MJO-Induced Variability of the Diurnal Cycle of Precipitation over the Maritime Continent

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Large-scale convection associated with the Madden-Julian Oscillation (MJO) initiates over the Indian Ocean and propagates eastward across the Maritime Continent (MC) into the western Pacific. As an MJO enters the MC, it often weakens or completely dissipates due to complex interactions between the large-scale MJO and the MC landmass and its topography. This is referred to as the MC barrier effect, and it is responsible for the dissipation of 40-50% of observed MJO events. One of the main reasons for the MJO's weakening and dissipation over the MC is the diurnal cycle (DC), one of the strongest modes of variability in the region. Due to the complex nature of the MJO and the MC's complicated topography, the interaction between the DC and the MJO is not well understood.

In this study, we examine the MJO-induced variability of the DC of precipitation over the MC. We use gridded satellite precipitation products (TRMM 3B42 and GPM IMERG) to: (1) track the MJO convective envelope using the Large-scale Precipitation Tracking algorithm (LPT), (2) analyze the changes in the DC of precipitation over the MC relative to the passage of the MJO. We find that the presence of an MJO not only increases the amount of precipitation over the MC, but that the increase is more pronounced over water than over land. The results from observations are compared to those from two reanalysis datasets (ERA5, MERRA-2). The reanalysis datasets are then used to examine the dynamic and thermodynamic changes that drive the variability in the DC of precipitation relative to the MJO. In addition, we separate MJO events into two groups based on whether they cross the MC, and independently examine their influences on the evolution of the DC of precipitation.