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Discussions

Interactive comment on "Reliability, sensitivity, and uncertainty of reservoir performance under climate variability in basins with different hydrogeologic settings" *by* C. Mateus and D. Tullos

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We are extremely grateful to reviewers for their thorough and extremely helpful reviews. The attached manuscript represents major revisions made in response to the three reviewers' comments. These revisions are documented in detail in the notes below. We believe the manuscript is greatly improved as a result of responding to reviewers' concerns, and are very grateful for their thoughtful and comprehensive reviews. To help reviewers we have submitted two versions of the manuscript; one with tracked changes

(in blue) and a finalized “clean” version.

General comments:

1) It seems strange for the reviewer that there is no literature review in the manuscript. This makes it difficult for the readers to understand the work the authors are doing, what the different things are between this work and others’ work, and what the value of this work is. The reviewer strongly proposes the authors add this part in the revised manuscript. The introduction was not well written according to the reviewer and is proposed to be rewritten.

We made substantial revisions to the Introduction, organizing it around themes of changing hydrology, impacts on reservoir operations, differences across hydrogeologic settings, and establishing the justification and objective of this study. In this major revision of the Introduction, we expanded the references to existing literature on these themes throughout the Introduction. In addition, we clarified the novel contributions of this work (page. 4, lines 1-12)

2) The reviewer believes that a manuscript must be self-independent. In this manuscript, the authors missed many descriptions of future climate change information, hydrological modeling, calibration and validation, and modeling results. It is proposed to add more details to make the manuscript self-independent.

We originally wrote the manuscript to be concise and provide only essential information to understand impacts of the modeling on the results. However, in this revised version, we have added content on the eight GCMs from which we acquired the temperature and precipitation projects (page. 8, lines 4-7), the selection of GHG emission scenario (page. 8, lines 7-11), the downscaling method (page. 8, lines 11-17), hydrologic model development (page. 8, line 18 to page. 9, line 30), model calibration and fit to observations (page. 10, lines 10-15).

3) What is Delta-Hybrid method? No details or references? Please add more details.

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We added more details about the Delta-Hybrid methods and its advantages (page 8, lines 7-13).

4) How is DREAM used to get posterior distribution?

We included more information about the algorithms underlying the DREAM analysis (page 8, lines 23-29) and about the development and transfer of parameter distributions (page 9, lines 10-27).

5) What are the eight GCMs used in this study?

We added information about the eight GCMs used in this study. Please see to page. 8 lines 1-3.

6) Why only A1B and B1?

The emission scenarios were the most recently available at the time of hydrologic modeling and were the most frequently chosen by scientists and managers for studying climate change impacts, mitigation, and adaptation options. We chose two reasonable end-members, with A1B representing a higher emissions scenario, whereas B1 reflects a more conservative estimate of GHG emissions as a result of reduction in population growth and transitioning industries (page. 8, lines 3-7).

7) Why not the newest scenarios and GCMs (CMIP5) used in this study?

CMIP5 results were not yet available when the hydrologic modeling for this project was conducted in 2010 and early 2011.

8) How is the uncertainty derived in the whole manuscript?

More information was added in the text on how percentile values for streamflow projections were estimated (page. 9, lines 18-29) and applied in the reservoir performance metrics (page. 13, lines 17-21).

9) What are reliability, sensitivity and uncertainty defined in this manuscript, since these

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words are all key words in the title? Please make this clear.

We included a better description and definitions of reliability, sensitivity and uncertainty in page. 7, lines 2-15 in the text. Further detail on how uncertainty was estimated is provided (page. 9, lines 25-29 and page. 13, lines 17-21).

10) The conclusion drawn is very much limited to the approaches used in this study. Although eight GCMs and two emission scenarios were claimed to be used, actually only the ensemble mean was used in the analysis. This makes the analysis incomplete. The uncertainty from future climate change projections is highly underestimated.

We extracted the 2.5, median, and 97.5 percentile values from each range of model output for each of the 8 GCMs. These are meant to be points of interest for the distribution of model outputs. We applied the ensemble mean for the three distributional points from the GCMs because running the reservoir operation simulations for three distributional points for each of the eight GCMs and two GHG emissions scenarios was beyond the available computational resources available to us. This explanation has been added in the text (page. 9, lines 25-29).

11) Figure 4: why was simulated historical data used instead of actual observations in this figure? Is this related to the performance of hydrological models?

We only present simulated historical data in this manuscript to avoid conflating the impact of the hydrologic models with the impact of climate change and to keep the emphasis of this manuscript on the comparison across basins. Adding the comparison to this manuscript would greatly lengthen the manuscript, with both figures and text, and would broaden the focus of the paper. We have added a statement (page 7, lines 17-21) to clarify this point. In addition, we added text on the fit of the model to historical observations (page 10, lines1-15). Finally, we note that we have conducted the observed vs. simulated historical comparison and it is included in another manuscript currently in review.

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12) The literature Surfleet and Tullos (2013) is not properly cited

Surfleet and Tullos (2013) is properly cited as follow: Surfleet, C. G. and Tullos, D. (2013), Uncertainty in hydrologic modelling for estimating hydrologic response due to climate change (Santiam River, Oregon). Hydrol. Process., 27: 3560–3576. doi: 10.1002/hyp.9485. Please refer to: http://onlinelibrary.wiley.com/doi/10.1002/hyp.9485/abstract;jsessionid=EB8E491C3AC8B9BDC77BAEB4F1AC472E.f04t0

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