

## HYDROL70533 - Editor decision - revise

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Dear Dr. Zhu,

I can now inform you that the reviewers and editor have evaluated the manuscript "A spatially hybrid hydrological modeling approach based on spatial heterogeneity of watershed characteristics" (Dr. Liang-Jun Zhu). As you will see from the comments below and on <https://www.editorialmanager.com/hydrol/>, publication in its present form is not recommended, and major revision is being requested.

Please consider the reviews to see if revision would be feasible. To facilitate further review, add line numbers in the text of your manuscript. Should you wish to resubmit you should explain how and where (i.e. by giving line numbers) each point of the reviewers' comments has been incorporated. For this, use submission item "Revision Notes" when uploading your revision. Also, indicate the changes in an annotated version of the revised manuscript (submission item "Revision, changes marked"). Please follow the order "Revision Notes", "Revision, changes marked", "Manuscript", etc. Please resubmit your revised manuscript by **12 Sep 2025**

Should you disagree with any part of the reviews, please explain why.

Please strictly follow the formatting requirements as presented in the Guide for Authors. When submitting your revised manuscript, please ensure that you upload the source files (e.g.Word). Uploading a PDF file at this stage will create delays should your manuscript be finally accepted for publication. If your revised submission does not include the source files, we will contact you to request them.

Any resubmittal received after deadline may, at the editor's discretion, be considered as a new paper.

To submit a revision, go to <https://www.editorialmanager.com/hydrol/> and log in as an author. You will find your submission record under Submission(s) Needing Revision.

When resubmitting, please present any figures, tables etc. as separate files. See the Artwork Guidelines on the home page right menu for further file naming conventions and format issues.

I hope that you will find the comments to be of use to you.

Research Elements (optional)

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With kind regards,

Yuefei Huang, Ph.D.  
Editor  
Journal of Hydrology

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Important note: If a reviewer has provided a review or other materials as attachments, those items will not be in this letter. Please ensure therefore that you log on to the journal site and check if any attachments have been provided.

#### COMMENTS FROM EDITORS AND REVIEWERS

Reviewer #1: This manuscript represents the authors' second revision, and they have made substantial improvements. All of my previous concerns have been thoughtfully addressed, and I find that the conclusions are now well supported by the revised results. While I remain interested in the development of a hybrid modeling framework that enables simultaneous integration of conceptual and fully physically-based components, the current approach presented by the authors offers a valuable contribution to the field. Additionally, the comparative performance of the hybrid model against both conceptual and what the authors describe as "semi-physically-based" models could stimulate meaningful discussion within the community.

Reviewer #2: The work proposes a hybrid modelling framework that enables the integration of different modelling approaches, at varying spatial scales, to solve for liquid discharge within a basin. This framework is designed to allow the application of different hydrological models to different areas or sub-basins, integrating their hydrological responses through the channel network. In my view, however, the study lacks a deeper discussion of scale-related issues and does not thoroughly assess the uncertainties arising from scale integration. As a result, the work presents the novelty of a new modelling platform, but without sufficient theoretical grounding and testing to substantiate the authors' conclusions.

I agree with the perspective of the former reviewer regarding the definition of physically-based models. Furthermore, the heterogeneity of characteristics and processes at the model scale can result in what is essentially a conceptual application of the model, through the use of representative parameters, even when fundamental physical laws are applied via differential equations, particularly due to the absence of a clearly defined upscaling law.

The atomistic concept of physically-based models, as defined here, assumes that an adequate representation of each process at the grid scale, at which the model's equations are solved, will collectively yield an accurate representation of the basin-scale hydrological response. Conversely, in hydrological calibration based on observed discharge time series, we often make the inverse assumption: if the model adequately reproduces the observed discharge at the basin scale, it is taken as evidence that the processes at the scale of the physical equations are well represented. On the other hand, conceptual models aim to capture response patterns at the basin, or hydrological response unit, scale by applying representative parameters that integrate heterogeneity occurring at lower (sub-grid) scales.

Thus, beyond the debate over the definition of physically-based versus conceptual models, I believe there is another unresolved issue in the work: the discussion ventures into the domain of hydrological scale problems, which have been extensively explored by authors from Dooge to Beven, Sivapalan, and many others. Nevertheless, the text does not examine in depth the coupling of processes across spatial and temporal scales within the model, nor the transfer of uncertainties

between those scales. The integration of scales is reduced to the aggregation of discharges within the drainage network, effectively forcing spatial and temporal scales into congruence. The case studies presented, evaluated primarily through the fit of simulated and observed discharge series, do not, in themselves, seem sufficient to enable the authors to address these scale-related questions.

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