AOGS 2005

Cause of Seasonal Dependence of Intraseasonal Variability in Tropical Atmosphere and Ocean

TIM LI, F. TAM, X. JIANG, and X. FU
IPRC and Department of Meteorology, University of Hawaii

The characteristics of tropical atmospheric intraseasonal oscillations (ISO) in boreal summer differ from their boreal winter counterpart. Using a simple 2.5- layer tropical atmospheric dynamic framework that consists of a 2- level free atmosphere and a planetary boundary layer, we show that this seasonal difference of ISO behavior is mainly attributed to the change of instability property of moist equatorial Kelvin and Rossby waves due to the seasonal shift of the thermal equator. Both idealized and realistic meridional profiles of summer and winter SST and surface moisture fields are used in this eigenvalue analysis.

Recent satellite observations show a significant intraseasonal variability of SST in the tropical Indian Ocean (south of the equator along 10S) in boreal winter. This intraseasonal SST variability is season-dependent; it has strong amplitude in boreal winter but is much weaker in boreal summer. The cause of this seasonality of the intraseasonal SST variability is investigated using a 2.5- layer ocean model with specified observed atmospheric intraseasonal forcing. The result shows that the primary cause is attributed to the sign change of the latent heat flux associated with atmospheric ISO forcing between boreal winter and summer. The seasonal switch of the mean flow leads to an enhanced local evaporation along 10S in northern winter during an active phase of the atmospheric ISO over the Indian Ocean. In this scenario, both the shortwave radiation and the latent heat flux act in the same direction to cool the ocean surface. On the contrary, in boreal summer the latent heat flux and solar radiation have an opposite sign and they are against each other. Ocean dynamics and mean thermocline and mixed layer distribution also play a role in contributing to the observed intraseasonal SST variability.