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Comment on hess-2022-44

Christian Birkel (Referee)

Referee comment on "Assessing the influence of water sampling strategy on the performance of tracer-aided hydrological modeling in a mountainous basin on the Tibetan Plateau" by Yi Nan et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-44-RC1, 2022

Dear authors of “Assessing the influence of water sampling strategy on the performance of tracer-aided hydrological modeling in a mountainous basin on the Tibetan Plateau”,

I had the pleasure to read your paper and in the following I provide some comments and suggestions aimed at improving your paper in a potential revision. I think that your paper has potential to advance the application and hydrological assessments using tracer-aided models in large-scale, mountainous catchments with an important glacier and snow contribution to streamflow. You clearly outline the challenges associated with working in such extreme environments and the difficulty to account for spatio-temporal variability of model inputs and outputs used for model evaluation. In this context, the use of isotope-enabled GCMs as input data for a hydrological model is a key result to me with potential for other applications elsewhere. Having said that, I have some doubts and suggestions you could consider incorporating into a revised paper:

- The model experiments are not clearly presented, which makes it in parts difficult to follow up on the results and conclusions.
- The model THREW-T, setup and data is poorly described raising questions about how the model treats isotope transport within model compartments. For example, I kept wondering throughout if and how the model treats glacier and snow isotope processes. To me, the glacier meltwater contribution (water and isotope) to streamflow is a simulated process within the model and part of the model evaluation. Your statements about a fixed glacier meltwater isotope signature to force the model (experiment 1) is not clear. Further, are the no model parameters associated to isotope transport and mixing? How did you arrive at the single (optimum?) benchmark parameter set for model comparison? The model calibration and how uncertainty was treated is also not clearly explained and no posterior parameter ranges after calibration are presented.
- The snow cover seems a crucial information for model calibration, but how was it derived and then simulated is not explained. Consider further sub-dividing the effect of snow cover on the model calibration compared to only streamflow and streamflow plus stream isotope calibration.

- The water source contributions to streamflow (Table 5) don't seem to add up to 1? Also, many of the boxplots do not show a difference compared to the benchmark. Maybe consider a different visualization or quantification of differences and/or similarities might help to support the conclusions.
- The bias-correction of the iso-GCM is described in equations 1-3, but the results not shown. How does the result perform against an inferred or measured isotope-elevation gradient and is the lapse the dominant driver as opposed to spatial variability over such a large catchment area? The results of model experiment 2 (Figure 8) should be evaluated against streamflow isotopes and not streamflow.

The paper should also be thoroughly edited for language, as I detected many odd wordings and grammatical errors. I attached an annotated pdf with comments and suggestions for your information. My overall recommendation is that major revisions are required for potential publication in HESS.

Best wishes,

Christian Birkel

Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2022-44/hess-2022-44-RC1-supplement.pdf