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Modes of Eastern Equatorial Pacific thermocline variability: implications for ENSO dynamics over the last glacial period

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Under present-day climatic conditions, the most important mode of interannual climatic variability is the El Niño/Southern Oscillation (ENSO). The ENSO variability that originates in the tropical Pacific Ocean has worldwide climatic repercussions, making its temporal changes a potential candidate for influencing past climatic changes at a global scale. In this perspective, assessing how the ENSO dynamics evolved under different climatic backgrounds is useful. Modelling experiments and paleoceanographic reconstructions attempting to reconstruct past changes in ENSO variability have evidenced a wide spectra of potential mechanisms susceptible to have influenced the ENSO variability in the past, including continental ice volume, orbital parameters and rapid (millennial-scale) climatic changes. However, extracting any univocal ENSO variability spectrum from paleoceanographical reconstructions in ENSO-sensitive oceanic areas has remained difficult because other parameters attributable to seasonal and/or ecological behaviours of planktonic organisms that ultimately produce the sedimentary record often generate second-order climatic signals.

In this study we circumvent this problem by reconstructing the thermocline variability of the Eastern Equatorial Pacific (EEP). By computing temporal variations of the expected δ^{18}O of calcium carbonate at the depth of the thermocline we show that this parameter is primarily influenced by temperature changes, and is significantly correlated

to the Southern Oscillation Index (an indicator for ENSO activity) without any kind of superimposed seasonal bias. In this area, the planktonic foraminifera *Neogloboquadrina dutertrei*, of which the ecology has been well constrained in the past is known to live at the base of the thermocline, making it a suitable specie to detect changes in the thermocline structure.

We then performed repeated isotopic analysis (δ^{18}O) on *N. dutertrei* single specimen on the MD02-2529 marine sediment core retrieved in the EEP (08˚12.33'N, 84˚07.32'W, 1619 water depth), that has already a well-established stratigraphy. By analysing about 80 single *N. dutertrei* specimen at several targeted time slices over the last 50 kyr BP we extracted the whole thermocline variability spectra at these time slices (i.e. during the Holocene, the last glacial maximum, Dansgaard-Oeschger interstadials and the Heinrich event 4), a parameter supposed to reveal changes in ENSO dynamics. By using this approach we did not detect any fundamental changes in the thermocline variability among the above-listed mechanisms that were proposed to have affected the ENSO variability in the past. Regarding our results we conclude that, although the ENSO dynamics remained active throughout the last 50 kyr BP under very different climatic backgrounds, it may not be the primary forcing for initiating climatic variability at a global scale.