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Millennial-scale variability in deep ocean circulation in the Eastern Arabian Sea based on the authigenic Neodymium Isotopes

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Thermohaline Circulation (THC) distributes heat, Oxygen, CO_2, and nutrients in the global ocean, thereby regulating global climate. It is linked to climate change on glacial-interglacial and multi-millennial time scales. The Northern Indian Ocean (NIO) receives North Atlantic Deep Water (NADW), Antarctic Bottom Water (AABW), and Antarctic Intermediate Water (AAIW) from the Atlantic and Southern Oceans. The intensities of these water masses in the Indian Ocean have been modulating over the Glacial-Interglacial (G-I) time scale, which is essential to track to correlate them with varying productivity and oxygenation. Sediments from a gravity core collected in the Eastern Arabian Sea (EAS; 14°N & 72°E) at a water depth of 2055 meters (probable interface between NADW and AABW) with a depositional history of ~42 ka have been studied to reconstruct the past variabilities in deep ocean circulation. A high-resolution (~400 years) authigenic Nd isotope record (ε_{Nd}) has been extracted from the carbonate and Fe-Mn oxyhydroxide fractions. ε_{Nd} record of EAS shows large variability ranging from -10.8 to -6.6 with more radiogenic value during cold/dry climatic events (HS 1 to 4, LGM, YD, 1.4 ka events, 4.2 ka events, 8.2 ka events, 9.4 ka event) and less radiogenic value during warm/wet periods, suggesting significant variation in water mass sources along with continental input. The more radiogenic Nd during cold/dry events indicates the reduced flow of NADW (0-50 %) with increased proportions of AABW (50 to 100 %) to the EAS. The less radiogenic ε_{Nd} value during warm/wet periods reflects more occupation of NADW in the EAS with a possible modest impact of continental input from nearby land masses. Our high-resolution study illustrates the impact of global cooling events on the THC, significantly affecting changes in the oceanic heat budget and atmospheric CO2 levels, productivity, and oxygenation in EAS over a millennial time.