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Comment on hess-2022-132

Anonymous Referee #2

Referee comment on "Seasonal δ^2H and $\delta^{18}O$ 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-RC2, 2022

General comments

This paper uses 2-years of monthly stable water isotope values in streamwater from a 100km^2 French Alpine watershed to estimate the average time shift between snowfall and snowmelt being discharged at the catchment outlet. They further calculate d-excess values with the aim to identify moisture sources of precipitation, however, the small data set does not allow a conclusive analysis.

The paper lacks a clearly defined research question or an objective. The study results were not well placed into the wider context of Alpine (isotope) hydrology (e.g., is the result of a 3-4 month time shift exceptional or rather expected from the findings in other studies).

It is not clear as to why this study is relevant. Whereas the authors talk at length about the importance of Alpine water resources and the potential impacts of climate change on earlier snowmelt, they don’t conduct the necessary analyses to support their statements.

Given that the data set is rather small and many conclusions remain unspecific, I recommend a rejection of the manuscript.

Specific comments

Does the paper address relevant scientific questions within the scope of HESS?

- This paper does not address a specific research question. It rather presents and discusses two years of isotope data from a 100km^2 catchment in the French Alps.

Does the paper present novel concepts, ideas, tools, or data?

- The data are presented for the first time, although stable water isotope data from Alpine streams have been published before.
- The first two sentences in the Introduction read (L30-34): "We investigated through a new methodological approach the complex relationship between the atmospheric water circulation, the local precipitations, the buffer effect of snow, swamps and soils and the resulting main water outlet of a watershed located in an alpine context. We show the importance of the transfer time from mountain-accumulated snow to the lower cultivated areas as a sensitive key variable responding to the current climate change, with a lowering of the snow cover surface and a reduced buffer effect of snow compared to rainfall.» However, nowhere in the paper, the authors explain why their method is «new», and they don't show the importance of the transfer time! Thus, the novelty of the data/results/conclusions is not at all discussed in the paper.

Are substantial conclusions reached?

- The small data set does not allow for the conclusions to be substantial. The authors conclude that (L304)"(...) the river water mostly preserved the original isotopic compositions of precipitations. This observation means that the water did not suffer significant evaporation or mixing with other sources of water during its transit through the watershed.» This conclusion cannot be drawn without considering the hydrologic regime at the time of sampling. I would suspect that samples collected during baseflow will have a different isotopic composition/d-excess than those collected during high flow (i.e., during rain or snowmelt).

Are the scientific methods and assumptions valid and clearly outlined?

- The methods for data collection are valid. Some assumptions for data analysis are questionable and not well founded. E.g., the authors assume that the lightest isotopes in precipitation always occur during Dec-Feb (although L234 says "March"); is not clear whether this is true for both years of observation and why the authors decided to calculate long-term mean-monthly precipitation isotope values instead of the actual

monthly isotope values for the specific study period. Furthermore, the authors interpret d-excess values without taking the climatic and hydrologic conditions into account.

Are the results sufficient to support the interpretations and conclusions?

- No, the results are insufficient to support the conclusions reached in this paper.

Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

- The authors provide the data in the manuscript.

Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

- This could be improved, e.g. the authors relate to other work during paragraphs that are not relevant to this study (e.g. L47-62). They don't relate their work to any isotope studies from other Alpine catchments, e.g. (Seeger and Weiler, 2014).

Does the title clearly reflect the contents of the paper?

- The tittle suggests a transit-time modelling study. This was clearly not done here.

Does the abstract provide a concise and complete summary?

- The abstract is not concise. It starts with mentioning that the Alps are an important water resource for Europe and ends with suggesting that water transit time modelling will help in evaluating the impact of climate change on Alpine water resources. This is not at all in line with the scope and the results of the presented study, which is based on 2-years of isotope data from one catchment. No transit-time model was used, no climate change impact assessment was conducted.

- A research question or objective is missing. Therefore, it is not clear, what the results of this study should be.

Is the overall presentation well structured and clear?

- The paper is not well structured. E.g., how can the authors conduct a study without a well-defined research question?
- The introduction starts with a repetition of the abstract (L30-37).
- Some Methods are part of the Discussion (Eq. 2 & 3). This is very confusing.

References:

Seeger, S. and Weiler, M.: Reevaluation of transit time distributions, mean transit times and their relation to catchment topography, Hydrol. Earth Syst. Sci., 18, 4751–4771, 2014.