

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
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Comment on hess-2022-107

Anonymous Referee #2

Referee comment on "Development of flexible double distribution quantile mapping for better bias correction in precipitation of GCMs" by Young Hoon Song et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-107-RC2>, 2022

This study proposed a new flexible double distribution quantile mapping (F-DDQM) method to correct the bias of global climate models (GCMs), through determine the varied δ value to divide the probability distribution of precipitation into two segments and fit these segments with three distributions rather than only the gamma distribution to improve the performance of bias correction. The results show that the F-DDQM method performs best in correcting bias in extreme precipitation compared with the flexible double gamma quantile mapping (F-DGQM), the double gamma quantile mapping (DGQM) and the single gamma quantile mapping (SGQM) methods.

From my perspective, this topic is not very innovate using different δ values to determe precipitation extremes and using different distribution for different segments. Using the monthly temporal scale data to validate the effectiveness of this proposed F-DDQM is not strongly persuasive.

My main concerns are:

- The section of Introduction is not well written, and the logic is not so clear. For example, what is the relationship between the paragraph 2 and 3? In Paragraph 2, you introduced the advantage of QDM method that can address the drawbacks of QM and also cited several different categories of methods developed based on QDM, thus

according to the normal logic, it should describe the method of QDM in Paragraph 3 rather than the QM. In addition, without giving the reasons that "QM does not always outperform other bias-correction methods at all locations", how did you get the conclusion of "this emphasizes choosing an appropriate probability distribution function for successful bias correction"? Furthermore, the objectives/problems aimed to be achieved/addressed are not properly stated in the last paragraph.

- In this study, using the monthly-scale precipitation to test the effectiveness of the newly proposed flexible double distribution quantile mapping method in correcting the bias of GCM is not proper and it cannot well reflect the extreme precipitation characteristics. The authors must valid the performance of this method in bias-correcting of daily-scale GCMs, the daily data present larger spatial variability and are more useful for climate change studies.
- This paper is written casually, and there exist many grammar and tense problems, which needs to be polished by native English speakers.

Specific comments:

Line 14-15: It is not appropriate to directly use the 90th quantile to reflect the question, because in many references they may also using the 95th or 99th quantile rather than only the 90th quantile.

Line 15: "Gamma probability distribution function" instead of "Gamma probability function".

Line 17: "consider" instead of "considered".

Line 18: add "e.g." before "Weibull, lognormal.....", add "the" before " two separate segments".

Line 20: delete "to correct bias".

Line 21 and 23: the tense is wrong. "show" instead of "show".

Line 25: delete "the" before "better projection of extreme values".

Line 45: why use "but" when there is no turning point?

Line 55: "and" <- "with" or "using".

Line 75: "is aimed to propose" instead of "proposed".

Line 77: Why do you choose these three PDFs since you mentioned that the most appropriate distribution can be different for different regions in Line 72? Whether the only three PDFs are too few? Are these three PDFs suitable for precipitation extremes, i.e., the segment larger than the given threshold like 90th quantile? Are these three PDFs suitable for precipitation extremes, i.e., the segment larger than the given threshold like 90th quantile?

Line 79: Why only use RMSE to select the dividing point? Are there any indicators that are more suitable to select the dividing point?

Line 81: add "method" after "The performance of the proposed".

Line 83-84: What do you mean "the performancebased on GEV distribution? It doesn't seem to be a complete sentence.

Line 126: "based on" instead of "for".

Line 127-134: What's the meaning of those variables in Eq. (1) – Eq. (2)? They are not stated properly and could not be well understood. How do you determine the surrounding grids close to one specific location that are used in Eq. (1) – Eq. (2)?

Line 144: Is the F_g^{-1} in Eq. (3) correct? It is very easy to consider F_g^{-1} as the converse function of F_g . Please explain the variables in a proper way.

In Section 3.3-3.4: These two parts are the core contents of this study, but the relevant information is too little. The detailed calculation process should be described here.

In Line 160: Why do you choose the δ values between 80%-95%? It seems also very random like other studies. In addition, how do you use RMSE to determine the δ has not been clearly given.

Line 161: "determine" instead of "determined". Add "the" before "optimal RMSE".

Line 169: Add "the" before "Gamma distribution". There are so many places where "the" has not been properly used or not been added. Please check it in the whole paper.

In Figure 2 and 3, what are the differences? What are your points?

Line 179: delete "the" before "other climate variables".

Line 195: add "by" before "positive value".

Line 202: Please check the correction of the Eq. (8).

Line 208-219: In Section 3.6, the aim of using the Generalized extreme value distribution in this paper should be firstly explained.

Line 218: "bias-corrected precipitation" rather than "precipitation bias-corrected".

Line 221: add the abbreviation KLD and JSD in the sub-title.

Line 245: The most selected quantile is the 80th that can be seen from Fig. 4, is this related with the lower bound of the δ values you set in this paper? This means whether the most selected δ value will be smaller than the 80th quantile if the lower bound of δ values is set lower than the 80th quantile. Similar for the second most selected 95th quantile.

Line 255-256: Please rewrite the title of Figure 5, same for Figure 10.

Line 301: The tense should be the present tense when describing the founded results. Please check in the whole paper.

Line 312: add "distribution" after "Weibull". Please check the tense.

For all figures, delete the "The" at the beginning place of the corresponding title.

Line 372: "based on" instead of "based".

Line 418-419: Please ensure the sentence is complete.

Line 433: Add "in" before "Figure 17". There are many places that the sentences are not complete.

Line 435: What do you mean by this sentence?

Line 447: Since you mentioned future projection, how do you determine the δ value for extreme precipitation in the future period using the methods in this study?

Line 466 and Line 475: Where are the figures for the performances of different fitted distributions, like the gamma distribution and the Weibull distribution?

Line 441-491: In the section of Discussion, the discussion should be strengthened rather than repeating describing the results in the part of results.