# THE ATLANTIC MERIDIONAL OVERTURNING CIRCULATION OVER TIME FROM ND ISOTOPES

GOLDSTEIN, S.L.[1], PENA, L.D.[2], YEHUDAI, M.[1], JAUME-SEGUÍ, M.[1,2], KIM, J.[1], KNUDSON, K.[1], BASAK, C.[1,3], HARTMAN, A.E.[4], LUPIEN, R.[5]

[1]Lamont-Doherty Earth Observatory, Columbia University, NY, USA
[2]Department of Earth and Ocean Dynamics, University of Barcelona, Spain
[3]Department of Geological Sciences, California State University, Bakersfield, CA, USA
[4]USGS, Columbia, MO, USA
[5]Department of Geological Sciences, Brown University, RI, USA

The Atlantic Meridional Overturning Circulation (AMOC) brings heat from the tropics to the high latitudes, and its temporal variability has major impacts on ice age cycles. We report north-south profiles from the North Atlantic to the Southern Ocean over the past ~2 Ma, using Nd isotopes in fish debris and Fe-Mn oxide encrusted foraminifera, which trace the changes in the AMOC over glacials and interglacials through this time period.

In each time slice our sites show a consistent north-to-south gradient in the North Atlantic source water (NSW) signal strength throughout, providing strong evidence that the data represent AMOC fluctuations. The North Atlantic data show strong evidence that the εNd of the NSW end-member remained similar to today through this time interval (Kim et al. this meeting). We have identified 5 modes of the AMOC circulation. We have identified 5 AMOC circulation modes. The most common ones are (1) the *"interglacial norm"*, similar to the present-day where the NSW signal remains strong into the South Atlantic, and (2) the *"glacial norm"*, indicating a weaker AMOC, with southern source water (SSW) extending into the deep North Atlantic. Less common are the (3) *"weak AMOC"* mode, typical of Heinrich events, the Mid-Pleistocene Transition (MPT), and MIS 10 and 16, where even the deep North Atlantic shows a strong SSW signal, and its counterpart the (4) *"ultra-strong AMOC"*, in MIS 9, 11, 19, 21 and 25, when the NSW signal is unusually strong south of the equator. Finally, during (5) the *"pre-MPT AMOC crisis"* mode, MIS 26-27, historically unique low Nd isotopes in the North Atlantic signals major input of Nd from the Canadian Shield directly preceding the 'MPT AMOC crisis' of Pena and Goldstein (Science 2014), reflecting the events there likely triggered it. The AMOC time-slice profiles will be useful as a means to directly relate climate to concurrent ocean circulation through time.