

Evaluation of the summer precipitation over China simulated by BCC_CSM model with different horizontal resolutions during the recent half century

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The performance of Beijing Climate Center climate system model with different horizontal resolutions (BCC_CSM1.1 with coarse resolution and BCC_CSM1.1m with fine resolution) in simulating the summer precipitation over China during the recent half century is evaluated, and the possible underlying physical mechanisms related to the model biases are also further analyzed and discussed. Results show that increasing horizontal resolution does improve the summer precipitation simulation over most part of China especially in western China due to the more realistic description of the topography. However, the summer precipitation amount (PA) over eastern China characterized by monsoonal climates is much more underestimated in the finer resolution model. It is also noted that the improvement (deterioration) of the summer PA over western (eastern) China in BCC_CSM1.1m model is mainly due to the better (worse) simulation of the moderate and heavy precipitation relative to BCC_CSM1.1 model. In addition, increasing model horizontal resolution can significantly improve the convective precipitation simulation especially over western China but shows very limited improvement in the large-scale precipitation simulation. The much more underestimated summer PA over eastern China in BCC_CSM1.1m model relative to BCC_CSM1.1 model is due to the significantly reduced positive biases of the convective PA but few changes in the negative biases of the large-scale PA. Further mechanism analysis suggests that both the underestimated land-sea thermal contrast and the overestimated Western Pacific subtropical high result in much less northeastward water vapor transport and summer PA over eastern China in BCC_CSM1.1m model than in BCC_CSM1.1 model.

Key words: China, summer precipitation, BCC_CSM model, model evaluation