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Pliocene hydrographic variations in the mid-latitude North Atlantic (IODP Site U1313)

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IODP Site U1313 (41°N, 32°57.4'W, 3412m) is ideally positioned to monitor past changes in the Atlantic Meridional Overturning Circulation (AMOC) because surface waters in this region are derived from the North Atlantic Drift (NAD) and in the deep North Atlantic Deep Water (NADW) is transported southward with the deep western boundary current. For the better understanding of climate change during the Pliocene when sea level and surface water temperatures were generally higher than today, we are generating millennial-scale stable isotope records of Globigerinoides ruber (white) and Cibicidoides sp. to monitor surface and deep water changes, respectively, during the period from 3.4 to 4.1 Ma. Besides the obliquity paced glacial/ interglacial cycles higher frequency oscillations are observed in the planktonic and benthic oxygen and carbon isotope records. Benthic carbon isotope values show the near continuous presence of NADW with only few short-term oscillations reaching lower values indicative of some Antarctic Bottom Water influence. So overall, the benthic data confirms a strong AMOC, also during most of the glacial periods. In the G. ruber surface water record high frequency oscillations are observed especially during the interglacial periods, although interstadial-type warm periods occurred during some of the glacial periods. In the overall trends, the G. ruber oxygen isotope record agrees well with the biomarker-based sea surface temperature record of Site U1313 (Naafs et al., 2010 in EPSL and new data). However, amplitudes of SST and oxygen isotope changes sometimes differ indicating that salinity changes also affected the plankton foraminifer isotope signal. The high-resolution isotope data clearly shows that higher frequency climate change was also common during the warm Pliocene.