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Seasurface temperature and salinity reconstruction in Fiji during the last century from muti-proxies of coral skeleton using neural network

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In contrast to the Equatorial Eastern Pacific where sea surface temperature (SST) anomalies are maximum during an ENSO, the western tropical pacific is essentially affected by both SST and sea surface salinity (SSS) variability, which could be a powerful indicator of ENSO during the past. Coral skeleton is regarded as the best archives to record oceanic conditions over the last centuries. Unfortunately, up to now, it seems difficult to decipher SST and SSS reconstructions even from multi proxies time series.

By combining geochemists and biologists understanding we recognize the processes involved in the coral skeleton deposit. We infer that the response to environmental forcing is embedded with biological reactions and geochemical records are not linear in the time. By using a neural network on multiproxies (carbon and oxygen isotopic ratio, trace elements and density) we reconstruct SSS and SST during the last century in a coral head collected in Yasawa (Fiji).

Fiji islands are key areas to record South Pacific Convergence Zone (SPCZ) migration. Located at the southern warm pool edge, this zone is submitted to heavy precipitation due to South Pacific Convergence Zone (SPCZ) during La Niña and salty subtropical waters are advected westward during El Niño. This situation has been well documented from SST and SSS data collected by ships between 1976 and 2000, but they are sparse in historical database, specially in this area. Thus, the first step of this mathematical treatment is to train our data set during the period 1961-1997. Then,

the reconstructions are derived over the last century. The interannual SST and SSS variability's respectively range from 1‰ to 1°C. As it has been observed from the last decades, during the whole XXth century, SSS is higher and SST lower during El Niño. The SSS increase is due to reduced precipitation and also the displacement of cold and salty water by a zonal advection. By performing a correlation between southern oscillation index (SOI) and SST and SSS records over a 15 years moving window, we reveal an anomaly between 1925 and 1935. During this period SOI peak corresponding to an El Niño event is not associated with the expected SPCZ migration.