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# Precise timing of deglacial tropical warming and humidification in the Timor Sea vs Antarctic warming and global atmospheric CO2 rise

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The centennial-scale phasing of climate events in the ocean, cryo-, and atmosphere provides crucial new insights into causal linkages that have controlled the events of global climate change during the last deglacial. During Termination Ia, a first significant sea level rise occurred as early as 19.4–18.7 ka (Hanebuth et al., 2008), a first Antarctic warming followed only 18.0/17.8 to 14.7 ka (Kawamura et al., 2007), a minor atmospheric CO2 rise after 17.5 ka, and a major rise at 16.7–14.5 ka (Monnin et al., 2001). Major progress in the precise age control of associated marine climate events resulted from accepting the results of the 14C plateau-tuning method (Sarnthein et al., 2007). Accordingly, 14C reservoir ages of surface waters revealed strong temporal and spatial changes for different parts of the ocean in contrast to the previously assumed constant modern global average of 400 yr. New plateau-tuning based age estimates from the Timor Sea (Core MD01-2378) exhibit a decrease in surface water ages from >2200 yr prior to 16 ka to 410 yr subsequent to 15 ka, thus providing a much improved basis for radiocarbon-based age control of deglacial events in tropical paleoceanography. Accordingly, the benthic delta18O record of deglacial ice melt and intermediate-water warming (near 1700 m w.d.) indeed reflects a first minor response to Antarctic warming after 17.8 ka, a major response, however, only from 17.0–14.4 ka. Likewise, major sea surface warming started almost 1000 yr after Antarctic warming, at 17 ka, almost coeval with the major deglacial rise in atmospheric CO2. In part, this warming may reflect a cease in the upwelling of intermediate waters along the eastern margin of the Indian Ocean, which is documented by a coeval major increase in the Mg/Ca-based temperature gradient between surface and thermocline waters and a halving of (chlorine) productivity at 16.8-16.5 ka, moreover, by the strong decrease in surface water reservoir ages, starting with 800 yr delay. In contrast, the tipping point of planktic delta18O (G. ruber) only occurred at 15.3 ka, 1700 yr after the onset of warming. This lag may result from increased local salinity in the southern Timor Sea during Heinrich-1 times, when this marginal sea region was more influenced by dry southeasterly trades.