Impacts of the Madden-Julian Oscillation on Rainfall, Atmospheric Moisture, and Circulation in Maritime Continent

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Abstract

The state of the Madden-Julian Oscillation (MJO: amplitude and phase) is defined using the Real-time Multivariate MJO index (RMM) based from Wheeler and Hendon (WH04) works. Using daily 850-hPa, 200-hPa zonal wind (1980-2000) from Japanese 25-year Reanalysis data (JRA-25) and observed daily OLR from NOAA polar-orbiting satellites, showed that the EOF1 explain 12.04% and EOF2 11.43% of the total variance. The impacts of the MJO on Maritime Continent (MC) rainfall, atmospheric moisture and circulation are examined during all four seasons with each element composited contemporaneously for eight strong MJO phases derived from those RMM index. Daily amount of rainfall from ASEAN Compendium dataset were used involved 667 rain-gauge stations covering from 15°N to 10°S, 90°E to 140°E. However, for simplicity the MC region was delineated into five climate regimes. During southwest monsoon (SWM), the impacts of the MJO can be categorised as an alternating period of wetter and drier conditions along with the modulation on the monsoon systems over Sumatra, Peninsula Malaysia, Borneo and southern Indochina. Secondly, the MJO modulates the tropical cyclogenesis activities over Philippines and the changes of sea surface temperature (SST) over the region of Maluku through the Indonesian Throughflow (ITF). Whereas there were no significant impacts observed over the southern Indonesian archipelago. Some changes occurred during northeast monsoon (NEM) where most of the region experiences alternating period of wetter and drier conditions, and modulation of the monsoon system over Nusa Tenggara, changes of SST through ITF in reverse effect in comparison to SWM over Maluku and no significant impact over the region of Philippines. During the transition period, the rainfall pattern and the atmospheric moisture anomaly in SON are quite similar to MAM. During this season, the MJO strongly modulates the tropical cyclogenesis activities over Philippines and southern Indochina region.