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The Arctic Oscillation at the mid-Holocene and the Last Glacial Maximum: A comparison between PMIP 2 models

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The change in the Arctic Oscillation (AO) is studied for the mid-Holocene and the Last Glacial Maximum (LGM) compared to the pre-industrial (PI) simulation, using 5 coupled ocean-atmosphere model output (i.e. CCSM, ECHAM5-MPIOM1, IPSL, MIROC3.2, and UBRIS-HadCM3M2) from the second phase of Paleoclimate Modeling Intercomparison Project (PMIP 2). In the mid-Holocene, the simulated AO appears to vary among models with an evident increase in sea level pressure (SLP) gradient between the polar and subtropical areas for ECHAM5-MPIOM1, CCSM, and UBRIS-HadCM3M2, while a small decrease for MIROC3.2 and IPSL. The AO-related Northern Hemisphere (NH) winter surface air temperature (SAT) increases over the northern Eurasia and the North American Great Lakes when the modeled AO is positive in the mid-Holocene, and vice versa. The ensemble mean of the 5 simulations indicates a more positive AO trend in the mid-Holocene than present day, although the AO signal in NH winter SAT is not a determining factor for the climatological winter cooling. In the LGM, on the other hand, the simulated AO becomes weaker in all coupled models with a decrease of more than 400 Pa in SLP over both polar areas and North Atlantic-Northwest Europe Section compared to the PI simulation. Significant changes occur in NH winter SAT in the LGM corresponding to a positive AO phase with a reduced cooling in polar areas, a warming trend in northern North America, and a southward shift of warming center in Eurasia.

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