Hydrology and Earth System Sciences Discussions

Interactive comment on "An educational model for ensemble streamflow simulation and uncertainty analysis" by A. AghaKouchak et al.

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The authors would like to thank the reviewer for the constructive comments and suggestions which led to substantial improvements in the revised version of the manuscript. In the following, the issues raised by the reviewer are addressed point-by-point in the order they are asked. Reviewer's comments are shown in italic; authors' reply is shown in regular text. For convenience and better tracking of changes, a copy of the manuscript with the changes highlighted is included.

Anonymous Referee 1 Received and published: 14 June 2012

RC: This article describes a new version of the HBV hydrological model, HBV-

Ensemble, which has been designed to complement theoretical hydrology lectures. The primary modification to the model is the ability to run multiple simulations, each with different sets of parameter values. The resultant ensemble of hydrological model simulations can then be used to gauge the uncertainty resulting from model parameter values. The model can be operated from a relatively simple Matlab-based GUI. This new version of HBV appears to be a very useful addition to the toolbox of hydrology-educators. Parameter uncertainty and equifinality are important concepts, and easy-to-use tools for the demonstration of the impact of these concepts (such as HBV-Ensembles) are to be welcomed. Overall, this paper fits well into the scope of this special issue of Hydrology and Earth System Sciences. It is well written and would be of interest to those involved in teaching hydrology. I find the manuscript to be acceptable for publication in HESS, although I do have a small number of suggestions for minor improvements:

RC: 1. The abstract needs to provide some mention that the model has already been used to teach a hydrology class, and indicate that this has been largely successful.

The abstract is revised based on the above comment.

RC: 2. Typographical error, p7300, line 6: remove "above"

Corrected; thanks.

RC: 3. Typographical error: p7301, line 18: change to "will then be partitioned"

Corrected; thanks.

RC: 4. It would be interesting to provide a little more information on the implementation of the model in the hydrology class (Section 4). How does student satisfaction compare with teaching conducted prior to the introduction of HBV-Ensembles? Has there been an improvement in satisfaction, or students going on to further study in hydrology? Similarly, have grades improved following implementation? It would also be interesting if the authors found any drawbacks to the introduction of this more complex model –

particularly as Q.10 (confidence in performing hydrological modelling) has the lowest response of the learning gains questionnaire.

In Section 4, more information is added on the implementation of the model in class. The instruction starts with the simplified version of the model (Excel spreadsheet [1]), and then continues with the MATLAB GUI version presented in in this manuscript ([2]).

Regarding, how student satisfaction compares with teaching conducted prior to instruction of HBV and whether the grades improved or not, unfortunately, we cannot provide any information as we do not have such survey information. It should be noted that the students were asked to evaluate their learning gains as a result of their work with this education toolbox in the class. However, the authors acknowledge that evaluating students' responses and associating them to only the model and not to the combination of instruction and model use was not possible in the current study (this information is included in Section 4). Such evaluation of the impact of pre- and post-use of the model on enhancing students' learning (e.g., using control versus treatment groups) can be the focus of future studies.

We agree with the reviewer that the response to Q. 10 is rather low. One reason could be that the students were asked to use this educational model in only one project (Final Project of class). We speculate that if the model is used in multiple projects throughout the class, students become more confident in hydrologic modeling. However, at this point, we do not have sufficient data to support this.

References

[1] AghaKouchak A., Habib E., 2010, Application of a Conceptual Hydrologic Model in Teaching Hydrologic Processes, International Journal of Engineering Education, 26(4), 963-973.

[2] AghaKouchak A., Nakhjiri N., Habib E., 2012, An Educational Model for Ensemble Streamflow Simulation and Uncertainty Analysis, Hydrology and Earth System Sci-

ences Discussions, 9, 7297-7315, doi:10.5194/hessd-9-7297-2012, 2012.

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