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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 #1

Received and published: 25 February 2019

Thank you for the opportunity to review this manuscript. This study deals with an important issue on uncertainty in hydrological models. The authors calibrated the VIC model using a multiobjective approach based on historical data. Sixteen sets of model parameters were randomly selected. Then the model with these 16 sets of parameters were applied to two future phases up to year 2100 with 18 different scenarios. The changes in system states were represented using ensemble means. It is an interesting study. However, it is not very clear what is the major contribution of this study considering the large number of studies on uncertainty in the literature. In addition, some major modeling steps/decisions are not described clearly or justified. Therefore, this reviewer recommends major revision.

Detailed comments: 1. Uncertainty is important as pointed out by the authors. How-

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ever, what is the major contribution of this paper considering there are a large number of studies dealing with uncertainty in hydrological models? One of the objectives of the study is to "quantify the uncertainty resultant from model parameters to projections of hydrologic flux and state variables". Has this never been done before? If so, please support with evidence in the introduction section.

2. The context in which parameter uncertainty is assessed. Parameter uncertainty is only one contributor of uncertainties, among model uncertainty, input uncertainty, climate uncertainty, etc. Where does parameter uncertainty sit among all uncertainties?

3. The authors emphasized uncertainty related to Climate Change in introduction. But ensemble mean across different future scenarios are used in the study, where uncertainty represented by the different future scenarios is lost.

4. The authors selected a large number of performance measures. Why were they selected? If they are randomly selected with no justification, the authors are increasing calibration effort without additional benefit.

5. The authors stated that "The 16 best performing parameter sets were chosen randomly using the Borg MOEA framework." This statement is confusing. If the "best" parameter sets are selected, they much be selected based on some criteria rather than randomly. Did the authors mean they are selected randomly from the Pareto-optimal front obtained from multiobjective optimization using Borg? Then why are they selected randomly? Will another different set of parameters selected randomly lead to different results and conclusions?

6. One of the conclusions in the manuscript is that future changes in system state are similar to those in the past (Section 5.3). However, the model was calibrated using historical data then applied to future scenarios. What is the implication of this approach to the conclusion?

7. The authors claimed that "variability due to parameter uncertainty was up to 10 %

annually and 26 % monthly under future climate change scenarios". Without understanding the whole picture of uncertainty, it will be difficult to reach this conclusion.

Minor comments: 1. Description on the Borg MOEA between lines 148 and 152 is inaccurate.

2. Many terms are used in an ad hoc manner. For example, Borg is an optimization algorithm not a framework. Line 224: "Borg MOEA framework".

3. Line 351 and Line 353: Remove "the" before "summer".

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