

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

Anonymous Referee #1

Received and published: 23 December 2020

The study by Snelgrove et al. investigates if ecohydrologic separation was possible in a northern mixed forest in Ontario, Canada. Their study design is built to assess the co-evolution of mobile-, bulk soil- and xylem water isotopic compositions during the year 2016. They formulate two questions to be considered during their investigation:

1. What are the temporal changes in the isotopic composition of soil water and xylem sap throughout the growing season, and is this behavior unique for each species? 2. Is there evidence for hydrological separation? If so, does that differ between species?

While I think this is an important and well thought and carried out study, I have some concerns:

The discussion is very long and hard to read. While I appreciate the detail, especially by using a review- like approach to discuss the results, I feel the main message is buried under too much detail. I would suggest the authors try and cut the discussion to half the length and keep their focus on the data they worked with, or try and combine Results and Discussion for the first two points (i.e. 4.1 and 4.2) and add the review part (i.e. 4.3) as a discussion/Conclusion section. The reader would benefit a great deal and it would separate the review section clearer from the discussion. For example, the first discussion point addresses the temporal changes in isotopic composition in both soil and xylem. While the authors are doing a good job in describing data from relevant publications, they repeat some the results (e.g. L291ff, L308ff, 336ff) and fail to provide a solid interpretation, which makes this section seem unstructured and not to the point. I understand the question to be answered with this section was a “what”-question, thus indicating a descriptive answer, but the whole manuscript would benefit in my opinion, from a “why”-question, which the authors then later try to provide with the third part of the discussion (i.e. 4.3) in a review like form. I encourage the authors to try and restructure the discussion to one (or another) of the above mentioned forms.

Also, I would encourage the authors to move away from trying to prove the ecohydro-logical separation idea wrong and move towards a solid interpretation of their data (i.e. what causes the offsets between xylem and soil water, and therewith also include a plant focused perspective (i.e. fractionation during water uptake? Fractionation during water transport? Interaction with stored water domains?) much like they tried in the last point of the discussion. That would enable them to formulate clear and concise questions and recommendations for future investigations.

Specific comments:

ABSTRACT:

Include one or two sentences about the most likely explanation at the end of the abstract (if the word count does not allow this, maybe cut one of the introductory sen-

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tences).

INTRODUCTION:

L37 include Brooks et al. 2010 with the mentioning of the “two water worlds” hypothesis. Their publication introduces the idea before McDonells et al. 2014 publication.

STUDY AREA AND METHODS

2.3

L104 were the same trees cored five times? How did you manage to extract five cores from the same height? Please elaborate.

2.4

L115 How often were these samples taken? Please add. Also, how long were the samples stored in Ziploc bags before measurements? Please discuss the concerns raised by Herbstritt et al. (2014) and Hendry et al. (2015) regarding potential water losses using ziplog bags in this context.

L118 how far away were the lysimeters to the trees cored for xylem sap? Why did you not use trees close to the lysimeters? Also, make sure you use the word tensiometer or lysimeter or suction cup consistently when talking about the mobile water fraction throughout the manuscript.

L126 the url does not work. Also, this section reads incomprehensible, please try to clarify.

2.5

For all three water pools (bulk soil, mobile, xylem) different methods for water extractions and measurements were used. Why is that? The data seem complicated enough and a common method would at least provide the same methodological artifact for all three pools. Please elaborate.

L159 Please read and discuss the Benettin et al. (2018) publication in this context. They provide solid concerns about best fit regression analysis of samples with regard to the LMWL. The implications could change the interpretations of your results, please also check in following sections of the manuscript.

RESULTS

L204 ff and Fig.3b) please indicate if the samples plotting to the right of the LMWL are bulk soil water samples from the summer (expected high evaporation fractionation) or not.

L210 please discuss this in relation to the different extraction/measurement techniques

L213 if the bulk soil samples was collected in 5cm increments as indicated in MM 2.4 why not compare the soil data from 5-15 cm instead of 0-15? Isooptic enrichment is expected to be highest in the upmost soil layers, creating a negative lc-excess.

Fig. 4 I find the combination of different colours and symbols is confusing. If I understand the figure right, neither would be necessary since facets were used to indicate different sampling timepoints. I suggest using one colour and symbol and then differentiating with solid and unfilled symbols. Also, please make sure that the axes have the same range and tickmarks. And I think one could benefit from a vertical line indicating a 0 lc-excess.

Generally, when printing the figures, the y axis title is not printed. I don't know if that's due to the figure resolution or format, but it might be worth checking.

DISCUSSION: I don't have specific comments for the discussion at this point. Please consider my suggestions above or if you can find a better solution, that's also great. I would be happy to read the manuscript again.

References used in this review:

Benettin P, Volkmann THM, Freyberg J von, Frentress J, Penna D, Dawson TE, and

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Kirchner JW 2018. Effects of climatic seasonality on the isotopic composition of evaporating soil waters. *Hydrol. Earth Syst. Sci.* 22: 2881–2890.

Hendry MJ, Schmeling E, Wassenaar LI, Barbour SL, and Pratt D 2015. Determining the stable isotope composition of pore water from saturated and unsaturated zone core: Improvements to the direct vapour equilibration laser spectrometry method. *Hydrol. Earth Syst. Sci.* 19: 4427–4440.

Herbstritt B, Limprecht M, Gralher B, and Weiler M 2014. Effects of soil properties on the apparent water-vapor isotope equilibrium fractionation: Implications for the headspace equilibrium method., p. Albert-Ludwigs-Univ. Freiburg i. Breisgau.

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