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A 1300-year reconstruction of the South Pacific Convergence Zone using a Pacific-wide tree-ring network

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The South Pacific Convergence Zone (SPCZ) is the largest driver of precipitation variability over South Pacific island communities during the austral warm season influencing the severity and duration of drought and the frequency of tropical cyclones. The SPCZ is known to exhibit variability on a range of timescales, from intra-seasonal to multidecadal variations, modulated by the Interdecadal Pacific Oscillation (IPO). Despite its climatic and societal importance, determining the causes of low frequency variability in the SPCZ has been hampered by the short instrumental data record, with most comprehensive analyses since the satellite era. Here we report the first paleoclimate reconstruction of the SPCZ, allowing climate variability in the South Pacific region to be explored back to 700 CE. Our 1300-year reconstruction of the SPCZI (South Pacific Convergence Zone Index; the difference between mean sea level pressure between Apia, Samoa and Suva, Fiji) is based on a trans-Pacific network of precisely dated tree-ring proxies. Capturing SPCZ teleconnections from both sides of the Pacific has produced a robust, unbiased reconstruction with excellent reconstruction skill over the entire period. El Niño-Southern Oscillation periodicities (3-7 years) are pervasive throughout the SPCZI reconstruction. Multidecadal periodicities wax and wane, apparently coinciding with the timing of the Medieval Climate Anomaly (c. 1000-1200 CE) and Little Ice Age (1300-1700 CE). We discuss some of the drivers of SPCZI variability including global dimming events. Our reconstruction helps improve our understanding of past hydroclimatic behaviour in the southwest Pacific and can be used to validate general circulation model projections for Pacific Island communities in the twenty-first century.