EGU2020-5346
https://doi.org/10.5194/egusphere-egu2020-5346
EGU General Assembly 2020

Impacts of the PMIP4 ice-sheets on Northern Hemisphere climate during the last glacial period

Kenji Izumi[1], Paul Paul Valdes[1], Ruza Ivanovic[2], and Lauren Gregoire[2]
[1]School of Geographical Sciences, University of Bristol, Bristol, United Kingdom of Great Britain and Northern Ireland (kenji.izumi@bristol.ac.uk)
[2]School of Earth and Environment, University of Leeds, Leeds, United Kingdom of Great Britain and Northern Ireland

The Last Glacial Maximum (LGM; 21,000 yr before present) is a target period of the paleoclimate simulations in the Coupled Model Intercomparison Project Phase 6 – the Paleoclimate Modeling Intercomparison Project Phase 4 (CMIP6-PMIP4) because of abundant paleoenvironmental data in continental, ice, and marine indicators. The LGM was a period of low atmospheric trace gases when large ice sheets covered over North America and Scandinavia. Paleoclimate reconstructions and modeling studies suggest that the Northern Hemisphere climate differed from today.

In this study, we used the coupled atmosphere and ocean model HadCM3B-M1 in order to investigate the impacts of the main LGM boundary condition changes, in particular, the ICE-6G_C, GLAC-1D, and PMIP3 ice-sheet reconstructions following the PMIP4 protocol, on the mean state of the climate over the Northern Hemisphere. First, we check the surface albedo forcing and feedback with a simplified partial derivative method and assess the surface temperature changes and their composition using a simple surface energy balance equation. Then, we investigate how patterns of stationary waves, westerly jet precipitation over the Northern Hemisphere change in response to the LGM ice-sheet configuration. Finally, we implement a paleo data-model comparison for validation of the large-scale climate changes over the Northern Hemisphere at the LGM. The wintertime stationary waves have the largest amplitude and different responses among the experiments, while stationary waves in summer are weak and similar responses. The LGM simulation with the ICE-6G_C better captures features of the LGM climate, but compared to the reconstructions, the climate model tends to overestimate cooling in summer and underestimate cooling in winter and simulate wetter conditions over the Northern Hemisphere.