M.S. Defense Announcement
Marquette Rocque
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Defense
Virtual (information to come)

Post Defense Meeting
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INTRASEASONAL AND DIURNAL VARIATIONS OF PRECIPITATION FEATURES OBSERVED DURING DYNAMO

The diurnal cycle (DC) of rainfall over the tropical oceans and within the Madden–Julian oscillation (MJO) has been investigated in numerous studies, but there has been limited research on how the DC of precipitation and convective organization evolve throughout phases of the MJO. Cloud and precipitation parameterizations in models have been the source of low MJO predictability, so understanding the fundamental convective processes occurring within the MJO, both on the intraseasonal and diurnal timescales, will be beneficial in improving these model simulations. This study employs measurements collected during the Dynamics of the MJO (DYNAMO) field campaign to investigate how the distribution of precipitation features (PFs) varies across MJO phase groups, throughout the day, and on-/off-equator. PFs identified from radar volume scans at the R/V Roger Revelle (80.5°E, 0°N) and R/V Mirai (80.5°E, 8°S) were classified into five morphologies based on shape and size. Additionally, several environmental parameters including sea surface temperature (SST), convective available potential energy (CAPE), and latent and sensible heat fluxes were analyzed to understand local interactions between the ocean, atmosphere, and convection.

The largest rain events occurred during phases 2&3 at the Revelle. Mesoscale events were found in all phase groups at the Mirai. However, convection was generally weaker at the Mirai, most likely due to extremely dry air (RH < 20%) in the mid-troposphere, and little variation in SST. Two westerly wind bursts (WWBs) were observed in phases 2&3 of the second MJO event at the Revelle which enhanced surface winds and air–sea fluxes and allowed stratiform precipitation to persist. Additionally, these WWBs enhanced the near-surface equatorial current known as the Yoshida–Wyrtki jet which caused a large amount of upper ocean mixing and significantly cooled SSTs into December.

The DC of rainfall was greatest during phases 8&1 and 2&3 at the Revelle with peaks in rain rate occurring in the afternoon and early morning hours. The afternoon peak was attributed to isolated and sub-MCS nonlinear PFs, apparently forced by SST heating and significant air–sea fluxes. These features then grew upscale through the evening into MCS nonlinear events, peaking in intensity just after midnight. MCS nonlinear features contributed the most to the rain volume during phases 2&3 at the Revelle at roughly 70%. Isolated and sub-MCS nonlinear features were the dominant mode of convection during the suppressed phases at the Revelle (4&5 and 6&7). Mesoscale systems were not observed in these two phase groups. MCS nonlinear systems were found in at least 15% of all radar scans for each phase group at the Mirai, and there was significantly less variability in environmental parameters between phase groups. Additionally, the DC of SST at the Mirai was much weaker than at the Revelle, which was attributed to enhanced surface winds that mixed out any diurnal warm layers. Thus, it was found the MJO had little modulation on the local environment off-equator.