to see some research happening.

'There's been a lot of focus on forecasting averages for growers. But when you think about the frost that occurred in the Wimmera on 10 November, it had a big impact on chickpea crops.



The Climatedogs are helping to demystify the science behind the drivers of climate in Victoria. Source: Victorian Department of Primary Industries 2011 survey

'Then we had one extremely hot day on 30 November. If that had happened two weeks, earlier the consequences would've been big.'

CSIRO's Steven Crimp has revealed disturbing trends in the occurrence of frost across southern Australia in the period 1960–2010.

'Even though mean temperatures are increasing—that is, we can see a global warming signal—we consistently find that the period over which frosts can occur, i.e. the frost window, is much wider, particularly in the eastern parts. So the seasonality of frosts has changed.'

Steven's analyses have revealed that, in the east, the frost window is both starting earlier (on average, up to 10 days earlier) and ending later (up to 46 days later).

The pattern of later endings is consistent across much of southern Australia, he says, whereas the earlier starts are more localised to western NSW and northern Victoria.

The frequency of more extreme cold temperatures is also on the rise across much of southern NSW and northern Victoria—Steven has identified an average increase of four frost days and around five cold nights each decade since 1970.

The reason for the trends is that the band of high pressure which normally sits across southern Australia has moved further south and intensified, allowing cold polar air to move onto the continent following the passage of any cold fronts.

The trend is more significant in eastern parts, from NSW right down to Victoria and South Australia, and has serious implications for cereal growers, says Steven.

'With increasing interest in dry sowing—planting a bit earlier and waiting for rain—if frosts are occurring later, the risk of them occurring in the grain-filling period increases.

'It's not financially viable to physically protect crops from frost. The key is the time of sowing and variety selection—this determines the risk of exposure.'

For Victoria, Steven has looked at fast-, medium- and slow-growing cereal varieties to identify the windows of risk.

Farmers should look at just the last 20 years of the frost record, he says, because they are a better indicator of what is to come.

So, is this trend a long-term frost trend or a multi-decadal blip? Will it get worse? 'That's the million dollar question', says Steven. 'I hope to have some answers by mid-2013.'

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Southern Australia

Agronomy meets irrigation

By Jennifer Hawkins

Region: Finley, southern New South Wales

Commodity: Canola, wheat, rice, cattle and prime lambs

Farming area: 1200 hectares

Average rainfall: 200–396 mm per year

Our farm is dependent on irrigation water supplied to us, and our winter and summer cropping production is heavily reliant on that water for establishment and finishing.

Over the last 100 years, the autumn break is trending downward in regard to the timing and extent of rains.

This is affecting the establishment of our crops and is where we need to concentrate our research—looking for an edge with machinery, varieties, pre-irrigation and anything that gives us better tools to manage this important climate trend.

There has also been an increase in summer rains which do not do a lot for us. They tend to be big events, so we have to manage the drainage and the increased weed problems.

The climate projections are for a reduction in rainfall, both here and in our catchment. It is concerning—we can manage with less rainfall here, but if we do not get it in the catchment, our production systems just stop.

The temperature variations affect us less, but low overnight temperatures can affect our rice crops during panicle initiation—a crucial time when the head forms, and the beginning of the reproductive process.

If we know the temperature is going to fall to critical levels overnight we can increase the water level, which helps to prevent shock to the crop. So, the forecasts of the duration of low overnight temperatures need to be very accurate.

We have reduced our exposure to climatic events by buying water entitlements, but this is not enough anymore. We need to see increased funding for research into irrigated crops and pastures.

For irrigation farming systems like ours, agronomy goes hand in hand with irrigation infrastructure development. We cannot just keep on developing irrigation infrastructure and not develop our agronomic systems—they require development and trialling together. The agronomic research needs to be integrated with irrigation practice.

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Missing spring

By Bill Hunt

Region: Bordertown, upper south-east region, South Australia

Commodity: Wheat, durum wheat, milling oats, beans, oilseed, barley, canola, South African Mutton Merino x Merino sheep for prime lambs

Farming area: 1000 hectares

Average rainfall: 440–520 mm per year

November 2009 is burned into my memory.

The cold, wet winter had carried through right to the end of October. Then, with grain still in the soft dough stage, over three days the cool southerly winds swung around to the north.

The hot winds blew for 10 days with temperatures surging to between 35 and 42 degrees.

It fried everything on the stick, causing hundreds of thousands of dollars worth of damage. Our durum crop that was expected to go 7.5 tonnes per hectare ended up going 3 tonnes per hectare of chookfeed.

The worst part was that we knew it was coming. The big high-pressure cell that had sat over the Bight for six to eight weeks, bringing the southerly, inevitably moved over the eastern seaboard and then the wind changed.

There is nothing we could have done about the heat. If we knew in April, maybe we could have planted at a different time. But even our early-sown crops had not filled up because it had been cool and damp and they were never stressed.

If we miss out on the spring, when our crops are finishing off, it is grim news—everything else I can live with.

In 2012 we had a mild October and, though it was dry, we got marvellous crops because there was not a lot of evaporation and we had the subsoil moisture.

There is nothing we can do about the weather. We would love to know what was coming six months before it got here. The reality is there is more to be gained by working with the things we can control. We have to keep adapting.

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The smell of rain—only a week or 100 kilometres away

By Alison Binney

Tropical farmers are a lot closer to knowing the likely onset and weekly variability of the big wet.

Farmers in Australia's northern regions make big decisions between September and March, decisions that hinge on the onset and weekly variability of the wet-season rain.

When and if to harvest, mill, muster, irrigate, increase stock, reduce stock, repair, vaccinate, burn and fertilise are all costly decisions that require careful attention to weather and climate products.

Dr Wasyl Drosdowsky and Dr Matthew Wheeler from the Centre for Australian Weather and Climate Research have been developing new forecast tools to make these decisions more informed.

'The new forecast tools we are developing fill an important knowledge gap in terms of the current weather and climate products available for Australia's northern farmers', says Dr Wheeler.

The tools aim to answer the big question asked every year in the tropics: when will the wet start?

They cover the northern parts of Western Australia, the Northern Territory and Queensland down to a regional scale of a few hundred kilometres—which is roughly the scale of the largest beef cattle properties in the region.

The wet-season onset (which the project defines as the time after 1 September when more than 50 mm of rain has been received in any one location) is most relevant for those areas that have a strong contrast between a dry winter and a wet summer, explains Dr Wheeler.

For this reason, he says, 'the wet season onset is much more relevant to the NT and northern Queensland than it is for northern NSW.'

Dr Wheeler and Dr Drosdowsky's research, funded by Managing Climate Variability, focuses on improving the simulation and subsequently the prediction by rainfall-related products for agriculture in tropical Australia.

'Our forecasts have the possibility of distinguishing what might be likely to happen in the north-east, compared with the north-central and the north-west. However, we can scale down only so far, and the outlooks currently work best for properties the size of the largest NT beef cattle stations', says Dr Wheeler.

Research for the onset forecasts is almost complete and a new experimental online tool is being trialled. Visit http://poama.bom.gov.au/wet_season/ws_home.shtml. Research into week-to-week variability is ongoing.

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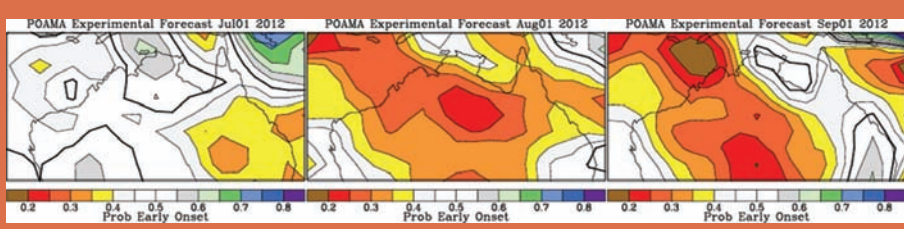

Real-time wet-season onset forecasts for 2012 from different starting dates. The probability refers to the chance that the onset for the coming season will be earlier than the mean onset date. In the above forecasts, which show mostly low probabilities (i.e. less than 0.5), a late onset is more likely than an early onset.

Bittersweet tropical margins

By Robert Quirk

Region: Tweed River coastal region, New South Wales

Commodities: Sugar cane and cattle

Farming area: 126 hectares of sugar

Average rainfall: 1600 mm per year

The major difference between the northern NSW region and other cane-growing regions is that it is wetter, colder and more marginal.

We are right on the edge of where you can grow sugar cane in Australia. But with innovations, we make our environment a lot less marginal.

Around 95 per cent of Australia's sugar is grown in Queensland and five per cent in northern NSW.

We need the science to get us to a point where we can make more accurate predictions months ahead, so we know whether or not to plant cane. For sugar, you need to know in about July whether you will have to stop harvesting and crushing in November and December because the paddocks will be flooded.

I have been planting the cane in mounds for 15 years. I believe this is helping to control nitrous oxide emissions, but we need to figure out why, scientifically.

The region is sinking about one centimetre a year because of the acid sulphate soil, but by leaving the leaves and tops of the cane on the ground when harvesting, as a trash blanket, we've not seen these levels of sinkage.

Frost is also a real issue. If cane freezes at the growing point, it just dies. We grow about 10 different varieties and we are now looking at more frost-tolerant varieties. A very even canopy helps reduce frost damage, and laser levelling [the fields] helps achieve an even canopy.

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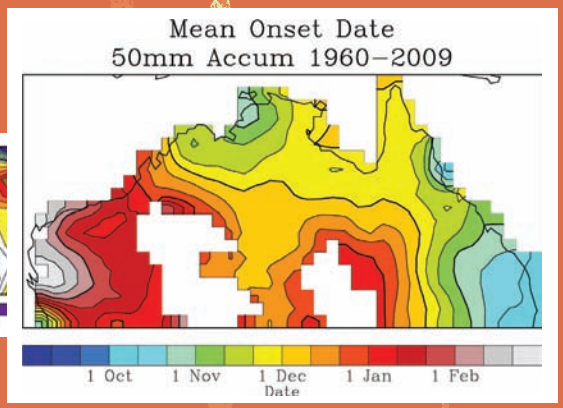

Farmers can use the observed mean onset date for their region, together with the probabilistic wet-season onset forecasts, to make more informed on-farm decisions that rely on the onset of tropical rainfall.

Northern Australia

Decisions on stock numbers hard to call in western Queensland

By Peter Whip

Region: Longreach, western Queensland

Commodity: Beef cattle

Farming area: Royston, 15 800 hectares; Bandon Grove, 7300 hectares

Average rainfall: 150–380 mm per year

We really need to see better forecasting for when and if the wet season is going to come for us.

We do not get a lot of rain through winter and spring, so summer is when we need to know if we are getting rain or not.

Some parts of Queensland were under water [summer 2013], but so far we have not had any rain at all, so many graziers in western Queensland are trying to move stock early as a risk management strategy.

Many graziers are assuming the rain is not going to come, meaning keeping normal stock numbers is not a sustainable option.

If we had a better idea of what the next few weeks and months were going to bring, we might make very different decisions.

The three-month forecasts are where I would like to see more accuracy. A layman's explanation about what the forecasts mean and how best to use them would be very beneficial, especially at this time of the year.

The recent weather patterns have been based primarily on storm patterns, so we have had problems with the short-term forecasts changing dramatically within a couple of days. We went from having huge rain forecast to zero.

We understand it is very difficult to forecast storm-based weather, but it is another factor that we have to weigh up when making our decisions.

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Knowledge is power

By Michael Waring

Region: Trebonne, 1.5 hours north of Townsville, north Queensland

Commodity: Sugar cane

Farming area: 133 hectares

Average rainfall: 1.5–4 metres per year

I use the longer term forecasting, mostly the Southern Oscillation Index, to get an idea of the forthcoming season.

There are times when they've been wrong and I have been burnt a little bit, but they are generally pretty good.

The most important period is five days out, and the forecasts for that period are pretty accurate now. It has improved a lot over the last decade.

The forecast that would be most beneficial, but at the moment is most unreliable, is the one that tells us what is happening a few months out.

The monsoonal rains are generally expected to start between December and February, and it is a time of the year when we are ready for it. Where we need to know more is for May to December. If the forecast for that period is wrong, we can end up doing some things that have serious consequences.

Improving the knowledge we have about nitrogen fertilisers is important. We put about double the nitrogen onto the soil compared to what is in the cane. The question is: where is the excess going? Knowing this would improve our efficiency both environmentally and economically.

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Evolutionary times

for our farmers and science

By Ian McClelland, Chair, Managing Climate Variability

From a farmer's perspective, survival—or better still, prosperity —requires, in the Darwinian sense of fitness, particular qualities.

Today's farmers have to be smart, adaptive, innovative and thorough. Coping with diversity of climate is just one of the many challenges farmers have faced since farming began.

There is nothing new about the need to adapt to our variable climate; new discoveries and technologies have always demanded that we do so. Recently, however, it has seemed that the challenge is to become even more adaptive.

How do we do it, and are we keeping up?

The assistance of science and industry, combined with farmers' flexibility to innovate, has meant that many of the challenges have been met.

We use water more efficiently, do our work in a more competent and timely manner, have access to and use massive information sources, understand more about the processes that drive production, and can benefit from improved weather predictions.

Vital to this adaptation process has been the cooperation between key players.

Renowned soil scientist Dr Albert Rovira used to say that many of his discoveries were made because a farmer told him the result before he worked out the reason for it happening. He said that it was necessary for him to continually keep 'one foot in the field' in order to learn from farmers' observations.

Similarly, many Bureau of Meteorology experts regularly consult with farmers, endeavouring to understand their needs and provide forecasts that assist in decision-making.

For example, the Water and the Land website's reliable seven-day forecast can be invaluable to farmers. And longer term forecasts are increasing in accuracy every year.

Scientists from CSIRO and state departments of agriculture, together with farming groups, are contributing to the successful adaptation to our variable climate.

In the grains industry, for example, farmers are sowing crops earlier every year, whether wet or dry, to avoid heat stress. Frost damage is managed by using varieties with differing maturity dates. Weeds are controlled with carefully managed herbicide strategies.

Farmers have access to a range of strategies in responding to the challenge of variable weather events and seasonal conditions. Being able to maximise profits in the good years and minimise losses in the drought years still lies at the heart of each strategy.

The close association and sharing of ideas between research providers, scientists, industry and farmers is vital in ensuring a sustainable, prosperous farming community.

Water and the Land website:
www.bom.gov.au/watl

GRDC
Grains Research & Development Corporation

mla
MEAT & LIVESTOCK AUSTRALIA

Australian Government
Department of Agriculture, Fisheries and Forestry

Rural Industries Research and Development Corporation

Sugar Research and Development Corporation

Managing Climate Variability is a collaborative program between the Grains, Rural Industries and Sugar Research and Development Corporations; the Australian Government through the Department of Agriculture, Fisheries and Forestry; and Meat & Livestock Australia.

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

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