

Interactive comment on “A new method for post-processing daily sub-seasonal to seasonal rainfall forecasts from GCMs and evaluation for 12 Australian catchments” by Andrew Schepen et al.

Anonymous Referee #1

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General comments The paper addresses the important issue of calibrating outputs from a General Circulation Model (GCM) for 12 Australian catchments. The authors implement two relevant methodological choices: (i) calibration of daily precipitation and (ii) use of a calibration method that accounts for the correlation between forecasts and observations. Furthermore, the authors evaluate the added value (value as a gain in skill) that the proposed method has over the use of raw forecasts and the simpler and popular Quantile Mapping (QM). The paper builds upon the work of the research group which fits nicely within the general scope of HESS and within the objectives of the "Sub-seasonal to seasonal hydrological forecasting" special edition. I believe that post-processing of seasonal forecasts is a subject still in its infancy. Any effort to

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improve the forecasts is a relevant addition to the field of forecasting due to the negative societal effects of issuing forecasts that exhibit biases. My recommendation is that the paper should be accepted after minor revisions which are mainly clarifications needed to ease the reading. Detailed comments are given below.

Specific comments

(Major Comments)

Page 3, Lines 30-32 and Sect. 3.4: As I understand it, the set up for the QM uses a sliding window of 11-days in order to estimate the predictive and the observed distribution functions, while RPP-S uses 14-days for week 1 and week 2 up to 56 days for weeks 13-16. I think the implementation of both methods should be consistent in order to achieve robust conclusions. Perhaps something in the lines of what is discussed in Page 12, Lines 17-21. Could the authors explain how the difference in implementations between QM and RPP-S may impact the conclusions?.

Page 5, Line 18: To my understanding, the number of ensembles after post-processing is 1000, is that correct? If this is the case, then I would consider the comparison to the raw and quantile mapping corrected forecasts unfair. Perhaps the authors should make an effort to debias the CRPS as in Ferro, et al., (2008) to add quantitative evidence of the claim in Page 13 Lines 11-14. On the other hand, if the number of ensembles is 11, then it should be stated more clearly on the text.

(Minor comments)

Page 3, Lines 30-32: These lines can be removed as you are also explaining this on Sect. 3.4.

Page 4-7: Merge Sect. 3.1 with Sect. 3.2.2 and 3.2.3 to avoid repetition and to make the manuscript shorter.

Page 7, Lines 14-20. Perhaps change this paragraph to the result section.

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Page 7, Lines 26-27. These two lines should be moved somewhere in Sect. 3.2.

Page 8, Line 1. Change BIAS for AB in Eq. (8).

Page 8, Lines 2-4 Repetitive sentence, I suggest it is changed from "Bias is calculated separately for each catchment, initialization date and day. The bias is calculated across 23 events. For a given day, we calculate the average absolute bias across all 12 catchments and 12 initialization dates." to "Bias is calculated separately for each of the 12 catchments, 12 initialization dates and day across the 23 events."

Page 10, Line 11. Could the authors clarify what do they mean by "after rescaling to mm/day"?

Page 11, Sect. 4.4 and 4.5. I understand how the shuffling affects the reliability of the accumulated totals as discussed in Sect 4.3. However it is not clear if in the evaluation of the skill scores you are using the shuffled RPP-S. Could you clarify this matter? Also, it is not clear how the accumulation is done. Are you accumulating rainfall from the start of the forecast until 2 days after, then 3 days, and so on until 112 days?. Then, in total you have 12 (catchments) x 12 (initialization days) x 111 (accumulation periods) number of points in Fig. 7 right panel (and similarly 12x12x112 on the left panel)? This is my interpretation of Page 11, Line 3-4 that reads "Accumulated totals are for two days or more. ...". Further explanation on the accumulation is also needed for Fig. 8 to Fig. 10.

Page 12, Line 13: I suggest changing "... RPP-S forecasts are more reliable for daily amounts than QM forecasts" to "... RPP-S forecasts are slightly more reliable for daily amounts than QM forecasts".

Page 17, Table 1: Order catchments from smaller to bigger to make the visualization easier.

Page 18, Fig. 1: Add catchment boundaries to map in figure to help the reader relate Fig. 8 to catchment size.

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Page 21 and 22, Fig. 4 and Fig. 5: Change label "Bias (mm)" to "AB (mm/day)".

Technical Corrections

Page 4, Line 14. "are mapped in Figure 1" should be "are mapped in Fig. 1". In general, mentions to figures should be changed throughout the manuscript to comply with HESS guidelines (https://www.hydrology-and-earth-system-sciences.net/for_authors/manuscript_preparation.html).

Page 5, Line 1. Missing parenthesis at the end of Eq. (1).

Page 8, Line 9. Change "streamflow" to "rainfall".

Page 8, Line 14. Missing parenthesis after "... (or simply PIT plot) ...".

Page 11, Line 9. I am not sure the word "bleeding" is the correct one.

Page 13, Line 13. Change "(Figure 5)" to "(Fig. 6)".

References

Ferro, C. A. T., Richardson, D. S., and Weigel, A. P.: On the effect of ensemble size on the discrete and continuous ranked probability scores, *Meteorol. Appl.*, 15, 19-24, 2008.

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