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Exploration of intensity change in daily precipitation using bias-corrected ERA-20c in South Korea over the whole 20th century

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The rainfall frequency analysis is routinely adopted for estimation of design rainfall of a given specific return period. The observed rainfall data are generally used for the analysis in practice, but the parameters of the descriptive probability distribution are generally estimated from limited data that are often available from the 1970s in many regions including South Korea. As an alternative, this study aims to utilize a century-long ERA-20c daily precipitation data, which have been provided by the European Centre for Medium-Range Weather Forecasts (ECMWF). In order to reduce the systematic errors in the reanalysis data, this study applies a quantile mapping approach by using a composite Gamma-Pareto distribution. More specifically, the extremes over certain thresholds (i.e. 95th or 99th percentile) are described by a generalized Pareto distribution (GPD), while the remains of rainfalls are fitted by a gamma distribution. In this study, non-stationarity such as monotonic trend and long-term climate variability is also considered in terms of the bias-correction approach, and the bias corrected ERA-20c daily precipitation is then used to explore the spatio-temporal change in design rainfalls over South Korea. Inter-comparison of the rainfall intensity between the past (1913-1950) and the recent (1973-2010) period is conducted to better understand the long-term change over South Korea. Finally, this study explores the reduction of uncertainty in the estimation of design rainfalls for the use of the bias corrected ERA-20c based on a Bayesian modeling framework.