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Hydrology and Earth System Sciences
Discussions

# *Interactive comment on* "Unexplained hydrogen isotope offsets complicate the identification and quantification of tree water sources in a riparian forest" *by* Adrià Barbeta et al.

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General comments

The work by Barbeta et al. highlights one critical issue in the application of stable isotopes as hydrological tracers for the study of plant water uptake patterns. Methods are described properly, but some clarifications are needed. In general, the data is clearly presented and the discussion is well written and focused. Some improvements could be made in the figures in order to make them more self-explanatory. Overall, the manuscript is timely, shows good quality data and makes a significant contribution to ecohydrology.



Specific comments

The calculation of the SW-excess, instead of the deviation from the LMWL, is properly justified in the methods section, and appears as a reasonable alternative for the context of this study. However, I am concerned about the fact that soil data did not always show a single evaporative line (e.g. 5/5/17; 23/5/17; 4/7/17). It would be useful to show the fitting statistics for these regressions (e.g. r2, intercept, slope, p-value). One way to consider this uncertainty is to take into account the confidence intervals of this slope in order to recalculate the errors associated to the SW-excess, and eventually include this as a kind of "analytical error" term in the models.

Regarding the degree of mixing between precipitation and different soil water pools (e.g. line 59, lines 70-75, lines 380-381), and the effect of recent rainfall on soil water d18O and d2H (lines 287-290), it is particularly suitable the discussion about rewetting-drying cycles presented in (Tang and Feng 2001). Indeed, (Tang and Feng 2001) also found little effect of recent precipitation below 50 cm depth, with the exception of particularly strong rain events.

Figure 4. The point that coarse roots show larger fractionation than twigs does not support the "fractionation during water uptake" hypothesis, but favours the option of some kind of isotopic-exchange undergoing in stored water. During a previous field study (Martín-Gómez et al. 2017), we did some preliminary tests comparing twig water with water extracted from trunk cores. Interestingly, and in line with the present study, we found a depletion in d2H of trunk water of about 10‰ as compared to soil and twig samples, although this was not consistent across tree species and sampling times (Martín-Gómez et al., unpublished). The apparent "bypass" of the root fractionation along the path from soil to twigs described by Barbeta et al., and the differences between xylem sap and distilled xylem water shown by Zhao et al. (2016), suggest that fractionation processes associated with water storage could be the key for the observed changes, and certainly deserve further studies.

Technical comments

Figure 1. Although the measurements were taken at different time intervals, it would be desirable to adjust all the panels to a single scale in the X axis.

In Figures 2, 6, 7, 8a, to facilitate interpretation, I would combine fill colours with different symbol shape, and keep them unified throughout the manuscript. For example, circles could represent xylem water, squares soil water, diamonds for fog and rainfall, upward triangles for stream water, ground water and rock water.

Line 165. If I understood well, 3 of the beech trees and 1 of the oaks were sampled from the roots, whereas in the rest of the trees the sampling was based on twigs. According to Figure 4, the observed d2H-depletion was much stronger in coarse roots than in twigs. However, I wonder whether the significant test shown simply indicates that twigs and roots have different SW-excess, or it shows the significance of the SW-excess (i.e. divergence from SW-excess=0). In this regard, the text citing the figure does not clarify this point: "we found differences in SW-excess when the xylem water was collected from coarse roots rather than from twigs (Fig. 4)." In any case, since SW-excess in roots is about twice that found in the twigs, it is worth to indicate them separately in the rest of the graphs.

References

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