



Distant origin of circulation changes in the Indian Ocean during the last deglaciation

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Well-dated benthic foraminifera isotopic record from Indian Ocean core MD98-2165 (9°38'96 S, 118°20'31 E, 2100 m) reveals that circulation changes repeatedly took place in the tropical Indian Ocean around 2000 m depth over the last deglaciation. We show that the observed changes can be explained by large-scale reorganization of intermediate water masses in the Atlantic and Indian Oceans. More specifically, during Heinrich event 1 and the Younger Dryas, while the formation of North Atlantic Deep Water was greatly reduced, brine formation in the North Atlantic and Nordic Seas led to the production of intermediate waters characterized by low $\delta^{13}\text{C}$ and low $\delta^{18}\text{O}$. These waters spread from North to South, far enough into the South Atlantic to be entrained by circumpolar currents and redistributed in the Indian Ocean, creating a circulation branch at intermediate depths that was more active than today. In contrast, our results indicate that there was no rapid transport of intermediate waters from the North Atlantic to the South Atlantic or Indian Ocean around 2000 m depth during the Last Glacial Maximum and after the Younger Dryas. $^{231}\text{Pa}/^{230}\text{Th}$ ratios measured in mid-latitudes North Atlantic core MD95-2037 (37°05.23' N, 32°01.87' W, 2159 m) provide additional insight on the rate of meridional overturning above 2160 m in the Atlantic Ocean and help constraining circulation changes across the last deglaciation.