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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Parameter regionalization of a monthly water balance model for the conterminous United States" *by* A. R. Bock et al.

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Author's Responses to referee #2:

Reviewer Main Points:

[1] Method Process diagram: A conceptual flow diagram is needed to explain the parameter regionalisation procedure more effectively. To visualize the most innovative aspect of the proposed methodology, connection between the first and second classification need more clarification. Figure 4 of the paper titled, "A different light in predicting ungauged basins: regionalization approach based on eastern USA catchments"

[Shoaib et al., 2013] can be seen as an example.

AB: Authors agree and will add a schematic/flowchart, and modify the appropriate locations in the text to reference the figure. Thanks for the example

[2] My other concern on the paper is that the best MWBM results were not shown relatively as achieved in simulating low –and median flows across the CONUS. Representation of the relative variability of MWBM results in low –median and high flow will enhance the importance of the paper

AB: Analyzing the variability and distribution of the mean monthly model error (Figures 8 and 10) is something we are looking at analyzing and incorporating into further modeling efforts. We felt there are enough interesting results with the monthly model error alone to justify focusing on that aspect of the model for follow-up work and publication, and we decided not to try and push more of that content into this paper.

Reviewer Minor Points:

[3] -p. 10030, line 8: the term FOPV needs more explanation. It is not particularly self-explaining to readers who are not familiar with GSA.

AB: Authors agree to change "FOPV" to output variance. For the sentence on p. 10030 "FAST is a variance-based global sensitivity algorithm that estimates the first-order partial variance (FOPV). . ." will be changed to "FAST is a variance-based global sensitivity algorithm that estimates the parameter contribution to output variance. . .". We will also change the Y-axis labels for Figure 5 to "Output variance".

-p. 10030, lines 14-15: Please clarify why you have avoid incorporating the seasonal adjustment factors in the FAST analysis

AB: We viewed the adjustment factors as more related to the forcing data itself and independent from the model structure.

-p. 10037, lines 24-25: The multi-term objective function is unclear. Inserting an equa-

tion with the mathematical definition of the objective function would help here. Though NSE, logNSE are mentioned in the manuscript, it is not clear what the authors try to represent the term multi-term objective function. What about SQRT NSE?

AB: The objective function for the final grouped calibration minimizes the sum of difference between the Z-scores of measured and simulated variables for four terms: Mean Monthly Streamflow (As shown in figures 8 and 10a), Monthly Streamflow (Raw monthly time series), Annual Streamflow (Time Series aggregated to annual time steps), Mean Monthly SWE with a 25% error bound. The first three terms of the objective function were chosen because they conveyed information that can be used to easily inform other models (such as daily time-step models).

We will include an equation into the text.

-p. 10058 and 10066, Figure 6 and Figure 14 are not that clear. It is understandable after reading the text, but it could be much improved

AB: For figure 10058 We can add details to the figure caption to indicate these are the final calibration regions representing the merge/intersection of the two classifications discussed in Section 3.2. i.e.: "Final 110 Monthly Water Balance Model calibration regions derived across the CONUS differentiated by color. Streamgages in each calibration group were calibrated in a group-wise fashion to produce a single optimized parameter set for the entire region."

For Figure 14. We will more detail to the figure caption, i.e., "Median Nash Sutcliffe Efficiency (NSE) of all streamgages used for calibration within each calibration region".

-p.10056, Figure 4 could be improved by showing the relative scale of sensitivity. The figure can be more quantifiable, to make the methods more applicable.

AB: We considered this, but we really wanted the symbology in this figure to emphasize the gradation of the parameter sensitivities across the US, along with the "hot spots" for individual parameters. We felt the scaling the sensitivity relative to each parameter

was the best way to illustrate this.

-A recently published papers on Monthly Runoff Regime Regionalization through Dissimilarity –based Methods[Qamar et al., 2015] and Simultaneous calibration of hydrological models in geographical space [Bárdossy et al., 2015] can be seen as added reference.

AB: Thanks for the additional information. We will read through the recommended works and consider where they might fit in the background and/or discussion.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 10023, 2015.