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Early Holocene Laurentide Icesheet deglaciation causes cooling in the high-latitude Southern Hemisphere through oceanic teleconnection

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The impact of the early Holocene Laurentide Icesheet (LIS) deglaciation on the climate at Southern Hemisphere high latitudes is studied in three transient simulations performed with the LOVECLIM global climate model of the coupled atmosphere-ocean-vegetation system. Considering the LIS deglaciation, we quantify separately the impacts of the background melt-water fluxes and the changes in topography and surface albedo. In our model, the melt-water input into the North Atlantic results in a substantial weakening of the Atlantic Meridional Overturning circulation, associated with absence of deep convection in the Labrador Sea. Northward Ocean heat transport by the Atlantic Ocean is reduced by 28%. This weakened ocean circulation leads to cooler North Atlantic Deep Water (NADW). Upwelling of this cool NADW in the Southern Ocean results in reduced surface temperatures (by 1 to 2 degree C) here between 9 and 7 ka BP compared to an experiment without LIS deglaciation. Poleward of the polar front zone, this advective teleconnection between the Southern and Northern Hemispheres overwhelms the effect of the 'classical' bipolar seesaw mechanism. These results provide an explanation for the relatively cold climatic conditions between 9 and 7 ka BP reconstructed in several proxy records from Southern Hemisphere high latitudes, such as Antarctic ice cores. It can then be expected that similar hemispheric connections existed during earlier deglaciations.