

Response to Reviewer #3.

Interactive comment on “On an improved sub-regional water resources management representation for integration into earth system models” by N. Voisin et al.

Anonymous Referee #3

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Authors: N. Voisin, H. Li, D. Ward, M. Huang, M. Wigmosta, and L. R. Leung
Title: On an improved sub-regional water resources management representation for integration into earth system models

General comments: The content of the paper falls into the the uncertainties of the reservoir models from different implementations of the generic operating rules. In this work, author set up a reservoir which is coupled to the routing model. Both models are run using the same time step, which can vary from minutes to days. In an offline mode like in this setup, the consumptive use is being extracted instead of withdrawals, which would be more appropriate in a fully coupled ESM in which the return flow would be simulated. Author use a similar set up for all the reservoir model configurations.

We wish to thank the reviewer 3 for his/her comments and constructive criticism which have led to an improved manuscript. Below are answers in line with the comments.

In general, the scientific work is relatively well established and meaningful. However, there are some major comments and suggestions also have to be considered:

1. The construction of some sections need to be considered, also the content should be concise. For example, I suggest not stating too much content that is not necessary in section 3.4 and 6, especially for the conclusion.

We edited the manuscript for shorter sentences.

2. Time distribution for data used in this paper is mostly 1984-1999. Due to the climate changes of recent years and some other reasons, river flow may change a lot. Is the result representative?

In this set up we were constrained by the period of availability of the USGS demand data. The period overlaps a dry and wet period, which is a topic of discussion in the manuscript for the Snake River Basin. The period is short enough to not have to consider change in flow due to climate change and regulation policies. Operating rules are generic. Inter-annual variability is represented but remains arbitrary and could be fine tuned for each reservoir independently and external information like snowpack could be used. Those are model refinements out of the scope of the present paper. The results of the sensitivity analysis for the different priorities and operating rules are representative as changes in storage due to the different priorities are significant and no change in flow will mitigate it. With regards to the predictors for the operating rules (natural/regulated flow, withdrawals/consumptive) the difference makes more sense at the regional scale rather than at the sub regional scale. As discussed, the

conclusions on the best combinations of predictors is linked to the overall extraction practices and hydroclimatological conditions of the region. We emphasized in the conclusions how representative and reproducible the results are.

3. Please recheck the references; they should be listed in accordance to the journal requirements. Although a large number of literatures were cited, but the literatures recent years are not sufficient, and the reference is not updated.

References have been revised for the journal requirement and updated where available.