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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Flood and drought hydrologic monitoring: the role of model parameter uncertainty" *by* N. W. Chaney et al.

Anonymous Referee #1

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Comments on hessd-12-1697-2015 "Flood and drought hydrologic monitoring: the role of model parameter uncertainty" by Chaney et al

This is an interesting study looking at parameter uncertainty and its impact on extreme hydrologic event modeling by applying annual, monthly, and daily scale constraints to ensemble simulations corresponding to 10000 Latin hypercube sample sets. The paper is well-written and I am offering the following comments/suggestions:

Page 1698, line 19: To me "accurate" means unbiased. I think the priors are better to be accurate (unbiased), precise (reduced uncertainty, narrow distribution), but also appropriately represented (e.g., derived with minimum-relative-entropy or maximum-entropy concepts). The shapes of the prior pdfs might significantly affect the sensitivity

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analysis results, especially for a problem with a high-dimensional parameter space.

Page 1699, line 27: Yes I agree that it is possible that an optimization get the right answer (e.g., good fits) for wrong seasons, for example, when model structural uncertainty or data uncertainty is large. The ensemble framework would make it possible to separate the parameter uncertainty from the data/model structural uncertainty.

Page 1701, line 1: the use of 10000 sample sets is arbitrary. Please justify. It is unclear whether this is adequate without a convergence test (e.g., evaluating the SA results vs the number of LH samples). The required numbers of samples depends on choices of response variables/metrics. BTW, one advantage of LHS is that you can add augmented samples to the existing ones if necessary.

Page 1702, line 21: that is, assume that model structural uncertainty and data uncertainty are negligible.

Page 1703, line 9: what is "temperature" climate group? It should be "temperate" or "mesothermal". Why not spell out the 5 veg groups and the 5 precipitation groups as well?

Page 1704, line 5: the range for the parameter Ksat seems is too narrow. And is it sampled in log10 space?

Page 1704, line 11-25: I am fine with the parameter set screening criteria (e.g., relative error > 10%, and correlation < 0.75), but I am not sure it is the best we can do by assuming the behavioral parameter values to have the same weights in the posterior distributions.

The procedure is similar to rejection sampling, but without replacement and is not dependent on previously accepted sample values. Two simple practices might yield better estimate of the posterior distributions: 1) the samples are accepted with a probability as a function of the corresponding misfits; 2) the samples are assigned weights as a function of misfits (which assumed to be normally distributed). Again, the point is that

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the behavioral sample values are not equally probable.

Page 1705, line 21: an alternative metric to CDF distance could be relative entropy (or Kullback-Leibler distance), which measures the relative change in information/uncertainty.

Page 1707, line 10: how many cores/cpus are involved? Did you run the simulations or part of them in parallel?

Page 1708, line 22: "a limited number of behavioral. . ." I would view the issue as existence of significant model structural errors. The screening criteria for "being behavioral" might need to be relaxed for these regions.

Page 1711, line 1-4: the statement is not clear to me.

Page 1713, line 18: do you meant "local" temporally, or spatially, or both? Regarding the prior distributions, the shape should be considered carefully in addition to refining its range.

Page 1714, line 9: add refs for "random forests".

Page 1715, line 12: I agree that adding process models lead to higher parameter dimensionality and more parameter uncertainty. Such additions have the potential to reduce model structural uncertainty; meanwhile the increased parametric uncertainty can be reduced through inversion, hopefully in a physically more plausible way.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 1697, 2015.