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Improved performances of High Resolution Climate Models in the simulation of East-Asian Summer Monsoon Rainbelt

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Simulation of East Asian summer monsoon (EASM) rainbelt has been a challenge for climate models. In this study, the significant improvement of high resolution climate models in simulating the spatial distribution and rainfall amount of EASM rainbelt was revealed based on the AMIP simulations from Coupled Model Intercomparison Project Phase 5 (CMIP5) models. Diagnosis of moist static energy (MSE) budget and moisture budget were performed to understand the mechanisms behind the improvements of the spatial distribution and rainfall amount of the EASM rainbelt. The MSE budget analysis indicated that the location of the EASM rainbelt was mainly determined by the stationary meridional eddy flow (v*) in both observation and climate models. The moisture budget analysis showed that the rainfall amount of the EASM rainbelt was mainly controlled by the convergence of the stationary meridional eddy flow. In low resolution models, the simulated v* was too weak and exhibited northward shift, which resulted in 5 degree northward shifted and underestimated monsoon rainbelt. In contrast, the simulated v* biases decreased dramatically in the high resolution models. Compared to those in low resolution models, the location and magnitude of simulated v* was closer to the observation in high resolution models. These improvements enhanced the moisture convergence flux by 183%. Therefore, the spatial pattern and rainfall amount of the simulated EASM rainbelt were improved in the high resolution models.