What is the Relationship Between North Atlantic Climate and Deep Ocean Circulation from 30ka to 90ka?

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Atlantic Meridional Overturning Circulation (AMOC) contributes to the global transport of heat and nutrients, as well as playing a leading role in the oceanic uptake of anthropogenic carbon. It therefore influences and in turn is affected by climate variability. In a warming climate, models have shown that AMOC could weaken or even collapse in the coming years. Understanding the relationship between AMOC and climate variability can help inform or predict future changes due to global warming and their consequences. Past work on deep-sea sediments deposited on the Iberian Margin has documented dramatic climate variability in the past that may be related to changes in AMOC. Site 1586 (37°37.7108′N, 10°42.6987′W, 4692mbsl) was recovered at a nearby location to previous studies, yet at a water depth bathed by a greater contribution of the Antarctic Bottom Water (AABW). To assess the extent of AMOC changes at this great depth, we used the $\delta^{18}O$ from shells of two genera of benthic foraminifera, the epifaunal C. wuellerstorfi and the infaunal U. peregrina. The $\delta^{18}O$ from these shells is used as a proxy for global climate, while the $\delta^{13}C$ is a proxy for the mixture of water masses at depth as an indication of ocean circulation. Site 1586 is ideal for these high-resolution measurements due to the high sedimentation rates and location for observing water mass geometries. This interval covers MIS 3, MIS 4, and MIS 5. The stable isotope data generally display an inverse relationship of higher $\delta^{13}C$ values associated with lower $\delta^{18}O$ values and the inverse. This indicates that times with a warmer climate have stronger AMOC, but during a cooler climate, AMOC is weakened. During intermediate periods, particularly throughout MIS 3, ocean circulation is more variable compared to the extreme climate conditions of glacial-interglacial cycles. Dramatic variability in AMOC extended into the abyssal depths of the eastern basin of the Atlantic Ocean, which compares to depths observed in the western basin.