Hydrology and
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Discussions

Interactive comment on "Hydrological model parameter dimensionality is a weak measure of prediction uncertainty" *by* S. Pande et al.

Anonymous Referee #1

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The paper with the title "Hydrological model parameter dimensionality is a weak measure of prediction uncertainty" present the analysis of that model prediction uncertainty does not necessarily come with parameter dimensionality. Authors have tried to prove their hypothesis using Vapnik–Chervonenkis (VC) generalization theory to make the relationship between prediction uncertainty, sample size and model complexity. Authors used two model structures, SAC-SMA and its simplification, SIXPAR, on five MOPEX basin data sets across the United States. They conclude that parameter ranges have greater impact on prediction uncertainty then the number of the parameters. The paper has brought an important discussion about source of predictive uncertainty, parameter space vs number of parameters. The focus of the paper is therefore certainly appropriate for the scope of HESS.

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The manuscript is seen to be written in hurry. There is many simple mistake. E.g abbreviation etc. are not explained. The manuscript need a proper revision to make the message clear. This is true that only number of parameter should be not use to define the predictive uncertainty of model. But as suggested by authors that only parameter range can define the predictive uncertainty of a model is not true. As number of parameter increases, the parameter space increase, hence difficult to find the optimal parameters during calibration that ultimately add to the predictive uncertainty of the model. In other hand parameter range increases the volume of the parameter space. Hence, parameter range alone cannot define the source of the predictive uncertainty. In my opinion, both parameter range and number of parameter need to be consider together.

Let say there is model A which have N number of parameters, and ranges are narrow, and there is model B with N-n number of parameters with wide ranges. Just by knowing these information it is very hard to tell which model will have less predictive uncertainty. It is simply because, more the number of parameters more the difficult to get optimal parameter set, same if the range of the parameter is wide. But dimensionality bring more complexity in model in term of calibration process (parameter interaction).

Authors need to explain, is the conclusion made in this study is valid for all kind of model (e.g. conceptual model, physically based model, empirical model, data driven model etc.) Paper need restructuring. It need more clarity in methodology. Is the methodology is applicable to all kind of model (e.g. conceptual model, physically based model, empirical model, data driven model etc.).

Authors need to give more details about the study area and model structure.

Authors need to explain the utility of the current study. Will the results and conclusion will changes if we use other model and other catchment. Authors have used Vapnik–Chervonenkis (VC) generalization theory to make the relationship between prediction uncertainty, sample size and model complexity, is there any other methods can be use,

please explain, why this method was selected?

Specific comments:

Page 2557 Line 2 ". . ...parameters) are considered less complex and hence are associated with low prediction uncertainty." This statement need some references

Line 5 "One can envisage a case wherein a model has significantly higher model complexity than another model yet the tradeoff between model performance and complexity may deem the more complex model with lower prediction uncertainty." this statement need some references

Page 2559 Line 16 to 25 Please explain all the abbreviation before it uses. (e.g. ANN, SVM etc.) Page 2560 Line 6 "SACSMA" should be SAC-SMA Line 14. Authors have used some places short form of Section and other full, so please be consistent.

Page 2562 What is time scale of the modelling? Please explain why only 500 point. Will the results change if we take more or less than 500 points?

Page 2563 It has been mentioned that algorithm 2 and algorithm 1 has been used before explaining the algorithm. For readability, it will be nice to explain the algorithm first. For that reason I will suggest to move the algorithm in Methodology section.

In many places it has been mentioned "The algorithm is obtained from Arkesteijn and Pande (2013)" so please avoid the replication.

Page 2563 Authors mentioned about catchment that they are different, but fail to mention in what sense they are different. Please give more detail about the catchment.

Algorithm suddenly appear in text without any connectivity. Please move them in methodology section.

Page 2565 Please explain what the advantage of using these algorithm are.

Table 3, please add flow information to understand the water balance in the catchment.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 2555, 2014.

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