Scale interactions in the tropics

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The relative contribution of intraseasonal (20-90day) and higher-frequency (HF, 2-20day) motion (including surface wind and air-sea humidity difference variability) on the intraseasonal surface latent heat fluxes in the global tropics is investigated using the observational data. It is noted that the HF wind and humidity variability accounts for about 50% of the total intraseasonal heat flux. The high percentage of the intraseasonal latent heat flux contributed by the HF motion implies that the synoptic-scale variability may exert a significant impact on the atmospheric intraseasonal oscillation (ISO) through the modulation of the wind-induced surface heat exchange (WISHE).

A negative correlation appears between all India monsoon rainfall and ISO intensity. It is argued that this negative correlation is attributed to the impact of the mean monsoon on ISO. A strong Indian monsoon leads to the weakening of convection over the equatorial eastern Indian Ocean, which may further suppress the eastward and northward propagating ISO variances and lead to a weakened intraseasonal activity over the monsoon region. The ISO, on the other hand, feeds back to the mean monsoon through the nonlinear eddy momentum transport.

The impacts of HF atmospheric wind variabilities on low-frequency (LF) wind stress anomalies associated with ENSO are investigated using the daily surface wind data of the ECMWF reanalysis from 1980 to1999. There are two-way interactions between the HF and LF variabilities. On one hand, ENSO enhances (suppresses) HF wind variability during El Niño (La Niña). On the other hand, the HF wind significantly modulates the amplitude and skewness of the LF wind stress anomaly. The ENSO-state-dependent HF wind activity leads to a switch from a negative to positive wind stress skewness, and thus is partially responsible for the El Niño and La Niña amplitude asymmetry.