Holocene marine reservoir correction for Lanyu Island, Taiwan: evidence of enhancing El Niño activity over the last 6,000 years

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The El Niño–Southern Oscillation (ENSO) is one of the most prominent climatic phenomena responsible for the wide temperature and precipitation variability across the globe. Modelling and palaeoclimate studies suggest reduced El Niño frequency and amplitude in the early to mid-Holocene (Tudhope *et al*. [1]; Moy *et al*. [2]), whereas Cobb *et al*. [3] claimed no evidence for a systematic trend in ENSO variance. Here we present a record of marine reservoir correction (ΔR) over the past 6,000 years for Lanyu Island off eastern Taiwan using 21 paired U-Th and ^{14}C dates on fossil coral samples. The ΔR values range from -343 to 47 yr, but bear significant decadal fluctuations, for instance varying from -319 yr at 3383 cal yr BP to -186 yr at 3364 cal yr BP, and from +18 yr at 152 cal yr BP to -80 yr at 142 cal yr BP. However, our record shows relatively low ΔR during the mid-Holocene and a broad increasing trend afterwards, which is opposite to the reported pattern in the South China Sea (SCS) (Yu *et al*. [4]). As Lanyu Island is located right on the path of Kuroshio Current, we can attribute the millennial ΔR variation to the changes in ocean circulation due to ENSO activity. Under El Niño conditions, northward shift of the North Equatorial Current bifurcation reduces the Kuroshio transport east of Luzon. This results in more ^{14}C-depleted water from the Philippine Sea to penetrate westward into the northern SCS through the Luzon Strait (Yaremchuk and Qu [5]), but less to stay in the northward path. Therefore, the contrast pattern in ΔR results between eastern Taiwan and SCS supports the hypothesis of reduced ENSO activity in the mid-Holocene.

[1] Tudhope *et al*. (2001) *Science* **291**: 1511-1517. [2] Moy *et al*. (2002) *Nature* **420**: 162-165. [3] Cobb *et al*. (2013) *Science* **339**: 67-70. [4] Yu *et al*. (2010) *Paleoceanogr*. **25**: PA3205. [5] Yaremchuk and Qu (2004) *J. Phys. Oceanogr*. **34**: 844-855.