

Interactive comment on “Assessing ecohydrological separation in a northern mixed forest biome using stable isotopes” by Jenna R. Snelgrove et al.

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Response to Reviewers

Reviewer 2 The authors studied the isotopic dynamics in gross precipitation, bulk soil water, mobile soil water and xylem water of four tree species, observed in a northern mixed forest (Ontario, Canada) during the growing season 2016. They put their results in context with the two water worlds / ecohydrological separation hypothesis. The manuscript presents a well carried out study and shows a nice data set. The study fits well within the scope of HESS, however, it needs some revision. In particular, the discussion is too long and could benefit from trimming and condensing. The discussion

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is generally a good review of current literature, however, it is too detailed and distracts too much from the authors' main findings and thereby fails to highlight and explain the observed differences in bulk soil water, mobile soil water and xylem water. The discussion should focus more on the authors' main results and their interpretation, and for this interpretation, it would help a lot to integrate the points in 4.3 earlier.

Response: We thank the Reviewer for these suggestions. As noted in our response to the comments of Reviewer 1 regarding the Discussion, we propose to reduce its length and improve its focus.

It would be also interesting to dig a bit deeper into why xylem water differed between species, pointing more at possible different species' strategies in water use (not just rooting depth) and their influence on xylem water, such as water storage in trunks /other plant compartments, different water use (water spender vs. water saver), dormancy, etc.

Response: We thank the Reviewer for these suggestions. The revised version of the paper will acknowledge that inter-specific differences in water use strategies may assist in explaining the xylem water isotopic composition results. The revised version of the paper will also note that detailed information is lacking regarding the water use strategies of the tree species that we studied, and how this should be a focus of further work.

In addition, it should be discussed more in detail how the different methods applied could have affected the results. Lysimeter vs. equilibration technique vs. cryogenic extraction. IRMS vs. ICOS (2 different analyzers).

Response: As we noted in response to a similar point raised by Reviewer 1, we will include references to our previous work that shows that the direct equilibrium method for extracting bulk soil water gives similar results to cryogenic extraction. We will also note in the revised version of the paper that the ICOS instrument was cross correlated with the IRMS.

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Also, there are many figures (8 figures). Maybe some figures could be moved to the appendix? It would be good to make clearer that there is some overlap in data with a previous study of Snelgrove (2019). (Table 1: tree information, Fig. 6: mobile soil water, SWC data of sites He and Or/Pw?).

Response: We thank the Reviewer for this suggestion and will move the current Figures 2 and 6 to the appendix of the revised version of the paper. The revised version of the paper will also note that some of the data appeared in Snelgrove et al. (2019); however, we will retain those data since they assist in interpreting the bulk soil water and xylem water isotopic composition results presented in the current paper.

I added my line-by-line notes as attachment. I am looking forward to reading the manuscript again!

Specific comments ABSTRACT Line 17-18: You write that xylem water and bulk soil water deviate from LMWL, but you do not explain explicitly in what direction. Instead you put them in relative context. Maybe mention the phrase in line 18 "with xylem water ..." later?

Response: This change will be made in the revised version of the paper.

Line 22-23: The soil depth may constrain differences in rooting depths but not necessarily in root water uptake depths.

Response: This point will be made in the revised version of the paper.

STUDY AREA AND METHODS Line 113: how many samples in specific (range, average)?

Response: This information will be provided in the revised version of the paper.

Line 118: tension lysimeters: which brand?

Response: The tension lysimeters were manufactured using Soil Test 2 bar ceramic cups and PVC tubing. This information will be provided in the revised version of the

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paper.

Line 119: why “trees that were not used for xylem water sampling”? And how far are these trees from the other trees?

As we noted in response to a similar comment from Reviewer 1, this was an error in the original submission – in fact, the lysimeters were placed adjacent to trees sampled from xylem water. This will be corrected in the revised version of the paper.

Line 126: reference

Response: We assume that the Reviewer is referring to the error with the url address. This will be corrected in the revised version of the paper.

Line 148: more details on the method applied here, please. How were those analyzers calibrated (IRMS, 2 ICOS)? Did you make a cross-comparison of these analyzers?

Response: Yes, we cross-compared the analyzers. This will be noted in the revised version of the paper. Information regarding calibration of the analyzers (including the standards used) will also be provided.

Line 165: Did you consider dependencies of samples since you always sample the same trees? Did you check on criteria of ANOVA (normal distribution of residuals, homogeneity of variances)?

Response: The issue of dependencies will be acknowledged in the revised version of the paper. Nevertheless, we feel that sampling the same tree at different times is a strength of the study (as will be noted in the revised version of the paper), since inter-tree differences in xylem water isotopic composition on a given sampling date would affect the temporal trajectory of the xylem water results that would be obtained by sampling different trees at different times. Our sampling strategy allows us to examine that trajectory for each of the sampled trees. Homogeneity of variances was examined using Levene’s test. This will be noted in the revised version of the paper.

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RESULTS Line 176: State time range of growing season.

Response: This information will be provided in the revised version of the paper.

Line 180. Where did you define / explain total water depth / soil water depth?

Response: This information was given in Snelgrove et al. (2019), and the reference will be cited in the revised version of the paper.

Figure 2: do you also have data from before June 2016?

Response: No, we do not.

Fig 3a and b: you could add precipitation/ soil water, e.g. $\delta^{2}\text{H}$ precip and $\delta^{18}\text{O}$ precip resp. $\delta^{2}\text{H}$ water and $\delta^{18}\text{O}$ water, equation for LMWL

Response: We feel that the suggested change would make the Figures too cluttered. However, we will provide the equation for the LMWL in the revised version of the paper.

Figure 3c: Please, explain why you summarize 0-15 cm and 30+, maybe offset less big if only 35-45 cm? And 5-15? Which soil areas do lysimeters see?

Response: We thank the Reviewer for making this point. As noted in our response to a similar comment from Reviewer 1, we will revise Figure 3c to compare the mobile soil water samples taken at 10 and 30 cm depths with bulk soil water samples from 5-10 cm and 10-15 cm and 25-30 cm and 30-35 cm depths (we have done this, and the revision does not alter our conclusions).

Line 210: maybe reference to figure already here: “given tree species (Fig 3c)”

Response: The suggested change will be made in the revised version of the paper.

Figure 2: How did you determine soil water depth of upper 0.5 m?

Response: This information was given in Snelgrove et al. (2019), and the reference will be cited in the revised version of the paper.

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Figure 4 uses colors for different periods that have been used before for tree species (use rather none? Or colours of species? Or completely different colours?)

Response: We will revise this Figure based on these suggestions as well as those of Reviewer 1.

Generally, it might be better not to use the same colours for soil values as for plant values.

Response: We agree and will revised this Figure accordingly.

The x-axes differ which is not ideal for comparison. Since the y-axis of each plot is the same, you could consider removing the space between plots.

Response: We agree and will revised this Figure accordingly.

Figure 5: You could again add xylem, $\delta 2H$ xylem. Also here plots share y-axes.

Response: We are not sure what the Reviewer means in the first part of this comment. However, we agree with the second point and will revised this Figure accordingly.

Figure 8: This figure has many colours. But I do understand that you are limited in colours here. You could use different patterns? Or also use grey/white instead of switching to a completely different colour (Or,Pw).

Response: We thank the Reviewer for this comment and will consider using different colours or patterns in the revised version of this Figure.

Fig. 8: big differences again within species. How come? Can you explain these differences maybe by tree traits (Table 1)?

Response: We thank the Reviewer for making this point. However, there do not appear to be consistent differences in the offsets between trees of a given species between sampling times. This point will be made in the revised version of the paper.

DISCUSSION Line 300: intra-specific as well

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Response: We agree, and this point will be added in the revised version of the paper.

Line 350: Give your values.

Response: This information will be provided in the revised version of the paper.

Line 353: SWCs were relatively large?

Response: We do not have SWC data for these periods; however, previous work at the study site indicates large SWCs at these times. This will be noted in the revised version of the paper.

I noticed that in the text it says Snelgrove (2019), in the references it is 2020.

Response: The correct date is 2019. This change will be made in the revised version of the paper.

Figure 5: big scatter within species as well.

Response: We agree, and this point will be noted in the revised version of the paper.

In the figure legends LWML is local mean water line, . . . meteoric . . .

Response: Yes, of course. We apologize for the error, which will be corrected in the revised version of the paper

Figure 6: typo soili

Response: This error will be corrected in the revised version of the paper.

Figure 6: Just to clarify: do you show here the bulk soil water average, or per depth?

Response: The Figure shows all of the individual bulk soil water samples.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-592>, 2020.

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