Session: B5 Oral presentation

Dynamical response of the South Asian monsoon trough to latent heating from stratiform and convective precipitation

Ayantika Dey Choudhury[†]; Krishnan Raghavan
[†] Indian Institute of Tropical Meteorology, India
Leading author: ayantika@tropmet.res.in

Simulation experiments using a simplified atmospheric GCM and supplementary diagnostic analyses of observations are performed to understand how the South-Asian monsoon-trough (MT) responds dynamically to latent-heating from meso-scale convective systems (MCS). Observations reveal that the MT during active-monsoons is characterized by a deep cyclonic vorticity extending from surface to 350 hPa and organized MCS covering over 3500-4000 km along the Indo-Gangetic plains. The MCSs during active-monsoons are composed of relatively higher abundance of stratiform-type precipitation (mostly nimbostratus) as compared to convective-type. The results suggest that stratiform-type heating profile is very effective in promoting upward development of continental-scale cyclonic circulation well-above the mid-troposphere over the MT region. This dynamical upliftment of the layer of cyclonic circulation is induced by mid-level (600-500 hPa) convergence and vorticity stretching above 500 hPa. By varying the population of stratiform and convective rain-types in the simulation, the horizontal scale of mid-level vorticity response is shown to increase significantly with stratiform population; in contrast the mid-level response is more localized when the MCS is dominated by deep-convective clouds. For large stratiform populations, the mid-level response is found to extend far westward up to the northern flanks of the African ITCZ, indicative of Rossby wave dispersion of PV anomalies which are generated near the level of maximum heating gradient. From the present findings, we conclude that the vertical deepening of MT during active monsoons is not merely a localized phenomenon; instead it represents a large-scale dynamical response to organized MCSs which exert pivotal influence on the upward development of cyclonic-circulation well-above the mid-troposphere