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Role of Cumulus Parameterization Scheme on the Diurnal Cycle of Precipitation over Southeast Asia in RegCM4

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This study examines the sensitivity of precipitation simulations over the CORDEX-Southeast Asia (SEA) domain to the cumulus convection scheme used in the Regional Climate Model version 4 (RegCM4). With the ERA-interim reanalysis as lateral boundary conditions, model integrations using the MIT-Emanuel cumulus parameterization scheme, and those using a "mixed convection scheme" (namely with the MIT-Emanuel scheme over ocean and the Grell scheme with Arakawa Schubert-type closure over land), have been carried out for the 2001-2010 period. On the seasonal average, the use of the mixed convection scheme, in comparison to MIT-Emanuel scheme everywhere, improves rainfall simulations over the South China Sea (SCS) by reducing the summer-time wet bias there. On the other hand, runs with the mixed convection scheme under(over)-estimate rainfall over land in Southeastern China (western coastlines of Indochina and the Philippines). For the diurnal variation of precipitation, it is found that the RegCM4 can reproduce well the characteristics of the diurnal cycle (DC) in SEA. Compared with the mixed convection scheme, the MIT-Emanual scheme performs better in reproducing the amplitude and phase of DC over the landside coastal area of Indochina during summer. Empirical Orthogonal Function (EOF) analysis indicates that switching from the MIT-Emanuel scheme to the mixed convection scheme leads to a reduction in importance of the second EOF mode, which corresponds to rainfall peaked in the afternoon (local time). Further analyses reveal that such underestimation is related to increased cloud cover in RegCM4 using the mixed convection scheme; enhanced cloudiness in turn leads to reduced surface air temperature over land and thus reduced convective instability at 1200 and 1500 local time in the model simulations.