

## Modes of the Atlantic Meridional Overturning Circulation from Nd Isotopes

YEHUDAI, M.<sup>1</sup>, GOLDSTEIN, S.L.<sup>1</sup>, PENA, L.D.<sup>2</sup>, JAUME-  
SEGUI, M.<sup>1,2</sup>, KIM, J.<sup>1</sup>, KNUDSON, K.<sup>1</sup>, HARTMAN, A.E.<sup>3</sup>,  
LUPIEN, R.<sup>4</sup>

<sup>1</sup> Lamont-Doherty Earth Observatory, Columbia University,  
NY, USA my2430@columbia.edu ,  
steveg@ldeo.columbia.edu, joohee@ldeo.columbia.edu,  
knudsonk@gmail.com

<sup>2</sup> Department of Earth and Ocean Dynamics, University of  
Barcelona, Spain lpna@ub.edu,  
maria.jase86@gmail.com

<sup>3</sup> USGS, Columbia, MO, USA ahartman@usgs.gov

<sup>4</sup> Department of Geological Sciences, Brown University, RI,  
USA , Rachel\_Lupien@brown.edu

The Atlantic Meridional Overturning Circulation (AMOC) brings heat from the tropics to the high latitudes, and its temporal variability has major impacts on climatic cycles. We report Atlantic Ocean north-south profiles over the past ~1.5 Ma, using Nd isotopes in fish debris and Fe-Mn oxide encrusted foraminifera, which trace the changes in the AMOC over glacial 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, providing strong evidence that the data represent AMOC fluctuations. The North Atlantic data show strong evidence that the  $\epsilon_{\text{Nd}}$  of the NSW end-member remained similar to today through this time interval. We have identified 5 main modes of the AMOC circulation. 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. Three less common are the (3) “weak AMOC” mode, typical of Heinrich events, the MPT AMOC-crisis event (MIS 24-22), and MIS 10 and 16, where even the deep North Atlantic shows a strong SSW signal, and its counterpart the (4) “ultra-strong AMOC”, during MIS 9, 11, 19, 21 and 25, when the NSW signal is unusually strong south of the equator, and the (5) “divergence mode” where there is a large difference in the  $\epsilon_{\text{Nd}}$  between the North Atlantic and the rest of the transect, and the North and the Equatorial Atlantic shifts in opposite directions, seen during MIS 41, 32, 27, 26, and 14. The “divergence mode” includes the interval just prior to the “MPT AMOC crisis” which is characterized by uniquely negative  $\epsilon_{\text{Nd}}$  values in the North Atlantic, signalling major inputs of Nd from the Northern Hemisphere Shields, and reflecting events that likely triggered the onset of the 100 kyr cyclicity. These AMOC time-slice profiles provide a useful new framework to directly relate climate past changes to concurrent AMOC circulation configurations through time.