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Surface heat storage in the subtropical North Atlantic during the LGM

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The transport of warm saline waters from the subtropical into the subpolar North Atlantic plays a major role in the stabilization of AMOC. During the Late Pleistocene this system experienced millennial scale variability with weak AMOC phases that are associated with heat and salt storage within the subtropics. The subsequent onset of AMOC is supposed to be fueled by the release and transport of the warm saline water into the northern hemisphere deepwater convection sites. Despite this conceptual model, contradicting reconstructions for such warm water storage exist for the Deglaciation to early Holocene and full glacial periods, either asserting a southward movement of the Subtropical gyre (STG) and subsurface heat storage or northward extension of the STG with warming of the surface waters.

Here we investigate the heat and salt storage patterns and extension of the warm subtropical gyre (STG) during MIS 2 well into MIS 3 (16- 30 ka BP) at centennial scale resolution using sediment core MD08-3181 (38°N; 31.13°W, 3060 m w.d.) retrieved immediately east of the Mid Atlantic Ridge south of the Azores Islands with sedimentation rates up to 100 cm/ ka. At present, this site is located at the northern rim of the Azores Current, which delineates the STG, recirculating warm waters of the North Atlantic Current. Due to its position at the boundary between temperate Northeast Atlantic waters and warm STG waters, the coring site is ideal to trace past changes in the influence of both water masses.

Parallel stable-oxygen isotope and Mg/Ca temperature records of surface-water dwelling foraminifera Globigerina bulloides (habitat depth 0-200 m) and subsurface dweller Globorotalia inflata (habitat depth 100-300 m) and foraminiferal transfer functions are used to reconstruct the temperature and salinity structure of the mixed layer. Additionally, the AF position is reconstructed using the abundance of the tropical to subtropical species Globigerinoides ruber white.

Preliminary results indicate a surface water temperature and salinity increase and a northward movement of the STG during the LGM that corroborates previous studies from the subpolar North Atlantic. However we identified different processes of heat storage with respect to millennial scale climate changes and those triggered by orbital forcing. While it seems that at full glacial interglacial cycles heat storage in surface waters plays an important role, subsurface warming most probably had a significant influence during short-term AMOC weakening phases.