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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Improvement of model evaluation by incorporating prediction and measurement uncertainty" *by* Lei Chen et al.

Anonymous Referee #1

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Uncertainty analysis constitute important challenge in hydrological and water quality modeling area. In this manuscript, the authors proposed a new approach to improve model evaluation by incorporating prediction and measurement uncertainty. This new method, if proven as valid, will contribute to the development of uncertainty analysis techniques and interest audience of the journal substantially. However, after reading this manuscript, I have some concerns, which are listed below:

About the CDFA method:

The idea of evaluating the goodness of model fit by comparing the distributions of model predicted values and observed values is appealing. However, in typical setting of a hydrological/water quality modeling problem, the distributions of model predictions are constructed using certain "calibration" process, as already indicated in manuscript.

The definition of measure of goodness of fit, which could be used for model evaluation such as the Nash–Sutcliffe model efficiency, should be able to be used to help reduce the parametric uncertainty of the model or, using the terms from GLUE, differentiate between "behavioral" and "non-behavioral" parameter sets. I did not see the CDFA approach proposed in this manuscript can function this way according to the description of the method provided in section 2.1. To put it another way, when there is knowledge of uncertainty or distributions of observed values, it is desirable to incorporate this knowledge into model calibration. However, it seems to me that the proposed CDFA approach does not provide a way to allow that information into model calibration and simply provides an alternative metric to summarize the model calibration results at the post-calibration stage. The utility of the new approach is therefore not significant.

About MCA approach:

As for the MCA approach, I am afraid I could not find which variables are discrete variables of interest in the case study designed to demonstrate the implementation of MCA approach (section 4.2). All SWAT output variables mentioned in the case studies seem to be continuous.

Of course, I would like to acknowledge that providing a thorough review on theoretical work in uncertainty analysis such as the one presented in this manuscript could be quite challenging. The concerns noted above may be due to my limited knowledge. But I hope that the authors can provide an explanation and clarification to these problems.

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