

Hydrol. Earth Syst. Sci. Discuss., author comment AC2
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Reply on RC2

Yi Nan et al.

Author comment on "The value of water isotope data on improving process understanding in a glacierized catchment on the Tibetan Plateau" by Yi Nan et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-134-AC2>, 2021

Response to Reviewer #2

Comment 1: This paper is very interesting by coupling the isotopic tracers and hydrological model, which has the potential to solve the problem of hydrograph separation in a large-scale catchment. The authors get reasonable results with their model. So I accept the paper after a minor revision.

Response 1: Thank you very much for your comment. We will revise the manuscript according to your suggestions.

Comment 2: Could the authors add some precious work to compare with their results on the hydrograph separation as well as the MRT and MTT in the discussion section?

Response 2: Thanks for your suggestion. The result of hydrograph separation has been compared with another work conducted in the same catchment in the limitation section. We will add a section to discuss the MTT and MRT in two aspects. One is to compare the estimated MTT and MRT with other studies conducted in snow-influenced catchments, and to explain the reason for the differences. The other is to analyze the influence factor of MTT and MRT, and compare the result with previous studies.

Comment 3: Page 2: Method: how to define the snow-melt and glacier-melt? And how to obtain their isotope values? In my view, it is really hard to differentiate them in the filed work because they are always mixed when do the sampling.

Response 3:

Thanks for your question. As a work focusing on quantifying the contribution of water sources, the simulation of water sources and their isotope composition is indeed need clarify.

The snowmelt and glacier melt were mainly differentiated according to the glacier coverage from the Inventory data. The melt water in glacier covered region is glacier melt, and the melt water in non-glacier region is snow melt. The two kinds of water sources are melting with different DDF. We simulated the variation of snow cover area using the method described in 2.2. For model simplification, the evolution of glacier thickness and area was not simulated.

As for the isotope values, the snowpack was regarded similarly with other hydrological simulation units, thus the isotope composition was simulated similarly by Eq. 8. The isotope composition of glacier meltwater was assumed to be constant, adopting the value reported in published paper (Gao et al., 2009).

We will clarify the above issues in the Method section in the revision version.

Comment 4: Page 10 Lines 353 -360 The calibration is quite interesting. The finding 'The single-objective calibration produced good performance for the simulation of discharge, but had an extremely poor performance for the simulations of SCA and $\delta^{18}O$ ' means without the tracers, even the calibration is accepted, the model may still bring large uncertainty. Is my understanding correct?

Response 4:

Yes, you are right. According to our result, even when the model produces good discharge simulation with high NSE_{dis} , the internal processes can be very different, because discharge is only an external characteristic of catchment. This phenomenon has also been highlighted in some previous modelling works (such as Birkel et al. 2011, Campell et al. 2012, Chen et al. 2017). This indicates that the parameter cannot be constrained well solely by the behavior of discharge simulation. Consequently, involving more datasets such as snow, glacier, isotope is helpful for reducing the parameter equifinality.

Comment 5: Page 11 Lines 391-393 Please reconsider your explanation on the river O-18. The temperature effect is kind of a statistical result, while the effect of southwest monsoon is more likely a reason to cause the temperature effect, and thus it is not suitable to put them together.

Response 5:

Thanks for your suggestion. We will change the explanation by attributing the reduced $\delta^{18}O$ to the effect of monsoon in the revision version.

Comment 6: Figure 3 Black circles and red line in sub-figure b are same to Fig.2?

Response 6:

No. They are same to sub-figure a of Fig. 3 (i.e., the black circles and red line represent the isotope composition of rainfall and snowmelt). We will clarify this in the revised version.