

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
<https://doi.org/10.5194/hess-2022-48-RC2>, 2022
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Comment on hess-2022-48

Anonymous Referee #2

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-RC2>, 2022

Title: Studying the dynamics of a high alpine catchment based on multiple natural tracers

Michelon et al., 2022 HESS

General comment:

The paper makes an important contribution to increasing the understanding on flow dynamics in alpine catchments. This is done by combining different datasets, including stable water isotope tracers, EC and Temperature. Sampling of stable water isotopes in different storage compartments in the catchment (including vegetation) helps disentangle different hydrological processes (i.e. how does the catchment function). The figures are well prepared and the fact that the data is available will surely aid further research in alpine areas. The methods are clear and sound. Having said that and despite the interesting topic and relevance of the study I have concerns with the presentation and structure of the manuscript. In general;

- The Methods section would benefit from being more brief.
- The results section should be revised and the sentences which discuss results moved to the discussion section.
- Interpretation of results from the multi-tracer approach would benefit from the addition of a conceptual diagram (see specific comments in E).
- More references to international literature is needed in discussion and careful selection of figures to be referenced.

- Conclusions section needs strengthening.

Below I leave section by section comments which include both specific and technical comments.

- Introduction:

Line 51 - 70: It seems that you repeat in a way the study aim (see technical comments below). I suggest to restructure that part starting with a clear overarching aim and then

- (Section 2.1.) Study area: this section is unnecessary long. Is all the provided information then related to the study results? If not, you can reference previous papers for details on e.g. geology, and save space here.

Lines 98-102: as written currently this paragraph reads like a discussion and it is not (e.g. "this topographic particularity might seem enough"). Please rewrite or move to discussion (e.g. to section 4.3.2.)

Figure 1: There is no "A" on the Figure 1, as indicated in the caption, please add. In caption "where the spring is picked up" – what do you mean by this? Also, can you make the legend of the B map, at present it is difficult to read.

- (Section 2.2.)

Line 130 – 135: This seems like results (i.e. you analysed the data to derive the annual average streamflow, for example). I would somehow include it in Results section.

Line 139 – 143 refers to the meteorology. Given the title of section 2.1. starts with meteorology, I suggest you present this first to follow a logical order.

- Method: This section is very long. While the methods described are worth mentioning the descriptions are too wordy and make the reading monotonous. Here a few

examples/suggestions on how to change that along with some minor technical notes.

Line 153: Change "Water" (first word) with "Streamflow". Water is too generic, you sample water from various places.

Line 167: " The same borosilicate glass vials were also used for..." – this sentence is long and redundant. Define the type of vials and their volume once at the beginning of the subsection 3.1.1. and then only refer to them as "vials". It will save a lot of reading time.

Line 179: remove "sampled", as it is redundant

Line 219: I can count 5 springs on Fig.1 but T was measured in four. Can you spell out in which one you did not measure temperature?

Subsection 3.1.2. Is extremely long and too much detail is given. These are standard methods, just give references and keep it tight. Only if you did something different or unique in the calculations then spell out which part that is to guide the reader.

Line 225: Reference "Figure 1" in "(At Auberge station).

Line 227: see previous comment on excessive description of the vials

236: change "particularly useful for us" to "particularly useful for this study"

244: you mention that the gridded data was useful for gap filling but you do not say when did you have do gap fill and what % of your data that is. Please spell out.

- Results

Specific comment: The results section contains parts of discussion which should be moved to the discussion section (some examples below).

The interpretation of results and to connect findings via different methods I suggest that you include a new figure, a conceptual model/diagram, which can also serve as a graphical abstract. This figure can be composed of 4 panels (A to D) and each one of them can describe graphically what have you learned with the multitracer method in A) The baseflow period, early melt period, melt period and seasonal recession period (as described in lines 248-249). This will aid the reader and will align with the aim "to provide transferable insights into the value of observed variables for hydrological process investigations in comparable catchments" (see lines 68-70).

Other comments:

Lines 257-259: This is discussion. Move it there.

Figure 3: Add to the legend what B, E, M R mean. This saves the reader having to go back to the text and search for definitions. What is the faint blue line in the bottom panel? It looks as faint as the streamflow. At present this bottom panel is a bit confusing. Refer to Figure 1 for the abbreviations of e.g. soils, piezometer, spring IDs.

Line 317: sentence is too long. Change to "Sampled spring and ground water sources show varying correlations..." and add...";having PZ1 the strongest correlatio..."

Lines 334 – 344: example paragraph where the conceptual diagram will help the reader understand the description.

Lines 353 – 359: this seems to belong to methods.

Lines 364- 368: Move this to the beginning of subsection 4.3.3. as this presents a more general finding. Then discuss the rest but please rewrite and remove the details that may belong to the methods.

(Section 4.1.)

374 – 379: This is more of a discussion, not a result.

379-381: Sentence is too long. Rewrite or split in two.

Figure 4: You do not make use of the subplot annotations A,B,C, etc. in the caption. Please edit your caption and organise by subplots. Also, when you reference this figure in the text you start with Figure 4F (Line 370). Please organise your subplots so they match the story line (e.g. if you first talk about EC then present the EC plot as Figure 4A). Same comment on the order applies to subsection 4.5.1.

Line 406: this is the first time you use lapse rate. Please define it very briefly earlier (e.g. in methods).

Subsection 4.5.1. is structured poorly. You mention a lot of Figures but make little use of them.

Figure 5- 7: Similarly to Figure 4 you make subplot annotations A,B,C,..but do not use them in the caption. Also, is there a way to skip one or two of the subplots (and move them to supplementary materials) and consequently make the plots larger and horizontally oriented. At present it is very difficult to read them if you don't print the manuscript.

Subsection 4.5.2.

Line 427-428: if the variations are similar between the different stable water isotopes and you will comment only on delta 18 O then why don't you save space and present those in supplementary material?

Line 439: remove "it's"

Subsection 4.5.3., 4.5.4.

Make more reference to your Figures in the text. And similarly to Subsection 4.5.2. - move to supplementary materials the figures you do not reference.

Subsection 4.5.5.

Line 480: The first sentence is not a good start of a subsection. Remove is and simply reference the figure in brackets in a rewritten first sentence. In the first sentence present the general idea/finding from Ic-excess. Second sentence at present is too difficult to

follow as it is too long– split in two.

- Discussion;

You discuss the results in terms of interpretation of the data but do not make a reference to other literature. In this regard the discussion needs more work and strengthening.

Also, the terminology used in this section sounds a bit awkward. Examples below:

Line 515: “enrichment in light isotopes during winter” – which are the light isotopes of hydrogen and oxygen? Do you mean “stable water isotope signal becomes more depleted during winter”?

Lines 516, 534: “light isotopes” – same comment. Revise the terminology

Section 5.2. would benefit from reference to the conceptual diagram I suggest above.

Lines 555 – 558: this sentence is too long and difficult to follow. Rewrite.

Line 578: “streamflow isotopes” would sound better as “isotope signal in streamflow”

Line 611: “which locations become more enriched in heavy isotopes” – the location do not become more enriched, it is rather the water in those locations shows a more enriched isotope signal. Please rewrite.

- Conclusions

The conclusions section needs strengthening. Mention what are the implications of your findings and how is this study important in terms of better understanding the water dynamics of Apline catchments.

Lines 650 – 655: This is not a strong ending of a conclusion section and it does not reflect the efforts employed in developing and executing the field study. I suggest a small subsection is dedicated on delta 17 O somewhere earlier in the manuscript and all the findings are concentrated there.