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Spatio-temporal variability of the SPCZ fresh pool eastern front from coral-derived surface salinity data

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The South Pacific Convergence Zone (SPCZ) is a major atmospheric feature of the southern hemisphere. It is a low atmospheric convergence band associated with intense precipitations. Its position and intensity responds to global changes but also modulates regional weather patterns. Interannual to long-term SPCZ modifications result in extreme events such as severe droughts or flooding with profound socio-economic consequences. The SPCZ oceanic counterpart is a large body of fresh water (SSS<34.5 pss) extending southeast from the Maritime Continent to the dateline. This freshpool is separated from the high-salinity waters of the South Pacific gyre to the west by a steep salinity front.

Various studies have shown a freshening of the freshpool and its south-eastward expansion since the 1970s, modulated by interannual to interdecadal variability (Cravatte et al., 2009). The scarcity of traditional SSS measurements limits our ability to describe accurately this variability. This study validates the use of coral d18O as a proxy for the reconstruction of SSS over the last 200 years. Derived SSS is validated against insitu data at 3 different locations along the SSS front (Fiji, Tonga and Rarotonga Islands). This new dataset enables us to investigate the spatio-temporal variations of the SSS front prior to the instrumental data.

Two robust modes of variability are present in the reconstructed SSS datasets: interannual variability and a secular trend. The reconstructed SSS variability follows El Niño Southern Oscillation index. The three sites present secular trends toward fresher conditions, but do not present similar variability, neither in timing nor strength over their total length. Furthermore, the role of atmospheric freshwater fluxes on SSS variability is evaluated by comparing reconstructed SSS to available historical rain gauge data. Results highlight the role of both atmospheric freshwater fluxes and ocean dynamics on SSS variability.