

## ***Interactive comment on “Assessing the temporally dynamic parameters in hydrological models: dynamic operations and evolutionary processes” by Tian Lan et al.***

### **Anonymous Referee #1**

Received and published: 1 July 2020

#### General

This study touches upon two very important but distinct topics in hydrological modelling: (1) temporal variation of model parameters and (2) model calibration issues: finding optima in a high-dimensional parameter space with a potentially rugged objective function landscape. The study finds that dynamic parameters increase the performance of the HYMOD model in validation setting, but have a poor correspondence to observed dynamic catchment characteristics. Even though the study addresses two very relevant topics, it remains unclear what the general value of the findings in this study are. The authors need to demonstrate this more clearly before I can recommend publication of

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this manuscript.

I have some fundamental objections to the approach of “dynamic parameters” that the authors use. The term “dynamic parameters” gives the impression that the parameters vary in time, i.e. during model simulations. As I understand it, this is not the case. The model is just fitted to different time periods individually with static parameters. Due to the considerable temporal memory in the model states, the parameter values fitted to a specific sub-period will, however, also be influenced by the period(s) before, not only the period it is intended to represent. It is unclear to which degree this is the case and to which degree it influences the results.

Pg19, Line 25-26: It is unclear what the methods were exactly that led to this conclusion. When looking at Table A1, how is the dynamic case calculated? I am missing some equations here. Furthermore, I see that the model performance is very poor for that catchment, independent of the “static” and the “dynamic” approach. How is the model performance for the other catchments? NSE-values of around 0.15 in the validation period are rather worrying. How do you explain that?

#### Conclusions section

Pg19 Line 26-27: This conclusion is not supported by the results. It is not shown that correlations between parameters is the reason for the missing improvement achieved with a single dynamic parameter.

Pg20 Line 5-11: The meaning of this paragraph is especially elusive, and it is unclear how these statements refer to the analysis presented in the manuscript. In general, the conclusion section is not very clear and it also doesn't clarify in which way this study is of general value.

#### Abstract

Line 11: remove “however”. “received little attention” is not true if it refers to constant parameters. If it refers to dynamic parameters this is true, but then repeat “dynamic” to

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make it clear.

Line 15: “probability distributions of violin plots” is an awkward formulation. “probability distributions visualized in violin plots” would be more accurate.

Line 21 “response [...] is generally poor”: not clear what this means. Poor in what sense?

Text

Pg2 Line 4: “for dynamic” and static “parameters in hydrological” would be more accurate.

Pg2 Line 14: did you mean: “the more local optima there are”?

Pg2 Line 32: How does this sentence relate to the previous part of the paragraph? The meaning of the sentence is not clear. What does “measurement of water resources problems” mean?

Pg7 Line 15-22: The authors suggest that the width of the parameter distribution is only a function of the number of local minima. This is not true, wide (or “flat”) distributions can also be unimodal, in that case, the parameters are just relatively insensitive to the objective function. This needs to be clarified throughout the manuscript (e.g. also on Pg 12, Line 12-13)

Pg9 Line 17: The authors repeatedly speak of “the divergence measure”. This sounds like there is a quantitative measure to describe the “divergence”, which I assume is a measure of the width of a distribution. The term “divergence” is, however, confusing since it has been commonly used for the difference between two distributions, which here is not the case. I suggest the authors replace “divergence” with “width of the parameter distribution” or “standard deviation”. Also, I would not call it “measure” unless it is a quantitative indicator.

Pg12 Line 5: I don’t understand what the authors want to say with this sentence. Figure

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7 is referred as Figure 8 in the manuscript.

Pg16 Line 17-18: It is not clear what the methods are that were used for this analysis. Please describe in more detail and move it to the methods section if necessary.

Table A1: the lower part (“verification-calibration”, I think this is supposed to be the difference between validation and calibration) does not add up for columns “NSE” and “LNSE”

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-195>, 2020.

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