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Extreme rainfall characteristics during MJO phases over the Indian region using TRMM

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Increased occurrence of extreme rainfall events (ERE) and their association with the subseasonal oscillations such as Madden Julian Oscillations (MJO) over the Indian Subcontinent is found intriguing. Previous studies have documented the various aspects of extreme rainfall characteristics, but the comprehensive understanding of dynamic and thermodynamic aspects of ERE during MJO phases still warranted across the seasons. ERE occurred in conjunction with the large-scale drivers (e.g. ENSO, IOD, MJO) may invigorate to the intensification of ERE. With this rationale, the present study aims to quantify the relationship between the MJO and ERE over the Indian subcontinent using the Tropical Rainfall Measuring Mission (TRMM) precipitation data. The percentile based threshold (95^{th}percentile) is used to identify the ERE events over the geographically distinct regions. In order to delineate the MJO phases the Real-time Multivariate MJO (RMM) index employed and based on the MJO convective centers, the phases are aggregated into active and suppressed phases to manifest the temperament of precipitation extremes. Further, the changes in the mean state of the large-scale synoptic circulations and atmospheric variables are analyzed using the composite analysis, for the zonal and meridional winds, geopotential height, outgoing longwave radiation and integrated moisture flux at 850 hPa during seasonal and anomalies of active (suppressed) phases for all the seasons. The perusal of preliminary results reveals the frequency of ERE events found significant during the active MJO phases. Specifically, during the post-monsoon season, the influence is substantially over the east coast of India and the southern Indian peninsula. During the Indian summer monsoon, the MJO influences were restricted to below 20^{o} N. Akin to this, the anomalies of outgoing long wave radiation and geopotential height reveals the enhanced (low) convection and anomalous trough (ridge) during active (suppressed) MJO periods. In addition, we found that the background synoptic conditions during active MJO phases might facilitate the necessary conditions for triggering of ERE. In this regards, our findings will help to understand the influence of the MJO on ERE across the seasons over Indian sub-continent. In addition, under the current warming scenario, the evidences suggest that the frequency of the MJO will escalate; therefore, this study has the practical implications in the flood forecasting, water resources management and mitigation, numerical weather predictions over the Indian subcontinent.

Keywords: Madden Julian Oscillation, Extreme rainfall events, TRMM, Indian Subcontinent.