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Deep-sea coral ^{14}C and Li/Mg records of ocean circulation and temperature in the Southwest Atlantic over the last 35 thousand years

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The ocean plays a key role in regulating climate. During the last glacial to deglacial interval, perturbations in the Atlantic Meridional Overturning Circulation (AMOC) have been linked with atmospheric CO_2 and temperature changes. However, our current understanding of the coupled ocean-climate system is incomplete as we lack information from intermediate depths. Gaps in paleoceanographic data are particularly apparent in the understudied South Atlantic region, thus a more complete understanding of deglacial Atlantic water mass mixing has remained elusive.

Here, we reconstruct Southwest Atlantic intermediate depth temperature using Li/Mg ratios in uranium-thorium dated deep-sea corals from the Brazilian margin (20°S to 35°S) and Rio Grande Rise (32°S 35°W). We supplement these data with paired radiocarbon measurements to trace the potential sources of the waters. We find a cooler and well-ventilated intermediate ocean during the last glaciation compared with modern seawater. During the deglaciation, we observed a pronounced warming, in conjunction with ^{14}C increase during Henrich Stadial 1 (~18 ka to 14.7 ka) - a result consistent with a northward advection of carbon- and nutrient-rich intermediate waters from the Southern Ocean. This is followed by a large ^{14}C enrichment during the late deglaciation (Younger Dryas; ~13 ka to 11.7 ka) that suggests a closer connection between our coral sites and surface waters. In the Holocene, intermediate water temperatures remain similar to modern values. Our data demonstrate that temperature in the intermediate Southwest Atlantic responds in step with AMOC perturbations and that are likely dictated by changing advection of southern sourced waters during the last glacial transition.