

Editor's review

Dear Adriano,

Thank you for your revised version of the manuscript. I believe it is much improved from the original version and would like to thank the reviewers for their constructive comments in the discussion. In my view the paper is an important contribution and thus should be published.

However, in line with the reviewers I do have concerns about the number of parameters in such a complex model, small changes to some of these may have profound impact on the outcomes while others may have negligible impact. I fully appreciate that a substantive sensitivity analysis is beyond the scope of this paper, it's not the purpose of the paper in my view, but I think in your response to the reviewers and edits to the manuscript this is perhaps underplayed given the level reviewers concerns.

Could I ask specifically that you review the sections outlined below as a technical revision.

Best wishes,
Jeff

Section 3.1 on model calibration.

This section is much improved however the section on calibration needs to be far more upfront on the limitations of the calibration conducted here. A distributed model with 13 parameters over a huge area has been calibrated to a single point. Thus, the model is likely to perform poorly in many other parts of the basin I would assume. At the moment, the difficulty of simulating the basin is highlighted but not the limitations of the calibration adopted – in a real application of the model more calibration data would be needed I assume? I don't think you need to change the calibration, but please be upfront about the limitations in this example. Furthermore, one-gauge location seems very limited, was this the only data available or did you chose one location for another reason?

4.3 Uncertainty section

Should this include model structure as a source of uncertainty? Presumably in such a complex system feedbacks and parts of the system could be omitted from the model, distorting the response other parts of the systems?

Around page 33 "We therefore leave data source uncertainty analysis to future publication that will to focus specifically on numerical outputs and implications" – Both reviews highlight this as a critical issues. I can appreciate that you are keen not to extend the paper to include a sensitivity analysis on the model parameters and data sources, but I think the reviewers raise legitimate concerns about the use of such a complex model for scenario analysis over large basins. The sentences here are insufficient at reflecting this in my opinion.

Thus, I'd be more comfortable if you either refute the opinion of the reviewers (and mine) or set out some expectations about how potentially challenging model parameterisation might be. My assumption is that data source and parametric uncertainty will likely have profound impact on the outcomes of the model and if you don't think this will be the case you need to explain why in the text.

Also please check the typo in this sentence.

Finally, I agree with Review 2 that the section on limitations is more focused on further development, or simply known limitations in model structure. Could you make the section title more specific in this regard?

Author's response

Dear Jeff,

Thank you for your comments and the revision work you did. I made further changes in response to the issues you rose.

In section 3.1 I now wrote more clearly that having one single station is a limitation for the hydrological model calibration. At page 16, line 18 of the newly uploaded manuscript I added:

“The Besham station is chosen because of its coverage of historical years, it incorporates the runoff from both glacial and seasonal snowmelt. However, multiple stations would be necessary to better represent regional heterogeneity (in particular lower versus upper basin). Future work will incorporate spatially distributed observations to improve the calibration. “

To address the concerns on the uncertainty, I added a preliminary parametric sensitivity analysis where input parameters are varied within a fixed range and we look at output variations. An entire new paragraph is added at page 28, line 19.

At the end of this paragraph I also mention the importance of structural uncertainty, which I believe is substantial but it is also a too vast topic to be assessed in this article.

Finally, I changed the title of the limitations section.

I think that these changes, in particular the additional sensitivity analysis, further improve the accuracy of some sections. I hope the article is now better in line with your suggestions and the journal requirements.

Kind regards,
Adriano