Towards reducing the high cost of parameter sensitivity analysis in hydrologic modelling: a regional parameter sensitivity analysis approach

MS No.: hess-2023-21

Response to reviewer comments

The authors thank the reviewer for his comments and suggestions. In this document, we address the reviewer comments (RC) individually as follows.

RC: In this manuscript, Larabi et al. present a sensitivity analysis for 25 basins in North America using the VIC model. In addition to discharge, they used evapotranspiration and snow water equivalent as target variable for the sensitivity analysis. For an efficient simulation, they have clustered the basins based on catchment attributes. Based on the results of the sensitivity analysis, they distinguished into parameters that are overall informative / non-informative and into those that are relevant in a part of the catchments (variant-informative).
This study is well-written. All steps are clearly described. The results are supported by good figures.
Thus, I have only a few comments and can recommend it for publication.

Response: The authors thank the reviewer for his comments and suggestions. We addressed them as follows.

RC: L.38-50: I suggest to add that the parameter space could also be reduced by constraining parameter ranges to a smaller range.

Response: We thank the reviewer for his suggestion. However, we disagree that constraining parameter ranges to a smaller range would reduce the parameter space. It would affect the convergence rate of the search algorithm to the optimal solution but will not be helpful in reducing the number of calibration parameters which we address in the paper. We address this point in the discussion Line 519-521 as follows: '*Another approach to reduce the complexity of the calibration problem would be reducing the parameter ranges to a smaller range, which could speed the convergence rate of the search algorithm to the optimal solution. Hence it would reduce the computation time, but is bearing the risk of optimal values not being included in the too narrow ranges leading to false results (Mai, 2023).*'

Reference: Mai, J. (2023). Ten strategies towards successful calibration of environmental models. Journal of Hydrology, 620(A), 129414. http://doi.org/https://doi.org/10.1016/j.jhydrol.2023.129414

RC: 247: Sawicz

Response: done.

RC: 258: Line below the table is missing.

Response: We thank the reviewer for his comment. The line 258 is a space between the table and the new paragraph.