

Reviews of HESS-2019-544

Title: Dynamics of hydrological model parameters: calibration and reliability

As fresh read of the revised paper, I think the paper reads well for most of aspects: paper structure, descriptions, focus, figures. Reviewing the responses, the authors addressed my comments adequately. I appreciate the revisions made based on my comments, but I still feel that introduction could be improved (though I do see the effort to revise that section). I think one more moderate revision would improve the paper.

Comment on introduction

1st paragraph: I think this paragraph is fine. A key message is that time-invariant parameter is not appropriate. Optimized hydrologic model (based the period covering various climate conditions) represent average hydrologic dynamics over the time used for optimization. Root of the problem is model structure deficiency (missing processes etc.).

2nd paragraph: This paragraph states two different things – 1) parameter dependencies and 2) introduction of the sub-period calibration strategy (which is raised based on the problem statement in the 1st paragraph). I have hard time linking 1) and 2), though there is a sentence (line 12-14) that tries to link. I agree to the point 1) that parameters should be treated as a set of parameter not individual parameter independently, for regionalization, etc. I feel that topic of the first half of the paragraph is abrupt.

3rd paragraph: This paragraph describes the previous studies on sub-period calibration studies in the first half and some problem statements (issue on high dimension calibration caused by use of multiple calibration periods).

Reading 2nd and 3rd paragraphs carefully, I would like to suggest combing two paragraphs (last half of 2nd paragraph and first half of 3rd paragraph are duplicated) and state the issues stated in 2nd paragraph and 3rd paragraph (which this paper is trying to investigate) together. Also it would be nice to state what the issues in the previous sub-period calibration strategies were (currently the paper states “the previous studies using sub-period calibration improved the performance, so what is the problem/question left?). I think this is needed to introduce the schemes used in this paper.

4th paragraph: this paragraph states how each scheme is assessed. I am not sure if there is need for detailed evaluation methods (L12-16), but I think I am ok with this paragraph.

Other comments:

Thank you for describing the method for partitioning of the simulation period into sub-periods. Here the authors provided additional information, which trigger my questions. *“The results showed that the performance of the model with a CPP framework was significantly improved at*

high, middle and low streamflow. The transferability of the dynamic parameter set from the calibration to the validation period was also greatly improved.”. This sentence gives nuance that sub-period calibration done in the previous study was successful. So, what really motivated this current study based on your previous study? I would suggest stating what issue/questions was posed in the previous study that motivates this current study, and what the differences in calibration methods between current paper and the previous paper are. This could be stated in introduction?

Also, thanks for responding to my question on selection of the dynamic parameter (that is exposed to sub-period calibration in the scheme 2)? I would suggest stating which parameter (among 5 HYMOD parameters) is the dynamic parameter (or indicating it in table 2). To me, the selection of the dynamic parameters should be based on temporal changes in soil (might be negligible) and land cover (may be significant), but I think I understand some of bucket and flux parameters are sensitive to climate condition due to imperfect model structures (missing processes or oversimplified parameterizations in the model).

Very minor line-by-line comments:

P2. L13. Spell out R. et al., 2010.

P2. L28. At the global level -> overall period (or similar)?

P 5. L9. I feel the model schematic figure of the model would be worth adding in main text (in addition to Table 1). This would help reader to interpret the figure 4-5 better. Please consider.

P 5. L13-14. This sentence (*The simulation have a warm period...*) is not clear.

P8. L11. Suggest move this sentence (*Here, the lower values....*) immediate after the first sentence of the paragraph.

Figure 4. I cannot tell difference between Scheme 4 and Scheme 5. I thought this would be error. I expect noticeable differences between the two schemes. But not sure. Please check.