

## LINKING GLOBAL CLIMATE CHANGE TO LOCAL RAINFALL: A CASE STUDY.

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The effect of global climate change on local rainfall cascades through a number of scales. Global warming alters large scale climate variability. Climate variability impacts synoptic weather systems. Synoptic systems in turn influence the level of local rainfall. Each of these pathways needs to be explored if we are to learn more about the effect of global warming on local rainfall.

One important synoptic feature for rainfall in south eastern Australia is cutoff low pressure systems. In this region cutoffs are responsible for at least half of all winter growing season (Apr-Oct) rainfall and most of the daily rainfall events of more than 25mm (Pook *et al.* 2006). Pook *et al.* further showed that although the number of cutoff lows has not decreased in recent times, the amount of rain each event brings shows a decreasing trend.

Our research begins with case studies of cutoff related rainfall in the Mallee region in a number of key El Niño years. Variations in the amount of Mallee rainfall do not clearly correlate with any one particular climate phenomenon. For example, 1997 was one of the strongest El Niños on record however rainfall totals were only just below average (Figure 1). Meanwhile a weak El Niño in 2002 resulted in one of the lowest rainfall tallies on record. In both years cut off lows were present, but in 2002 they only brought half as much rain per cut off day.

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By using an air-parcel back-tracking algorithm (McIntosh *et al.* 2007) we determine the origin of the moisture that supplies the rainfall. We demonstrate that, in our case studies, it is the position and timing of the low level high pressure ridge near Queensland that is critical. In years (such as 1982 and 2002) when this ridge contracts eastward, the moisture pathway is reduced or absent, and cut-off lows are ineffective at providing rainfall to the Mallee region.

Our case studies are only the beginning of learning how climate change will affect Mallee rainfall. With better understanding of the relevant mechanisms, we might begin to predict long term changes to rainfall for the Mallee and the wider Murray Darling Basin with more confidence.

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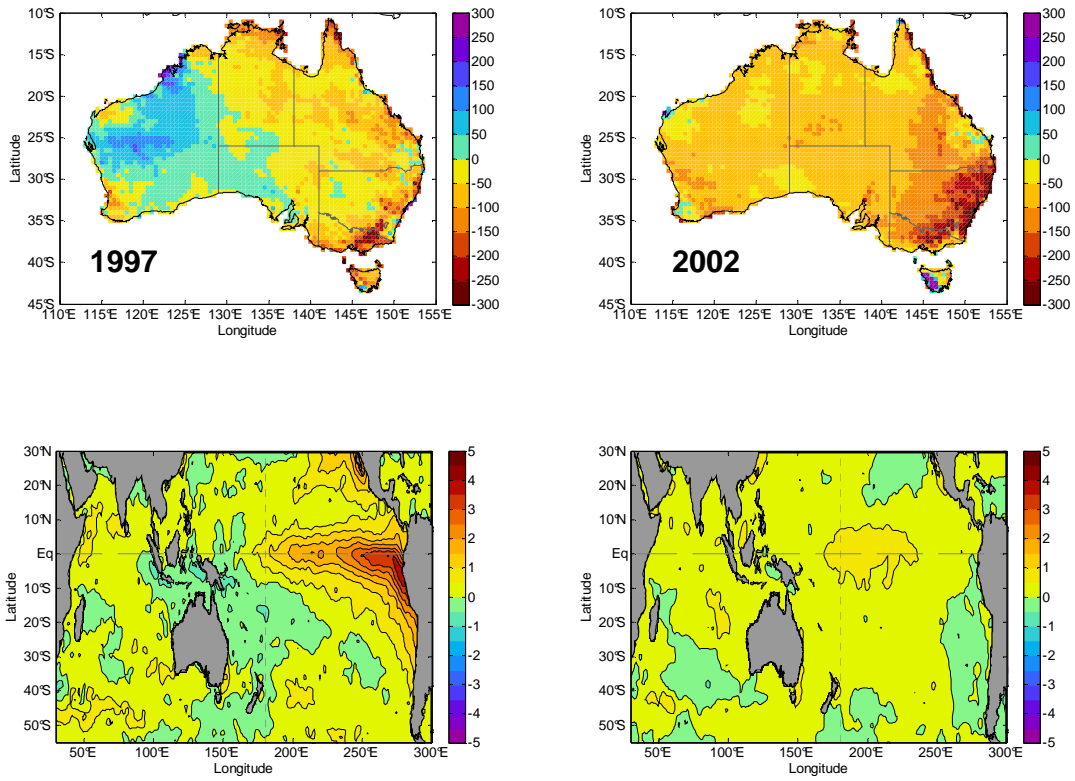


Figure 1: Top: Anomalous rainfall for Apr-Oct (mm) in 1997 and 2002 (SILO rainfall). Bottom: Anomalous Apr-Oct SST (°C, from HadISST) for the large 1997 El Niño event and the 2002 El Niño Modoki.

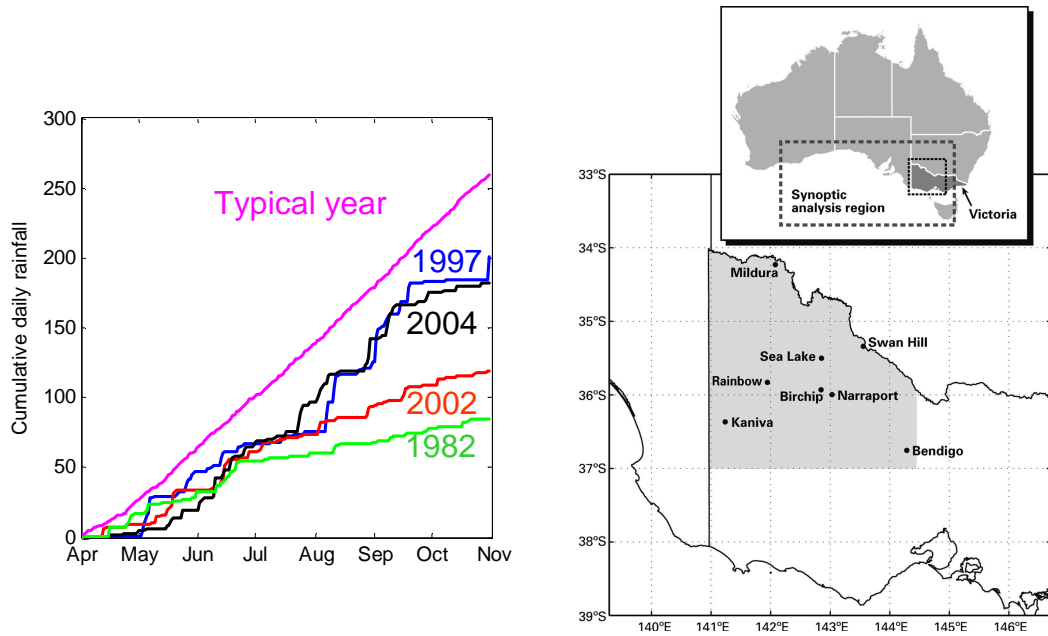


Figure 2: Cumulative daily rainfall averaged over the 8 Mallee stations, for a typical year (pink), and four case study years: 1982 (green), 1997 (blue), 2002 (red) and 2004 (black). Right hand panel shows the location of the eight rainfall stations studied.