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Comparison of MRI-AGCM precipitation outputs with observed precipitation as a basis for the prediction of future extreme precipitation in Asian region

Hironori Inomata, Kuniyoshi Takeuchi, and Kazuhiko Fukami
(inomata@pwri.go.jp)

It is described, in the IPCC 4th report published in 2007, that frequency and magnitude of heavy precipitation events will increase due to climate change in 21st century. Because such change in precipitation characteristics may lead to the increase of flood risk, countermeasures are necessary. Future projections in precipitation are usually based on the simulation results of General Circulation Models (GCMs). However spatial resolution of GCMs are about several hundred kilometers and that is usually too coarse to predict and understand the change of precipitation characteristics which is the basis of countermeasures in interested regions. In such a situation, the Meteorological Research Institute of Japan (MRI) has developed the Atmospheric General Circulation Model (MRI-AGCM) which spatial resolution is roughly 20km. This simulation outputs is highly expected to be used as a basis of establishing adaptation measurements to the increase of flood risk in interested regions especially in Asian region. In that situation, the purpose of this study is to investigate the performance of MRI-AGCM precipitation output. MRI-AGCM has two ensemble members named MRI-AGCM3.1S (3.1) and MRI-AGCM3.2S (3.2). Both precipitation outputs were compared with the observed precipitation data which name is the APHRODITE Monsoon Asia (APHRO_MA). APHRO_MA is the historical gridded precipitation data made of many ground observation data in Monsoon Asian region. As a comparison result, both 3.1 and 3.2 shows relatively good agreement with observation in terms of annual and monthly precipitation in many areas in Asia. It is remarkable that they well reproduced the precipitation distribution which is affected by orographic effect in Asian region because of its fine resolution. However, they show some difficulties in reproducing extreme precipitation which is important for flood risk management. We investigated the occurrence Julian day of extreme daily precipitation (top 0.5% daily precipitation samples) of observation and both 3.1 and 3.2. Then, it was found that there are some areas in which the extreme daily precipitation of both 3.1 and 3.2 occurred earlier than observation. In addition to that, the averaged intensity of top 0.5% daily precipitation samples of 3.1 and 3.2 are different each other very much. While 3.1 underestimates observation, 3.2 overestimates. Accordingly, the averaged intensity of top 0.5% daily precipitation samples of 3.1 and 3.2 in the future climate condition are also different very much. As a result, at many areas in Asia, MRI-AGCM series could reproduce and show high accuracy in the annual and monthly precipitation with expressing the area in which orographic effect is dominant. On the other hand, MRI-AGCM series still show high varieties in expressing extreme precipitation and it is required to use MRI-AGCM series carefully for the future projection of extreme precipitation.