ABSTRACT

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SGER: Teleconnection Structure and Evolution in the Coupled Model Simulations

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The recurrent patterns of interannual variability (teleconnections included) will be extracted from the Community Climate System Model (CCSM), the Geophysical Fluid Dynamics Laboratory (GFDL) model, and the Goddard Institute of Space Sciences (GISS), coupled simulations and closely compared with their observational counterparts, particularly, ENSO (the El-Nino-Southern Oscillation), PNA (Pacific/North American), NAO/AO (North Atlantic Oscillation/Annular Oscillation), and the Western Pacific (WP) patterns manifest during Northern winters of the present-day climate. The land/ocean surface temperature, ocean heat-content, 200 and 850 hPa geopotential, 200 hPa divergence, 1000 hPa (surface) winds, and the associated precipitation patterns will be the focus of intercomparison. The variables constitute a minimal set for monitoring the quality of simulated interannual variability; the variable choice will facilitate scrutiny of tropical-extratropical interactions, ocean-atmosphere interactions in the tropical and extratropical basins, hydroclimate variability, and of the global warming signal itself.

Intercomparison of the variability patterns' mature-phase structure will be followed by comparative analysis of the pattern evolution; this should provide a quick, albeit incomplete, check on the realism of the underlying variability mechanisms in the coupled simulations. The evolution analysis will be conducted at submonthly resolution; preferably, at pentad time scales.

An even more fundamental descriptor of the atmospheric general circulation is the zonally symmetric circulation, specially the zonal-mean zonal winds (U). Seemingly subtle differences in the (U) latitude-height structure can be consequential for climatological stationary waves and climate teleconnections, from modulation of wave propagation in/across the troposphere. The PIs will illustrate the dynamical significance of the inter-model variations of (U)-climatology by computing the orographic circulation response during winter, using a steady, linearized version of the atmospheric model's dynamical core (the diagnostic model). Additionally, since interannual variations of (U) in the middle-to-high latitude winters have figured prominently in recent discussions of troposphere-stratosphere interactions, specially, in context of the development of the NAO and global warming signals in the troposphere, a principal component analysis of (U) variability in the troposphere and stratosphere will be conducted. The significance of inter-model differences in the (U)-variability structures will again be illustrated through diagnostic modeling.

Broader Impacts:

This work will establish the baseline information for evaluating global and regional climate and water resource model projections for the 21st century. This is important information for environmental management and environmental policy decisions.

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