

Global and regional effects of Hudson Bay closure during deglaciation periods

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During the Quaternary, the Hudson Bay switched between closed (covered by ice sheet) and open (ice sheet-free) condition due to large variations of ice sheets. However, how the closure and opening of the Hudson Bay have affected the local and global climates is still poorly understood. Using the LOVECLIM1.3 model, here we investigate the global and regional effects of Hudson Bay closure at the beginning of each deglaciation period of the last 800 ka. Sensitivity experiments are performed at nine selected dates at the early stage of the deglaciation periods which are characterized by large Northern Hemisphere (NH) ice sheets, relatively low CO₂ and different combinations of astronomical parameters. Two experiments are performed at each date, one with the Hudson Bay open and another with the Hudson Bay closed. Our model results show that the closure of the Hudson Bay could lead to a strengthening of the Atlantic Meridional Overturning Circulation (AMOC), which in turn leads to a warming in the Northern Hemisphere with notable warming in the Labrador Sea and northeast North Atlantic, a cooling in the Southern Hemisphere and a northward shift of the Inter-tropical Convergence Zone (ITCZ). In addition to the large-scale climate changes related to the modification of AMOC, the closure of Hudson Bay also has a great effect on regional climate. For example, there is a cooling over the Hudson Bay and over the southeast of Greenland. Our results also show that the effect of the Hudson Bay closure depends on background climate conditions, and it could weaken or slightly reinforce the effect of the ice sheets for different astronomical configurations.