Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2018-580-RC2, 2019

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Multi-model approach to quantify groundwater level prediction uncertainty using an ensemble of global climate models and multiple abstraction scenarios" *by* Syed M. Touhidul Mustafa et al.

Anonymous Referee #2

Received and published: 25 January 2019

This paper deals with uncertainties in groundwater level predictions due to greenhouse gas scenarios, climate models, conceptual hydrogeological models (CHMs) and groundwater abstraction scenarios. To achieve this aim, ensemble of alternative CHMs, recharge and abstraction scenarios were used. The study confirms Bayesian Model Averaging (BMA) is the most suitable technique designed both to develop multi-model ensemble approach and to help account for the uncertainty inherent in the model selection process. The topic of the note lies within the aims and scope of Hydrology and Earth System Sciences and deals with a topic of considerable interest.

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Discussion paper

Multi-model approaches can be profitably associated with sensitivity analysis in order to answer the following questions: for a given set of measurements, which conceptual picture of the physical processes, as embodied in a mathematical model or models, is most appropriate? What are the most valuable space-time locations for measurements, depending on the model selected? How is model parameter uncertainty propagated to model output, and how does this propagation affect model calibration? Recent examples of methods to combine sensitivity-based calibration and model selection have been presented in literature right in the context of groundwater modelling. I suggest to the authors to deepen this topic since, at this stage, the paper does not introduce significant scientific advances respect to the state of art. It's true that typically parametric uncertainty dominates in literature with respect to the uncertainty related to models and scenarios. Nevertheless, this is not enough to make the paper self contained. This is a general evaluation on the study that brought me to the decision that the work still needs major revisions to make it acceptable for publication.

Specific suggestions to improve the quality of the paper are listed below.

1. I suggest to add a schematic representation of the system investigated for the sake of clarity. This will help identifying the calibration parameters in one/two/three-layered models respectively. 2. With the goal of facilitating the understanding of the study, it may be worthwhile to insert the equations used in the analysis and not just references. 3. Please reword paragraphs 2.7 "Future groundwater recharge scenario" providing more details about model adopted and 2.10 "Data analysis" explaining more clearly the procedure followed. 4. Improve the quality/size of the figures to highlight the results of the analysis

Minor points:

5. Check line 65, "CHMs", remove "s". 6. Check line 192, in "step" a "s" is missing; 7. Check line 424, reference is missing; 8. Check Line 480, reference is missing.

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580, 2018.