Mesoscale Convective Systems during SCSMEX: Simulations with a Regional Climate Model and a Cloud-Resolving Model

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The South China Sea Monsoon Experiment (SCSMEX) was conducted in May-June 1998. One of its major objectives is to better understand the key physical processes for the onset and evolution of the summer monsoon over Southeast Asia and southern China. Multiple observation platforms (e.g., upper-air soundings, Doppler radar, ships, wind profilers, radiometers, etc.) during SCSMEX provided a first attempt at investigating the detailed characteristics of convection and circulation changes associated with monsoons over the South China Sea region. SCSMEX also provided precipitation derived from atmospheric budgets and comparison to those obtained from the Tropical Rainfall Measuring Mission (TRMM).

In this paper, a regional scale model (with grid size of 20 km) and Goddard Cumulus Ensemble (GCE) model (with 1 km grid size) are used to perform multi-day integration to understand the precipitation processes associated with the summer monsoon over Southeast Asia and southern China. The regional climate model is used to understand the soil-precipitation interaction and feedback associated with a flood event that occurred in and around China's Yantz River during SCSMEX. Sensitivity tests on various land surface models, sea surface temperature (SST) variations, and cloud processes are performed to understand the precipitation processes associated with the onset of the monsoon over the S. China Sea during SCSMEX. . These tests have indicated that the land surface model has a major impact on the circulation over the S. China Sea. Cloud processes can effect the precipitation pattern while SST variation can effect the precipitation amounts over both land and ocean. The exact location (region) of the flooding can be effected by the soil-rainfall feedback.

The GCE-model results captured many observed precipitation characteristics because it used a fine grid size. For example, the model simulated rainfall temporal variation compared quite well to the sounding-estimated rainfall. The results show there are more latent heat fluxes prior to the onset of the monsoon. However, more rainfall was simulated after the onset of the monsoon.

This modeling study indicates the latent heat fluxes (or evaporation) have more of an impact on precipitation processes and rainfall in the regional climate model simulations than in the cloud-resolving model simulations. Research is underway to determine if the difference in the grid sizes or the moist processes used in these two models is responsible for the differing influence of surface fluxes on precipitation processes.