The Coherence of Atlantic Meridional Heat Transport in Climate Models

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Previous work has suggested that the Atlantic meridional Heat transport (MHT) anomaly is coherent from the Southern Ocean (SO) to 40°N. We probe the robustness of this conclusion by examining a hindcast of a global isopycnal ocean general circulation model GOLD (Generalized Ocean Layer Dynamics, NOAA-Geophysical Fluid Dynamics Laboratory) from 1948 to 2009 and one simulation of a historical run from a coupled global climate model MRI-CGCM3 (Meteorological Research Institute - Coupled Global Climate Model 3) during 1948-2005. An EOF analysis of MHT shows consistent results between these two different simulations and reveals that EOF mode 1 of Atlantic MHT anomaly is the dominant coherence mode from 35°S to 40°N, with maximum in the tropics, while mode 2 and 3 represent the different phases of the two hemispheres and opposite phases between tropics and subtropics, respectively. Regressions of MHT anomaly on EOF principal components (PCs) suggest the importance of the different modes in each region, with mode 1 dominating in the tropics and mode 2 and 3 dominating in the southern and northern subtropical areas. A lagged correlation shows that PC3 leads PC1 by 1-4 years, implying southward propagation of MHT anomaly; an extended EOF also provides similar results.