Title: An investigation of air-sea interaction in the tropical Atlantic

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Precipitation anomalies on certain regions of South America and Africa are associated with changes in cross-equator sea surface temperature (SST) gradient (CESG) in the tropical Atlantic (Lamb 1978; Mehta 1998). Recent atmospheric general circulation model (GCM) simulations (Okumura et al. 2001; Sutton et al. 2001) further suggest that tropical SST changes induce extratropical climate variability. Conflicting views exist with regard to the origin of tropical Atlantic variability (TAV) and the role of air-sea interaction. Some investigators hold that one-way atmospheric forcing is dominant while others find that local air-sea interaction, such as the wind-evaporation-SST (WES) feedback, also contributes significantly.

Results from coupled GCMs vary among themselves and are inconclusive, partly because the global method (such as EOF) used to analyze model outputs is inadequate in distinguishing meridional variations in the strength and nature of air-sea coupling. A recent analysis of observational data shows that lagged cross-correlation between cross-equatorial SST and principal component of atmospheric fields becomes more and more symmetrical with respect to the zero lag as the poleward boundaries of EOF analysis domain becomes closer and closer to the equator (Chang et al. 2001), suggesting a two-way interaction near the equator. Given that nearly all the GCMs simulate consistent atmospheric response to changes in CESG, we hypothesize that two-way interaction between the ocean and atmosphere exists at least near the equator.

We propose to apply Chang et al. (2001) analysis method to output from all CMIP models and to determine the changes in the nature and strength of this two-way interaction in the meridional direction. Initially, the dataset necessary for the proposed analysis includes global month-mean fields of all available model variables at the sea surface and the thermocline depth, for multi-decades. Later, our analysis may expand into investigating vertical structure in the ocean and atmosphere.

Reference:

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Relevant publications by the proposed subproject leaders

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