



Understanding extreme rainfall events in Australia through historical data

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Historical climate data recovery is still an emerging field in the Australian region. The majority of Australia's instrumental climate analyses begin in 1900 for rainfall and 1910 for temperature, particularly those focussed on extreme event analysis. This data sparsity for the past in turn limits our understanding of long-term climate variability, constraining efforts to predict the impact of future climate change.

To address this need for improved historical data in Australia, a new network of recovered climate observations has recently been developed, centred on the highly populated southeastern Australian region (Ashcroft et al., 2014a, 2014b). The dataset includes observations from more than 39 published and unpublished sources and extends from British settlement in 1788 to the formation of the Australian Bureau of Meteorology in 1908. Many of these historical sources provide daily temperature and rainfall information, providing an opportunity to improve understanding of the multidecadal variability of Australia's extreme events.

In this study we combine the historical data for three major Australian cities — Melbourne, Sydney and Adelaide — with modern observations to examine extreme rainfall variability over the past 174 years (1839–2013). We first explore two case studies, combining instrumental and documentary evidence to support the occurrence of severe storms in Sydney in 1841 and 1844. These events appear to be at least as extreme as Sydney's modern 24-hour rainfall record.

Next we use a suite of rainfall indices to assess the long-term variability of rainfall in southeastern Australia. In particular, we focus on the stationarity of the teleconnection between the El Niño–Southern Oscillation (ENSO) phenomenon and extreme rainfall events. Using ENSO reconstructions derived from both palaeoclimatic and documentary sources, we determine the historical relationship between extreme rainfall in southeastern Australia and ENSO, and examine whether or not this relationship has remained stable since the early to mid-19th century.

Ashcroft, L., Gergis, J., Karoly, D.J., 2014a. A historical climate dataset for southeastern Australia, 1788–1859. *Geosci. Data J.* 1, 158–178. doi:10.1002/gdj3.19

Ashcroft, L., Karoly, D.J., Gergis, J., 2014b. Southeastern Australian climate variability 1860–2009: A multivariate analysis. *Int. J. Climatol.* 34, 1928–1944. doi:10.1002/joc.3812