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Salinity budget of the northern Caribbean Sea over the mid-Pleistocene transition

Sophie Sepulcre, Laurence Vidal, Kazuyo Tachikawa, Frauke Rostek, and Édouard Bard

CEREGE, UMR 6635, Aix-Marseille Université, Collège de France, CNRS, IRD, Europôle de l'Arbois BP80, 13545 Aix en Provence, France (sepulcre@cerege.fr)

The tropical Atlantic hydrology is a key control for the Atlantic Meridional Conveyor (AMC) that transports warm and salty waters from low latitudes into the North Atlantic. It played a critical role in past changes of the AMC and the northern latitude climate at glacial-interglacial timescale. Here we propose to explore the role of the tropical hydrology over the Mid-Pleistocene Transition (MPT), as the source of the heat, salt and moisture to the north Atlantic basin required for the establishment of stable Northern Hemisphere Ice-Sheets (NHIS) implied in the setting of the 100 kyr-cycles in climate records.

Using core MD03-2628 from the Northern Caribbean Sea, we aim at reconstructing changes in surface water hydrology over the last 940 kyr by using the $\Delta\delta^{18}$O of sea water (the difference between modern and past δ^{18}O of seawater) as a proxy for sea surface salinity (SSS). We calculated the past δ^{18}O of seawater by combining alkenone thermometer with the δ^{18}O of planktonic foraminifera *Globigerinoides ruber* (white) and we corrected from the ice-sheet volume effects. At the studied site, modern SSS is mainly modulated by the seasonal migration of the ITCZ, with a maximum freshwater supply linked to its northernmost location. The $\Delta\delta^{18}$O results reveal a marked glacial/interglacial pattern with higher salinities during all glacial periods of the last 940 kyr, with a similar average $\Delta\delta^{18}$O value of 1.3 ($\pm$0.09) ‰. Superimposed on this variability, the $\Delta\delta^{18}$O record exhibits a longer trend for the interglacial stages, with lower values for the last 450 kyr (0.50 ± 0.05‰) than for the time interval 940 to 650 kyr (0.95 ± 0.05‰).

The higher $\Delta\delta^{18}$O values observed during glacial periods indicate increased SSS in the Caribbean Sea that can be explained by a southward shift of the ITCZ, induced by a steeper interhemispheric temperature gradient during glacials. As the southern ITCZ location is associated with a reduced northward cross equatorial oceanic transport, the results suggest that the link between tropical salinity budget and the AMC at glacial-interglacial timescale persisted over the last 940 kyr.

At a longer timescale, the lower salinities recorded in core MD03-2628 during interglacial stages of the last 450 kyr suggest a northward migration of the ITCZ. This movement over the MPT might be forced by changes in interhemispheric temperature gradient associated with the northward position of the Southern Oceanic Fronts (SOF) then amplifying the transport of heat and moisture to the North Atlantic. This hypothesis is supported by records from the South Atlantic indicating enhanced northward oceanic mass transport during the Terminations of the last 450 kyr linked to the abrupt resumption of the AMC. This last process may have contributed to the the emergence of merged NHIS that could survive during insolation maxima and reach continental-scale size.