Interactive comment on "Exploring the Long-Term Reanalysis of Precipitation and the Contribution of Bias Correction to the Reduction of Uncertainty over South Korea: A Composite Gamma-Pareto Distribution Approach to the Bias Correction" by Dong-Ik Kim et al.

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As summarized by reviewer 2, "The authors present and evaluate a bias correction of the ECMWF ERA-20c reanalysis for South Korea. The correction is based on a parametric quantile mapping and calibrated between reanalysis grid-box and observed station precipitation, and extended to the full field by interpolating the transfer function parameters in space."

The context of the underlying study was however not clear. As formulated in the response to reviewer 3, "this study mainly focused on the bias correction of ERA-20c daily precipitation, especially for extreme values, because the century-long precipitation dataset could contribute to the reduction of the uncertainty in hydrologic frequency analysis where a limited number of observations were generally given.". In other words, this study proposes to apply bias correction to a long precipitation reanalysis data set to improve the estimation of design variables. In response to reviewer 2, this is formulated as "However, a primary objective of this study is to statistically extend the sample size, especially for extreme values, in a certain area with spatio-temporally sparse observation network." With this respect, the title and the abstract where misleading ("Exploring the Long-Term Reanalysis of Precipitation and the Contribution of Bias Correction to the Reduction of Uncertainty over South Korea: A Composite Gamma-Pareto Distribution Approach to the Bias Correction").

The three reviewer were very critical about the manuscript both in terms of scientific quality and relevance. Two reviewers suggested rejection, one major revisions.

Reviewer 3 questions the novelty of the discussed methods. In their response, the authors argue that the novelty lies in the fact that the presented methods are applied to "long reanalysis data" (rather than short reanalysis data sets), which then opens new perspectives for extreme event analysis.

While this might a prior justify publication of this manuscript, reviewer 2 discusses in detail why the proposed bais correction method is not useful for extreme event analysis. In summary (cited from reviewer 2) "Deterministic bias correction of precipitation cannot be used for downscaling, and in particular not to create spatial fields. (..), the corrected time series have similar marginal properties as the local observations, but do not have the correct spatial-temporal properties. This is a problem in particular for spatial fields, as the spatial distribution of the corrected field is still that of the reanalysis (apart from the wet-day correction), but only inflated."

The authors response to this comment is not satisfying ("We agree that there may exist the spatial bias between local station observation and gridded reanalysis, and the bias corrected values could misrepresent spatial-temporal pattern. However, a primary objective of this study is to statistically extend the sample size, especially for extreme values, in a certain area with spatio-temporally sparse observation network. Therefore, specific day-to-day variation or trend analysis was not our main concern in this study."). The authors do in particular not discuss the problem of spatial rainfall properties. Their reasoning is motivated by how design rainfall is usually obtained ("Second, one generally collects annual maximum rainfall series or extreme values over a certain threshold from historical records to derive Intensity-Duration-Frequency (IDF) relationships."). From an engineering practice viewpoint, it might indeed seem a possible option to extend rainfall records at individual stations without accounting explicitly for the properties of the spatial rainfall field. From scientific viewpoint, however, it is highly questionable to produce time series at individual stations without accounting for spatial properties.

The authors furthermore justify their approach by the uncertainty reduction obtained if longer time series are used for design rainfall estimation (extreme event analysis). This reduction is however spurious: obviously, the estimation uncertainty seems to decrease if the data is extended. But since the uncertainty of the new data (obtained with bias correction) is not included in the analysis chain, this decrease of uncertainty has no direct value.

In conclusion, the answers of the authors to the reviewers' comments are not convincing and I thus reject this paper for publication in HESS.