Low-Frequency North Atlantic Climate Variability in the Community Earth System Model Large Ensemble Simulations

Who M. Kim[1*], Stephen Yeager[1], Ping Chang[2,3], and Gokhan Danabasoglu[1]

[1] *National Center for Atmospheric Research, Boulder, Colorado*

[2] *Department of Oceanography, Texas A&M University, College Station, Texas*

[3] *Ocean University of China, Qingdao Collaborative Innovation Center of Marine Science and Technology, Qingdao, China*

There is observational and modeling evidence that the low-frequency variability in the North Atlantic has significant implications for the global climate, particularly for the climate of the Northern Hemisphere. Given some indications that multidecadal variability simulated in coupled models is relatively weak compared to that of observations, in this study, low-frequency variability in the North Atlantic during the 1920-2009 historical period in a set of Large Ensemble (LE) simulations obtained with the Community Earth System Model is investigated. Solutions from these simulations are compared to available observations as well as those of an ocean – sea-ice hindcast simulation. While comparable on interannual to decadal time scales, the simulated variability in Atlantic meridional overturning circulation (AMOC), North Atlantic sea surface temperature, and Sahel rainfall is underestimated on multidecadal time scales compared to observations and/or the hindcast simulation. It is argued that the weak multidecadal variability can ultimately be traced to similarly weak multidecadal variations in the simulated North Atlantic Oscillation (NAO), which is conveyed via the AMOC to surface climate. The weak multidecadal NAO variability in LE simulations appears to be consistent with the results of previous studies from the Coupled Model Inter-comparison Project phase 5 (CMIP5) analysis. We provide possible reasons for this weak multidecadal NAO variability.