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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Minimizing the impact of vacating instream storage of a multi-reservoir system: a tradeoff study of water supply and empty flushing" *by* Chia-Wen Wu et al.

Anonymous Referee #2

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General comments

The paper "Minimizing the impact of vacating instream storage of a multi-reservoir system: a tradeoff study of water supply and empty flushing" describes a modelling framework simulate sediment flushing in reservoir and to derive the optimal dam water release strategy to guarantee adequate sediment flushing without excessively hindering water availability, in river systems where along with the primary reservoir there are others that can be used to reduce the water scarcity when the flushing is in progress and during the subsequent refilling. Both the timing and the volumes of water release are taking into consideration, as well as how the different operating strategies of the

dams in the network interact among each other to avoid water scarcity while allowing for sediment removal in reservoirs. In general, I found the paper to be well written and scientifically sound; the new methodology is described in detail, and the reasoning behind each assumption and parameter is clearly stated and explained. The model is then applied on the case study of the Tsengwen and Wushanto Reservoirs, in southern Taiwan. The different combinations of optimal release and flushing strategies are adequately explored, and the results shown are solid, and reinforced by a sensitivity analysis of the results for a parameter on the transport capacity equation, a numerical simulation of the flushing process to validate the effectiveness of the flushing and a validation of an optimal flushing strategy selected on a time period different to the one used for calibration. However, I believe the paper suffers from a general lack of focus in the first part, where the methodology is presented, and some shortcomings in the application of the framework on the case study.

Specific comments

To start, I believe the case study application should be cited both in the abstract and in the introduction. In section 2 multiple case study are cited, including the Tsengwen and Wushanto Reservoirs, that is however not reported as the main case study. The objective of the author might be to present the methodology in broader way possible, in order to highlight its flexibility and general nature, but I still believe that it should be made clear to the reader which of the numerous cited reservoirs are used for the application of the framework, from the beginning of the paper.

I believe section 2.1 needs a general rewrite, as I think the number of parameters, case studies, example and lead to a lack of focus and damage the readability of the paper. For example, I believe table 1 to be superfluous in this case, as the numerous examples of flushing in the tables are not properly commented and do not benefit the overall narrative of the section, and so they should be moved to the supplementary material or remover altogether and substituted with proper references. Likewise, I would also remove table 3 and 4 in section 3 and just leave the relative references (table 4 is not

even referenced in the paper).

I think section 2.3 should be greatly reduced or altogether removed and integrated into the conclusion section. While the environmental effects of empty flushing are definitely worth considering, they are not the focus of the paper and are not integrated in the analysis of the optimal strategy in the case study application. Given its length, section 2.3 may give the impression to the reader that the downstream environment protection is one of the objectives formalized in the search for the optimal flushing strategy, which it is not. The impact on the downstream environment is only brought back in a small section on page 50, not enough to justify the presence of section 2.3.

Regarding the application on the case study, I think one aspect that should be considered would be the simulation of the hydrological conditions not considered in the studied timeframe (1975-2017). In particular, I think the approach would benefit from the analysis of the objective performances under synthetically generated annual hydrological series with extreme events, both floods and drought, confronting the performances with or without flushing. In particular, droughts are of particular concern in this case, as shown in figure 17. I believe this point should be explored further, as it is it seems the obtained solutions do not perform well under for the water supply during period with unexpected lack of floods.

I think the results shown in fig. 18 should be commented further. From the figure, it looks like employing the optimal empty flushing strategy in the past would have led to a desilted volume of approximately half a million m3. I think it should be given a framework to the reader to evaluate if this value is low or high, comparing it to the increased water scarcity. Moreover, I would also show in this figure the trajectories for the other optimal strategies reported in table 5, as I believe it would be far more explicative than the data reported in the table.

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