Re: Manuscript #hess-2024-384, entitled “A Novel Framework for Calibration and Evaluation of Hydrological Models in Seasonal Catchments”

Dear Editor,

We sincerely thank both reviewers for recognizing the significance and innovation of our work, as well as for their time and effort. Based on this feedback, we have conducted systematic and substantial revisions. Centered around the scientific question, we have restructured the manuscript and the chain of evidence. It is worth noting that the reviewers did not dispute the novelty or scientific value of this study. Based on our comprehensive response to the review comments, we respectfully request that the editor and reviewers reconsider the content and quality of the manuscript.

First, we have systematically revised the overall structure and logic of the manuscript. Centering on the research theme mentioned above, we rewrote the transition between the Introduction and Methods sections, clearly distinguishing the roles of data preprocessing, sub-period partitioning, and calibration experiments within the study framework. This helped to establish a clear logical chain of “problem statement—method design—result presentation—scientific interpretation.” To improve readability, we have moved the description of the extracting seasonal dynamic catchment characteristics method and its role in the model calibration framework into the main Methods section with a concise overview, while retaining detailed technical processes in the Supplementary Information. Additionally, we have standardized key terminologies, replacing all instances of “validation” with “evaluation”, and redrawn and split figures so that each focuses on a single information point, with clearer legends. This reduces reliance on the appendices and enhances the clarity and interpretability of the methods and results.

Second, we significantly improved the transparency of the methodology and the consistency of the experiments. In response to the issues raised regarding insufficient detail and inconsistent descriptions of the experimental schemes, we have added a schematic diagram of the HYMOD model structure, a definition table for parameters, states, and fluxes, and a summary of the core logic of the calibration process in the Methods section. We have standardized the descriptions of all seven experimental schemes (including their objectives, optimization algorithms, objective function configurations, and parameter treatment), and ensured that diagrams and text correspond one-to-one. To guarantee comparability across experiments, we have adopted the SCE-UA algorithm uniformly across all schemes and have included the mathematical definitions and applicable scopes of each performance metric in the Evaluation section. These modifications enhance the traceability and reproducibility of the method and respond to the reviewers’ suggestion that the core methodology should appear in the main text.

Third, we overcame the technical problems, expanded the scope of the results, and improved the integrity of the evidence chain. To enhance the robustness of the conclusions, we extended the diagnostic experiments from representative cases to the entire MOPEX dataset, and included statistical results and multi-metric evaluations covering the full study region. Specifically, sub-period identification was conducted across all 219 MOPEX catchments, among which 217 exhibit significant seasonality. The summary statistics (e.g., boxplots) were examined over the entire study area. On the basis of retaining mechanistic analysis, we have advanced and enhanced diagnostic outputs at the process level (e.g., flux mapping and time series of state/flux variables), which support the claim that “the recommended scheme yields balanced improvements across different flow stages and sub-periods” from an internal response perspective. We also investigated parameter transferability and the consistency of performance during the evaluation period, thereby making the results more generalizable and scientifically interpretable.

Finally, we have enriched the discussion on academic depth, applicability boundaries, and methodological limitations. Compared to the original manuscript, the revised version adds discussions on key scientific topics such as parameter identifiability and model structural uncertainty. Through additional diagnostic experiments, we further illustrate the roles and limitations of dynamic parameters in compensating for structural model deficiencies, thus significantly enhancing the academic depth of the study.

In summary, the revised manuscript includes targeted and verifiable improvements in structure, methodological rigor, evidential support, and theoretical interpretation. Overall, these efforts significantly enhance the clarity, rigor, and persuasiveness of the manuscript, while better demonstrating the potential value of the proposed framework for model calibration and process diagnosis in seasonal catchments.

In addition, it is important to emphasize that Jiajia Zhang and Wenqing Cheng have made substantial contributions during this round of revision. They took the lead in refining the study’s conceptual framework, performing the necessary recalculations, and substantially improving the writing. Their efforts have been central to the successful enhancement of the manuscript. Therefore, with the agreement of all authors, we respectfully request that they be included as co-authors to duly acknowledge their important contributions to this work.

We have submitted a revised manuscript and point-by-point responses to the reviewers along with this letter, and respectfully request your kind review of the revised manuscript and its reconsideration.

Sincerely,

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