

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1  
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## Comment on hess-2022-132

Anonymous Referee #1

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Referee comment on "Seasonal  $\delta^2\text{H}$  and  $\delta^{18}\text{O}$  changes in river water from a high-altitude humid plain of the southern Alps (Cervières, France): tracking the transit time through a watershed" by Christoph Lécuyer et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-132-RC1>, 2022

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The authors present stream water isotope data from a catchment draining part of the French alps. The study considers seven sampling sites that have been sampled once and another site at which monthly samples were taken over a two year period. The water samples were analyzed for their stable isotopic composition ( $2\text{H}$  and  $18\text{O}$ ) and the authors show that there is a seasonal pattern in the  $18\text{O}$  which they interpret to infer a rough transit time of snow to discharge at the sampling location "of about 3 to 4 months". The analyses are very limited and also the data set is rather small. There is little novelty in the study over all. The manuscript is not well prepared, the structure is off with large parts of the methods and results showing up in the Discussion section. The introduction reads partly as a results and partly as a methods section, while no research question or hypothesis was posed. The conclusion refers to climate change, which was not discussed in the manuscript. The maps and photos contain very limited information to the reader, as one would have been interested in a map of the catchment extend and the elevation distribution.

Over all, the manuscript does not provide the necessary quality to grant a publication.

I believe that there are publications that show a why to address the research question that I believe the authors were targeting and I recommend the following work:

Kirchner, J. W. (2016a). Aggregation in environmental systems—Part 1: Seasonal tracer cycles quantify young water fractions, but not mean transit times, in spatially heterogeneous catchments. *Hydrology and Earth System Sciences*, 20(1), 279–297. <https://doi.org/10.5194/hess-20-279-2016>

Kirchner, J. W. (2016b). Aggregation in environmental systems—Part 2: Catchment mean transit times and young water fractions under hydro- logic nonstationarity. *Hydrology and Earth System Sciences*, 20(1), 299–328.

von Freyberg, J., Allen, S. T., Seeger, S., Weiler, M., & Kirchner, J. W. (2018). Sensitivity of young water fractions to hydro-climatic forcing and landscape properties across 22 Swiss catchments. *Hydrology and Earth System Sciences*, 22(7), 3841–3861. <https://doi.org/10.5194/hess-22-3841-2018>

Campbell, É. M. S., Pavlovskii, I., & Ryan, M. C. (2020). Snowpack disrupts relationship between young water fraction and isotope amplitude ratio; approximately one fifth of mountain streamflow less than one year old. *Hydrological Processes*, 34, 4762-4775. doi: <https://doi.org/10.1002/hyp.13914>.

I provide some more technical and specific comments below:

L 30 – L37: The first paragraph of the introduction, in which you state what is being presented in this manuscript is in-conventional.

L 54-62: The number of references seems excessive.

Very detailed info (e.g., definition "orographic precipitation, alpine)

L86 – 90: This reads like something one would expect in the methods section

L 94: Why does this sentence start with "Why"?

L124: MAAT is not the correct expression when talking about months.

Figure 1: The map of central Europe is unnecessarily large and could instead be an insert in the lower satellite image.

Figure 2: The A) and B) of the caption should also be shown in the respective subplots. Instead of two satellite images, I would rather prefer a map showing the elevation and the area of the catchments.

Figure 3: These photos are not needed. I do not see any justification to show these photos.

L 133: "inhomogeneity" = heterogeneity?

L 134: Is that sampling spot as well shown in the Figure 2B that you refer to? I cannot see it labeled.

L 156 – 158: This would be part of the methods section

Figure 4: "binary plot"? That's something else, because the presented data is not binary.

L 167: "pseudo cyclicity"? How is that defined? To me, it looks not pseudo at all, but like a very common seasonality pattern for such data.

L 181: I don't see a relevance to compare your alpine data with "warm and dry areas such as Africa" (also Africa is too large to just have one defined climate).

L 188: Is there permafrost in the studied catchments? If so, please add info to site description.

Fig. 5 and 6: What do the error bars indicate?

L 199: MAAT? You had this defined earlier as mean annual air temperature. This needs to be adjusted here.

L 198 – 201: This fits better in a methods section

L210: minor role

219: "pseudo-cyclicity"?

L213-224: This is all part of methods

L225-233: This is all part of results

L246: I think that you are suggesting to use the time lag between the estimated precipitation isotope data (derived from temperature observations) and the observed river water isotopes to infer the time it takes for snow to melt and rout to the outlet. However, it seems that this approach would neglect the time the snowpack accumulates and is present. This latter time would be also part of the time lag and not only the mentioned snowmelt and flow paths.

L 267: Why "if"?

L286: "equation of state of water predicts" definition and reference missing

L 313: It is unclear why it is referred to a "dampening effect of snow melting". The opposite is the case. The relatively concentrated snowmelt allowing large amounts of precipitation to enter the catchment in short time period – compared to a no-snow climate in which the same precipitation amount enters the catchment over several months – is intensifying the changes in the isotope composition of the stream water.

L 317: It seems that this 3 to 4 months also includes the period of a present snowpack, because you do not present any consideration of lag between snowfall and snow melt.

L 320: The effects of climate warming have not been discussed in this manuscript.