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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Contribution of model parameter uncertainty to future hydrological projections" *by* Q. Zhang et al.

Anonymous Referee #2

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This paper explored how model parameter uncertainties propagate to future projections. This is an important topic and the simulation experiments are generally well designed. However, I fully concur with the first reviewer that the major contribution of this study is not well identified, given the large number of uncertainty studies already in the literature. Also, some of the key procedures and their rationale should be explained more clearly. Therefore, substantial changes are necessary before the manuscript can be considered for publication.

Major comments:

1. It would be beneficial if the authors would highlight their additional contribution compared to Mendoza et al. (2016), who also concluded that parameter uncertainty could affect the direction and magnitude of projected changes, based on four hydrologic mod-

els (including VIC) and three US catchments. Seiller et al. (2017) also examined the effect of parameter uncertainty on future projection, based on multiple catchments, GCM and lumped hydrological models. Could the uncertainty from parameters be compared to uncertainty introduced by different GCMs? What are the minimum parameter sets the authors would recommend for decision-making purpose, considering the computation requirement? By focusing on one model and one catchment, the authors could also carry out more in-depth analyses such as on the plausibility/sensitivity of some parameter values.

2. Based on the results, it is also not quite clear if the authors' general conclusion is fully supported ("multiple optimal parameter sets are needed in order to make meaningful projections of water resource availability into the future"). What projections would be meaningful for this basin, for example, would a few percent increase or decrease in annual flow play a significant role in water supply here, or would the timing be more important? Additionally, the importance of parameter values would be better understood in the context of other uncertainty sources, and previous study showed the relative importance of model structure and parameter values was catchment dependent (Kay et al., 2009). Therefore, it might be worthwhile for the authors to rethink the conclusions from their results.

3. I also have some questions regarding the methodology. In P4L19 "eight parameters were calibrated at 1/8 degree spatial resolution": are there different values on each 1/8 degree grid, or is each parameter the same for the whole basin? Another question is on the climate forcing data. What is the bias correction method used in USBR, and why do the data need to be corrected again by the delta-change method? Would the multiplicative method the authors use lead to some unrealistically high daily precipitation values in future, if the RatioPm is large?

As substantial changes are needed, I would only raise two minor comments at this stage:

- There are numerus grammatical errors in the manuscript such that a careful proof-reading is mandatary. For example in the abstract alone: L16 “parameter sets to”->”parameter sets for”; L23 “result to”->”lead to”. - Figure 4. Which period is validation period, which is calibration?

References Kay, A.L., Davies, H.N., Bell, V.A., Jones, R.G. (2009) Comparison of uncertainty sources for climate change impacts: flood frequency in England. Clim. Change 92, 41–63. doi:10.1007/s10584-008-9471-4.

Seiller, G., Roy, R. & Anctil, F. (2017) Influence of three common calibration metrics on the diagnosis of climate change impacts on water resources. J. Hydrol. 547, 280–295. doi:10.1016/j.jhydrol.2017.02.004

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