

A high-resolution, quantitative,
rainfall record of the last 1000 years
in the Australian sub-tropics

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A HIGH-RESOLUTION, QUANTITATIVE, RAINFALL RECORD OF THE LAST 1000 YEARS IN THE AUSTRALIAN SUB-TROPICS.

LATE-HOLOCENE RAINFALL IN SE QUEENSLAND

ABSTRACT

Knowledge on the behaviour of the El Niño–Southern Oscillation (ENSO) over the past millennium has been composed of proxy records collected across the Southern Hemisphere but conflicting patterns often emerge. Few western Pacific ENSO records exist covering this timeframe, even less focus on the effect of ENSO on Australian climate. To develop a quantitative late-Holocene climate record for sub-tropical Australia, leaf fragments of *Melaleuca quinquenervia* were extracted from a sediment core from Swallow Lagoon, North Stradbroke Island, south-east Queensland. The sub-fossil leaves were isolated from lake sediments under a microscope. AMS ^{14}C -dating was performed and an age-depth model covering 514-2013 common era (CE) was developed. Carbon isotope ratios ($\delta^{13}\text{C}$) of bulk leaf tissue were measured and carbon isotope discrimination (Δ) was calculated. A previously developed equation (Tibby et al. in review) based on the relationship between modern *M. quinquenervia* Δ and rainfall was used to reconstruct late-Holocene rainfall. Reconstructed rainfall was compared to historical records from the region. When individual samples were compared to instrumental records, there was no observable relationship between Δ and rainfall. However, multi-decadal shifts in climate seen in the historical record were reproduced by the proxy reconstruction, with the mean reconstructed rainfall falling within the 1σ range of the instrumental data. The rainfall reconstruction for the late-Holocene was then examined to assess shifts in climate state across multi-decade scale climate phases including the Medieval Climate Anomaly (MCA) and the Little Ice Age (LIA). The median rainfall during the MCA was found to be similar to that of the LIA (1663 mm and 1654 mm respectively), while the historical period was significantly drier (1236 mm). The results of this study characterize ENSO conditions in Australia as La Niña-dominated during the LIA and MCA. The historical period, by contrast, was more El Niño-dominated than any other period.

KEYWORDS

Geochemistry, Carbon Isotope ratio, *Melaleuca quinquenervia*, Holocene, Precipitation, El Niño Southern Oscillation

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