A composite empirical-pareto distribution approach to correct the bias of daily precipitation from climate models

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Systematic biases relative to observed rainfall makes rainfall from climate models unfit for direct use. To correct the biases of these rainfall, Quantile Delta Mapping (QDM), which is an adaption of quantile mapping (QM), is recently used as it doesn’ t rely on the assumption of stationarity. However, QDM employs an empirical way to fit extreme rainfall events, which is not accurate. In order to improve the accuracy of simulating extreme rainfall events, pareto distribution has been used to fit these extremes. In specific, this paper proposes a Modified Quantile Delta Mapping (MQDM) approach by using a composite empirical-pareto distribution to fit the rainfall events. Empirical distribution is used for the normal rainfall events while generalized Pareto distribution is used for 99th percentile extreme rainfall events. MQDM is compared with QDM by using “obsprecip” and “modprecip” dataset, which contain the observed and simulated daily precipitation data at MOSS in Norway, in R “qmap” package and Root-Mean-Square Error (RMSE) is calculated by the simulated extremes and observed ones. The result showed MQDM is found to be more accurate than QDM. For 99th percentile extreme rainfall events, QDM had RMSE of 2.9 mm while MQDM had RMSE of 1.53 mm. For the highest 5 extreme rainfall events, QDM had RMSE of 7.6 mm while MQDM had RMSE of 1.7 mm. MQDM can be used to correct the bias of extreme rainfall events from climate models in the future.

Keywords: Modified quantile delta mapping, Generalized Pareto distribution, Statistical bias correction, Extreme rainfall, Climate change

