Geophysical Research Abstracts
Vol. 17, EGU2015-8092-1, 2015
EGU General Assembly 2015

Changing surface water conditions for the last 500 ka in the Southeast Atlantic:Tracking Agulhas leakage using UK37' and δD

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The Southeast Atlantic Ocean is an important component of global ocean circulation, as it includes heat and salt transfer into the Atlantic through Agulhas Leakage. Here, we reconstruct sea surface temperatures (SSTs) and sea surface salinity from Ocean Drilling Program (ODP) Site 1087 in the Southeast Atlantic to investigate surface ocean circulation patterns during the late Pleistocene (0-500 ka). The alkenone-derived $U^{K'}_{37}$ index and assemblages of dinoflagellate cysts are used to reconstruct SSTs. The hydrogen isotope composition of the alkenones ($\delta D_{alkenone}$) is used to reconstruct changes in sea-surface salinity.

The greatest amplitude of SST warming precedes decreases in benthic $\delta^{18}O$ and therefore occurs early in the transition from glacials to interglacials. The timing of the early warming is consistent with previously published foraminifera reconstructions from the same site (Caley et al., 2012). However, $\delta D_{alkenone}$ decreases at the start of interglacials, suggesting that sea surface salinity increased earlier than the deglacial warmings, and indicating that the pattern of Agulhas leakage is more complex than suggested by SST proxies alone. Furthermore, the $\delta D_{alkenone}$ values indicate a strong salinity increases occurred before both MIS 11 and MIS 1, which are both periods where there is evidence of connection between increased Agulhas Leakage and a stronger Atlantic meridional overturning circulation (AMOC). Finally, the ODP site 1087 record shows an overall trend of increasing SSTs and $\delta D_{alkenone}$ towards the present day, suggesting that Agulhas leakage has strengthened since 500 ka, which may have impacted the intensity of the AMOC.

Caley, T., Giraudeau, J., Malaize, B., Rossignol, L., Pierre, C., 2012. Agulhas leakage as a key process in the modes of Quaternary climate changes. Proc. Natl. Acad. Sci. 109, 6835–6839. doi:10.1073/pnas.1115545109