

A difference of diurnal variation in simulated precipitation characteristics with and without cloud convective scheme

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Performance of a regional climate model for precipitation characteristics differs with use of a cumulus convective (CC) scheme or not. To clarify effects of the CC scheme on diurnal variations in precipitation frequency and intensity, numerical experiments are conducted over Bangladesh and its surrounding area where significant diurnal variation in precipitation has been observed for both of pre-monsoon and monsoon seasons. Three kinds of experiments were conducted using Weather Research and Forecasting (WRF) model version 3.5.1 with different horizontal mesh size (20, 10, and 5km). Note that the CC scheme was adopted for only the 20 km experiment. An analysis period covered during April through September for 3 years, from 2003 to 2005.

A seasonal variation in daily precipitation was well simulated in all experiments while the WRF performance for diurnal variations in precipitation frequency and intensity varied with use of the CC scheme or not. The 10 km and 5km experiments without the CC scheme captured a minimum peak of precipitation frequency during evening in the pre-monsoon season as well as an evening maximum peak and double minimum peaks during afternoon and midnight in the mature monsoon season. Those two experiments also performed a spatial distribution of simulated precipitation intensity during pre-monsoon season, i.e. its increase over northern mountainous area (southern plain area) in the nighttime (daytime), and diurnal contrast of precipitation intensity during mature monsoon season. Meanwhile, in the 20 km experiment with CC scheme, precipitation frequency was too high during monsoon season and its diurnal range was insignificant during pre-monsoon season. In addition, a diurnal change of the simulated precipitation intensity was inconsistent with observation. We need to conduct other experiments, e.g. the 20 km experiment without CC scheme and the 10 km experiment with CC scheme, to examine differences of the WRF performance for precipitation characteristics depending on horizontal resolution.

Key words: diurnal variation of precipitation characteristics, regional climate model, cumulus convective scheme