

Australian Droughts and Indo-Pacific Climate Variability: Implications for Predictions

Caroline C. Ummenhofer

Between 1995 and 2009, a large region of Australia had been gripped by the most severe drought in living memory, the so-called “Big Dry”. The ramifications for affected regions were dire, with acute water shortages for rural and metropolitan areas, record agricultural losses, the drying-out of two of Australia’s major river systems and far-reaching ecosystem damage.

When investigating links between Indo-Pacific climate variability and Southeast Australian (SEA) rainfall over the past 120 years, significant differences were found between the dominant drivers of drought at interannual and decadal timescales. On interannual timescales, both the Pacific and Indian Ocean modify SEA water availability. Decadal variability over SEA, including multi-year drought periods, seems to be more robustly related to Indian Ocean temperatures rather than Pacific conditions. The frequencies of both positive and negative Indian Ocean Dipole events are significantly changed during periods of prolonged drought. In contrast, the frequency of El Niño-Southern Oscillation events remains largely unchanged. The “Big Dry” and other iconic 20th Century droughts in SEA, including the Federation Drought (1895-1902) and World War II drought (1937-1945), are driven by tropical Indian Ocean variability, not Pacific Ocean conditions as traditionally assumed. Specifically, a conspicuous absence of characteristic Indian Ocean SST conditions that are conducive to enhanced tropical moisture transport deprived SEA of its normal rainfall quota. Implications for agricultural management decisions and predictions of Australian droughts are discussed.