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Hydrology and Earth System Sciences Discussions

Interactive comment on "Future changes in Mekong River hydrology: impact of climate change and reservoir operation on discharge" *by* H. Lauri et al.

Anonymous Referee #2

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Comments on "Future changes in Mekong River hydrology: impact of climate change and reservoir operation on discharge" (Lauri et al.)

This manuscript presents coupled hydrological and reservoir operation modelling of the downscaled output from multiple GCMs. An overall aim is to identify how discharge is influenced by projected climate change and expanded hydropower production. The analysis methods are rigorous and generally well described. In particular, I appreciate the efforts of using multiple GCMs, which greatly contributes to the understanding of inherent uncertainties. The topic is of general interest and important in many aspects.

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Interactive Discussion
Discussion Paper

However, the scientific contributions and some aspects of the results interpretation would need to be clarified. Therefore I recommend that the following main issues are addressed before publication.

1. In order to clarify the scientific contribution of this work, it would need to be related to the state-of-the art knowledge; currently, the contribution is almost only explained in the light of investigations closely related to the Mekong River. This is also reflected in the reference list. However, there are many journal papers – considering other parts of the world - on the topics of combined impacts of different reservoir operation schemes and climate change, or reservoir management under the uncertainties of climate change (none of which are mentioned in the manuscript, as far as I can see). Key questions are:

a – What has been concluded previously from studies of other river systems, regarding this paper's focus question of discharge effects?

b - Do findings from other river systems support some of your conclusions? Hence, can part of this study's results be more generally valid, or are they likely to be constrained, e.g. to systems under influence of monsoon dynamics?

c – Did the optimal solutions for reservoir operation differ in some way (e.g., regarding water levels or stored volumes), with and without climate change? If so, are there some further implications? For instance, are there implications for levee heights (an issue of discussion in many regulated river systems)?

2. Regarding the results interpretation, a main conclusion is that the impact of reservoir operation is larger on the Mekong river hydrology/ hydrograph than climate change impacts. However, the conclusion seems to be drawn based on relative changes in monthly discharges only. For instance, if the total discharge over a year (the hydrograph area) is considered, would not the impact of climate change be larger than the impact of reservoir operation? Such total, annual water volumes changes must be of interest for hydropower production. Please clarify this issue and rephrase the conclu-

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sions accordingly. Please also clarify whether or not the additional evaporation from the considered reservoirs is considered in the modelling of discharges (or if this effect would be negligible under prevailing climatic conditions).

3. More generally, regarding the analyses, the results are of course sensitive to the actual choice of reservoir operation rules, as also acknowledged in the manuscript. It is mentioned that irrigation could expand in the basin, which would create a need for multipurpose reservoirs. Would not this create opposing needs for water storage, such that the here discussed reservoir operation effects could become less pronounced, relative to the assumed conditions? Or is it possible that the needs can coincide, creating amplifying effects during parts of the year, under considered climatic conditions? It would be interesting to add a brief discussion of this issue.

Detailed comments:

I. p. 6573, row 19: Downscaled GCM data for the period 2032-2042 was used in this study. However, in climate change quantifications, time periods of 20 to 30 years are most often considered, to avoid effects of annual to decadal anomalies. Are the results based on multiple simulations per GCM for this 10-year period, to avoid such bias? If not, please motivate the choice of such a short time period, and discuss potential bias effects.

II. p. 6579, row 22: Since evapotranspiration has a main influence on (changes in) basin scale water balances, it would be useful to include key equations used to calculate evaporation and evapotranspiration as supplementary information, including the leaf area index quantification methods.

III. p. 6581, row 11: "Delta factors were calculated compared to..." Please check language here.

IV. p. 6583, row 15: Figure 3A (p.6610). The figure heading reads "average annual temperature" whereas the figure caption reads "average annual daily maximum tem-

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perature". Please correct. I suspect that the figure can regard the changes of maximum temperature; however, I think it would be much more useful to show the mean temperature changes. It would also be useful to see the evapotranspiration changes in a separate panel.

V. p.6583, row 16. Why does the average temperature need to be computed from the maximum and minimum temperatures, thereby probably introducing some errors?

VI. p. 6584, row 20. The text reads "a 10.4 degree decrease" referring to Table 5, showing a 10.6 degree decrease. Please correct.

VII. p. 6588, row 12. It is stated that increases in annual precipitation will lead to increases in river discharges. This is only true if (temperature-induced) ET increases does not counteract the precipitation increase.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 6569, 2012.