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The Holocene Thermal Maximum: A possible analogue for future Ocean-Atmosphere climate Dynamics?

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There is increasing evidence that the accelerated warming in the Arctic due to global warming is associated with increased climate variability at mid-latitudes affecting ocean-atmosphere climate dynamics over the subpolar North Atlantic basin. However, our understanding of how warmer high latitudes will specifically impact north-west European climates, remains limited. This is due to the restricted availability and low spatial coverage of high resolution paleoceanographic records focusing on the impact of warmer climates for this region.

Targeting the warmer than present Holocene Thermal Maximum (HTM) we present a paleoclimate record collected from the eastern margin of the subpolar North Atlantic basin. At 110m water depth on the Irish continental shelf, the site is influenced by both North Atlantic waters and local Irish Shelf waters. Reconstructions of bottom water temperatures (BWT) and stable oxygen isotopes of sea water (Mg/Ca - δ18Osw – Hyalinea balthica) allow us, in combination with existing paleoceonographic records, to assess the nature of the ocean-atmosphere climate shift that took place over the HTM – Late Holocene transition. In accord with future climate model simulations for a warmer climate, our results support a more eastward location of the Icelandic Low during HTM winters. We propose that the oceanographic response to this atmospheric shift resulted in a larger influence of North Atlantic waters on the Irish shelf and thus warmer BWT's of up to 2 ± 0.7°C and heavier δ18Osw values of up to 0.5 ± 0.3 ‰ until circa 4.0 ka. Thereafter our results show a cooling trend into the Neoglacial period that we interpret with a westward shift of the Icelandic low towards the Irminger Sea and the growing influence of colder and fresher shelf waters at the core site. The paleoceanographic changes presented here enhance our spatial and temporal understanding of ocean-atmosphere dynamics that operate during warmer than present climates in the North Atlantic sector.