Ventilation of the deep South Indian Ocean and atmospheric CO_2 increase during the last deglaciation

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Ocean-atmosphere ^{14}C disequilibria reflect past changes in the efficiency of ocean-atmosphere CO_2 exchange, ocean mixing and global-ocean respired carbon storage. A full assessment of the causes of deglacial changes in atmospheric CO_2 is hampered by a lack of ^{14}C observations for instance from the deep Indian Ocean, possibly due to limitations by low foraminiferal abundances in marine sediment cores. Here we circumvent this issue by performing high-resolution benthic and planktic foraminifer ^{14}C analyses on small samples (<1 mg $CaCO_3$) from sediment core MD12-3396Q (47°43.88′S, 86°41.71′E) using the UniBe Mini-Carbon Dating System to estimate deglacial changes in ^{14}C ventilation of the deep South Indian Ocean (3,615 m water depth). Complementing multi-proxy analyses of sea surface temperature variations and bottom water [O_2] estimates allow the construction of an independent age model, and the quantification of surface ocean reservoir ages and deglacial respired carbon changes at our study site. We find reduced (^{14}C *and* O_2) ventilation and increased respired carbon storage during the Last Glacial Maximum. However, although increased ventilation and oxygenation of deep waters is observed during Heinrich event 1, strong ventilation occurred only at the onset of the Bølling-Allerød interstadial, which paralleled a rapid ~12 ppm-rise in atmospheric CO_2. Supported by quantitative estimates, our new findings highlight an efficient teleconnection between northern-hemisphere climate events and significant CO_2 "outgassing" from the Southern Ocean, possibly through interactions between the southward advection of northern-sourced water masses and dynamical changes of the Antarctic Circumpolar Current.