EGU2020-22296
https://doi.org/10.5194/egusphere-egu2020-22296
EGU General Assembly 2020

Enhanced multidecadal Greenland surface temperature variability during the Last Glacial Maximum linked to the Interdecadal Pacific Oscillation

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Stable oxygen isotope records from northern Greenland suggest that the local multidecadal surface-temperature variability exhibited a large reduction from the last glaciation to the Holocene. The origin of the reduced variability is thought to be perturbations in the mean atmospheric circulation due to Northern Hemisphere ice sheet variability. We reassess the factors driving the large multidecadal Greenland surface temperature (T_{2m}) variability during the Last Glacial Maximum. The Kiel Climate Model has been integrated under preindustrial and glacial boundary conditions. We find that both atmospheric teleconnections from the Interdecadal Pacific Oscillation (IPO) and North Atlantic/Arctic sea ice variations strongly intensify under glacial boundary conditions, driving enhanced surface wind and in turn heat flux variability over Greenland. Additional simulations that restore the Pacific sea-surface temperature (SST) to its climatology confirm the important role of the IPO.

To investigate the relative contributions of atmospheric teleconnection from the IPO and sea-ice on the Greenland T_{2m}, we force the atmospheric component of the coupled model in stand-alone mode by SSTs and sea ice concentrations simulated in coupled mode. The influence of atmospheric teleconnection is three times larger than that of sea ice. We conclude that the enhanced multidecadal Greenland surface-temperature variability during the LGM can largely be attributed to stronger atmospheric teleconnection from the IPO.