The role of interactive SST in the cloud-resolving simulations of aggregated convection

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This study investigates the role of interactive SST in the early development of aggregated convection using a vector vorticity equation cloud-resolving model (VVM) coupled to a slab ocean. The simulations are initialized by a mock Walker circulation driven by initial SST gradient in the elongated x-axis, with an average of 300K and sinusoidal variation of amplitude ranging from 1.5K to 3K. According to large-scale perturbation strength, which is caused by SST variation, the results can be divided into two groups. Under weak perturbation, convection-SST feedback efficiently eliminates SST gradient and moisture anomaly. The large-scale environment is homogenized within two days. Even though SST in the group with stronger perturbation undergoes a similar process, significant moist static energy (MSE) advection in the boundary produces enough moisture difference to introduce virtual temperature effect and aggregation is triggered. Once dry zone starts to expand, radiative and convective effects regenerate SST gradient, which intensifies circulation and accelerates the process. We further show that the evolution of aggregation or not is captured by the trend of MSE-EIS variance. The results highlight the boundary layer processes on the formation of aggregated convection in the tropics.

Keywords: boundary layer processes, large-scale moisture, aggregated convection

