

The impact of glacial ice sheets on abrupt climate change

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Reconstruction from ice cores show that millennial climate change such as D-0 events frequently occurred during mid-glacial period, when atmospheric amount of Greenhouse Gases and ice sheets over the continent were lower/larger compare to the interglacial period, but not as full glacial period. Couple modeling experiments using MIROC recently showed that the climatic response to fresh water release to the ocean becomes larger and more abrupt under larger ice sheets. This suggests that the expansion of the ice sheets may play a role in modifying the abruptness and the amplitude of the climate change, though the mechanism behind this remains elusive. Here we conducted several sensitivity experiments using an atmospheric general circulation model (AGCM) and ocean general circulation model (OGCM) to investigate the results reported in MIROC. Using the AGCM, modern and glacial ice sheets are applied under large and small sea ice conditions. Using the OGCM, changes in the surface wind are applied at different magnitudes, ranging from the full glacial to modern levels. The results suggest that stronger interaction between the Icelandic Low, cold advection into the northern North Atlantic and surface heat flux from the ocean is important. Results from the OGCM sensitivity experiments are also discussed.

Keywords: abrupt climate change, glacial ice sheet, Icelandic Low