Geophysical Research Abstracts
Vol. 17, EGU2015-2453, 2015
EGU General Assembly 2015

Mechanisms of Internally Generated Multidecadal Variability of SST in the Atlantic Ocean in a Coupled GCM

Hua Chen (1), Edwin Schneider (2,3), and Zhiwei Wu (1)

(1) Earth System Modeling Center and Key Laboratory of Meteorological Disaster of Ministry of Education, Nanjing University of Information Science and Technology, Nanjing, China (chen@cola.iges.org), (2) Dept. of Atmospheric Oceanic and Earth Sciences, George Mason University, VA, (3) Center for Ocean-Land-Atmosphere Studies, Institute of Global Environment and Society, VA

Mechanisms of the internally generated multidecadal variability of SST in the Atlantic Ocean are investigated in a long control simulation of the Community Climate System Model version 3 with constant external forcing. The interactive ensemble (IE) coupling strategy, with an ensemble of atmospheric GCMs (AGCM) coupled to an ocean model, a sea-ice model and a land model, is used to diagnose the roles of various processes in the coupled GCM (CGCM). The noise components of heat flux, wind stress and fresh water flux of the control simulation, determined from the CGCM surface fluxes by subtracting the SST-forced surface fluxes, estimated as the ensemble mean of AGCM simulations, are applied at the ocean surface of the IE in different regions and in different combinations. The IE simulations demonstrate that the climate variability in the control simulation is predominantly forced by noise. The local noise forcing is found to be responsible for the SST variability in the Atlantic Ocean, with noise heat flux and noise wind stress playing a critical role.

The control run Atlantic multidecadal variability (AMV) index is decomposed into interannual, decadal, multi-decadal and centennial modes based on the ensemble empirical mode decomposition, and the multidecadal mode of 50-year period is examined in detail. The North Atlantic Oscillation (NAO) pattern in the atmosphere, dominated by the noise component, forces the AMV 50-year mode through noise heat flux and noise wind stress. The noise wind stress forcing on AMV is associated with ocean dynamics, including gyre adjustment and the Atlantic Meridional Overturning Circulation. The atmospheric response to SST, including the SST-forced heat flux and SST-forced wind stress, acts as a damping on AMV.