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Leading role of ocean mixing in the Norwegian Sea for Dansgaard-Oeschger events

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Several studies have identified the Nordic Seas (NS) and the ice-ocean atmosphere interactions therein as a key-operating center to explain the pace and magnitude of the rapid climate fluctuations associated with Dansgaard-Oeschger cycles in the North Atlantic region. However, it remains elusive how cryosphere and ocean interactions evolved during the course of a D-O event and shaped temperature responses over Greenland. Here an overview of the sequence of events taking place in the eastern NS throughout Greenland interstadials (GI) 9 till 5 (40.4-32 ka BP) is presented.
We use a unique high-resolution set of paired 42 radiocarbon (14C) ages on planktic foraminifera Neogloboquadrina pachyderma (sinistral) and 31 mixed benthic measurements (excluding Miliolid species) to reveal insights into the dynamics of cryosphere and ocean interactions. Based on foraminiferal subsurface and intermediate $\Delta^{14}C$ ventilation reconstructions we find a stratified water column and sea-ice build up in the early stadial phases. Each Greenland Stadial (GS) is characterised by a gradual aging of the water masses and subsurface warming in the NS with planktic and benthic reservoir ages in the terminal phase of each GS up to 2500 yrs. A potential explanation for the observed pattern could be a slow interior upward mixing of older (warmer/saline), radiocarbon-depleted deep water to the surface which helps to erode the sea-ice cover in the final phases of each GS. The sea ice decline probably led to subsurface heat and marine CO_2 release to the atmosphere in the transitional phase into GIs and thereby, contributing to the abrupt warming over Greenland. The processes we identify from the proxy data are in good qualitative agreement with results from an idealized model study.