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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 #2

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General comments: This manuscript reports the development of a rainfall post-processor for GCM forecasts in the sub-seasonal to seasonal period (RPP-S). The proposed method is surely an important contribution as it attempts to advance in methods for post-processing rainfall forecasts in this time scale. The method elaborates on authors' previous work and makes use of the Bayesian joint probability (BJP) modeling approach to account for predictor-predictand skill relationships. The post-processor generates daily amounts which are then aggregated to in-season totals using the Schaake Shuffle. The method is applied to rainfall forecasts from the ACCESS-S model for a set of catchments in Australia, and is found more skillful than ACCESS-S forecasts post-processed using quantile mapping (QM).

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Discussion paper

I find the paper well written and the experimental setting well described, although in some instances additional clarifications would be desirable. I have only minor comments on some methodological assumptions which need more justification to ease the readability and warrant reproducibility of the proposed method. Apart from that, I found this manuscript suitable to be published on this special issue. Below, I elaborate these minor/specific comments:

Specific comments: In section 3.2.1, pooling of multiple GCM runs and grouping forecast days are key steps in the proposed method. The proposed RPP-S follows a particular configuration and authors argue that this is a practical measure to enable post-processing of rainfall forecasts across a range of perennial and ephemeral catchments, but there is no restriction for the RPP-S configuration. P6 L11-L13: "....The size of the day groups expands farther from the initialization day. Smaller day groups in early periods are intended to extract skill from initial conditions. Larger day groups in later periods are intended to better approximate the climatological distributions." Could the authors elaborate this statement in a more generic way? The point being, how can one estimate the size of day groups, without knowledge of the rainfall forecasts distribution properties? I see this issue is extensively discussed later in section 5, e.g. lines: L22-L27 in P12. Perhaps, some elements of the discussion should come earlier in the paper, e.g. in section 3.2.1

P7 L10-L13: "BJP forecast ensemble members are randomized and are not linked across days by default. To deal with the problem, we apply the Shaake Shuffle...." The use of the Shaake Shuffle approach is an important component of the proposed method, which is of major relevance when looking at time windows beyond the weather scale. Given the reliance on such technique to create realistic temporal patterns from BJP forecasts, a few lines describing details of the Shaake Shuffle rationale and its operational implementation are needed.

P12 L4-L5: "RPP-S forecast outperform QM forecasts, primarily because QM does not take into account the correlation between forecast and observations..". I also share

the first reviewer's concerns on how differences in the implementation of the QM (as described in section 3.4) and the RPP-S method could impact the results from the benchmarking experiment. It would be worth to discuss at length those differences and their implications on the conclusions.

Technical corrections:

P3 L25: Reference Hudson et al. (2017) is missing in the list of references

P5 L11: Symbols in Eq. (5) are no described

P8 L9: "...the forecast probability integral transforms (PITs) of streamflow observations..." Is it not rainfall observations?

P8 L14: "...probability plot (or simply PIT plot." Missing parenthesis

P12 L14: "...yet QM and RPP-S forecasts do not exhibit any obvious differences in the magnitude of biases (Figure 3)". Is it not Figure 4?

P13 L13: "reliable than RPP-S forecasts (Figure 5)". Is it not Figure 6?

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