

***Interactive comment on* “Climate change impacts model parameter sensitivity – What does this mean for calibration?” by Lieke Anna Melsen and Björn Guse**

Anonymous Referee #3

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General comments

This study analyses changes in sensitivity of model parameters due to changes in climate projections. The sensitivity and its changes are evaluated by using 3 different models in large sample of catchments in U.S. (CAMELS dataset).

In general I agree with two previous reviews, i.e. study is potentially interesting, but a revision/extension is needed/suggested. The main critical comments are:

1) Introduction does not fully cover studies that evaluated changes/temporal stability/sensitivity of model parameters in (observed) varying climate conditions, as well as studies evaluating different sensitivity approaches in hydrological modelling (e.g. De-

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vak, Dhanya, 2017). This can improve the formulation the current state of the art of the problem and the research gaps.

2) Methods are not described in a sufficient detail and rigorous way. It will be very interesting to see similarities and differences between the models, including differences in model inputs and calculation of different runoff generation processes (snow accumulation and melt, evapotranspiration, soil moisture changes, etc.).

3) I agree with reviewer #1 that there is a missed opportunity to expand the sensitivity analysis to seasonal and event scales. The selection of target variable (i.e. mean annual runoff) limits the significance and contribution of the study. The impact of expected climate change on hydrological processes is interesting mainly because of changes in seasonal and event-based characteristics. The setup and results of using selected target variables is to some extent obvious and technical (i.e. not related to changes in the main runoff generation processes). For example for HBV model. It is clear (and expected) that in catchments with snow influence it is the SCF parameter which is sensitive to annual runoff, because it is the only one model parameter which can increase/decrease the precipitation input to the model. This is not related to climate change, it is a technical feature of the model. All the processes simulating accumulation/melt/runoff generation and routing are practically insensitive to long-term annual runoff. Similarly for arid catchments, it is only parameter representing limit for potential evaporation which can somewhat change the overall water balance. Why to test the sensitivity of other model parameters? For the reader it will be interesting to see some strategy and research hypotheses which parameters and why are expected to be sensitive in relation to climate change. So, this is why I fully support the comment asking to expand the analyses and to use some other target variables representing seasonal of event based runoff characteristics.

4) I would like to support the comment of reviewer #2 to expand the evaluation of results and to assess “the role of model structure on parameter sensitivity and change in parameter sensitivity”. This can be, in my opinion part of the results not just part

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in the discussion. Comparison and more detailed evaluation of three different types of models will for sure improve the significance of the results.

References

Manjula Devak, C. T. Dhanya; Sensitivity analysis of hydrological models: review and way forward. *Journal of Water and Climate Change* 1 December 2017; 8 (4): 557–575. doi: <https://doi.org/10.2166/wcc.2017.149>

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