

Interactive comment on “Hierarchical Sensitivity Analysis for Large Scale Process-based Hydrological Modeling with Application in an Amazonian Watershed” by Haifan Liu et al.

Anonymous Referee #2

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General notes

The topic is interesting and relevant for the scope of HESS. However the paper does not clarify if there are new significant results achieved and the innovations are not clear. In particular hierarchical global sensitivity analysis was already implemented by Dai & Ye (2015), several applications are reported in literature (see for example Dai et al., 2017; Dai et al., 2019) and the new contribution with this paper to the technique remains unclear. The suggestion is a deeper analysis of the work and therefore it should be completely reviewed.

Specific comments

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1. Page 3 Line 68 - Hierarchical global sensitivity is not implemented for the first time. New aspects are related to parameter sampling technique and the general framework is applied to PAWS+CLM hydrological model for the first time. This is not explained inside the paper.
2. Page 4 Line 98 - Parameter α should have the dimension of the inverse of a length (L^{-1}) and not dimensionless. Physical meaning of the Van Genuchten parameters used for the sensitivity analysis should be reported.
3. Page 7 Line 175 - Prior weights for models and scenarios may affect output results. The choice of equal weights should be motivated. An interesting point might be studying the variability of results with respect to different weights. This could be a useful tool to understand different sources of uncertainty.
4. Page 10 Line 245 – Conductivities K have wrong measurement units.
5. Page 10 Line 255 – It is not clear which outputs are reported in Figure 5, if they are spatial averaged or not. Comments to Figure 5c needs a more detailed explanation (and figure reference is not 4 but 5).
6. Page 11 Line 290 - An appendix with main model equations should be included for reader understanding.
7. Figure captions are too short and only acronyms of variables are reported. They should be more exhaustive.
8. Formulas and indices need references.
9. Physical interpretation of results is very poor and absent in general. Substantial conclusions of the work are not highlighted. It is not clear if the hierarchical sensitivity analysis is a good tool to capture output sensitivity related to several uncertainties or not.

References

C2

Dai, H., Ye, M. (2015). Variance-based global sensitivity analysis for multiple scenarios and models with implementation using sparse grid collocation. *Journal of Hydrology*, 528, 286-300

Dai, H., Chen, X., Ye, M., Song, X., Zachara, J. M. (2017). A geostatistics-informed hierarchical sensitivity analysis method for complex groundwater flow and transport modeling. *Water Resources Research*, 53(5), 4327-4343

Dai, H., Ye, M., Hu, B. X., Niedoroda, A. W., Zhang, X., Chen, X., ... Niu, J. (2019). Hierarchical sensitivity analysis for simulating barrier island geomorphologic responses to future storms and sea-level rise. *Theoretical and Applied Climatology*, 136(3-4), 1495-1511

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