Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2017-28-AC1, 2017

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Identifying the connective strength between model parameters and performance criteria" *by* Björn Guse et al.

Björn Guse et al.

bguse@hydrology.uni-kiel.de

Received and published: 27 March 2017

Comment from reviewer#2: In this manuscript, parameter uncertainty (incorporated with the SWAT model) was explored by using Latin Hypercube sampling.

Reply from the authors: We have to mention that we do not agree with this summary of our manuscript. As clearly stated in the manuscript, our focus was to investigate the relationship between model parameters and performance measures. Thus, we show which model parameters impact which performance measure and which performance measures are influenced by the different model parameters. This approach is fundamentally different from a parameter uncertainty analysis. We do not tangle the parameter values in the manuscript and did not investigate the uncertainty of model parameters. We even do not mention the term "uncertainty" in the entire manuscript.

Based on the overall summary of the reviewer we suspect a severe misunderstanding of the topic of our study. We kindly ask the reviewer to clarify his statement considering our hopefully clarifying comments. In particular, we would appreciate if the reviewer could clarify why he came to the conclusion that this manuscript deals with a study of a parameter uncertainty analysis.

C: In general, the manuscript is overall well written and I personally really like Figure 4 and 5 (the way of presentation).

R: We thank the reviewer for this very positive comment.

C: However, I cannot recommend for publication in HESS for mostly the reason of novelty and also the following concerns:

R: To our knowledge, the idea of investigating the relationship between model parameters and performance measures from both sides is certainly new. This is also worked out in the introduction of the manuscript. Based on our literature review, we propose the concept of connective strength which was introduced in this manuscript and is to our knowledge new to the hydrological modelling community. Moreover, we think that it is still a challenge to understand which performance measures are really able to capture the variation in a certain model parameter and how this relationship varies for different catchments. If a set of performance measures is used in a hydrological study, it is still unclear which model parameters are adequately captured by at least one of the performance measures and which model parameters are not identifiable at all by the selected performance measures. Moreover, we show how many model parameters are impacted by a certain performance measure. In case of high bijective connective strength the model parameter can be clearly identified with the respective performance measure. If several performance measures influence the same model parameter(s) or one performance measure is impacted by a set of model parameter, the parameter identification is limited compared to the first case. For all these reasons we argue that our manuscript provides indeed new ideas, which might be beneficial for the hydrolog-

ical community.

C: 1. Parameter uncertainty along with complex watershed models (in this case, SWAT, or other cases such as HSPF, MIKE SHE, and others) has been extensively explored for decades.

R: We agree that there are several studies on parameter uncertainty, but as mentioned above, this was not the topic of the current manuscript. According to our previous explanations, our intention is to improve the parameter identification of a hydrological model with a new methodical approach that fundamentally differs from uncertainty analysis.

C: It does not mean there's no value (in terms of academic novelty) in investigating parameter uncertainty anymore, however, similar approaches (parameter uncertainty, sensitivity, model calibration for flow related variables) have been conducted previously.

R: As we have argued above, the concept of connective strength and investigation of the relationship between model parameters and performance measures is new. We are not aware of any closely related paper. We would be thankful if the reviewer could provide examples, if available.

C: The proposed work may not meet the scientific standards of HESS.

R: We would be glad if the reviewer could give some more information why the scientific standard of HESS is not fulfilled. We think that this is something different from the argument that there are already similar studies (which is, in our opinion, not the case).

C: The value of this work may be enhanced by highlighting some local issues such as (i) what's the current concern(s) (Agricultural? Domestic? Industrial? Environmental?) in the Treene and Upper Saale catchments; and (ii) what would be the benefit(s) to use the propose approach in the study area.

R: We have selected both catchments since they are characterised by different landscapes (lowland vs upland). As suggested by the reviewer, we will provide additional

information on the catchments in the revised version of the manuscript. We think that these contrasting catchments are appropriate to show how the results change between the catchments. Our approach is in general applicable to all models and catchments, since the core idea is to analyse the relationship between model parameters and performance measures. This is of general relevance in all model applications.

C: 2. Details of both catchments were not provided. I would say most people know the location of Germany but maybe not the given two catchments.

R: We agree that we could give more information on the catchments including their location and we will do so in the revised version of the manuscript.

C: Parameter uncertainty and the associated comparisons may not be very much meaningful if the information of the targeted regions was not clear.

R: We hope that this point becomes clearer after improving the presentation of the catchments as outlined above.

C: 3. It seems that previous work from H. V. Gupta (famous scholar we know that), B. Guse, and M. Pfannerstill was cited a lot in the manuscript.

R: Since this manuscript is based on former studies of these three authors, we had to include some of their papers. However, we can try to reduce the number. In this context, we like to emphasise that we included more than one paper from other first-authors as well such as T. Wagener (4 times), K. Van Werkhoven and R. Singh, since our work is also based on their studies. We would like to emphasise that we did not have any joined publication with them. Thus, overall, we think that the reference list is appropriate and fairly balanced to meet the requirements of the scientific standard.

C: However, as I mentioned previously, there are many other similar research available (at least in the past 10_15 years) but not being discussed or compared.

R: As suggested by the reviewer, we can enhance the discussion by including more papers from past on the overall topic. However, again we would like to emphasize that

parameter uncertainty is not the topic of this manuscript so that the number of papers dealing with parameter identification is very limited and is already integrated.

C: It also may be a considerable issue of the proposed work for the general evaluation against others was not provided.

R: We do not understand which kind of comparison is expected here. We kindly ask the reviewer to give some more detailed explanation so that we can consider a possible comparison in a revised version of the manuscript.

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