

## **Comment on hess-2020-674**

Anonymous Referee #2

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Referee 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-RC2>, 2021

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In this paper, Mennekes et al. present an application of in-situ, high-frequency measurements of stable water isotopes in soil and tree xylem to a semi-controlled water labelling experiment involving three tree individual from three different species. From this, they derive water travel time from soil to the xylem, analyse tree water source depth, and compare this method to results brought by destructive isotope sampling and sap flow measurements. From the consistency between in-situ- and sapflow-derived travel times, and the higher robustness of isotopic signatures across in-situ measurements as compared to the variability found here (as in other studies) with destructive sampling, the authors underline the potential of this in-situ methodology to better infer water pathways and associated travel times in the soil-vegetation continuum.

The topic addressed by this study is highly relevant to the ecohydrological research community, and the paper outlines promising potential for this methodology to address the current need for higher temporal resolution in isotopic measurements to understand which water are plants using, and when. I found the paper pleasant to read, with a clear description of this very interesting experimental protocol. However, it seems to me that some more effort needs to be devoted to the text itself, in particular the discussion of the results, after which it will be suitable for publication in HESS.

Overall, I agree with the other Reviewer that the Discussion could be shortened, and some repetitions could be avoided. As several points are being discussed there, a better management of logical connections between paragraphs is generally needed as well to help the reader to grasp take-home messages.

### **Specific comments**

- **L39-41:** This is quite a strong statement, all the more that there is a growing body of literature reporting fractionation -somewhere between the soil and evaporation- (e.g. Vargas et al., 2017; Barbeta et al., 2019, Poca et al., 2019). Maybe you should simply state that no fractionation is one of your working hypothesis/assumption for this study? Such an assumption could also be discussed, albeit briefly, somewhere in the discussion, as this novel data set enables looking for preferential isotope uptake along the across soil depth and xylem heights.
- **Figure 5:** The isotopic concentrations scale are quite narrow and make it hard to tease out the breakthrough dynamics. I'd suggest to split the figure in two panels (one isotopic, one for cumulated sap flow), arranged vertically to see the synchronicity (or lack thereof) between isotopic dynamics in soil/xylem and sap flow.
- **L480:** I did not understand how the author can directly derive this conclusion from Fig.4, could you expand?
- **L480-481:** If my understanding is correct, in case of complete replacement, i.e. if  $\delta_{\text{soil}} \sim \delta_{\text{label}}$ , Fig. 7c would be the "transpose" of Fig. 7a, since Fig. 7c would then plot  $\delta^2\text{H}_{\text{label-X15}}$  against  $\delta^{18}\text{O}_{\text{label-X15}}$
- **L485-486:** I am not sure to understand the logical connection leading to / coming after this sentence, maybe move it somewhere else?
- **L549-550:** Again, the logical flow seems to be interrupted with this two-line sentence.
- **Conclusion:** The conclusion mostly repeats the results and discussion sections, which makes it somewhat redundant, in my view. Considering merging it with the revised Discussion. The Conclusion could be the place for a high-level perspective on this study and its implications, for example using a slightly more compact version of what is currently the "Future implications" subsection of the Discussion.

## Technical comments

- **L165:** Custom-made?
- **L267:** It seems that Fig. 4 is described before Fig. 3 in the main text, maybe switch the order of the two?
- **L481-484:** I would suggest rephrasing for clarity, for example: "Furthermore, Figs. 5, 7b and 7d all suggest that the tracer arrival in X150 was less pronounced than in X15 [...]. This attenuation was stronger for Pinus than for Quercus, while for Alnus no sufficient data were available."

## References

- Barbeta, A., Jones, S. P., Clavé, L., Wingate, L., Gimeno, T. E., Fréjaville, B., Wohl, S., and Ogée, J.: Unexplained hydrogen isotope offsets complicate the identification and quantification of tree water sources in a riparian forest, *Hydrol. Earth Syst. Sci.*, 23, 2129-2146, <https://doi.org/10.5194/hess-23-2129-2019>, 2019.
- Poca, M., Coomans, O., Urcelay, C. et al. Isotope fractionation during root water uptake by *Acacia caven* is enhanced by arbuscular mycorrhizas. *Plant Soil* 441, 485-497, <https://doi.org/10.1007/s11104-019-04139-1>, 2019.
- Vargas, A. I., Schaffer, B., Yuhong, L., and Sternberg, L. da S. L.: Testing plant use of

mobile vs immobile soil water sources using stable isotope experiments, *New Phytol.*, 215, 582?594, <https://doi.org/10.1111/nph.14616>, 2017.