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Surface and thermocline variability in the tropical eastern Indian Ocean since the Last Glacial Maximum

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The tropical eastern Indian Ocean is part of Earth´s largest warm pool and its surface and thermocline temperatures exert strong control on deep atmospheric convection and play a critical role for the development of basin-wide, zonal climate anomalies across the Indian Ocean. However, the nature, timing, and mechanisms of changes in the Walker circulation in the tropical Indian Ocean since the Last Glacial Maximum (LGM) are poorly constrained owing to a lack of suitable proxy records and proxy-model disagreements (DiNezio et al. 2016; Mohtadi et al., 2017). Here we reconstruct surface and thermocline temperature and hydrographic changes in the tropical eastern Indian Ocean based on high-resolution, planktic foraminiferal (*G. ruber* and *P. obliquiloculata*) d18O and Mg/Ca records from three sediment cores retrieved offshore west Sumatra along a latitudinal transect across the equator. These records are put into a chronological framework based on numerous radiocarbon ages of surface-dwelling planktic foraminifera and cover the last 22 ka.

Sea surface temperatures at all three sites show a stepwise warming of ~3°C with an 'Antarctic timing' between 18 ka and 11 ka. The thermocline temperature variability is also consistent among the three core sites but distinctly different from the sea surface temperature variability. Thermocline temperatures show a major warming of 2–3°C between ~13 ka and ~10 ka, while differences between LGM and Holocene temperatures are rather small. The resulting surface-thermocline temperature gradient reveals not only a difference between LGM and Holocene thermocline depth levels, but also a major breakdown pointing at a rapid deepening of the thermocline at ~12 ka. This thermocline deepening might have been associated with a strengthened convective activity and Walker circulation, with its timing suggesting a connection to feedbacks related to inundation of the large Sahul Shelf during deglacial sea level rise. Supplemented by deuterium isotope analyses of leaf waxes, our new set of proxy records will provide unprecedented insights into sea surface and thermocline dynamics in the tropical eastern Indian Ocean since the LGM, their relationship to local rainfall, and whether and how basin-wide

circulation and rainfall anomalies were shaped by sea level rise and deglacial climate change.

DiNezio et al., 2016, Paleoceanography 31, 866–894, doi:10.1002/2015PA002890

Mohtadi et al., 2017, Nature Communications 8, 1015, doi:10.1038/s41467-017-00855-3