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Link between intermediate water hydrology and meridional overturning circulation during the mid-Holocene climatic optimum in the North Atlantic region

J.-M. Gherardi (1), L. Labeyrie (2), H. Elderfield (3), T. M. Dokken (1), and E. Cortijo (2)

(1) Bjerknes Center for Climate Research, Allégaten 70, 5007 Bergen, Norway (jeanne.scao@bjerknes.uib.no/+47 5584330), (2) Laboratoire des Sciences du Climat et de l'Environnement, IPSL-CNRS-CEA, Parc du CNRS, 91198 Gif sur Yvette, France, (3) Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, UK,

The Holocene is commonly referred to as a period of relatively stable climate conditions. It is however affected by a climate anomaly 8.2 kyr ago, postulated to be the result of weakened Meridional Overturning Circulation (MOC) triggered by a freshwater outburst. This time period offers then a good opportunity to study the relationship between intermediate water masses renewal and hydrology.
We have focused our work on core MD95-2037 (37°05,23 N ; 32°01,87 W, 2100 m) located in the subtropical North Atlantic gyre, on the eastern side of the mid-Atlantic ridge. Age model has been constrained using 14C AMS measurements on planctonic foraminifera, and the studied time interval is restricted between 3 and 11 kyr. Reconstructed Sea Surface Temperature (SST), and the benthic oxygen and carbon isotopes at this site remained stable during the studied period.
In order to reconstruct intermediate water mass hydrology, we used Mg/Ca of benthic foraminifera as a representation of deep water temperature. Mg/Ca measurements were performed on a single benthic species C. wuellerstorfi and a linear temperature calibration has been established from published and new core-top data. In-situ deep water temperature is 3.7°C, and is within temperature range where carbonate chemistry of ambient deep water is expected to have an increasing effect on the processes controlling the incorporation of Mg during shell growth.
We show a gradual increase of benthic Mg/Ca from 11 kyr, reaching a maximum during the abrupt cold climate anomaly at 8.2 kyr. From this time the benthic Mg/Ca is steadily then decreasing towards core-top value.
Using the comparison of Mg/Ca-Temperature signal with the dynamic tracer 231Pa/230Th record from the same core we show the synchrony between a decrease of the renewal rate of the intermediate water masse and change in intermediate water hydrology connected with the climate anomaly 8.2 kyr ago. However, whereas intermediate overturning seems to be drastically affected, going from a "Glacial mode" characterized with important renewal rate of intermediate water masses to the "modern mode", with slower intermediate renewal rate, hydrology appears only temporarily disturbed.