

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1  
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## Comment on hess-2022-107

Anonymous Referee #1

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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-RC1>, 2022

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This manuscript developed a new bias correction method that improved the popularly used double gamma quantile mapping method. It showed the out performances of the flexible double distribution quantile mapping method over single and double gamma quantile mapping methods in terms of various performance indicators. In addition, this study showed the intermediate improved method, the flexible double gamma quantile mapping method. Therefore, readers could easily follow the strengths of the new method developed in this study. In my opinion, it has clear originality compared to any other previous studies and has shown the distinct reasons why the flexible double distribution quantile method should be used in the bias correction of general circulation models. Therefore, it is worthwhile being published in HESS. However, the miscellaneous following must be checked and revised carefully.

- A few notes on annual rainfall value might help in assessing the typical climate patterns over the study area. Describing trend of rainfall values would be nice. Also, where was the climate data collected? [L91]
- 3.3 Flexible double gamma quantile mapping (F-DGQM) - > bold [L156]
- I wonder why authors use RMSE to determine delta. For example, several studies use AIC or BIC to find a suitable distribution. However, the authors determined the distribution using only RMSE. Please tell us why you used RMSE.
- Because JSD and KLD evaluated the performance of bias-corrected precipitation, Sections 3-7 should be included in Sections 3-5.
- As shown in Figure 5, the most suitable deltas are at both extremes. Authors should add a discussion of the determined delta to section 5 or section 4-1.
- The authors should elaborate on the metrics results in Figures 6 and 11. For example, MD is more sensitive to extreme values  $\hat{\square}\square\hat{\square}$  than NSE.
- Figure 6: bias - > bias
- In the scatter plot of Figure 8, it isn't easy to discern the difference between F-DGQM

and DGQM. Therefore, the authors should remove figure 8 as these results have already demonstrated a difference with the evaluation indices. It would also be nice to present an annual time series figure, but it is unnecessary to add it.

- My comment on Figure 10 is like Figure 5. Authors need to improve their results.
- My comment on Figure 14 is like Figure 8.
- To avoid confusion about what the difference is in Figure 15, the authors need to indicate in the title.
- The authors should add about this study later in section 6 for the improvement of this study.
- The authors need to improve the resolution for the legend in Figure 1.
- How about moving Figure 1 to Section 2-1? It doesn't fit with section 2-2.
- Authors should specify the number of grids in the study area [L132].
- Improve the resolution for Figure 16. Or find another way to show the results clearly.
- Authors should state the limitations of the study in the conclusion. For example, authors may use a variety of metrics.
- double gamma quantile mapping [L494] - > DGQM
- The shapes of distributions in Figure 2 and 3 looks same. The shape in Figure 3 can be different because various distributions can be used here.
- L82-84 Check the grammar.
- The lowest value of delta is 80% in this study. How about considering lower values below 80%?
- L330-331: Make a paragraph.
- What is SD in Table 2?
- L448-449 Check the meaning.
- The future study should be described in the end of conclusion. I want to know the future plan based on this new technique. For example, more distributions can be considered. The dataset for more stations. More GCMs can be used.
- The format of references must be checked. ex.) Heo et al. (2019), ...
- Check the following errors.

L189 add "and" after "outputs".

L213 add "and" before "k".

L433 add "in" after "boxplots"

L434 change "The" by "It" or "This result".