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Orbital-scale Pleistocene hydroclimate in equatorial Indonesia from the sedimentary record of Lake Towuti

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The Indo-Pacific region hosts Earth's most important zone of deep atmospheric convection. Variability of heat and water vapor fluxes from this region through time are known to significantly influence both regional and extraregional climate and form a critical component of the global climate system. Existing, though temporarily constrained, paleoclimate records from the region show strong spatial heterogeneities in climate and emphasize a complex interplay of orbital, greenhouse gas, remote, and regional forcings on Indo-Pacific hydroclimate during the late Pleistocene. Additional climate records, spanning several glacial-interglacial cycles, are required to better understand the complex interplay of different forcing mechanisms on the regions hydroclimate under different climate boundary conditions.

Lake Towuti (equatorial Indonesia) is a 560 km2, 200-m deep tectonic lake and one of the few terrestrial archives in the region that hosts a continuous sediment succession, which spans multiple glacial-interglacial cycles. In May-July 2015 we recovered a total of ∼1000 m of sediment drill core through the entire sediment infill and down to bedrock in the framework of the ICDP Towuti Drilling Project. Age-depth relationships established using magnetostratigraphy, tephrostratigraphy, and OSL indicate that our record continuously spans the last ∼500 kyr BP. Results from high-resolution inorganic geochemistry datasets, along with detailed groundtruthing of elemental proxies for lake-level, runoff, and lake water oxygenation, emphasize the sensitivity of the record to past changes in hydroclimate. Signals recorded in these datasets exhibit a strong orbital to suborbital variability in moisture balance with superimposed, lower amplitude millennial- and centennial-scale variability at our site. These datasets thus promise to provide a deeper mechanistic understanding of the influence of the different forcings on the regions hydroclimate with implications for global scale teleconnections.