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Diurnal cycle in SST and the MJO initiation during DYNAMO: A regional coupled modeling study

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The Scripps Coupled Ocean-Atmosphere Regional Model version 2 (SCOAR2), coupling WRF and ROMS models in a tropical channel configuration, is used to examine the role of the diurnal cycle of SST in the initiation and intensity of MJO convection during DYNAMO. A high-resolution regional coupled model in a channel configuration allows for the circum-global tropical disturbances to freely evolve and interact with the ocean at high resolution. For an improved representation of thin (1-3 m) diurnal warming observed during DYNAMO, a large number of vertical levels are allotted in the upper ocean (e.g., 4-5 layers in the top 1 m). A series of ensemble SCOAR2 simulations targeting the November MJO event in 2011 is carried out with varied coupling frequency from 1h to 24h to adjust the intensity of sub-daily SST variation. The results show that both the amplitude of diurnal SST variation and the daily mean of SST become higher as the coupling is made more frequent. This higher mean SST is despite the stronger evaporative cooling over warm SSTs. This increased latent heat flux moistens the lower atmosphere prior to the initiation of the convection. A column-integrated moist static energy (MSE) budget analysis indeed suggests that the increased latent heat flux is the only significant source term that accounts for a faster buildup of MSE. This induces a greater discharge of MSE via deep convection during the active phase and hence higher precipitation. This result demonstrates a robust sensitivity of MJO to SST via diurnal cycle on a local scale.