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Fennoscandian trigger for D-O events

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Dansgaard-Oeschger (D-O) events are abrupt warming events occurring intermittently throughout much of the last glacial period, but most prominently during marine isotope stage 3 (MIS3, 60-30Ka). Marine and ice core data suggest that North Atlantic climate shifted between cold stadial and warm interstadial states within decades, involving large changes in atmospheric and sea surface temperatures.

Based on a new high resolution marine sediment core from the Nordic Seas and simulations with a coupled ocean-atmosphere-sea ice model of intermediate complexity, a conceptual model is presented illustrating the main mechanisms of a D-O cycle.

In this model a freshwater discharge into the glacial North Atlantic ocean from the Fennoscandian ice sheet creates a surface freshwater lens, accompanied by extensive sea ice, and a weak Atlantic meridional overturning circulation (AMOC). The resulting climate state is comparable to the cold stadials of D-O cycles. In this state of weakened meridional overturning circulation, heat accumulates below the freshwater lens and expanded sea ice cover in the Nordic Seas. Once there is enough heat to destabilize the water column beneath the sea ice, the freshwater lens is rapidly eroded together with the overlying sea ice, exposing the relatively warm ocean surface to the atmosphere above. As a result, Greenland experiences a warming similar to the rapid warming observed at the onset of a D-O event in Greenland ice cores.