

# Reconstructing Deep Atlantic Circulation During Past Glacial-Interglacial Cycles

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The Atlantic Meridional Overturning Circulation (AMOC) plays a key role in Earth's climate system by moving heat and carbon between the surface and deep ocean. Understanding how AMOC changed during past glacial–interglacial cycles helps explain long-term climate variability. Carbon and oxygen isotope data ( $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$ ) were measured from benthic foraminifera at IODP Site 1587, located off the Iberian Margin, to study changes in deep Atlantic circulation between Marine Isotope Stages (MIS) 19 and 39. These records were compared to global isotope stacks and previously published datasets from the Atlantic and Pacific.  $\delta^{13}\text{C}$  values reflect the source and age of deep water masses, while  $\delta^{18}\text{O}$  values are used to track global ice volume and changes in seawater temperature. The benthic species *Cibicides wuellerstorfi* was selected for isotope analysis, and stable isotope measurements were performed using mass spectrometry. Results show that during glacial periods,  $\delta^{13}\text{C}$  values were generally lower, suggesting weaker North Atlantic Deep Water (NADW) formation and greater influence of southern-sourced waters. In contrast, higher  $\delta^{13}\text{C}$  values during interglacials point to stronger overturning and better deep water ventilation. The findings suggest that deep Atlantic circulation responded closely to glacial–interglacial climate changes and likely contributed to shifts in ocean carbon storage. Patterns observed at Site 1587 match trends seen across the Atlantic Ocean in previous studies, including evidence from Raymo et al. (1990) and Curry and Oppo (2005), which highlight the contrast in deep water sourcing between warm and cold periods. The isotope record was aligned with the LR04 stack for age assignment and Marine Isotope Stage identification (Lisiecki and Raymo, 2005). Overall, these results support the idea that changes in AMOC during earlier climate cycles played a key role in carbon exchange between the ocean and atmosphere, offering insight into how deep circulation may respond to future climate change.