Impact of the diurnal cycle on the propagation of MJO convection across the Maritime Continent

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Influences of the diurnal cycle on the propagation of the Madden-Julian Oscillation (MJO) convection across the Maritime Continent (MC) are examined using cloud-permitting regional model simulations and observations. A pair of ensembles of control (CONTROL) and no-diurnal cycle (NODC) simulations of the November 2011 MJO event are performed. In the CONTROL simulations, the MJO signal is weakened as it propagates across the MC, with much of the convection stalling over the large islands of Sumatra and Borneo. In the NODC simulations, where the incoming shortwave radiation at the top of the atmosphere is maintained at its daily mean value, the MJO convection signal propagating across the MC is enhanced. Examination of the surface energy fluxes in the simulations indicates that the surface downwelling shortwave radiation is larger in the presence of the diurnal cycle (CONTROL simulations) because clouds preferentially form in the afternoon. The diurnal co-variability of surface wind speed and skin temperature results in a larger sensible heat flux and a cooler land surface in the CONTROL runs compared to the NODC simulations. An analysis of observations indicates that ahead of and behind the MJO active phase, the diurnal cycle of cloudiness enhances downwelling shortwave radiation and hence land-locked convection over the MC. Enhanced land-locked convection competes with convection over the water, which is the main convective signal of MJO events that propagate through the MC. The propagation of MJO across the MC is thus disrupted.

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