Rebuttal
hess-2020-179
Climate change impacts model parameter sensitivity - implications for calibration strategy and model diagnostic evaluation

Dear editor,

Thank you for organising the review process. Below we respond to the minor suggestions from the reviewers.

Best regards,

Lieke Melsen
Björn Guse

Reviewer 2

I want to thank the authors for the revisions made. In my opinion, the results now show more robust and general outcomes. I have only two last suggestions before recommending the manuscript for publication:

Please add some more details to the description of the methods, particularly how is the model used/setup. There is not a sufficient detail of information allowing reproducibility of work and the interpretation of some results in its current form. For example, what are the model inputs and parametrisation variant used for the VIC model? (is the VIC model controlled only by air temperature and precipitation changes?) Or how is potential evaporation estimated for HBV model? Why are results (increase in air temperature but a smaller change in runoff, evaporation, soil moisture, snow) of the VIC model different to the other two models?

It will be interesting to add some more details about the characteristics of catchments describing some results (i.e. extending description of some groups of catchments mentioned). For example are there some consistent patterns in catchment characteristics for catchments which have a change in sensitivity depending on the hydrologic model (l.11, l.13, l.335-337, etc.).

We extended the description of the model set-up in response to the first points raised by the reviewer, see line 93-96. The results of VIC deviate from the HBV and SAC models because this model has a completely different structure - HBV and SAC are more comparable in terms of structure.

Concerning the second point of the reviewer, linking to catchment properties; we believe that this analysis is not appropriate for the global sensitivity analysis that we conducted. Since we did a global sensitivity analysis, the models were not calibrated for specific catchments. This means that catchment properties are not reflected in the results - only climate properties. That is why we differentiated the results across climate, but not across catchment properties.

Reviewer 3

Thank the authors for addressing my concerns and the study has much been improved. Specific comments: Fig.5 is difficult to read.

The labels of Figure 5 have been increased and the legend has been reworked. Unnecessary legends have been removed.