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Difference in water vapor amount between reanalysis datasets: Application to regional climate models

Hiroshi G. Takahashi
JAMSTEC/TMU(Tokyo Metropolitan University), Japan (hiroshi3@jamstec.go.jp)

Dynamical-downscaling methods is important to understand climate changes on regional scale. At this current moment, regional climate changes themselves have not fully understood. Because a hydrological cycle, such as rainfall, has stronger non-uniformity, compared to a parameter like temperature, it would be a coming challenging issue of the climate changes. Regional climate model (RCM) is a practical option of the investigation of the regional climate changes. Actually, initial and boundary conditions are needed for simulations of RCMs, which strongly affects their simulation results. Most of hindcasts (simulation for the present climate) have been using reanalysis datasets as initial and boundary conditions. However, the major reanalysis datasets, such as The National Centers for Environmental Prediction/National Center for Atmospheric Research reanalysis (NCEP1), 40-year Reanalysis (ERA40) of the European Centre for Medium-Range Weather Forecasts (ECMWF), and Japanese 25-year reanalysis (JRA25) of Japan Meteorological Agency (JMA), have large differences, especially in water vapor amount. To understand the impact of difference in water vapor amount, we run a RCM using three different reanalysis datasets.

Results showed that climatological precipitable water (PW) are largely different over the whole globe. PW of ERA40 (NCAP1) was moistest (driest). The difference in PW directly affects on the simulated rainfall amount over a study area. When we used an unrealistic atmospheric condition as boundary condition, the simulated results were very poor. If the reproducibility of the present climate is very poor, it is very difficult to project future regional climates.