Forecasting the Seasons – What to Look For

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What happened last year?

Good early season rainfall in south-east Australia in 2007 indicated the break-down of the dry conditions in 2006 which were caused by a weak El Nino together with a positive Indian Ocean Dipole (IOD). Pacific Ocean temperatures early in 2007 suggested a La Nina could be developing. Historically, nine out of 10 years like 2006 were followed by a La Nina, a negative IOD, or both. Generally, the rainfall in such years was higher than average. To add to the optimism, most computer models were forecasting a La Nina. There were high hopes for 2007.

There were just a few early warning signs. The SOI was not strongly positive, meaning that in the Pacific, the ocean and atmosphere were not coupled together. In the Indian Ocean, the Japanese SINTEX model [1] was forecasting another positive IOD. This model successfully predicted the 2006 positive IOD. However, early in the year it was not clear whether to take the 2007 prediction seriously. First, it was the only model making such a forecast (a number of other models disagreed); second, there have been questions about whether this model forecasts an IOD too often; and third, the combination of a La Nina and a positive IOD has never been seen since observations started (although some argue that 1967 was such a year).

We now know that 2007 was a late-developing La Nina; the ocean and atmosphere did eventually couple together in October. We also know that a positive IOD did develop in September, although ocean temperatures to the northwest of Australia were colder than normal some months earlier [2]. These Indian Ocean temperatures returned to normal or above normal around November, when the rains returned to southeast Australia. There is some evidence that warm ocean temperatures off the north-west of Australia, together with colder temperatures in the mid-Indian Ocean, act to drive moisture down over Australia from the north-west. The opposite temperature gradient, as occurred from the middle of the year through to about November, tends to reduce the influx of moisture.

In synoptic terms, the early season rainfall in 2007 was caused almost entirely by cutoff lows. The rainfall from cutoff lows is sometimes enhanced by atmospheric blocking (where an intense slow-moving high forms near Tasmania), and this was definitely the case in 2007. But by the middle of the year, cutoff rainfall had disappeared. Rainfall from other synoptic systems (such as fronts) was unusually low for the entire year. However, fronts and cutoffs still occurred with about the usual frequency. It was just that they had little moisture influx from the north-west, particularly from the middle of the year through to November.

What might happen in 2008?

History is of little use in terms of the transition from the La Nina/+IOD of 2007. The only possible similar year is 1967. In this case, 1968 was a negative IOD but with no ENSO (i.e. neither El Nino nor La Nina). In autumn, the whole country was wet, and the rains continued in winter except in NSW and Queensland. By spring the rainfall had fallen below normal over most of the country except for the southern tips of Victoria and SA, and the western half of Tasmania. It is not wise to base a forecast on a single historical example.

Most computer models are predicting the current La Nina will persist until at least autumn [3]. The SINTEX model is predicting a neutral IOD in the second half of 2008, tending towards small negative values in spring 2008. POAMA 1.5 (the latest version of Australia's seasonal forecast model) gives a similar forecast on their experimental products site [4]. Very few other models report forecasts for the Indian Ocean.

Rainfall forecasts for autumn and winter from SINTEX and POAMA differ somewhat, with SINTEX predicting a dry Victorian autumn with the rest of the country wetter than normal, with the reverse for winter. POAMA is predicting a wet southeast in early autumn, but slightly drier than normal thereafter. Rainfall forecasts from seasonal prediction models should be treated with considerable caution, as this is the hardest quantity to predict accurately.

A good technical summary of the previous years ENSO and IOD, together with forecasts for the next year, is available from the US Climate Prediction Centre in PowerPoint form [5]. The briefing is updated every month. Another good source of information is the Bureau of Meteorology's ENSO Wrap-Up [6], which is updated every two to three weeks. This site contains a summary of Nino3 forecasts from half a dozen reputable dynamical models. Of these, the ECMWF model seems to have the best track record at the moment judging by the comparison on the International Research Institute (IRI) model comparison site [7] (although this site compares Nino3.4 forecasts).

It is important to remember that forecasting Nino indices is only part of the overall seasonal forecast task. Rainfall over south-east Australia is only moderately related to Pacific Ocean temperatures, and is also affected by Indian Ocean temperatures. Further influences come from the south via the Southern Annular Mode (SAM), although this is probably only important for the southern extremes of Australia [8, 9].

What else is important?

Seasonal timescales may be very important for farmers, but the shorter weather timescales and longer climate change timescales are also relevant. Weather is covered very well by the Bureau of Meteorology's web site [10], while a good place to start for climate change is the joint Bureau/CSIRO web site [11]. Seasonal climate variability is still the most important factor to consider on an annual basis, but longer term planning cannot ignore climate change.

An excellent place to get weather and seasonal climate information is the Bureau's Water and the Land site [12]. This site includes daily rainfall forecasts from a suite of computer models, extending out to five days. It also contains links to a vast range of other information including the Bureau's seasonal outlooks and recent rainfall data.

In the last couple of years there has been increasing focus on the timescale that sits between the weather and seasonal variations. This timescale covers ten days to a couple of months. It is beyond the ability of weather models to make specific forecasts on these timescales, but it is believed that seasonal forecast models might have quite useful skill at these shorter times. The most important phenomenon on these timescales is the Madden-Julian Oscillation (MJO), which is a large-scale atmospheric wave straddling the equator that starts in the western Indian Ocean and propagates eastward. It recurs every 30 to 80 days, and exhibits enough predictability to be useful as an indicator of rainfall on this timescale [13]. The MJO can be monitored in real-time [14], and a useful commentary is provided by APSRU [15].

References

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