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Subject: Submission of a revised version of a manuscript

Rennes, October 22th, 2024.

Dear editor and reviewers,

Please find enclosed a revised version of our manuscript, “Improving the hydrological consistency of a process-based solute-transport model by simultaneous calibration of streamflow and stream concentrations”, written by Jordy Salmon-Monviola, Ophélie Fovet and Markus Hrachowitz.

We describe below how we have responded to the issues raised by the editor and the reviewer.

Thank you for considering the revised version of our manuscript.

Sincerely,

Jordy Salmon-Monviola on behalf of the co-authors

Editor and Referee comments on "Improving the internal hydrological consistency of a process-based solute-transport model by simultaneous calibration of streamflow and stream concentrations" Salmon-Monviola, J., Fovet, O., and Hrachowitz, M., Hydrol. Earth Syst. Sci. Discuss. <https://doi.org/10.5194/hess-2023-292>, 2024.

Editor and reviewer comments are shown in black. Authors replies are in blue.

We thank the editor and the reviewer for their very constructive comments, which help us to improve our paper. Below we outline how we have responded to the issues raised in the revised manuscript.

Editor Comments 14 Oct 2024

Thanks for your efforts in revising your manuscript. We have received one positive review from one of the reviews from the first round but have been waiting for another review (also from a reviewer from the first round). However, as we are now far beyond the submission time and the authors did a good job in revising the manuscript (and detailed replied to the former comments), I decided that we can move on even without the second review. There are a few minor issues as listed by the one reviewer and below, which should be addressed before publication.

We thank the editor for its positive and constructive feedback, as well as the valuable suggestions provided on this paper.

L211: "The rainfall-runoff model uses daily precipitation (P) ": please be careful whether you talk about rainfall or precipitation. I understand there is no snow in your catchment (and the model), so I suggest always using the term rainfall.

The term 'precipitation' has been changed to 'rainfall' in the manuscript and in Table A1. The term "precipitation" has been left in the text when it comes from a reference.

Appendix C presents 'common' knowledge and is, thus, not needed. Another reason for removing this part is that here, the equations are mathematically incorrect (multi-letter variable names, implying multiplication) (in the main text, the authors mainly use correct variable names, but please correct Eq 21).

Appendix C has been removed. Reference for NSE_{FDC} and NSE_{RUNOFF} (Sawizk et al., 2011) has been added in Table 3. Reference for PBIAS (Moriassi et al., 2007) has been added in section 3.4.1.

Eq 21 has been modified to be mathematically correct:

$$\Delta mass_{DOC_i} = Production_{DOC_i} - Loss_{DOC_i}$$

To

$$\Delta M_{DOC_i} = P_{DOC_i} - L_{DOC_i}$$

loss coefficient (L_{DOC_i}) (dimensionless) has been changed to l_{DOC_i} in text, in Table 2 and in Fig 2.

In Table 2, to be in coherence with the text, $k_{DOC_{SU}}$ and $k_{DOC_{SUR}}$ have been modified from DOC concentration in unsaturated storage and riparian storage, to the DOC concentration at which daily DOC production occurs in unsaturated and riparian storage, respectively.

Just as a comment beyond the current study, a further alternative of an objective function that could be considered in future studies would be the modified KGE suggested by Pool et al. (2018).

Pool, S., Vis, M., & Seibert, J. (2018). Evaluating model performance: towards a non-parametric variant of the Kling-Gupta efficiency. *Hydrological Sciences Journal*, 63(13–14), 1941–1953. <https://doi.org/10.1080/02626667.2018.1552002>

Thank you for recommending the work of Pool et al. (2018). We will consider this objective function in future studies.

RC1: 'Comment on hess-2023-292', Anonymous Referee #1, 18 Jul 2024

In their manuscript entitled “Improving the hydrological consistency of a process-based solute-transport model by simultaneous calibration of streamflow and stream concentrations”, Salmon-Monviola et al. have addressed all comments raised to my full satisfaction. I only have some minor suggestions to improve clarity and writing style, listed below. Besides these minor revisions, I am convinced it will be of high value for the readers of HESS.

We thank the reviewer for its positive and constructive comments, as well as the valuable suggestions provided on this paper.

Minor comments:

I acknowledge toning down the title and I am fine with both options. Personally, I prefer the first title starting with “Improving”

Thank you

L25: “significantly improved”, not the other way around

We have corrected the sentence in the abstract.

L41-43: Sorry, but it took me three attempts to understand this sentence. Can you split it to simplify it, please?

We split this sentence

L57: Hard to follow in that order. Please rewrite to something like: “In hydrology, these insufficient model constraints can result in many equally good alternative model solutions, frequently referred to as equifinality (Beven, 2006).”

This sentence has been changed

L160: I suggest you write “opposing dynamics of” or “contrasting dynamics of”, instead of “opposition of dynamics of”

This sentence has been changed

L188-190: Nested catchment is not a convincing argument for me. If you can show that soil types, slopes, and elevation are similar – that would be convincing. Otherwise, I would tone that down to “it could be indicative” instead of “it could represent”

We have revised the sentence.

“Although the Toullo station lies outside Kervidy-Naizin, we assumed that, as Kervidy-Naizin and Naizin are nested, it could represent Kervidy-Naizin’s soil moisture conditions in the upland zone. “

to

“Although the Toullo station lies outside Kervidy-Naizin, we assumed that it could represent Kervidy-Naizin’s soil moisture conditions in the upland zone. This assumption is supported by the fact that Kervidy-Naizin and Naizin are nested and have similar characteristics, such as soil types, slopes, and elevation (Matos-Moreira et al., 2017; Sorel et al., 2010). “

Matos-Moreira, M., Lemercier, B., Dupas, R., Michot, D., Viaud, V., Akkal-Corfini, N., Louis, B., and Gascuel-Oudou, C.: High-resolution mapping of soil phosphorus concentration in agricultural landscapes with readily available or detailed survey data, *European Journal of Soil Science*, 68, 281–294, <https://doi.org/10.1111/ejss.12420>, 2017.

Sorel, L., Viaud, V., Durand, P., and Walter, C.: Modeling spatio-temporal crop allocation patterns by a stochastic decision tree method, considering agronomic driving factors, *Agricultural Systems*, 103, 647–655, <https://doi.org/10.1016/j.agsy.2010.08.003>, 2010.

L478: I would suggest to place Figure 4 earlier (somewhat around here). Right now, it comes very late. Also, you have all the information on NSE =XX in Figure 4, right? So writing it again in parenthesis is redundant and makes reading harder. I suggest you take that out.

Figure 4 has been moved earlier. The information of metrics in parenthesis have been removed in section 3.2.

Figures 3, 5 and 6 have also been move earlier.

L846: Nice and clear conclusion

Thank you