Reviewer 3

Comment

It is not really appropriate to use monthly precipitation to validate the proposed methods in correcting precipitation extremes from my perspective. For the precipitation extremes, the daily or sub-daily scale precipitation data is required.

Answer

Thanks for your comment. We agree with your comments. Therefore, we changed the data to daily precipitation, and it was all reflected in the article.

Comment

What is the relationship between F-DDQM and F-DGQM authors proposed? Since the F-DDQM performs best because of the consideration of diverse distribution function, what is the point of the F-DGQM's existence?

Answer

Thanks for your comment. In this study, when performing quantile mapping by dividing into two segments, the first goal is to find an appropriate delta because the distribution of precipitation is different for each station.

F-DGQM determines the appropriate delta for distribution by station based on five evaluation metrics. Based on the F-DGQM results, we demonstrated that the dividing point could be different for each station because each station's scale and trend of precipitation were different.

The second goal of this study is to select the distribution in each segment. F-DDQM may outperform F-DGQM in historical performance and emphasizing research creativity. Our study also presented F-DDQM, a method that can achieve both goals.

Comment

Segmenting the precipitation series to two fragments by selecting an optimal threshold, is a good idea. But in my opinions, it is not optimal to use QM based on the theoretical distribution function approach for two different sequences. For the non-extreme series, the non-parametric transformation, i.e., interpolation method in Q-Q plot, is able to capture more precipitation information compared with parametric transformation method and theoretical distribution function method. For the extreme series, when the future precipitation extremes lie outside the domain of historical model data, the simple extrapolation algorithm, such as linear, cubic, and spline interpolation, might lead to great bias. So, in this situation, the theoretical distribution function can be applied due to its advantage of extending the data reasonably.

Answer

Thanks for your comment. We agree with your comment. When projecting future precipitation with the suggested method, we applied the selected distribution for the future. For example, if the selected distributions are Weibull and Gamma for the two segments (1%-70%: Weibull; 71%-100%: Gamma) for the historical period, respectively, we used the Weibull distribution to project into the future precipitation below the 70th quantile, and the gamma distribution to project future precipitation of above 71st quantile. These methods can more accurately reflect the distribution of precipitation over historical periods. In addition, the extreme precipitation for the future period can be better than one distribution.

Comment

For equation 3, the Fg corresponds the GCM outputs and the Fg-1 corresponds the observed data. I think this is wrong. Different letters subscript should be used.

Answer

Thanks for your comment. In response to your comments, we modified the Equation 3 as follows:

$$P_g(t) = F_o^{-1}\left(F_g(P_m(t), \alpha_m, \beta_m), \alpha_o, \beta_o\right) \quad (3)$$

The modified the paragraph as follows:

where $P_g(t)$ denotes the bias-corrected monthly precipitation, $P_m(t)$ represents GCM raw data, F_o^{-1} is the inverse CDF of the observed data to which the gamma function is applied, and F_g is the CDF of the GCM outputs. α_o, α_m, β_o and β_m represent shape and scale parameters of observed and GCM simulation, respectively.

Comment

I don’t know why the authors used the GEV to fit the corrected models data compared with observation. A direct comparison of the empirical distribution functions of the extreme value series seems more appropriate. Additionally, for the extreme series obtained by POT model, GP distribution is generally more appropriate, rather than GEV.

Answer

Thanks for your comment. The GEV distribution is popularly used to estimate the extremes. Its performance has also been demonstrated in several studies.

This study did not use GEV to fit the bias-corrected model data. Instead, we compared the corrected precipitation using the GEV distribution using the quantile mapping methods. The results of KLD and JSD showed the difference between bias-corrected data by quantile mapping and observed data.