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The early Holocene thermal maximum in the northern Nordic Seas: An advective signal or a direct response to strong summer insolation?

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Multi-proxy data representative for the surface and subsurface layer has been compiled for three sites from the eastern Nordic Seas. The surface proxy is alkenone based SST's, while foraminiferal abundance data, Maximum Likelihood foraminiferal based SST estimates, and oxygen isotope measurements on planktic foraminifera were used to reconstruct subsurface conditions. The three sites follow the path of the north flowing North Atlantic Current: the Vøring Plateau, SW Barents Sea and the Barents Sea Margin. The effect of the high summer insolation on the ocean temperatures on the upper part of the water column are explored using a 1-D column model, and allows estimates of changes in ocean heat transport and direct response to the maximum summer early Holocene insolation at high northern latitudes.

An early Holocene warm pulse is seen subsurface in the SE Nordic Seas 10.5-9.6 ka BP. With a slight delay, this subsurface warm pulse can be followed to NE Nordic Seas where it peaked at 10-9.4 ka BP. After the culmination of this subsurface warm peak, the maximum early Holocene temperatures are recorded in the surface water masses (9-6 ka BP). Preliminary results using the 1-D column model indicate that the increased summer insolation only influence the upper 20 m of the water column, increasing the temperature there by approximately 1°C compared to the present summer temperature of the mixed layer.

A direct response to the high Northern hemisphere summer insolation is thus seen in the surface water masses both in the SE and NE Nordic Seas. However, the high early Holocene insolation did not influence the temperatures underneath the mixed layer depth at any of the studied sites. The earlier subsurface warm peak probably reflects increased northward heat transport released to the Nordic Seas region through the deglaciation, and cannot be seen as a direct response to the external forcing.