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Freshwater fluxes from the Northern Hemisphere ice sheets during the Last Deglaciation

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The disintegration of the Northern Hemisphere Ice Sheets during the Last Deglaciation is thought to have significantly influenced the global climate through oceanic and atmospheric feedbacks. Besides changes in topography and albedo over the large continental ice sheets, freshwater fluxes probably had large effects on the ocean circulation and on the global temperature evolution. To study possible changes in the ocean circulation, it is crucial to track both the intensity and location of meltwater runoff and iceberg calving into the ocean.
We have simulated the northern hemisphere ice sheets with a 3D thermomechanical ice sheet model forced with output from a coupled atmosphere-ocean model (ECBilt-Clio) with prescribed ice sheets (extent, elevation, and albedo) for the Last Deglacation. The ice sheet model calculates changes in topography as well as the evolution of the freshwater fluxes, resulting from iceberg calving, basal melt and surface ablation. The ice sheet melt fluxes are routed through a continental runoff scheme that provides the runoff paths over the continents and gives for each continental grid point a corresponding drainage location in the ocean.
The results are very dependent on the climate forcing that serves as input for the ice sheet model. Taking GRIP (Greenland Ice Core Project) scaled temperature and precipitation input, we find three major freshwater pulses during the Last Deglaciation. The first meltwater peak occurred at approximately 17 kyr BP, with an amplitude of 0.45 Sverdrup. The second, with the highest intensity of 0.8 Sverdrup, occurred around 14 kyr BP. Large parts of this meltwater is channeled to the North Atlantic, where it might have triggered the Younger Dryas cold period. The third and last meltwater peak happened about 10 kyr BP, corresponding to a switch in the freshwater routing from the North Atlantic to the Artic Ocean.