From synoptics to climate change

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Model predictions of climate variability and climate change emerge as variability and trends in the average behaviour of the model weather systems. Therefore, climate models must be able to represent weather processes accurately. If a model gets the right rainfall for the wrong reasons, this casts doubt on rainfall projections.

The most important weather system associated with rainfall in south-east Australia is the cut-off low. A case study shows the complexity of moisture pathways and trigger mechanisms leading to rainfall from a cut-off low in June 2008. Composites of air parcel trajectories over many events show that the inflow of moisture from the north-east of Australia is an important factor in high rainfall events, despite the fact that cut-off lows propagate from the west.

The ability of a number of climate models to simulate cut-off lows over a period of 50 years is shown to be moderate at best. This behaviour is related to a deficiency in atmospheric blocking, which in turn is related to the models' inability to simulate accurately the meridional pressure gradient in mid-latitudes. The latitude of the sub-tropical ridge is shown to be similarly compromised.

Synoptic processes are important in linking remote drivers such as ENSO to regional rainfall, and in setting the variability of rainfall. Evaluation of synoptic processes in climate models is an important step in improving regional climate scenarios.