



The role of remote and regional boundary forcing in the evolution of 2010 summer monsoon heavy rainfall over northwest Indo-Pak region

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The evolution of sub-tropical south Asian heavy rainfall during 2010 summer and its relationship with tropical boundary forcing, is diagnosed in this study. Interestingly, the summer time Indo-Pacific SST during 2010 evolved as a combination of three dominant modes of variability. In addition to the strongest La Niña event on long-term record, warming over tropical Indian Ocean and a negative phase of the Indian Ocean Dipole (IOD) phenomenon were also prominent during 2010 boreal summer. A high resolution AGCM is used in this study to distinguish the role of remote and regional tropical SST boundary forcing on the heavy rainfall over northwest Indo-Pak region.

The remote boundary forcing over Pacific seems to induce a westward shift of the large-scale monsoon circulation and significantly weakens the convection over Bay of Bengal, but is not sufficient for a realistic simulation of the flood event during 2010. The intensification of northward moisture transport from Arabian Sea into the subtropical Indo-Pak region leading to positive rainfall anomalies as observed in 2010 could be attributed to regional boundary forcing over Indian Ocean. The warmer SST anomalies over southeast Indian Ocean significantly strengthen the cyclonic convergence (divergence) over the region (Bay of Bengal and central and western Indian Ocean). Furthermore, divergence over equatorial Indian Ocean together with positive SST anomalies over north Arabian Sea enhances regional convection and promotes northward moisture transport, which is important for explaining the rainfall anomalies over northwest Indo-Pak region during 2010.