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

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We greatly appreciate the editor for evaluating and processing our manuscript. We will substantially revise the manuscript following the valuable comments and suggestions provided by the three reviewers. The point to point responses for every comment have been arranged in the response letters. We summarize the planned major revisions for the manuscript as follows:

(1) Both reviewer #1 and reviewer #3 made comments about the purpose or motivation of this study needs to be more highlighted. To improve this weakness, we will rewrite the abstract and introduction sections to highlight and emphasize the motivation and

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goals of this paper: to develop a new tool and demonstrate its implementation to a pilot example for comprehensive global sensitivity analysis of large-scale hydrological modelling. We believe that this work would be helpful to discover and understand the different types of uncertainty sources of PBHMs and to further provide modelers insights of dominant physical processes that control hydrologic fluxes such as ET and baseflow etc.

(2) Reviewer #1 made a major comment about the writing of this work needs to be improved, especially the logic. We will substantially revise this manuscript, to make sure that the logic flows smoothly and avoid making any conclusions without any justification. Besides, we will hire the professional English language editors to polish the language of this manuscript.

(3) Both reviewer #1 and reviewer #3 made comments about a few figures in manuscript need revisions and more discussions. Based on the comment of reviewer #1, we will update Figure 2 using a higher resolution and a larger font. Following the suggestion of reviewer #3, we will replace Figure 4 to find a better way to exhibit the great uncertainty of the model simulation results. We will also add more discussions of some figures, e.g., in Figure 7, the sensitivity index for aquifer thickness is about the average aquifer thickness for the whole watershed, rather than the thickness 'right' under the river cells. As for the Figure 9, we will add more discussions about the difference between headwater and stem river cells. Moreover, we will expand our discussions of Figure 11 to further analyse the effects of three subdivided groups of parameters on ET and QG.

(4) Reviewer #1 suggests us to highlight the contribution and novelty of this new method, thereby distinguishing it from previous work. And reviewer #3 thinks we should shorten Section 2.2 or move this section to appendix. To address these comments, we are going to move the main equations of the hierarchical sensitivity analysis method to appendix. And we will focus on the improvements we made to the previous hierarchical sensitivity in the method section.

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(5) Reviewer #1 poses questions about the efficiency of the LHS method and the applicability of the binning method. We provide preliminary responses to Comments 9 and 10 in the letter to reviewer #1. We will present and explain more details about these two methods in the revised manuscript.

(6) All three reviewers made a suggestion for adding additional discussions of results in the manuscript. Based on the comment of reviewer #1, we will add discussions of insights learned from this pilot example. As suggested by the reviewer #2, we will expand the results and discussions on the relative importance of unconfined and confined aquifers.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2020-87/hess-2020-87-AC4-supplement.pdf

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