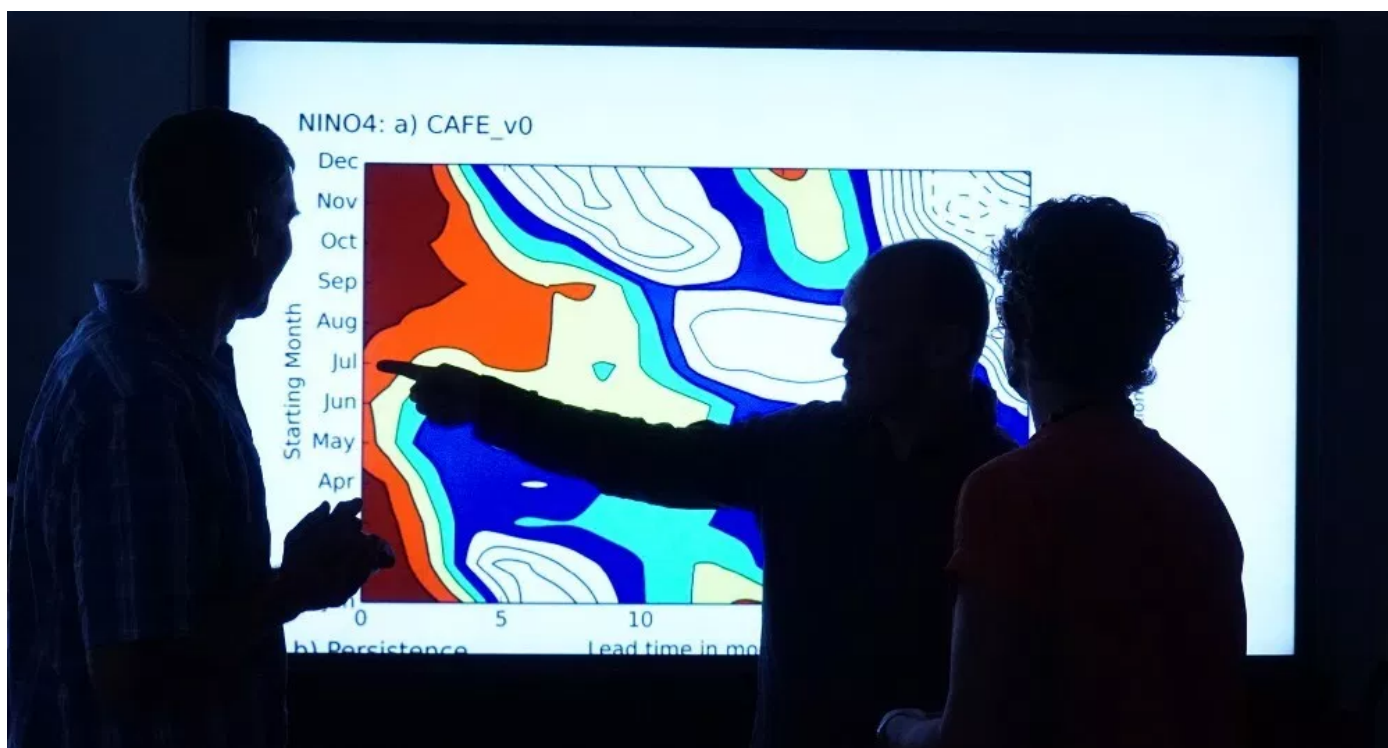


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# Predicting the climate of the 2020s

By Simon Torok | November 29th, 2018

As the saying goes, forewarned is forearmed. Decadal forecasting can provide an assessment of probabilities for the climate system over the next one to 10 years, important inside knowledge for industries affected by climate.



Dr Richard Matear and team discussing output from the CAFÉ model.

THE saying goes that knowing the weather influences the clothes you wear, while knowing the climate influences the clothes you buy. We have confidence in weather forecasts that stretch several days into the future. We have predictions of the season ahead thanks to climate outlooks of the coming three months. And from climate projections we have scenarios of how climate change may play out over coming decades.

But until now there has been a wide gap between forecasts of the coming days and months, and projections of climate change over the coming century. While we may be able to work out the clothes to wear and buy, we're lacking wardrobe advice for two or three

years' time. That gap between timescales is now being filled by new research into decadal forecasting.

“It’s an exciting time,” says Dr Richard Matear, leader of the Decadal Climate Forecasting Project in CSIRO’s Climate Science Centre. “It’s a big challenge, and many groups around the world are trying to achieve it but making slow progress.”

## **Between predictions and projections**

Decadal forecasting research focusses on the 1 to 10-year timescale. That’s the time over which many business decisions are made, so the ability to identify times of increased profitability or risk would be invaluable for industry.

Dr Matear explains it’s also the time in which there is a transition in the workings of global circulation models – the computer simulations that provide our weather forecasts and climate projections.

“The decadal forecasting period is the time when you switch between climate models being influenced by initial conditions, to being influenced by whatever the perturbation or forcing mechanism is. So decadal predictions deal with the period where things change from being an initial value problem to a forced response problem.”

That puts decadal forecasts in the grey area between forecasts influenced by today’s weather, and scenarios of the distant future where climate depends on large scale changes such as increased greenhouse gases; a major perturbation that climate models must address in the longer term. In the no-man’s land between predictions and projections, it’s more important than ever to understand the current state of the climate.

## **A new wealth of ocean observations**

Dr Matear says climate models predict the future based on the equations that describe the Earth system, but if you can start off the model looking like the real ocean then variations in the short-term climate appear in the model at the right time.

“When looking at 2020, the initial state of the climate is important – where we will be in two or so years is influenced by where we start from,” says Dr Matear.

“The ocean is the long-term memory of the climate system. So we use as many ocean observations as possible to initialise decadal climate forecasts. There has been a revolution in ocean observations in recent years – including satellite observations, robotic instruments such as Argo, and new marine observation networks such as IMOS (the Integrated Marine Ocean Observing System). This revolution puts us in a better place to use ocean observations to characterise the current climate state. We can use sophisticated ways to bring this wealth of ocean observations into the climate model to get it looking like the real ocean.”



Argo floats deployed in oceans have provided significant new data over time for use in climate models.

Dr Matear says the challenge is to provide Australia with useful multi-year climate information to help better deal with climate extremes.

“People need more targeted information than a global temperature projection of 1 degree in the next couple of decades. People are interested in extremes, not average conditions. Our work aims to fill that gap and provide more insight into extreme weather. Decadal forecasts provide an assessment of probabilities for the climate system over the next one to 10 years – in a similar way that weather forecasts today provide the probability of rainfall rather than just if it will rain or not.”

However, he says climate forecasts are only one of many sources of information that industries consider in their forward planning.

“By having a dialogue with selected agriculture, fisheries and energy companies we can understand what climate information they need now, how they use it, and the pressure points for making decisions.”

## Applications for industry

One such organisation is Hydro Tasmania, Australia’s largest generator of renewable energy. “Our product is electricity, and our fuel is water, which is driven by the weather,” says Mr Greg Carson, Water Operations Advisor at Hydro Tasmania. “Understanding rainfall patterns is crucial for our business as it determines how we work in the short and long term.”

Hydro Tasmania uses weather information over many timeframes: the current weather influences energy demand, seasonal outlooks advise decisions about meeting the electricity demand in the medium term, and climate change projections inform long-term investment decisions in a changing climate.

Mr Carson says having a view of the climate one to three years ahead may affect how they manage the water behind dams.



Devils Gate Dam on spill. Image: Hydro Tasmania

“The water for hydro comes from rain, so if we don’t have enough we’ll struggle to deliver electricity. In that case, we need to look at alternatives,” he says. “If we know it will be dry, we may buy more gas so we can operate our thermal power station rather than hydro. Or if it will be wet, we can be confident we can meet the demand and won’t need to buy as much gas. These are multi-million-dollar business decisions, so having good information on future climate patterns is important.”

He says as well as advising decisions about consistency of electricity supply, decadal forecasts can provide information about future consumer use. “Demand for electricity is driven by what’s happening with the weather – if it’s cold then people use heaters more, if it’s hot then there’s more air conditioning. If we can see that in two to five or even 10 years’ time, then we can set our lakes up to meet the future electricity demand.”

The CSIRO decadal forecasting project builds on decades of research into climate.

“Our research taps into and extends past work on understanding climate processes, ocean forecasts and climate modelling but pushes the boundaries and directs this expertise to a new, really important problem,” says Dr Matear. “Australia is a very climate exposed country that continuously experiences extremes such as droughts and floods. Such climate variability is in our psyche, and has huge impacts on our society, environment and economy. That’s a good motivation for research.”

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Follow the group’s work: <https://research.csiro.au/dfp/>

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