



Non-stationary relationship between rainfall and ENSO in the tropical Indian Ocean: a result of the recent sea surface temperature rise?

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We have developed a bimonthly resolved, 120 year long stable oxygen isotope record from the tropical Indian Ocean (Chagos Archipelago, 70°E, 5°S). The November to February (NDJF) coral isotope record tracks rainfall variations associated with the intertropical convergence zone (ITCZ) in the central Indian Ocean (Pfeiffer et al., 2004). El Nino typically leads to a warming of the tropical Indian Ocean by 0.5-1°C. During recent El Nino events, these relatively small sea surface temperature (SST) anomalies triggered extremely large rainfall anomalies. In fact, the rainfall anomalies in the tropical Indian Ocean were as large as in the central tropical Pacific. Based on these recent observations, we would expect a strong ENSO signal in the NDJF coral isotope record from the Chagos Archipelago. We therefore computed the running correlation coefficients between the NDJF coral record and the Nino 3 Index over the past 120 years. A strong correlation with Nino 3 only emerges after the 1970s. Prior to that time, correlations vary around zero and are not statistically significant. The question is: Why is there such a strong ENSO signal in the most recent part of the coral record, -but not before? The mean NDJF SST record in the central Indian Ocean (ERSST, v1) shows that SSTs have risen gradually since 1880, with an accelerated warming after 1970. After the 1970s, the anomalous, albeit small, warming during El Nino events pushes SSTs above 28.5°C. We believe that SSTs above this critical threshold may trigger atmospheric convection that leads to abundant rainfall. Our interpretation has been corroborated through a detailed analysis of meteorological data (Timm et al., in press) and, additionally, by coral Sr/Ca measurements, which are a function of SST only. Our results imply that warmer mean SSTs in the tropical oceans may have great

effects on the hydrological balance.

References: Pfeiffer, M, Dullo, W.-Chr, Eisenhauer, A., Variability of the Intertropical Convergence Zone recorded in coral isotopic records from the central Indian Ocean (Chagos Archipelago), *Quaternary Research* 61, 245-255, 2004. Timm, O., Pfeiffer, M., Dullo, W.-Chr., Non-stationary ENSO-precipitation teleconnection over the equatorial Indian Ocean documented in a coral from the Chagos Archipelago, *Geophysical Research Letters*, 32, L02701, doi:10.1029/2004GL021738, 2005.