

Interactive comment on “Conditioning rainfall-runoff model parameters for ungauged catchments and land management impacts analysis” by N. Bulygina et al.

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This paper presents a great next step towards a fully Bayesian approach to PUB. It builds nicely on previous work that has been published and is cited here. Below are a few comments to further put the paper in context and to potentially strengthen some points made by the authors.

We are grateful for the comments and drawing our intention to the work by Zhang et al. (2008), which we find very closely related to ours. We are looking forward to possible collaboration in this area of hydrological research. The paper has been significantly revised to include a new period of simulation, and a new extended discussion, plus

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various minor improvements.

[1] One thing that you could be utilized a bit more are the experiences with regionalized or conditioned parameters of the model you are using from others: [1] Zhang et al. (2008, WRR) show to which constraints the model parameters are sensitive (their Figure 6). Your figure 5 shows exactly where BFIHost as a constrained fits in. Both together might provide insight into how many constraints are needed! Both papers use the same hydrological models and both have the UK as a study region which makes the comparison very straightforward.

We agree that more emphasis should be given to discussing improving the applicability of the method by introduction of more information, including additional response indices, with reference to the investigations of Zhang et al. (2008). The discussion has been re-written around this, answering this comment and also improving the structure of the discussion section.

[2] Parameter k_f (or k_q in our case) is the one parameter next to α that often regionalizes well (see results of Lamb 1999, WRR and Wagener and Wheater, 2006, JoH). Some further discussion on which parameters could be derived how would be good.

This is included in the revised discussion section.

[2] Why is b always the most difficult parameter? This is the one parameter in PDM type models that seems to be most tricky. How could we solve this issue? Add something on this.

This is included in the revised discussion section.

[3] What are the computational demands to derive a generic Bayesian framework and what are potential future bottlenecks that have to be overcome to extend this approach further?

First of all, the appropriate indices should be regionalized, so that if the focus is on a small scale than the indices should be derived for that scale. After that a parsimonious

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model (models) is to be chosen, so that parameter space dimension is low. The low dimensionality is essential for satisfactory parameter space sampling. A possible bottleneck may be using multiple indices utilization, because multiple indices most likely to be dependent, and if this dependence is not represented appropriately, it may lead to prediction uncertainty underestimation. This is covered in the revised discussion

[4] The referencing needs checking!

This has been done

REFERENCES Lamb, R. (1999), Calibration of a Conceptual Rainfall-Runoff Model for Flood Frequency Estimation by Continuous Simulation, *Water Resour. Res.*, 35(10), 3103–3114. Wagener, T. and Wheater, H.S. 2006. Parameter estimation and regionalization for continuous rainfall-runoff models including uncertainty. *Journal of Hydrology*, 320(1-2), 132-154. Zhang, Z., Wagener, T., Reed, P. and Bushan, R. 2008. Ensemble streamflow predictions in ungauged basins combining hydrologic indices regionalization and multiobjective optimization. *Water Resources Research*, 44, W00B04, doi:10.1029/2008WR006833.

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