



Early Holocene variability in the Arctic Gateway - High-resolution records reflecting Atlantic Water advection and ice coverage

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The Arctic Gateway between Greenland and Svalbard is the main passage for the advection of Atlantic Water to the Arctic Ocean. Water temperature and intensity of this advection largely determine the degree of ice coverage which is fed by sea ice export from the north. Supported by a maximum in insolation, the Early Holocene was a period of extraordinarily strong advection and relatively high near-surface water temperatures in the eastern Nordic Seas (cf. Risebrobakken et al., 2011, *Paleoceanography* v. 26). Here we present a synthesis of radiocarbon-dated records from the northern and western part of this area, reaching from the SW Greenland Sea (73°N) to the Yermak Plateau (81°N) and revealing temporal and spatial differences in the development of the so-called Holocene Thermal Maximum (HTM). In the northern part of this region, the HTM started ca. 11-10.5 ka as indicated by rapidly increasing amounts of subpolar planktic foraminifers in the sediments. In the eastern Fram Strait and on the Yermak Plateau, our records of (sub)millennial scale resolution show that the maximum influx terminated already 2,000 years later (9-8 ka). Most likely, this development went along with a N-S relocation of the sea ice margin. According to the current stratigraphic model for a core with submillennial-scale resolution from Vesterisbanken seamount (73°N) in the Greenland Sea, the timing was different there. Increasing total amounts of planktic foraminifers in the sediment indicate an early (11-10 ka) reduction in sea ice coverage also in this region. However, evidence from subpolar planktic foraminifers for maximum Atlantic Water advection is younger (9-6 ka) than in the north. Apparently, the site in the SW Greenland Sea was affected by Atlantic Water in the Greenland Gyre that decoupled from the northward flowing Norwegian Atlantic Current/Westspitsbergen Current south of the Fram Strait. Thus, in a suite of events, strong Atlantic Water advection first affected the northeastern sector of the Nordic Seas for ca. 2,000 years. Around 9 ka, the Westspitsbergen Branch weakened somewhat and the Greenland Gyre was strengthened by a westward flow of relatively warm and saline waters. Only in the middle Holocene, when the increasing sea ice production in the Siberian Arctic may have reached conditions comparable to modern, Atlantic Water advection by the Greenland Gyre to the SW Greenland Sea decreased and the current system in this area reached the modern state.