Precipitation Features During a Canonical Southeastern Asian Monsoon Event

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Abstract. Summertime westerly monsoons dominate the hydrological cycle within southeastern Asia, contributing greater than 75 percent of the annual precipitation in regions such as Bangladesh and the Philippines. The summertime monsoons are an interconnected hydrological process, wherein the atmosphere and land-surface interact through a multitude of complex mechanisms. While these feedbacks are important to the evolution of the monsoon, deep atmospheric convection and the precipitation it produces are predominantly tied to the atmospheric environment within which the convection occurs. Identifying atmospheric environments conducive to deep convection is therefore critical to understanding the hydrological response to the monsoon. However, monsoonal process studies are commonly performed at a coarse resolution due to the spatio-temporal expansiveness of monsoonal regimes, which limits the explicit representation of smaller scale processes such as individual deep convective clouds. By including cloud-scale processes, regional monsoonal patterns can be dissected using a scale-aware approach.

Using a cloud-resolving model, we simulate a canonical summertime southeast Asian monsoonal event, wherein an established monsoonal regime is perturbed by atmospheric waves with periodicities ranging from the life span of mesoscale deep convective clouds to regional intra-seasonal oscillations. Within this framework, we can examine the evolution of convective systems within the background monsoonal state as a function of the various extraneous waves. This work therefore offers insights into how convective regimes change throughout the summertime southeast Asian monsoon.

Of related interest is the broad applicability of these results to other monsoonal regimes. While the convective environments identified within this study are predominantly applicable to the southeast Asian monsoon, the methodologies are transferrable to other regions of the world.