Future changes in East Asian summer monsoon precipitation and their uncertainty in 60km-mesh MRI-AGCM ensemble simulations

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This study investigates future changes in summer monsoon precipitation over East Asia and their uncertainty, based on ensemble simulations with a 60-km mesh Meteorological Research Institute (MRI) atmospheric general circulation model (AGCM). The ensemble includes 28 members projections with a wide variety of sea surface temperature (SST) warming patterns that are obtained from coupled models of the Coupled Modeling Intercomparison Project phase 5 (CMIP5) as well as 12 members projections combining different types of convective parameterization schemes with different SST warming patterns. In the present-day climate realizations, which are forced by an observed SST, the MRI-AGCM shows high performance in simulating the Meiyu/Baiu rainband in terms of intensity and seasonal progress.

Future climate projections at the end of the 21 century under the RCP8.5 scenario show that both summer precipitation and summer monthly precipitation will generally increase over East Asia, accompanied by specific spatial patterns with some uncertainty. In June, the Meiyu/Baiu rainband is projected to enhance and slightly shift southward especially in the eastern part, with high agreement among the ensemble members. In July, there is large uncertainty in behavior of the Meiyu/Baiu rainband over Japan. In August, precipitation is projected to increase over the Eurasian continent and the surroundings.

Further analysis based on idealized experiments with the MRI-AGCM indicates that an SST warming has a dominant role in the general increase of precipitation in East Asia as well as the enhancement and southward shift of the Meiyu/Baiu rainband, while an CO₂-induced land warming exerts large influence on the increase of precipitation over the Eurasian continent, especially in late summer.

Keywords: monsoon precipitation, global warming, East Asia