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The Southern Annular Mode change for the Last Glacial Maximum derived from PMIP2 simulations

Seong-Joong Kim (1), Junmei Lu (2), and Baek-Min Kim (1)

(1) Korea Polar Research Institute, Polar Climate Research Center, Incheon, Korea, Republic Of (seongjkim@kopri.re.kr), (2) Chinese Academy of Meteorological Sciences, China Meteorological Administration

The increasing trend of the Southern Annular Mode (SAM) in recent decades has influenced the climate change in the southern hemisphere. How will the SAM respond to the increase of greenhouse gases in the future still remains uncertain. Understanding the variability of the SAM in the past under colder climate such as the Last Glacial Maximum (LGM) helps understand the response of the SAM for the future warm climate. We analyzed the changes in the SAM for the LGM in comparison to the pre-industrial (PI) simulations using 5 coupled ocean-atmosphere models (i.e. NCAR Community Climate System Model version 3 (CCSM), LASG/IAP Flexible Global Ocean-Atmosphere-Land System Model (FGOALS), L'Institut Pierre-Simon Laplace-CM4 (IPSL), Model for Interdisciplinary Research on Climate version 3.2 (MIROC), and third climate configuration of the Met Office Unified Model with Met Office Surface Exchanges Scheme version 2 (HadCM)) from the second phase of Paleoclimate Modelling Intercomparison Project (PMIP2). In CCSM, MIROC, IPSL, and FGOALS, the variability of the simulated SAM appears to be reduced in the LGM than the PI with a decrease in the standard deviation of the SAM index. Overall, four out of five models suggest the weaker variability of the SAM in the LGM, in consistent with the weaker southern hemisphere polar vortex and westerly winds at the surface found in some proxy records and model analyses. The weakening of the SAM in the LGM is associated with the increase in the vertical propagation of Rossby waves in southern high latitudes.