

Impacts of Including Rain Evaporative Cooling in the Initial Conditions on the Prediction of a Coastal Heavy Rainfall Event during TiMREX

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Abstract

A cycling run, which began 36 hours before the model forecast, was employed to assimilate special Terrain-influenced Monsoon Rainfall Experiment (TiMREX) soundings, global telecommunications system (GTS) data, and Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) global positioning system (GPS) radio-occultation (RO) refractivity profiles to improve the model initial conditions provided by the National Centers for Environmental Prediction (NCEP) Global Forecast System (GFS) to study a coastal heavy rainfall event over southwestern Taiwan during 15-16 June 2008. The 36-h cycling run with data assimilation, or the control run (CTRL), has a positive impact on the depiction of subsynoptic flow in the model initial conditions at 1200 UTC 15 June, including the warm moist tongue and southwesterly monsoon flow over the open ocean. The cold pool caused by the evaporative cooling of antecedent rains during 14-15 June and orographic blocking over southwestern Taiwan are better resolved in the nested high-resolution domain in the CTRL run as compared to the initial conditions provided by the NCEP GFS (GFS-FCST run). As a result, local circulations and rainfall patterns over Taiwan, which include the coastal heavy rainfall along the southwestern coast and adjacent ocean, and the afternoon localized heavy rainfall over northern Taiwan, are better predicted in the CTRL run.

Model sensitivity tests are also performed to diagnose the effects of terrain and rain evaporative cooling on the intensity and depth of the cool pool and degree of orographic blocking on the southwesterly flow over southwestern Taiwan.