Hydrol. Earth Syst. Sci. Discuss., 10, C999–C1002, 2013
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Hydrology and Earth System Sciences Discussions

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 #1

Received and published: 22 April 2013

This paper presents a comprehensive analysis on the sub-regional water resources system modeling, in which reservoir operation models using generic operating rules are studied in terms of the use of reservoir usage priorities, withdrawals vs. consumptive demand, as well as natural vs. regulated mean flow for calibrating operating rules. Generally, the case study of the Columbia River Basin is well demonstrated, and the simulations of flow, storage and supply are also well discussed with respect to implementations of generic reservoir operating rules. Although the obtained findings would make a good contribution to improving earth system models when incorporated with reservoir models, this manuscript should subject to major revision before acceptable,

and the following issues need further clarification.

Major Comments:

1. Although the authors introduce the basin of interest in details, it is ambiguous to understand how the 125 reservoirs are indeed represented in the modeling system. I think only 29 reservoirs are used to analyze the priority in the operating rules, while there are less than 29 orange circles in the Fig.1. Therefore, the number of reservoirs using the combined priority is not same with that using irrigation or flood control. Thus, the conclusion "overall the best performing implementation is the use of the combined priorities operating rules calibrated with mean annual natural flow and mean monthly withdrawals (P 3502, L16)" should be clarified. In my opinion, the authors may want to refer to the improvement of the simulations.

2. Calibration schemes of the operating rules have led to very important conclusions, while the authors do not clearly present the setups of the reservoir model configurations. For example, what is difference between the use of withdrawals and consumptive demand to calibrate the operating rules in simulation processes? How do they may affect the integrated modeling system and its associated outputs? More details should be provided.

3. The authors claim that "this approach allows us to isolate the sources of errors and uncertainties coming from the reservoir model and the hydrologic simulations without the vegetation growth and irrigation module components" (P 3507, L19). Would the authors please explain how to isolate the sources of errors and uncertainties from the hydrologic simulations of the CRB? This paper focuses on the water resources management and the reservoir model, and the effects of uncertainties from the VIC model and the routing modules on the sensitivity seem to be not well addressed. If the simulated natural flows based on VIC are the same, the uncertainties of the routing modeling as a result of different reservoir operation implementations should be discussed, and in addition, the calibration operation in the modeling system should be

further clarified.

4. Although the authors have presented lots of details on the multiple reservoir operation representations, it is still hard to identify how the water resource management system was analyzed and how sub-regional water resources management representation was "improved". A diagram to describe the modeling processes is highly recommended as well as the realizations for performing the sensitivity analysis. In addition, the authors used so many long and complex sentences, which significantly reduced the readability of this paper.

Minor comments:

1. Page 3505, L4: Sentence "... adding a virtual-storage that stores water available for extraction from the simulated releases and keeps it available 5 for extraction for 5 days else is released into the river," should be revised.

2. Page 3513, L4: Replace "yr" with "(yr)", "k$_{rls}$" with "(k$_{rls}$)".

3. Pages 3513 and 3514: Please distinguish the same symbols in an equation. For example, symbols "$d_{mean,m}$" and "c" in equations (4) and (5) are confusing. Please revise them and distinguish their different meanings in the equation. The same problem also exist in equation (6) for "$r_{m,yr}$".

4. Page 3517, L 9: Replace "affect" with "affects".

5. Page 3517, L14: Sentence "We validate the improvement of the operating rules by evaluating the simulated natural and regulated flows at the outlet of the basin, The Dalles, and the simulated regulated flow and the simulated reservoir storage at Grand Coulee and American Falls reservoirs." should be rewritten.

6. Page 3519, L4: Should "at and upstream" be replaced with "at the upstream"?

7. Please specify the accurate meaning of MCM in Figs. 1, 2, 5, and 9.

8. There are so many abbreviations in the legends of Figs. 4, 5, 6, 8 and 9, which

significantly reduced the readability of the paper.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 3501, 2013.