Hydrol. Earth Syst. Sci. Discuss., 11, C6855–C6859, 2015
www.hydrol-earth-syst-sci-discuss.net/11/C6855/2015/

Hydrology and Earth System Sciences
Open Access
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

C. Mateus and D. Tullos

mateuscm@onid.orst.edu

Received and published: 12 May 2015

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:

I am not in a position to recommend its acceptance in HESS, for the following reasons:

1) The research contribution of the manuscript is negligible. The work merely assembles together available models and (now, rather simplistic) methodologies and applies these to the case study.

We agree that the earlier version of this manuscript needed to be clearer regarding the novel contribution of this work. We have revised the text (page 4, lines1-12) to clarify the gap in existing literature around interactions of hydrogeology and reservoir operations in the sensitivity of basins' responses to climate change, and in the unique aspect of uncertainty evaluation.

In addition, we have added considerably more text to clarify the methods applied. 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).

Finally, we have added a figure (Fig. 13) to summarize the broader hypotheses developed from this study, which should be generalizable and evaluated elsewhere.

2) Even as a contribution to a case study, the manuscript suffers because of the poor discussion on the methodologies used. For example, the authors state that a formal Bayesian approach, DREAM, is used for obtaining the distributions of hydrologic model parameters - but no details are given on how this is done: only a reference to an earlier work is provided. This would have been acceptable if the results provided some insights into the behavior of the hydrologic model. There are no such results in the

manuscript.

Please refer to comment #1. We also 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).

3) Similarly, discussion on the VIC model calibration is missing in the paper.

We agree with the reviewer that more information about the VIC model was needed. We added more information about the VIC model projections (page 10, line 16 to page 11, line 2) and how the two datasets were matched based on water year (page 11, lines 3-9), and potential impacts of combining the two models (page 25, lines 17-27).

4) A major limitation of the manuscript arises, however, from neglecting (or, at least not discussing satisfactorily) the uncertainties in the climate change projections. A classical and now well-accepted methodology is to employ hydrologic projections arising out of (use of) several GCMs and addressing uncertainties thereof. The uncertainties also cascade into the hydrologic models. While Fig 4 does show the uncertainty bands in the flow projections, the basis for obtaining these bands is not discussed at all.

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). In addition, 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).

5) The performance measures used are rather simplistic. The authors may refer to Raje, and Mujumdar (2010), for a discussion on reservoir performance under climate change: it is necessary to relate the performance to partial failures also, especially in the context of flood protection and hydropower generation. Reference : Raje, D., and Mujumdar, P. P. (2010), Reservoir performance under uncertainty in hydrologic impacts of climate change, Advances in Water Resources, 33(3), 312-326.

doi:10.1016/j.advwatres.2009.12.008

We selected the metrics presented in our analysis based on consultation with reservoir operators in the study basin and based on the literature. The analysis presented by Raje and Mujumdar (2010) is a valueable approach but was not one that our stakeholders were familiar with, and thus we selected the approach that would be most familiar to them. We included a statement in the text (page 25 line 28 to page 26 line 5) acknowledging that there are other approaches available such as Raje and Mujumdar 2010 who has taken a step forward by adding partial failures and adaptive policies for “worse case scenarios”.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 13891, 2014.

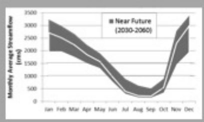
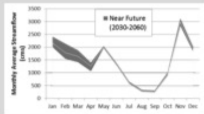
Reservoir Network	North Santiam (Detroit-Big Cliff reservoir system)	South Santiam (Green Peter-Foster reservoir system)
Hydrogeology	High permeability, deep aquifers and springs (90% High Cascades, 5% Western Cascades, 5% Alluvium)	Low permeability, low connectivity to aquifer (95% Western Cascades, 3% Basalt, 2% High Cascades)
Dominant Water Source	Substantial groundwater recharge Sustained baseflows	Shallow subsurface and surface flow Rapid runoff response
Precipitation Pattern	Rain and Snow precipitation at Detroit reservoir (477 m) 25% of the basin (507 km^2) located in the snow precipitation area (>1,200 m)	Rain precipitation at Green Peter (310 m) and Foster (165 m) reservoirs. 6.5% of the basin (176 km^2) located in the snow precipitation area (>1,200m)
Sensitivity to Climate Change **Response relative to historical** **Across basins**	Winter: Increases, Higher Summer: Decreases, Lower	Winter: Increases, Lower Summer: Decreases, Higher
Uncertainty across basins	Higher winter and summer uncertainty 	Lower winter and summer uncertainty 
Impacts on Reservoir Reliability across basins	Higher uncertainty in meeting summer flow targets	Higher frequency of failures in meeting summer flow targets.

Fig. 1.