Hydrology and Earth System Sciences Discussions

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# Reply on RC2

Ravindra Dwivedi et al.

Author comment on "Tandem use of transit time distribution and fraction of young water reveals the dynamic flow paths supporting streamflow at a mountain headwater catchment" by Ravindra Dwivedi et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-355-AC2, 2021

**RC2**: 'Comment on hess-2021-355', Anonymous Referee #2

2.1 The work of Dwivedi et al. studies travel times in the Marshall Gulch research catchment, Arizona, for a better understanding of flow paths and storage in a mountain catchment. This is done through a strong data set of stable isotopes and tritium. The paper is mostly well written. I like and appreciate the combination of tritium and stable isotopes, I believe that this is an important endeavor. However, the current manuscript has a range of serious limitations.

Our response: We appreciate the reviewer recognizing the benefits to using multiple tracers. To address your concerns and comments, we plan to make major revisions to our paper described below. Please see also our specific responses to the comments # 2.2 and 2.3.

2.2 First, the introduction reads like a patchwork of ideas and concepts but stays vague and thus not convincingly outline a limitation/research gap. Thus, the research question came somewhat out of the blue for me. I was not able to find any information if the research on these objectives is needed or not. After reading the full manuscript, I felt that this even more important as the work read like a compilation of applying methods without a clear strategy concluding that there are different results depending on tracer and methods.

Our response: We acknowledge that some reorganization and restructuring of our paper is clearly warranted. As a roadmap forward, please see our response to comment # 1.2 from the first reviewer where we more clearly describe the novel contributions of our study. **Therefore, in the revised version of our paper, we plan to reorganize the introduction section for better highlighting the research gaps. We further plan to use the revised introduction section to reorganize the other parts of the paper, e.g., methods, results, and discussion.** Thank you for your suggestions.

2.3 Second, the methods are an issue. It is unclear why the methods are chosen. It feels like an application of a range of methods and see what comes out. I cannot find a clear strategy behind. Even more critical, by applying time invariant approaches for travel time distributions, the paper methodology is lacking a decade behind recent developments in the field (see the wide range of work, even cited, on time variant TTD and SAS functions).

The young water fraction is state of the art though, but here the work again suffers from the lack of clear strategy. In addition, stable isotopes and tritum tracers should ideally be used in a joint calibration to obtain a travel time consistent for the tritium and stable isotope observations (cf. Rodriguez et al., 2021). You might even be able to calibrate the multimodal age distributions of your travel time doing so – however, this is just speculation. Yet, his could be a really nice contribution to the field of TTDs.

Our response: Our aim was to apply the fraction of young water metric in conjunction with the mean transit time metric to improve scientific understanding of transient flow paths in high elevation mountain systems. That said, we respectfully disagree with the criticism that our methods are lagging behind recent developments in the field. Please see our response to comment # 1.2 from the first reviewer. We also highlight that *Rodriguez et al.* [2021] who used both stable water isotopes and tritium in jointly assessing a suitable TTD type, sampled both tracers under similar dynamic flow conditions, which contrasts our sampling conditions for tritium.

2.4 Overall, I think that the manuscript would need a very major rework to be publishable. This would include a full adaption of the methods to the state of the art. I have doubt that this can be done within a major revision.

Our response: Please see our responses to comments #1.1, 1.2, 2.2, and 2.3 above.

**References**

Rodriguez, N. B., L. Pfister, E. Zehe, and J. Klaus (2021), Testing the truncation of travel times with StorAge Selection functions using deuterium and tritium as tracers, *Hydrol. Earth Syst. Sci.*, *25*, 401–428.