

Hydrol. Earth Syst. Sci. Discuss., author comment AC3
<https://doi.org/10.5194/hess-2022-48-AC3>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Reply on RC3

Anthony Michelon et al.

Author comment on "Hydrodynamics of a high Alpine catchment characterized by four natural tracers" by Anthony Michelon et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-48-AC3>, 2022

Dear third reviewer,

We are very thankful for the time and feedback you gave us.

Please find below a point by point response (in italics) to your specific comments. We are pursuing deeper analyses similar to those that you recommend for subsequent publication. This paper is really meant to focus on the added value of this set of observations fairly directly from the field. We will however develop our discussion and conclusion to address the imbalance you describe. We also will refine our conclusion to be concrete rather than the vague claim that you perceived of "more must be done".

We will carefully revise the manuscript and incorporate your minor comments and technical corrections once we receive the editor's response.

Sincerely,

The Authors

=====
=====

I am reviewing MS HESS-2022-48 by Michelon et al. on "Studying the dynamic of a high alpine catchment based on multiple natural tracers". The authors report on a quite comprehensive (3 years long) dataset of temperatures, water electrical conductivity (EC) and stable isotopic compositions in a range of (eco)hydrological compartments (stream, springs and vegetation) of the Swiss "Vallon de Nant" high-altitude headwater catchment for the investigation of "dominant hydrological processes".

The MS is well written, easy to follow and of appropriate size, and the figures are well crafted (despite incomplete legends). Finally, the MS obviously fits the scope of HESS well.

The main outcome of the study seems to be that "more must be done", possibly using the

same types of observations (using a multi-tracer framework by coupling EC, temperature, and isotopic analyses) but at higher temporal resolution to achieve the aforementioned goal. There is a general imbalance between the amount and quality of data collected and the quite superficial analysis presented. For a deeper analysis, the authors could, for instance test a simple two-end member approach as per the seasonal origin index, with rain vs snow as end-members to investigate tree water uptake seasonal use?? Also, some of the co-authors have extensive knowledge of catchment hydrology process-based modeling; the data may also call for such an application to calculate e.g. transit time distribution etc.

>> Thank you for this feedback and suggestions.

My specific comments follow below.

TITLE

The dynamic in what?

>> This is a good point. As you know, Alpine catchments are considered particularly dynamic (see the introduction of the Mächler 2021 paper about the same catchment for a more complete explanation) and we would like to emphasize that in the title. With the support and recommendation of the editor, we are planning to change the title to:

- Hydrodynamics of a high alpine catchment as characterized by four natural tracers.

ABSTRACT

L16. This goes for pretty much all environments displaying dynamics in water δ , right?

>> This is true, but is especially apparent and relevant in this environment with clear seasonal cycles influencing these tracers. In any case, the abstract has been completely reworked according to suggestions of other reviewers and this sentence no longer appears. In the one location still using the phrase "such environments", we have added "dynamic" to clarify the characteristic of the environment that necessitates year-round water sampling.

INTRODUCTION

L55. I would not refer to unpublished works, also because you have quite a few papers to cite from, some of which are only 1 year old.

>> the reference list will be updated upon resubmission and any still unpublished works will be removed.

L64. It is your "overall" objective, not (one of) your specific one(s).

>> indeed, we will change the wording.

L65-66. Or a mix of the two? Or is it implied here?

>> indeed, we have clarified this by changing the wording to: "the alteration and mixing of subsurface storage and from localized snow melting"

METHOD

L186. It comes as a surprise at this point of the MS that you would sample from the vegetation. What is the purpose? This should be introduced somewhere earlier.

>> Indeed, we will remove this and save it for a subsequent analysis (and manuscript) focused on hydrological interactions with vegetation.

L190. There is just one delta notation, used for different elements and their stable isotopes. Please rephrase.

>> this has been rephrased

L196-197. "and data from the last 6 injections were kept"

>> thank you

L209-210. To be "less temperature sensitive" and "convey additional information on evaporation processes and on climatic conditions" seems to be contradicting... please rephrase/elaborate

>> We have reworded this:

Both d-excess and ^{17}O -excess are known to respond to relative humidity during evaporative processes but ^{17}O -excess may be less temperature sensitive (Surma et al., 2021; Bershaw et al., 2020) than d-excess and thus changes in its composition may be more sensitive to net evaporation, including secondary evaporation, as well as the meteorological conditions even when they would be invisible with d-excess (Risi et al., 2010).

L219. Why "GRAS" and "ROCK" are in capital letters?

>> We are using four letter capital abbreviations for names of sampling locations. We will make this more clear in the site description.

L241. "long"?

>> We have replaced with the length of series.

L242. "influenced by the low"

>> We have replaced "influenced" with "limited"

Figure 3. It is a nice picture, but could use more info: e.g., name each of the three different panels. It is difficult to understand what "bottom" refers to (i.e., is it the bottom part of the top panel, or the actual bottom graphics?). The caption should be as self-explanatory as possible, therefore define also here what "B", "E", "M", and "R" mean. Bottom graphics: it is difficult to differentiate between streamflow data and the water temperatures in gray colors. Maybe move the 2nd y-axis legend ("Streamflow [mm/day]") a bit down so that it faces lower values, e.g. [0-20 mm/day] in each panel?

>> Thank you for your feedback. We will incorporate as many of your suggestions as possible as we rework the figure.

RESULTS

Usually, (campaign) results are related in past tense to differentiate with literature findings and general statements (made in present tense). Also avoid using "shows this and that...". Use a more direct formulation, e.g., in L251: "The baseflow period extends from the end of September to early spring (mid-March to beginning of April) and shows a streamflow of around 1 mm/d only" vs. "The baseflow period extends from the end of September to early spring (mid-March to beginning of April) with streamflow values of approx. 1 mm/d only..."

>> Thank you for this feedback. We will take it into account as we edit and restructure the results section.

L257-259. Could be a nice discussion and moved there.

>> Thank you, we will.

L260. "due to an important water input from snowmelt." Do we need this piece of info again?

>> You are right, this is redundant. We will delete it.

L260-262. But isn't it because there was no early melt period that the melt period started

sooner in 2018?

>> Perhaps, we will reword this to make this clear.

L317-319. Avoid such formulation and just start with the actual results, e.g., "Correlation between spring and air temperature at the Auberge station was source-specific...".

>> Indeed, this sentence has been modified as to recommendations from a previous reviewer.

Also: BRDG and ICEC acronyms are not defined

>> Thank you for pointing this out, we will define all point names in the site description section.

L320. I am not a specialist, but does a spring have a "volume", strictly speaking?

>> You are right, we have clarified this to refer to the magnitude of flow out of the spring.

L325. "temperature [curve]"

>> We have changed this to: "The shape of the curve of temperature fluctuations of the ..."

Table 1. Why it the maximum stream temperature not reported?

>> This is an oversight on our part, we will add it.

L353-354. The Lag "L" should have its own equation reported in section 3.2. It is difficult, at least to me, to understand what was done here...

>> As noted, we reported this in Appendix 2, but will happily move it back to the methods section so that it is clearer for the readers.

L401-402. Such an intro within the result section is not needed. Instead give the results and point to the figure/table for substantiation.

>> Thank you for this reminder. We plan to vigorously edit the results sections so that it is more to the point.

L403. Please define "lapse rate".

>> Indeed, we have added a sentence regarding lapse rate definition and determination in the methods as per a recommendation from another reviewer.

Fig. 5 vs Fig 6 & 7. Why are you connecting the dots for springs, therefore implying linear interpolation, when you do not do this for e.g., streamflow or rainfall?

>> We are sorry that you felt like we are misleading you. We felt that this depiction made it easier to distinguish and compare the fluctuations at the different springs. We will reconsider the lines and be more clear about their purpose in the text, regardless.

Also replace " δD " by " δ^2H " throughout, please. I would remove all unnecessary material, that is all variables that are not described in the text. This would also make the figures more reader friendly.

>> Thank you for this advice, indeed, we only use δ^2H in the text. We will change the notation in the figures. Additionally, we are planning to move some material from the figures to the supplementary files.

L427-428. What is shown in Fig. 5 should be discussed, so why showing both δ^2H and $\delta^{18}O$ when only $\delta^{18}O$ is discussed?

>> indeed, we are planning to move the other subplots to the supplementary information as per suggestions from other reviewers.

L431. "with [lower] isotopic values"

>> thank you

L455. "and a significant decrease in the [isotopic composition]".

>> thank you

What about the rest of the variables this time ($\delta^{18}O$ & $\delta^{17}O$)?

>> indeed, we said we focus on $\delta^{18}O$, we will correct this or clarify.

L475. "local scale process information". Name some examples.

>> Here we are referring to the interplay of mixing verses fractionation in the immediate vicinity of sampling. In order to interpret these results, we must consider the storage and

release processes on a catchment scale.

L481. What evaporation line? Here you are looking at the deviation from the LMWL...

>> true, this is a typo on our part

L484-485. I do not understand. Please rephrase. Do you mean to say that larch trees xylem water have low Lc-Excess values, meaning they sample from water departing isotopically from meteoritic water sources (i.e., evaporatively-enriched soil water)?

>> You are correct, this is an oversimplification on our part. We will remove discussion of vegetation for the purposes of this paper and focus on it in a subsequent paper.

L486. "negative median [lc-excess] value"

>> Thank you

L492-496. 17-Excess measurements are very tricky, and I ask myself if differences to other studies have to do with the analysis technique used, i.e., mass vs. laser spectrometer?

>> We do not believe that this is the case, as for both mass and laser spectrometers, the calibrations are done with standards that are calibrated with the MS-analytical approach. However memory effects can influence the 17-O measurements. We will add more discussion regarding the risk of this in the respective methods and discussion sections as appropriate.

L508-509. This is not needed.

>> Indeed, we will reword this to actually be a topic sentence.

DISCUSSION

L514-515. This I never read δ □□□: please change to e.g., "an enrichment (depletion) in heavier stable isotopes at AUBG (BRDG)..."

"Such a depletion by heavier isotopes"

>> We've revised it to read:

However, we measured diverging isotopic ratios in two springs, one demonstrating an enrichment (AUBG) and the other a depletion (BRDG) in the heavy H- and O-isotopes during winter (Figure 5).

L534-535. "Although the $\delta^2\text{H}$, $\delta^{17}\text{O}$ and $\delta^{18}\text{O}$ annual medians of AUBG, ROCK, BRDG and ICEC decrease with elevation"

>> Thank you

L622. Again, I doubt that the $\delta^{17}\text{O}$ and ^{17}O -Excess add value to the already measured $\delta^2\text{H}$ and $\delta^{18}\text{O}$ time series...

>> This discovery would already be an added value as not that many $\delta^{17}\text{O}$ and ^{17}O -Excess have been made so far. We will emphasize this.

CONCLUSION

L650. The reader still does not know what you mean by "local-scale snow hydrological processes"

>> We will move this conclusion into a discussion section and elaborate more extensively and explain what we are referring to here.