

Interactive comment on “Technical Note: Downscaling RCM precipitation to the station scale using quantile mapping – a comparison of methods” by L. Gudmundsson et al.

Anonymous Referee #3

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I recommend the manuscript for publication after major revisions. My major concerns are the

- focus and novelty aspect of this study
- use of the phrase **quantile mapping** as a synonym for **bias correction**
- performance assessment of 1960-2000 data without discussing the basic assumptions of bias corrections and their transferability

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For further details, please see the comments below.

1 Does the paper address relevant scientific questions within the scope of HESS?

The submitted manuscript by Gudmundsson et al. (2012) deals with the **relevant** topic of RCM bias correction. Several bias correction methods for RCM simulations are compared and assessed in terms of their performance using a set of skill scores. The topic fits well in the scope of HESS.

2 Does the paper present novel concepts, ideas, tools, or data?

The actual review of bias correction methods does **not present novel concepts**. Similar reviews were presented by

- Chen, Jie, François P. Brissette, and Robert Leconte. 'Uncertainty of Downscaling Method in Quantifying the Impact of Climate Change on Hydrology'. *Journal of Hydrology* 401, no. 3–4 (2011): 190–202.
- Chen, Jie, François P. Brissette, Annie Poulin, and Robert Leconte. 'Overall Uncertainty Study of the Hydrological Impacts of Climate Change for a Canadian Watershed'. *Water Resour. Res.* 47, no. 12 (2011): W12509.
- Johnson, F., and A. Sharma. 'Accounting for Interannual Variability: A Comparison of Options for Water Resources Climate Change Impact Assessments'. *Water Resources Research* 47, no. 4 (2011): W04508.

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- Teutschbein, Claudia, and Jan Seibert. 'Bias Correction of Regional Climate Model Simulations for Hydrological Climate-change Impact Studies: Review and Evaluation of Different Methods'. *Journal of Hydrology*, no. 0 (2012). <http://www.sciencedirect.com/science/article/pii/S0022169412004556>.

However, the authors present an interesting tool to assess the performance of bias correction methods. They suggest a **novel set of skill scores** and introduce the so-called **10-fold cross-validation**. For this paper to be relevant for the scientific community, I would suggest to shift the focus rather to the skill scores and the ranking of methods. This will entail a restructuring and rewriting of the manuscript.

3 Are substantial conclusions reached?

The authors conclude with a ranking of the bias correction methods. Based on comment (2.) I would also like to see a conclusion about the CV, how effective and reliable this method is.

4 Are the scientific methods and assumptions valid and clearly outlined?

The different bias correction methods are clearly stated and equations are given. However, the authors do not discuss the fundamental problem of stationarity (i.e., the correction algorithm and its parameterization for current climate conditions are also valid for future conditions.). The presented study was performed for 1960-2000 data only and does not make a statement about the transferability to other time periods. For impact modelers, the ranking of methods seems somewhat irrelevant if we do not know whether this applies also for other conditions. Furthermore, the description of the rank-

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ing with help of skill scores needs revisions. Especially the cross validation needs more explanation!

5 Are the results sufficient to support the interpretations and conclusions?

In general, the results are sufficient.

6 Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

The tenfold cross validation needs more explanation.

7 Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

The authors give credit to a number of studies. However, especially regarding other bias correction reviews, the authors should also consider mentioning some of the papers listed above (see comment 2.) Furthermore, authors should indicate more clearly their original contribution (skill scores?).

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8 Does the title clearly reflect the contents of the paper?

The use of the phrase *quantile mapping* in the title and the manuscript is confusing. The authors use *quantile mapping* as a synonym for *bias correction*. In the scientific community, *quantile mapping* is rather used for a very specific type of bias correction, namely the matching of CDFs with help of theoretical distributions (also called distribution mapping, probability mapping, histogram equalization, etc.). The mentioned *parametric transformations* such as linear scaling (Eq. 3-4) or power transformation (Eq. 5-6) do not belong in the category of quantile mapping (they were not 'designed to adjust the distribution') but are different types of bias correction methods alongside quantile mapping. I think the authors should rethink their classification scheme and use commonly accepted terminology.

9 Does the abstract provide a concise and complete summary?

Yes.

10 Is the overall presentation well structured and clear?

The manuscript needs a better structure: There should be a separate section for data and/or implementation. Section 3.1 'data and implementation' does not belong to the section 'performance of quantile mapping'. Furthermore, methods and results should be clearly separated. This applies especially to sections 3.2 and 3.3 are

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11 Is the language fluent and precise?

Language is fluent, some minor mistakes.

12 Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

Make sure that abbreviations are explained when first used:

- h in Eq. 1 is not explained
- Eqs. 3-7: explain parameters a, b, c, x, t

13 Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

The manuscript seems a bit short in general. Methods should be clarified as mentioned above.

14 Are the number and quality of references appropriate?

Add some of the references mentioned above.

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15 Is the amount and quality of supplementary material appropriate?

Yes.

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