

# ***Interactive comment on “Bias correction of gauge-based gridded product to improve extreme precipitation analysis in the Yarlung Tsangpo-Brahmaputra River Basin” by Xian Luo et al.***

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## 1. General comments

The paper by Luo X. and al propose to compare the performance of four bias correction methods (Linear Scaling, Local Intensity Scaling, Power transformation and Quantile Mapping) of daily precipitations during 1951-2015 over Yarlung Tsangpo-Brahmaputra River Bassin (YBRB). The data to correct comes from the gridded APHRODITE dataset, and the reference dataset are sparse observations from meteorological sta-

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tions. In the first section the dataset and methods are introduced, but it is not clear what time series is matched between model and observations? The observations are interpolated? Aggregated? Strangely, the authors can compute the error due to biased correction method between corrected dataset and observations used as reference, but not for extremal indexes. So the final section discussed the influence of bias correction but can not check the quality of the correction itself. Furthermore, a classic way to test of a bias correction is the cross validation step. (cut a least the dataset into calibration and validation period, and swap its), not used here. In the state of the paper, I can recommend the publication only after major revisions taking into accounts (at least) of my comments, detailed below.

Response: Thank you for your comments concerning our manuscript entitled “Bias correction of gauge-based gridded product to improve extreme precipitation analysis in the Yarlung Tsangpo-Brahmaputra River Basin”. We have revised the manuscript according to your kind advices and detailed suggestions. We have added statements about the calculation and interpolation of extreme precipitation indices. In the grids distributed with rainfall stations, the parameters of bias corrections were determined using corresponding available rainfall observations. After that, APHRODITE estimates during 1951–2015 in these grids were corrected, and extreme precipitation indices were then calculated. Finally, spatial interpolation was performed to obtain extreme precipitation indices in other grids with no rainfall station distributed. To improve the study, we have used leave one-out cross-validation method to further discuss the quality of the different bias correction methods and the influence of bias correction on extreme precipitation analysis. The observations in each one of the rainfall stations was leaved and used to calculate extreme precipitation indices alternately for validation. The observations in all other rainfall stations were used for bias correction and extreme precipitation analysis, and extreme event statistics in the rainfall station for validation were obtained from interpolation and compared with the results calculated from observations. A new figure named “Mean error of extreme precipitation indices for leave one-out cross-validation in the YBRB” was added.

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## 2. Specific comments

(1) Section 2.2 At the end of this section, you have two dataset, APHRODITE (to correct) and some observations at stations. The stations, considering the Fig. 1 does not match with the grid of APHRODITE, so how do you associate the time series to be correct with the reference time series? At the end of this section we need to know exactly what is the biased dataset X matched with the observations Y.

Response: We have added statements about the bias correction on APHRODITE estimates and calculation of extreme precipitation indices. This study associated the observation at rainfall stations with the APHRODITE estimates according to the location and observation time. In the grids distributed with rainfall stations, the parameters of bias corrections were determined by using corresponding available rainfall observations. APHRODITE estimates during 1951–2015 in these grids were corrected, and extreme precipitation indices were then calculated. Finally, extreme precipitation indices in other grids with no rainfall station distributed were obtained by spatial interpolation.

(2) Section 2.3 Related to previous questions, I am not sure to understand exactly what is Pobs and Paph. For example: Paph is a time series of APHRODITE at a grid point and Pobs is the interpolation of observations to correspond to the grid of APHRODITE? Or you aggregate all data in your three zones TP; HB and FP?

Response: We have modified the explanation about the variables. Pobs is the observation at rainfall station, while PAPH is APHRODITE estimate at corresponding grid.

(3) Section 2.3 For the quantile mapping, how do you fit the Gamma distribution? MLE? Moments? What is the error of the fit? (I think the error of quantile mapping comes from also from the error of the Gamma model)

Response: For the quantile mapping, we fit the Gamma distribution by maximum likelihood estimates. Though the Gamma distribution has been proven to be effective in

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precipitation analysis, error could be also caused by the Gamma model.

(4) Section 3.2.1 This section is based on the description of Fig. 3, which is not readable, please remove the colormap of topography and increase the size.

Response: To make Fig. 3 more readable, we have removed the topography and increased the size.

(5) Section 3.2.2 to end of section 3 You compare the original and bias corrected dataset. But without reference, how can you assess an improvement or a degradation by the bias correction method? You can investigate the effect of bias correction, but not the quality of the correction.

Response: We have added the analysis on leave one-out cross-validation and modified section 3.2. By using leave one-out cross-validation method, we studied the quality of the different bias correction methods on extreme precipitation analysis. The effects of bias correction were further investigated by comparing the original and corrected APHRODITE estimates. Thanks for all of your suggestions.

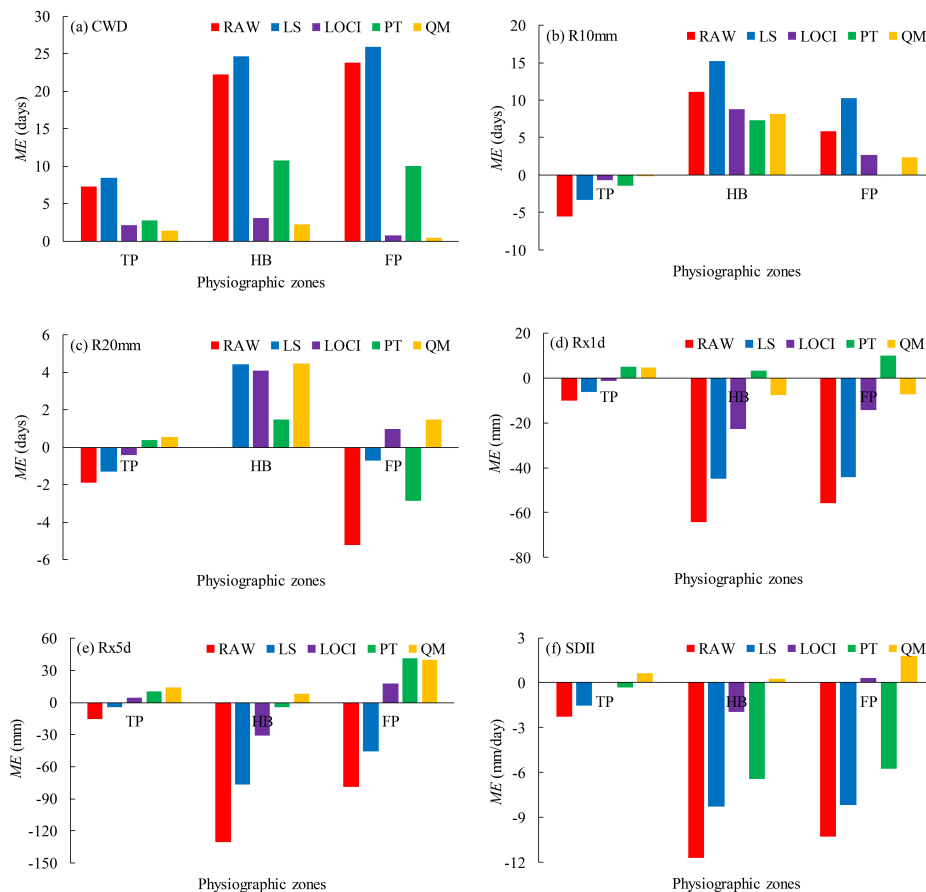
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**Fig. 1.** Mean error of extreme precipitation indices for leave one-out cross-validation in the YBRB