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The rapid constriction of the Indonesian Gateway across 3.4-3 Ma as a main contributing factor for global climate change

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The mid-Pliocene climate transition across 4-3 Ma marks a global cooling in line with the onset of the Northern Hemisphere Glaciation and most distinctly, with the shoaling of the global thermocline. It is still a major scientific issue whether these changes are related to variations in the North Atlantic thermohaline circulation connected with the constriction of the Central American Seaway, or are rather amplified by the narrowing of the Indonesian Gateway. Here, we present sea-(sub)surface foraminiferal Mg/Ca-temperature and salinity data from the tropical eastern Indian Ocean (DSDP Site 214) for the time period from 6.8 to 2.4 Ma to reconstruct changes in the Indonesian Throughflow (ITF). According to the striking hypothesis of Cane and Molnar (2001), the changing plate tectonic constellation across 4-3 Ma caused a switch in the source of the ITF waters from warm/saline S-Pacific towards cool/fresh N-Pacific waters entering the Indian Ocean. In response, cooling of the tropical Indian Ocean caused droughts in Africa, and Northern Hemisphere Glaciation (NHG) intensified. For the critical time period of 3.4-3 Ma, we observe a pronounced freshening and cooling (ca. 4˚C) of subsurface waters and hence, a shoaling of the thermocline. We regard these changes to reflect an increasing influence of N-Pacific subsurface waters in the throughflow area, implying that the plate tectonic reorganization in the ITF region rather affected subsurface than surface water masses. Hence, the constriction of the Indonesian Gateway significantly contributed to the global cooling of the thermocline, which presumably terminated permanent El Niño conditions at that time.