M.S. Defense Announcement
Michael Natoli
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Defense
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Post Defense Meeting
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Intraseasonal Variability in the Diurnal Cycle of Precipitation in the Philippines

Precipitation in the region surrounding the South China Sea (SCS) over land and coastal waters exhibits a strong diurnal cycle associated with a land-sea temperature contrast that drives a sea-breeze circulation. The boreal summer intraseasonal oscillation (BSISO) is an important modulator of the daily mean precipitation rate and the amplitude of the diurnal cycle. Using 19 years of the CMORPH precipitation product for the Philippines, it is shown that in aggregate the diurnal cycle amplitude is maximized before the arrival of the broader oceanic convective envelope associated with the BSISO. Over Luzon Island in the northern Philippines, the diurnal cycle amplitude is not in phase with daily mean precipitation, which peaks with the large-scale BSISO convection. An increase in nocturnal and morning precipitation more than compensates for the reduced precipitation rates during the afternoon peak amidst the BSISO active period. This pattern is not seen over Mindinao Island in the southern Philippines, where diurnal cycle amplitude tends to determine daily mean precipitation. A strong diurnal cycle in coastal waters west of the Philippines is evident in the transition from the inactive to active phase, due to offshore propagation of convection generated over land.

This behavior is dramatically different on small spatial scales within the Philippine archipelago, depending strongly on topography. For example, the BSISO influence on the diurnal cycle on the eastern side of the high mountains of Luzon is nearly opposite to the western side. It is proposed, using wind, moisture, and radiation budget products from the ERA-Interim reanalysis, that the enhanced diurnal cycle over land and coastal waters west of the mountains during BSISO suppressed phases is a consequence of increased insolation and weaker prevailing onshore winds. Offshore propagation, and thus the diurnal cycle over the coastal waters of the SCS, is suppressed until ambient mid-level moisture increases during the transition to the active BSISO phase. In the BSISO enhanced phases, strong low level winds out of the southwest combine with increased cloudiness to suppress the sea-breeze circulation and thus the diurnal cycle of precipitation in the SCS region. Strong frictional moisture convergence leading the BSISO is not found to be concurrent with the peak in the diurnal cycle. Results are consistent when examined in other precipitation products or BSISO indices, and support conclusions derived from studies focusing on intraseasonal modulation of precipitation in other regions of the Maritime Continent, with some important local distinctions owed to geography.