Atlantic Multidecadal Variability in CESM1.0

*Edwin Schneider[1], Ben Kirtman[2]

1. George Mason University, 2. University of Miami

The properties and mechanisms of Atlantic Multidecadal Variabilty (AMV) are examined in a new ongoing 375+ year current climate simulation made with a relatively high resolution version of the CESM1.0 (Community Earth System Model) CGCM. The simulation produces realistic-looking multidecadal SST variability in the North Atlantic. The AMV mechanisms are identified by regressions and heat budget analyses, and also by comparison of the CGCM simulation to a corresponding simulation made with a new configuration of the interactive ensemble version of CESM1.0, IE-CESM.

This configuration of IE-CESM couples a 10-member atmospheric model ensemble mean to the ocean model, where each atmospheric model ensemble member is coupled to its own land surface model and its own sea ice model. The atmosphere, ocean, land, and sea ice components of IE-CESM, as well as the ocean initial conditions are identical to those in the CESM1.0 simulation. This coupling strategy eliminates the systematic biases between the climatologies of the CESM1.0 and IE-CESM simulations, while greatly reducing the forcing of the ocean by atmospheric noise in IE-CESM as compared to that in CESM1.0.

The analysis of the results from the simulations suggests that both forcing by atmospheric heat flux noise and ocean heat transports unrelated to the noise forcing make substantial contributions to the simulated AMV in CESM1.0. However, there are outstanding issues that remain unresolved.

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