FSU Meteorology Seminar Series, Fall 2019

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Characteristics of intraseasonal oscillations in the Indian summer monsoon rainfall

Abstract

Indian summer monsoon rainfall (ISMR) shows a wide range of variability in both space and time with intraseasonal oscillations (ISO) representing a dominant mode of variability. Northward propagating 20–60-day periodic low-frequency ISO (LFISO) and northwestward-propagating 10–20-day periodic high-frequency ISO (HFISO) significantly modulates the rainfall patterns over the Indian subcontinent. Our results suggest that a large number of local onset (59%) and demise (62%) events occur during positive developing phases and positive decaying phases of two ISOs, respectively, with phase-locking between LFISO and HFISO being particularly important.

The governing dynamics that modulate the propagation characteristics of LFISO during summer monsoon over the two ocean basins, Bay of Bengal (BoB) and Arabian Sea (AS), are investigated using observational analysis and high-resolution regional coupled ocean-atmosphere climate model simulations. ISO features are extracted over the Indian region using a data-adaptive spectral method called multichannel singular spectrum analysis. ISO exhibits stronger intensity over the BoB than over the AS. But ISO-filtered rainfall propagates at a faster rate (~1.25 deg/day) over AS as compared to BoB (~.74 deg/day), giving rise to a northwest-southeast tilted band of rainfall anomalies. However, the composite diagrams of several atmospheric fields associated with northward propagation like vorticity, low-level convergence and oceanic variables like sea surface temperature and mixed layer depth do not show this difference in propagation speed and all exhibit a speed of nearly 0.75 deg/day in both the ocean basins. The difference in speed of ISO-filtered rainfall is explained through moisture flux convergence. An increased positive anomalous moisture advection nearly 10 days before the rainfall maxima possibly triggers the generation of atmospheric instability and subsequently rainfall over AS. Anomalous wind acting on climatological moisture gradient is the dominant term in the moisture advection equation. Easterly wind anomalies associated with a low-level anticyclone over India helps advect moisture from the eastern side of the domain. The northwest-southeast tilt of ISO is dictated by the atmospheric processes of moisture advection with the upper ocean playing a more passive role in causing the tilt.

Time: Thursday, Nov. 7 @ 3:30 PM
Location: LOV 353