

***Interactive comment on* “Ubiquitous increases in flood magnitude in the Columbia River Basin under climate change” by Laura E. Queen et al.**

Anonymous Referee #4

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generated using precipitation projections by Global Circulation Models (GCM) down-scaled to daily values used in combination with four conceptual hydrologic models for the period 1950-2099. The authors compared the flood statistics for period 1950-1999 with period 2050-2099 and found that there was a general increase in the daily maximum flood ratio between the two periods. The flood statistics were based on 40 model ensembles consisting of 4 hydrologic models and 10 GCM projections. Along with flood ratio, the authors also look at changes to flood timing in the basin and suggest that reservoir rules should be revised to account for changes in a future climate. While the topic and the premise of this paper is very important and relevant to HESS and in the current context of climate change, and the fact that the Columbia River system is critical to the western USA, the paper needs substantial revisions to

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both content, writing and presentation prior to accepting for publication. Following are the three major comments/points/questions that should be addressed in the revisions. Additional minor comments are listed in the table below.

1. How does the daily rainfall and resultant flood statistics compare with historic data? How well does the GCM downscaling match up and how well does the 4 hydrologic model generated flood event compare with the historic data for magnitude and timing. As mentioned in the paper, the previous work was based on annual and monthly flood statistics and the change in modelling timesteps require some sort of validation. Acknowledging that this basin has a lot of flow control, even the comparison of the upper reaches of the river system might be sufficient to gain some level of comparison on how well the four hydrologic model simulations compare with historic data.
2. As addressed in the conclusion of this paper, the question on how much of a contribution does the PRMS model results have on the increase in flood ratios needs to be addressed in some way as this paper suggests an increase in flood risk which is different to many other studies. A possible way that can be considered might be, were PRMS flood predictions higher for both periods of comparison? How do the result change if the results from the PRMS models are not considered?
3. The introduction needs to present the objective and the importance of this paper better than a single line at the end. The introduction should present the case for why this work is important. Also, the methods section needs more detail on how things are different from the previous work from which this paper was derived.

Line #(s) Comment

- 1 43 Indicate the overall area of the basins that are part of this study
- 2 53 Need a citation or some additional support on this sentence.
- 3 63 This is an important point which relates to a lot of this study and should be explained better to show relevance and why this stud can be useful.
- 4 95 Similar to above comment, the gap that this paper looks to explore and study is not made clear. Why is this study important and how does it differ from the study that this work is based on? What is the primary objective of this paper?
- 5 128-135 At are the 4 models? Descriptions provided for only 2 of the models used. What level of conceptualization and under lying assumptions rule these models?
- 6

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161-179 Language and sentence structure should be edited. Vague language such as 'sometimes' 'more or less' 'just below' should be avoided 7 181 The change in flood magnitude along the river should also include some discussion on tributaries contributing flow 8 191 Correct me if I am wrong, but Isn't base flow accounted for in the extreme value analysis? 9 200 delete this sentence 10 203-205 Move to start of this section 11 299-311 This paragraph is good

Please also note the supplement to this comment:

<https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-474/hess-2019-474-RC5-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2019-474>, 2019.

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