

EGU25-10609

EGU General Assembly 2025

© Author(s) 2025. This work is distributed under the Creative Commons Attribution 4.0 License.



Effect of Hudson Bay closure on global and regional climate under different astronomical configurations

Zhipeng Wu¹, Qiuzhen Yin¹, Andrey Ganopolski², André Berger¹, and Zhengtang Guo³¹Université catholique de Louvain, Earth and Life Institute, Louvain-la-Neuve, Belgium (zhipeng.wu@uclouvain.be)²Potsdam Institute for Climate Impact Research, Potsdam, Germany³Key Laboratory of Cenozoic Geology and Environment, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China

During the Quaternary, the Hudson Bay switched between closed (covered by ice sheet) and open (ice sheet-free) conditions 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 under-investigated. Using the LOVECLIM1.3 model, we have investigated the effect of the Hudson Bay closure under glacial conditions with different astronomical configurations, greenhouse gases (GHG) concentrations and Northern Hemisphere (NH) ice volume. Our model results show that the closure of the Hudson Bay could lead to a strengthening of the Atlantic Meridional Overturning Circulation (AMOC) due to the increased evaporation minus precipitation over the Labrador Sea which leads to saltier water and stronger deep convection in the Labrador Sea. This in turn leads to a warming in the NH with notable warming in the Labrador Sea and northeast North Atlantic, a cooling in the Southern Hemisphere (SH) and a northward shift of the Inter-tropical Convergence Zone (ITCZ). In addition to the large-scale climate changes, the closure of Hudson Bay also leads to a strong cooling over the Hudson Bay region due to changes of surface properties and a cooling to the southeast of Greenland due to more wind-driven sea ice export from the Arctic. However, 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 under different astronomical configurations.