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Invigoration of Indian Ocean zonal circulation drove Pleistocene eastern African aridification

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The coupled ocean-atmosphere circulation of the Indian Ocean Dipole (IOD) controls monsoon rainfall in eastern Africa and southeast Asia at seasonal to decadal time-scale. In years when the dipole is particularly active, it can lead to catastrophic floods and droughts. A growing body of evidence suggests that IOD variability influenced the continental hydroclimate also at longer timescales in the past and thus may have affected human evolution. However, long-term continuous high-resolution well-dated records have so far been unavailable to test this hypothesis. In 2016, long-term continuous deep-sea sediment cores have been recovered from the Davie Ridge in the Mozambique Channel during Expedition 361 'Southern African Climates' as part of the International Ocean Discovery Program (IODP).

Here, we present a more than seven million-year-long multi-proxy record of Mozambique Channel Throughflow (MCT), which is tightly coupled to IOD variability; defined here as the zonal sea surface temperature gradient (Δ SST) between the Indo-Pacific warm pool (IPWP) and the Arabian Sea. We show that the MCT was relatively weak and steady until 2.1 million years ago (Ma), when it started to significantly accelerate with progressively increasing glacial-interglacial amplitude, culminating in high flow speeds from 0.8 Ma onwards. The invigoration of MCT activity coincided with increasing zonal Δ SST, which fuels the atmospheric Walker Cell circulation along the tropical Indian Ocean. Our results demonstrate that the overall intensification of the Indian Ocean Walker Cell amplified the coupled ocean-atmosphere Indian Ocean zonal circulation at orbital time-scales, which agrees with the heightened glacial continental aridity recorded in other eastern African climate proxy records. We argue that the corresponding progressively drier glacials alternated with relative humid interglacials, providing the climatic-environmental setting –varying at seasonal to orbital timescales– for speciation and global expansion of our genus *Homo* after 2.1 Ma.

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