Sensitivity of Australian monsoon to changing climate boundary conditions during the late Miocene and across the Mid-Pleistocene Transition

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The Australian Monsoon (AM) subsystem is a highly sensitive monitor of tropical hydroclimate variability, due to its location at the southern edge of the largest amplitude seasonal swing of the Intertropical Convergence Zone (ITCZ) within the large-scale Asian-Australian monsoon system. However, the sensitivity of the AM to changing climate boundary conditions such as ice volume and greenhouse gas concentrations and the interhemispheric coupling with other monsoonal subsystems remain enigmatic due to our limited understanding of its past variability. During IODP Expedition 363, two extended (sedimentation rates: 6 and 10 cm/kyr), hemipelagic sediment successions were retrieved for the first time off NW Australia (Site U1482: 15.055S, 120.435E, water depth: 1466 m and Site U1483: 13.087S, 12.804E, water depth: 1733 m). These carbonate- and clay-rich sequences provide ideal archives to monitor the intensity and variability of the AM and to better constrain its sensitivity to changes in radiative forcing. We developed high-resolution X-ray fluorescence (XRF) scanner derived records of terrigenous runoff (austral summer monsoon precipitation) and paleoproductivity (winter monsoon wind-driven upwelling) over the late Miocene to early Pliocene interval at Site U1482 and across the Mid-Pleistocene Transition at Site U1483. These two periods registered fundamental changes in the global ice volume, interhemispheric thermal gradient and response of the ocean/climate system to radiative forcing, thus offering the opportunity to explore climate-carbon cycle dynamics under different mean-states of Earth’s climate variability. In combination with a high-resolution benthic oxygen isotope stratigraphy, these records will shed light on the timing of major re-organizations in Southern Hemisphere tropical climate, linkages of high- and low-latitude climate change and dynamic coupling of the AM with other monsoon subsystems, thus helping to unravel driving mechanisms of climate change.

Keywords: Australian Monsoon, Late Miocene, Mid-Pleistocene Transition, Stable isotopes, XRF-scanning, IODP Expedition 363

