

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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Reviewer Minor Points: -p. 10024, lines 1-2 “to transfer ... model uncertainty information”. What type of uncertainty information is transferred and how? This is mentioned here and in the conclusion but it is not clearly discussed throughout the paper.

AB: Mean Monthly errors for each calibration region (visualized in Figure 8 and 10a) can be estimated and added back to simulated streamflow estimates at ungaged locations as a source of model uncertainty. This is not explicitly discussed or applied in detail in this paper, so authors may need to add more detail at one location of text or remove.

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-p. 10026: lines 28: “these methods ignore parameter interaction, and often assume that model algorithms have linear responses to different parameters”. I think this sentence is misleading and I would suggest to delete it. Parameter interactions can be evaluated in local SA by computing second-order derivatives (see for example Norton, 2015). Also, when estimating local sensitivities the linearity assumption finds its rationale in the Taylor series expansion and hence it is quite reasonable.

AB: Authors agree to removing sentence.

-p. 10028, line 25 to the end of page: this list of parameter names and meaning does not add much to the information provided in the Table, I would probably avoid it.

AB: Authors agree, parameter definitions and functions are also well-explained in the cited McCable/Wolock papers listed in the reference section. Sentence at p. 10028, lines 23-24 “Table 1 lists...”, and climate adjustments sentence beginning with “The Ppt_adj and...” (p. 10029, lines 2-3) should be moved to the concluding sentence of the opening paragraph of Section 2.1. The remaining sentences can be removed.

-p. 10030, line 8: the term FOPV is not particularly self-explaining to readers not familiar with GSA. I would explain what it is (“contribution to output variance from...”)

AB: Authors agree. The sentence “FAST is a variance-based global sensitivity algorithm that estimates the first-order partial variance (FOPV)...” can be re-worded to “FAST is a variance-based global sensitivity algorithm that estimates the contribution to output variance...” . “Output Variance” should replace FOPV in text, including the Y-axis labels for Figure 5 will be re-named to “Output Variance” with a single axis label.

-p. 10030, line 12: “much less information and parameter sets”. What do you mean by “information”? Unclear. As for “parameter sets, it is possibly less ambiguous if you call them parameter samples or even directly model evaluations

AB: This second half of the sentence is pretty ambiguous. The application of FAST discussed in the paper used a larger number of parameter sets than the minimally

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sufficient number suggested by R, so the sentence should probably be removed.

-p. 10032, lines 12-13: "The patterns of ...". Sentence needs rewording

AB: Agreed. Change to: "Tsnow, Train, and Meltcoef all share similar patterns of areas with higher sensitivity across the CONUS."

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-p. 10033, line 25: "While this idea...". What idea? The one described in the previous sentence? But then is it really in contrast with the one illustrated on lines 27-28? Please clarify.

AB: This is a good point on semantics. The emphasis should be on grouping proximate areas based on similar model behavior, rather than physiographic characteristics. The authors suggest this sentence be changed to: "This idea is rooted in the hypothesis that geographically proximate HRUs share similar forcings and conditions, and thus will behave similarly. This application uses similarity in SA results as a basis for organization, rather than similarity in physiographic characteristics."

-p. 10034, lines 11-13: citation of Pianosi et al., 2015 does not seem to be appropriate here. That paper introduces a toolbox for Sensitivity Analysis but it does not discuss the issue of setting the threshold for sensitive and non-sensitive parameters. The threshold issue is (partially) discussed in Tang et al. (2007). Pianosi et al. have another paper under review which is more focused on the threshold issue, however it has not been published yet. The authors might cite that paper when it will be published (title is "Global Sensitivity Analysis of environmental models: Convergence and validation", journal is Environmental Modelling and Software).

AB: We have referenced Tang et al (2007) already in the paper, so we will replace Pianosi et al 2015 with Tang et al (2007). Thanks for the heads up on the upcoming

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paper.

-p. 10037, line 17: Please give a very brief definition of a reference streamgage.

AB: Reference quality streamgages are judged to be largely free of human alterations. From Kiang et al. (2013), these sites were "categorized as either reference quality or nonreference quality by calculating a hydrologic disturbance index (presence of dams, change in reservoir storage, number of canals, road density, proximity to major pollutant discharge site, estimates of water withdrawals, and fragmentation of undeveloped land), reviewing historical digital maps and imagery for evidence of hydrologic alteration and human activity, and reviewing comments in USGS annual water data reports for information on regulation or diversions.". We will paraphrase this to: "Reference streamgages are USGS streamgages deemed to be largely free of anthropogenic impacts and flow modifications, and can subsequently be used for estimation of natural flow statistics (Falcone, 2010; Kiang et al., 2013)."

-p. 10038, line 9: "simulated streamflow" should be "simulated variable" (since one of the four is SWE and not runoff)

AB: Authors agree to the suggested change.

-p. 10038, line 20: Recall here that a parameter is deemed insensitive if sensitivity index is below 5%

AB: Authors agree to the suggested addition to text

-p. 10038, lines 21-23: "on a mean monthly based". Unclear. Possibly it might just be dropped, since it was already said that monthly variables are used to compute the Zscores.

AB: Authors agree "mean monthly" should be removed from 21 and 23 since other terms were used in the objective function.

-caption of Fig. 1: "model parameters used in..." Maybe better: "processes influenced

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by the model parameters used in...”

AB: Authors agree to the suggested change

-Figure 3: maybe not needed. Anyway, if maintained, vertical axis should show units of measurements. Also, it would probably be better to show Drofac and Rfactor in a separate panel.

AB: Between the two suggestions (Remove or make two panes!), authors would prefer remove graphic (though Andy B. really likes this graphic).

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