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Comment on hess-2021-376

Anonymous Referee #2

Referee comment on "Evaporation, infiltration and storage of soil water in different vegetation zones in the Qilian Mountains: a stable isotope perspective" by Guofeng Zhu et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-376-RC2>, 2021

General Comments

This a potentially interesting paper, but one that needs major attention before it is suitable for publication. The paper is poorly written in places. While I have sympathy with authors having to write in a second language, which is something that I cannot do, some sections of the paper are very difficult to follow. More importantly, the sections of the paper are not well linked. It is not clear from the Introduction how the paper addresses the important issues. The same can be said about the Discussion where it is not clear how the data in this paper inform the issues being discussed. For example, runoff generation is mentioned in the introduction and appears in the general conclusions, but there is no discussion as to how the data in the paper help us understand it (there are several similar examples as well). The sections describing the data tend to be very generalised and the data description needs to be more informative. Moreover, the data need to be presented in the paper or as a supplement.

Overall, the paper needs to be rewritten so that the data are discussed in a more rigorous manner that help understand the aims. I am not convinced that it actually addresses important issues or that the aims of understanding the memory effect or runoff generation are advanced by this study.

Title: Having a title that is grammatically incorrect is not a good way to promote your research. Something like: "Evaporation, infiltration and storage of soil water in different vegetation zones in the Qilian mountains: a stable isotope perspective" would be better

Abstract

The abstract needs improvement. Abstracts are important as they are what convince the readers to look at the rest of the paper. They should convey not only what has been studied and why, but should also contain enough details so that the main conclusions are evident. This abstract needs improving, specifically:

- Be specific: "different water bodies in different vegetation zones" does not convey what you have done
- Avoid qualitative terms such as "weak"
- Some of the sentences are unclear. I am not sure what "The water storage capacity of surface soil was weak in vegetation zones" really means as surely all the catchment is vegetated?)
- There are several grammatical and spelling errors (Nevertheless) that detract from the work.

Introduction

The introduction is also not very clear. Some of this reflects the writing style and occasional poor grammar. As well, there needs to be a much clearer explanation of the background. The explanations are vague and would not convey much meaning to anyone not working in the field. There needs to be clearer explanations and more precise terminology.

L31-33. Not very clear what you mean here

L48. "Storage" is not a transport mechanism

L50. Do you mean on the ground surface or in the near-surface part of the soils?

L48-75. This would not be readily understandable to many readers who had not worked with these types of data. It is too generally worded and needs details. This paragraph is important as it sets the framework for using the stable isotopes to understand processes

- Define that you are discussing ^{18}O and ^2H data (there are lots of stable isotopes!).
- Terms such as "makes soil water isotopes enriched" are vague. Specifically,

evaporation enriches the residual water in ^{18}O or ^2H (or increases the $\delta^{18}\text{O}$ and $\delta^2\text{H}$ values)

- Likewise, "soil moisture fractionation is positively correlated with evapotranspiration but negatively correlated with precipitation". Are you talking about the magnitude or sign?
- How significant?
- Define the d-excess (briefly)
- L63-70. Lacks detail and is unclear.

L76-78. Not clear what you mean by this. Are the water resources more unstable or are they transitioning?

L84. "Heat conditions" – do you mean temperatures?

L82-90. These are fine as general aims, but can you explain (briefly) why this is important (i.e. what are you doing that is new, what are the broader implications?). There is a disconnect here between the broad general themes in the rest of the introduction and your specific study. Also, runoff generation and the memory effect are not explicitly discussed in any depth in the paper (need to make sure that your aims are actually what you discuss).

L88. If it is important, define the memory effect and explain why we need to understand it

Study Area

This section needs referencing. Also a few more details as to the spatial variation of rainfall and temperature (I presume that the highest rainfall and lowest mean temperatures are in the mountains?)

L94. What is a "first-class tributary"?

L98-101. Probably worth reporting the Koppen Zones.

L103-106. Refer to Fig. 1.

Fig. 1. What is the inset on the left-hand map?

Data and Methods

The methods used here are standard and suitable for the project. As with much of the rest of the paper, there are a few details lacking and the explanations are not very clear.

L111-113. It would be helpful here or in Section 2 to outline what 2017 was like in terms of rainfall and temperature as these vary year-by-year. In particular, distinguish between long-term averages and values in the sampling year.

L116-122. This is rather a clunky description (not sure that you need to specify explicitly that you wrote dates on bottles). What do you mean by "four parallel samples" being also collected?

L143. It's "permil" not "thousands". As written, "thousandths of the Vienna Standard Mean Ocean Water (VSMOW)" is meaningless.

Section 3.2. The analysis is only part of the uncertainty. Did you perform multiple extractions on the same sample to test the uncertainty associated with that. This will undoubtedly be higher and needs to be considered.

Section 3.3.1 The line-conditioned excess is less used than the d-excess (but is potentially more informative). You should explain what it is (and define the term). The explanation "The physical meaning of l_c -excess is expressed as the deviation degree between isotopic values in samples and LMWL, which indicates the non-equilibrium dynamic fractionation process caused by evaporation (Landwehr et al., 2014; Sprenger et al., 2017)" is not very clear.

Section 3.3.2. More details are needed as to where these data are derived from. Are they local data measured at the field site or interpolated estimates? Application of the Penman-Monteath equation is very data sensitive. What do you think the errors are here?

Section 3.3.3. These are based on your measurements, yes? Again, do you have estimates of uncertainties. Also, some of the techniques (eg moisture content) need more detail.

Results

This section suffers from the shortcomings of the rest of the paper. The explanations are not very clear and are often overly general. Also, I cannot see where the raw data are (no Table or Appendix); presenting the actual data is required.

L175-178. How precise are these values (i.e. is the 1dp precision warranted)? What was the rainfall during those times?

L180-182. Not very clearly worded.

L213-220. The ranges in stable isotope values are probably more useful. Suggest that you report the range and the mean (you can omit the SD as that is less useful). Also report the number of observations, so we get an idea of how much data there is. Ideally the mean should be weighted by precipitation amount (it is not clear that that is the case, but you should be clear whether it is).

L220-224. Poorly worded.

L224-227. This isn't really that obvious from Fig. 3. Can you report the magnitudes in the text?

L232-260. This section has too little detail in it to follow. You need to explain the data more specifically (avoid vague terms such as "depletion" or "enrichment" and report some values). More importantly where are the data? Fig. 4 is labelled as a "heat map" but seems to be the values (I think) and they are on Fig. 5. However, these also need to be in a Table somewhere.

L266-269. Speculative, can you provide a reference to show that these processes cause secondary evaporation.

L270-275. A reference would also help here

L275-276. Seems redundant as I'm not sure where else the moisture could come from.

L288-295. Again, lacks detail. It is difficult to follow these arguments when the data is discussed in very vague terms.

L298. What is "dynamic fractionation"?

L296-309. As with much of the rest of this section, I struggled to follow the details. The explanations are not clear, there are a fair number of general statements that lack detail, and a number of findings that are not obvious. For example, "Evaporation signal can easily penetrate deep soil, which made the GWC value of all sampling activities at this site lower than 20% (Fig.6)" which seems to be at odds with "With the increase of soil depth, the fractionation signal gradually weakened".

Discussion

This section has some interesting ideas in it but it is not well linked to the data in the study. You need to show how the data that you collected informs our understanding. Some of the later part of this section is written more like an introductory literature review.

Section 5.1

L325-354. Some of this section describes the data (the observations on soil moisture) and that material belongs in the results.

Section 5.2

This section does not link well with the results. It is difficult to follow how your data help you make these conclusions. More justification and explanations are required. Moreover, there is little discussion of processes here – how does the data help understand how processes operate? You have concentrated on discussing the isotopic variability, without using it to understand what is going on.

This is the section where you should discuss aspects such as the memory effect and runoff generation, but you do not do so.

Section 5.3.

This section reads more like an introduction. It is not clear how what you have done in this study relates to these broad general findings. As with the Introduction, you need to make a clearer link between your study and these general statements. This are all important

issues, but there needs to be linkages.

Climate change is mentioned several times, but it is not clear how your study informs our understanding of its impacts. Those types of links need to be made clearer if they exist. Likewise, there are comments about groundwater recharge and runoff but no indication of how your results help understand those processes. Runoff generation was not actually discussed in the body of the paper (it appears in the introduction and the end of the discussion, but not in the discussion of the specific results).

Same comments apply to: subsurface runoff (presume that you mean interflow?); the management practices; human activities. These are topics that all appear in this section with no real link to the data in the rest of the paper.

There are also a number of superfluous details here. For example, why is mining waste (L426-428) relevant to this study.

Conclusions

As with the discussion, the links to the study are not well made. In some ways this material is less general than some of the latter parts of the Discussion (Section 5.3) and it would be worth reordering so that you have the more general ideas at the end.