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Simulation of monsoon circulation and tropical storms activities in the WRF 30-km Regional Climate Model

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Two of the important large-scale circulation that affect the tropical storm activities are the monsoon trough and the Western Pacific subtropical high. The gross features of these large-scale circulations are often well captured by the Global Climate Models (GCMs). However, the structure of tropical storms are usually poorly simulated by the GCMs due to their coarse resolutions. In this study, Weather Research and Forecasting (WRF) Regional Climate Model (RCM) at 30-km resolution is adopted to simulate the climatological feature of monsoon trough and tropical storms from 2000 to 2009. Numerical experiments with three different domains are conducted to investigate the relative contributions from tropical East Pacific Ocean, Indian Ocean and land-sea contrast. The results show that the gross features of large-scale circulations are well captured by all three experiments. Nevertheless, monsoon troughs are too strong, while subtropical highs are too weak in two experiments without Indian Ocean. This causes that the low-level convergence region in these two experiments shift to the east of the observation. It is suggested that the location and strength of monsoon trough are influenced by both the Pacific and the Indian Ocean. With the inclusion of Indian Ocean and land-sea contrast, the strength of monsoon trough, subtropical high, and low-level convergence are well represented in numerical simulation. The relationship between the large-scale circulations and the typhoon activities in all three experiments are further investigated.