P48

Reproducibility of AGCM20 Precipitation Output and Its Dependence on Topography

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In 2007, Japan's Ministry of Education, Culture, Sports, Science, and Technology (MEXT) launched the Innovative Program of Climate Change Projection for the 21st Century (Kakushin21), and have developed a super-high-resolution atmospheric model having 20-km spatial and 1-hour temporal resolution (hereafter AGCM20).

This study provides preliminary evaluation results on the precipitation output of the AGCM20 for the present climate condition (1979~ 2003) by comparing with the AMeDAS observed precipitation, considering orographic effects on precipitation. Orographic effect and elevation dependency of precipitation is well known phenomena, especially in mountainous area as of Japan.

According to the AMeDAS observation, annual mean precipitation during 1979 and 2003 is 1684.3 mm, and the AGCM20 output shows 1703.8 mm of annual mean for the same duration, which shows very good consistency (Fig. 1). Spatial pattern of the annual mean precipitation also shows considerably good match with 0.78 of spatial pattern correlation. However, it is noticeable that the clear spatial pattern of the observed precipitation is presented in somewhat smoothen way in the AGCM20 precipitation output. It is mainly because of topographic information in the AGCM20, which also has 20-km averaged elevation values.

The AGCM20 output also shows some limitations to simulate clear orographic effects mainly due to its 20-km resolution topographic data. The AGCM20 precipitation output shows low dependency on topographic elevation. When the mean rainfall amount during summer season (July~September) in Kyushu was compared considering the elevation information of 20-km grid in the AGCM20, the AMeDAS observed rainfall amount shows clear dependency on elevation (even though it is spatially averaged within the 20-km grid). However, the AGCM20 output was not able to show reasonable elevation dependency of precipitation.

One who wants to carry out hydrologic impact analysis using the AGCM20 output on a certain mountainous area should consider these characteristics of the AGCM20 output. Further research is currently undergoing with the output of a regional circulation model and another AGCM having 60-km of spatial resolution, to figure out the relation between the model resolution and the orographic effects reproducibility.

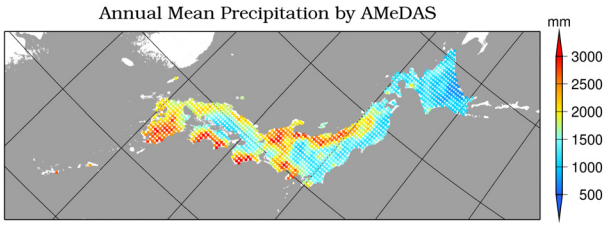

Fig. 1(a) Annual mean precipitation of Japan, observed by the AMeDAS (1975~2003) and converted into 20 km grid data, showing 1684.3mm of mean value.

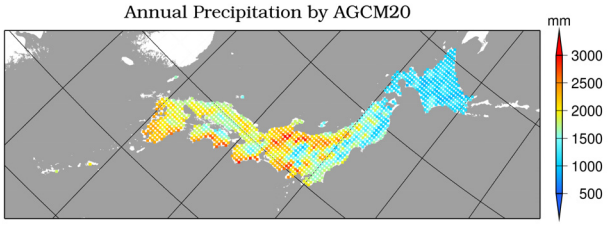

Fig. 1(b) Annual mean precipitation from the controlled run output (1975~2003) of the AGCM20. It shows 0.78 of spatial pattern correlation to the observation, and the mean annual precipitation is 1703.8mm.