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Large changes in sea ice and climate triggered by small changes in Atlantic water temperature

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Changes in sea ice are proposed as an important component in Dansgaard-Oeschger events; the abrupt climate change events that occurred repeatedly during the last ice age.
Here, we study the sensitivity of sea ice in the Nordic Seas to changes in Atlantic water temperature using an eddy-resolving configuration of the Massachusetts Institute of Technology general circulation model with idealized topography. We show that a full sea-ice cover and Arctic-like stratification can exist in the Nordic Seas given sufficiently cold Atlantic water and corresponding low transport of heat across the Greenland-Scotland Ridge. Under sufficient cold conditions, a halocline capped by sea ice emerges spontaneously due to redistribution of freshwater through sea-ice formation and melt.
There is a non-linear response in sea ice to Atlantic water temperature with large abrupt changes in sea ice given small changes in inflowing temperature. The stability of a sea-ice cover in the Nordic Seas is dependent on the background climate and large changes in stratification and sea ice occur with small changes in forcing. This suggests that the Dansgaard-Oeschger events were more likely to have occurred during periods of reduced warm Atlantic water inflow to the Nordic Seas. In addition, additional freshwater experiments show self-sustained oscillations in sea-ice cover without a change in forcing. Results with the addition of external freshwater might be more consistent with proxy reconstructions.