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Tropical Atmosphere-Ocean Interactions and Teleconnections in a Conceptual Framework

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Statistical analysis of observations is used to address two questions: First, does an analogous mechanism to that of the El Nino Southern Oscillation (ENSO) exist in the equatorial Atlantic or Indian Ocean? Second, are the tropical Atlantic or Indian Ocean remote forcings for the ENSO mode? These questions are addressed by assessing the existence and strength of the Bjerknes and delayed-negative feedbacks in each tropical basin, and by fitting conceptual recharge-oscillator models, with and without interactions among the basins.

In the equatorial Atlantic the Bjerknes and delayed-negative feedbacks exist, although weaker than in the Pacific. Equatorial Atlantic variability is well described by the recharge oscillator model, with an oscillatory mixed ocean dynamics-sea surface temperature (SST) mode present in boreal spring and summer. The dynamics of the tropical Indian Ocean, however, appear to be quite different: No recharge-discharge mechanism is found. Although, some positive Bjerknes feedbacks from July to September are found, the role of heat content seems secondary.

Results also show that Indian Ocean interaction with ENSO tends to damp the ENSO oscillation and is responsible for a frequency shift to shorter periods. However, the retrospective forecast skill of the conceptual model is hardly improved by explicitly including Indian Ocean SST. The interaction between ENSO and the equatorial Atlantic variability is weaker. However, a feedback from the Atlantic on ENSO appears to exist, which slightly improves the retrospective forecast skill of the conceptual model.