

Reply on RC1

David Mennekes et al.

Author comment on "Ecohydrological travel times derived from in situ stable water isotope measurements in trees during a semi-controlled pot experiment" by David Mennekes et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-674-AC1>, 2021

We thank Referee #1 for the comments, which were very useful to prepare an improved version of the manuscript. We answer below to each comment in a point-to-point reply.

(comments by RC are bold, answers are normal font)

General comments

1)

Thank you for this comment. We agree and connected the first part of the introduction better with the importance of the here presented in situ method. Furthermore, we mention and transfer arguments in the introduction again in the discussion.

2)

Thank you for this comment. We shortened the results, e.g. for the climate, soil conditions subsection we deleted more specific air temperature information.

For the isotope label arrival section, we summarized / shortened information about specific arrival patterns (starting L292).

We changed the order of results in the subsection "comparison of in situ vs destructive", talking first about 2H and then 18O which is more consistent with the other text.

Regarding figure 6: We understand the problematic of the figure. We tried to rearrange axes and categories. However, we think that in the current version one can see best, especially for 18O, that differences between methods (in situ vs. destructive) are much higher than between species. Furthermore, one sees well the variability for 2H. Regarding differences between the cryogenic extraction and water vapor equilibrium method, we agree that differences are hard to detect in the graph. However, we argue that this was not our main focus since here also more data would be needed for a fundamental research.

3)

Thank you for this comment. We generally shortened the discussion and start with an introductory sentence now. Regarding your specific points:

Avoid repeating the aims/goals of the study. This information should be in the Introduction

We did delete the repetition of our aims/goals.

Start the Discussion with an opening paragraph in which in a couple of sentences, you report the two or three most relevant results of the study but without going into much detail. Importantly, compare these main results with the most relevant literature. Currently this would be in the paragraph starting at L400, but I am not sure that you are putting everything relevant there. Obviously, my proposal for this first paragraph is questionable. In any case, I find it useful for the readers to make it easy to find the most relevant results and conclusions in the beginning of the Discussion.

Thank you for your suggestions. We followed your suggestion and start the discussion with an introductory sentence.

Try to avoid as much as possible the repetition of the results (L475-484 but check the rest).

We checked the discussion for possible repetition and deleted those where possible.

Do not report others' results if they are not clearly linked to yours (Millar et al. 2018).

Thank you for your remark. We deleted this section since it is clearly not relevant for our paper.

Structure the paragraphs (not only the subsections) with clear and identifiable concepts, do not leave isolated two-line sentences.

We improved the structure of this paragraph.

The Conclusions are well-written but somewhat repetitious with the rest of the Discussion. I would use this briefer conceptual scheme for the rest of the Discussion, while embedding the relevant literature. In any case, I think that the Discussion should be shortened, retaining only the most relevant points to discuss.

Thank you for this comment. We have combined conclusions and implications into one section and considerably shortened it

Specific comments

Abstract (L9): Perhaps I miss a sentence on the main goal of the experiment.

Rephrased the beginning of the abstract (L9 – 11) to make our main goal clearer.

L21.

Thank you for pointing this out. It is based on the measured stable water isotope signals. We added this to the sentences.

L30-32

We rephrased the sentences to: "Challenges are partly the lack of sufficiently resolved data but also the lack of ecohydrological process understanding, e. g. the origin of water used by different tree species (Brinkmann et al., 2018; Ellsworth et al., 2007; Sprenger et al., 2016a; Volkmann et al., 2016b)."

L35

Thank you for your comment. We rephrased the sentences according to your suggestion.

L37

We agree with your comment and rephrased the sentences: "For the separation of water pools based on the concept that potentially each water pool has its own unique stable water isotope signature due to underlying physical or chemical fractionation processes, highly precise and / or frequent stable water isotope measurements are needed (Dubbart et al., 2019; Ehleringer and Dawson, 1992; Evaristo et al., 2015)."

L40-41

We totally agree with your comment and changed the text.

L42

We deleted the study by Wigmosta et. al. in our citation.

L42-48

We added some words to the paragraph to make our message more precise.

L49

Thank you for your suggestion! We changed information to "composition"

L50

Yes, "consecutive" was the wrong word. We changed it to "subsequent".

L52

Yes. We changed it according to your suggestion.

L56

We changed the beginning of the sentences to: "However, it is undebatable that...."

L66-68

we rephrased the sentences to: "Furthermore, for membrane-based systems no isotope fractionation could be observed when water vapour passes through the membrane. However, it should be considered that a considerable amount of air / vapour is withdrawn from the soil or xylem media by the necessary flow rates of the isotope analyser."

L93-94

Thanks. We added the word "water"

L127-L128

Yes maybe... However, we also wanted to start the experiment a bit earlier but ran into some troubles just before starting. Next time we would use a soil with better known isotopic composition. On the other hand, since the "old" water wasn't completely replaced we found some interesting results regarding the plant water uptake.

L130

We changed the sentences to: "During the first labelling, we split the total applied amount of label water into two rounds of irrigation to be able to better monitor the arrival in soil water content"

We hope that the sentences is clear now.

212

We added the relevant information.

L280

Partly yes. A colleague of us, Simon Haberstroh, works a lot with cork oak and sap flow sensors. He told us that likely the tree would inactivate damaged sapwood tissue which somehow would be a sensor failure. He observed partly similar behaviour for his trees. However, we didn't really find a paper which did publish data to sensor failure. Unfortunately, talking about non-working experiments is not very popular... We are also aware that the result fits partly with the general inactivity of the oak tree. However, we also measured photosynthesis and vapour conductance (not mentioned in the paper) and both values were more or less normal. Summarized, we did not really consider the cork oak for our results but instead of excluding the tree completely one can learn about possible difficulties and potential improvements in future..

Figure 3

Yes, it would be helpful. However, the second label is far above the limit of the x-axis which would cause quite some white space. We did add the number as text.

L341-344

we rephrased the sentences to: "when comparing in situ isotope data with destructive measurements, the later showed a wider spread of isotope measurements within"

L378

the sentence was removed...

L374-385

the paragraph was rephrased.

L388-392

Thank you!

L396

We followed your general comments and rephrased the beginning of the discussion.

L403

Yes, thank you for mentioning. We changed it to depths

L408

we added the sentence: "This could be caused by temporal trapped water or different flow path lengths and velocities or potential isotopic fractioning effects reduced the isotopic tracer signal"

L416

Yes. We added Barbeta et al. 2020 here.

L457

Thank you for your important comment. We are aware of the related problems of using a Mediterranean species in Germany and added the sentence "it should be mentioned that *Quercus suber* is a Mediterranean species and does not naturally grow in Germany."

L478

We added: ", e. g. slower decrease in VWC after irrigation (Fig. 4)" to support the statement

L480-484

This paragraph was rephrased

L486

This paragraph was rephrased

L502-506

This paragraph was rephrased

L509

This paragraph was rephrased

L511

Thank you for your question. We did not test for significant differences here because of the limited number of datapoints. We rephrased the sentence to make this clear.: For instance, we found, in general, that δ -values for both isotopes were mostly more positive for the destructive measurements than for in situ measurements.

L531-543

This paragraph was deleted.

L549-550

We joined the sentences to another paragraph.

L551-568

We did connect the results by Millar with our study by adding the following sentences:

"However, in our experiment we found that most δ -values of cryogenic vacuum extraction were more negative than from the water vapour equilibration method (Fig. 6). Nevertheless, we are aware of our small destructive sampling size and therefore focus less on differences between both destructive measurement methods."

L536-656

Sorry, we don't understand your comment. Also, the line numbers might be wrong / misleading.

L568

Thank you for your valid comment and your argumentation to move this section into the method section. However, we would like to keep this section in the discussion part to get higher reader attention regarding future possible experimental set-ups. Consequently, we

here want to discuss and present our thoughts why we did our experiment the way we did it.