Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC3
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Comment on hess-2022-48

Anonymous Referee #3

Referee 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-RC3, 2022

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.

My specific comments follow below.

TITLE

The dynamic in what?

ABSTRACT

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

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 I would not refer to unpublished works, also because you have quite a few papers to cite from, some of which are only 1 year old.

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

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

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.

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

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

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

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

L241. “long”?

L242. “influenced by the low”

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?

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…”

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

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

L260-262. But isn’t it because there was no early melt period that the melt period started sooner in 2018?

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…”.

Also: BRDG and ICEC acronyms are not defined

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

L325. “temperature [curve]”

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

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…

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

L403. Please define “lapse rate”.

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? Also replace “δD” by “δ2H” 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.

L427-428. What is shown in Fig. 5 should be discussed, so why showing both δ2H and δ18O when only δ18O is discussed?

L431. “with [lower] isotopic values”

L455. “and a significant decrease in the [isotopic composition]”. What about the rest of the variables this time (δ18O & δ17O)?

L475. “local scale process information”. Name some examples.

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

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)?

L486. “negative median [lc-excess] value”

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?

L508-509. This is not needed.

DISCUSSION

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

“Such a depletion by heavier isotopes”

L534-535. “Although the δ2H, δ17O and δ18O annual medians of AUBG, ROCK, BRDG and ICEC decrease with elevation”

L622. Again, I doubt that the δ17O and 17O-Excess add value to the already measured δ2H and δ18O time series…

CONCLUSION

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