



## **Out-of-phase relationships between convection over northwest India and warm pool region during the winter season**

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In this paper, we investigate the effect of convection over warm pool region of Indonesia on northwest India winter precipitation (NWIWP) using an analysis of latest available observed climate data. The analysis is based on correlations and composites performed using India Meteorological Department (IMD) records of station data. We find that there is an out-of-phase relationship between convection over warm pool region and northwest India during the winter season. In particular, a positive precipitation anomaly over northwest India is typically found in correspondence to subdued convection over warm pool region. A physical mechanism for such effect is proposed, by which during excess years of NWIWP the tropical cooling over the warm pool region due to suppressed convection generates an upper-level convergence (cyclonic circulation) anomaly over south Asia which intensifies the westerly jet stream over Indian region. Also, the reduced convection over the warm pool may be due to reduced Madden-Julian oscillation (MJO) activities on the intra-seasonal timescale. The Rossby-gyre dynamics with the strong vertical and westward meridional tilts in the tropical baroclinic atmosphere forms cyclonic circulation anomalies at the upper troposphere due to a weak MJO which intensifies the westerly jet stream over the Indian region. The jet stream guides the western disturbances (WDs) and hence increases precipitation over northwest India. The seasonal persistence in migration of convective maximum from south Asia (foothills of the Himalayas) to Indonesia during the peak months of boreal summer to winter increases the seasonal predictability of NWIWP.