The Long-lived Monsoon Depressions of 2006 and Their Linkage with the Indian Ocean Dipole

Ayantika Dey Choudhury1 , R. Krishnan1, Vinay Kumar2 and Samir Pokhrel1
1Indian Institute of Tropical Meteorology
Pune 411008, India
2Florida State University
ayantika@tropmet.res.in

A highlight of the 2006 boreal summer monsoon season was the enhanced activity of long-lived monsoon depressions and low-pressure systems (LPS) over the Indian region. Another important phenomenon during this period was the evolution of a positive Indian Ocean Dipole (PIOD) event. While past studies have investigated the impact of PIOD on the large-scale monsoon response, their influence on monsoon LPS activity is not well-understood. Based on detailed diagnostic analyses of monsoon LPS during 2006; as well as those associated with other PIOD events during (1958-2007), the present work addresses two specific issues concerning the roles of *(a)* PIOD-induced large-scale circulation changes *(b)* Internal feedbacks between latent-heating and dynamics, in sustaining the monsoon LPS activity.

The results reveal that PIOD conditions generally favor increased propensity of long-lived (>5 days) LPS with long westward tracks extending into northwest India. The average contribution of long-lived monsoon LPS to the total is found to be ~12% higher during PIOD episodes as compared to non-PIOD. The PIOD events showed two important large-scale elements conducive for enhancement of LPS activity (**a**) Strengthening of cross-equatorial moisture-transport from south-eastern tropical Indian Ocean into Bay-of-Bengal (**b**) Enrichment of barotropic instability of monsoon-flow. Estimates of latent-heating profiles from TRMM-satellite products during the 2006 LPS revealed heating in the meso-scale updrafts above 600 hPa with maximum ~400 hPa; while cooling prevailed in lower-levels. Stratiform-precipitation covered ~70-85% of rain-area during the prolonged LPS; and the large-scale monsoon Hadley-type circulation was found to be intensified with strong mid-level inflows entering the stratiform rain-region. The overall findings suggest that the PIOD-induced background circulation together with internal feedbacks between meso-scale convective systems and large-scale circulation can effectively enhance the life period of monsoon LPS. These results should serve as important inputs for numerical weather forecasting of extreme rainfall events associated with the regional monsoon phenomenon.

Keywords: Low pressure systems, Life period, Indian Ocean Dipole