Role of coastal convection to moisture buildup during the South China Sea summer monsoon onset

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In this study, the climatological characteristics of object-based precipitation systems (OPS) and moisture development are analyzed over the South China Sea (SCS) during the sharp transition of summer monsoon onset. The satellite observed OPS statistics showed that during the pre-onset period, small (<100 km) to medium size (100-300 km) OPS are active over surrounding land, while convection over the ocean is mostly suppressed. During post-onset, large OPS develop over the coastal ocean and contribute to over 60% of the total precipitation. The results suggest that when the convection is strong over the surrounding islands, a local circulation with anomalous subsidence over the ocean can develop and suppress convection. The number of observed large OPS significantly increases along with the sharp moisture buildup during the SCS onset period. The moisture budgets suggested that local contribution from convection vertical mixing is the major moisture source during monsoon onset pentad, while large-scale moisture advection tends to be weak. The relationship between moisture buildup and convection organization is then examined using a set of idealized cloud-resolving model (CRM) experiments, with a land-ocean configuration approximating the SCS basin. The CRM appropriated represents the observed development of coastal convection. With a non-shear environment, the strong basin-scale circulation is formed, which suppresses the ocean moisture development. When large-scale vertical wind shear is imposed to represent the changes of large-scale circulation during the onset pentad, organized convection systems are increased over the coastal ocean and propagate toward the open ocean, accompanied by fast ocean moistening. We identified through the CRM simulations that the moistening time-scale by the transition of coastal convection organization is within 5-10 days.

Keywords: Convective Organization, Coastal convection, Moisture, TRMM, CloudSat, Cloud-Resolving Model

