

## Author's Response - "point-by-point reply"

#####

### Response to the Editor

Dear Miss Coenders-Gerrits,

Thank you very much for your thoughtful comments and for coordinating the review process. I greatly appreciate your feedback.

We acknowledge the concerns raised regarding the link to urban green spaces and the use of stable isotopes to study vegetation cooling. In the revised manuscript, we have stepped back from this narrative and concentrated on the insights on sub-daily vegetation-mediated water cycling, the plant physiological processes there and in situ stable water isotope monitoring to convene a more quantitative understanding of ecohydrological partitioning. We have improved and streamlined the text accordingly.

Additionally, we have reduced the figure count by relocating several figures to the supplementary and keeping the 6 most important figures in the manuscript. As you suggested, we have added the units for P as mm/day and PET as mm/h (hourly values to interpret the sub-daily dataset), to more accurately reflect their nature as fluxes in Figure 2 (line 285).

Below we carefully address all other reviewer comments including changes in the manuscript in detail to strengthen the overall quality of the study.

With best regards,

Ann-Marie Ring (on behalf of all co-authors)

#####

### Response to Referee Comment 1:

We sincerely thank the reviewer for their thorough and thoughtful evaluation of our manuscript. We are particularly grateful for the generous characterization of our work as a seminal contribution. We also appreciate the constructive suggestions provided, which help to further enhance the clarity and impact of the paper. We are confident that addressing the comments is straightforward and serves to better communicate the core message of our study. Below, we respond to each of the reviewer's points in detail and also give reference to exact line numbers of made changes in the attached revised manuscript, which includes track changes.

Sincerely,

Ann-Marie Ring (on behalf of all co-authors)

#####

Monitoring sub-daily dynamics in stable water isotopic signatures in plant xylem ( $\delta xyl$ ) and atmospheric water vapor ( $\delta v$ ) reveal marked diurnal patterns in water cycling. In their study, the authors relate observed dynamics in isotopic signatures to several environmental drivers (radiation, vapor pressure deficit, soil moisture, ...). The main insights are summarized in figure 11, highlighting that dry season conditions mark a period of large  $\delta xyl$  differences between day and night, i.e., a 38‰ daytime enrichment. Diurnal differences in  $\delta xyl$  also manifest during the wet period, but to a lower extent (approx. half the observed dry period differences). Atmospheric isotope concentrations tell an

opposite story, with daytime depletion in  $\delta v$  (~26‰) during the dry period, and mostly no differences observed during the wet season.

This is a very clear and convincing study providing an interesting and timely contribution to the body of research unveiling overlooked complexities in the use of stable water isotopes to assess water cycling and source contributions in plants and atmosphere. The study is very well executed. I am confident that this will be a seminal paper and will pave the way for many new and exciting research opportunities. I do have a few comments (listed below) that concern making the work more concise, diverting the current narrative to a broader one, and reducing the number of figures in the main text, which all stands to benefit the reader.

**\*\*Thank you for this positive evaluation of our manuscript!**

#### Main comments

The link between monitoring stable water isotopes in plant and atmosphere to the cooling effect and insights sought herein to inform urban green space planning must be strengthened or dropped altogether. The narrative of urban green spaces (UGS) and their vulnerability and cooling function with respect to climate change, feels rather tangential.

It remains unclear how observed patterns (diurnal and dry-wet) in stable water isotopic signatures in xylem and atmospheric exactly relate to the cooling potential of urban trees and green spaces. The mechanistic link is not presented, nor is it apparent how using an isotope assessment strategy exceeds those simply relying on directly monitoring air humidity, thermal cooling, and/or plant transpiration rates (which would be logistically easier, cheaper, and can cover a higher temporal and spatial resolution). Consequently, the UGS narrative distracts from the fascinating and likely much broader insights this study holds for plant physiology, ecology, and stable water isotope assessment. I suggest presenting a very clear and mechanistic link between the obtained insights and how this informs UGS planning and functionalities (be very concrete, although I argue that following such narrative might undercut your key findings), or the authors could tone down/step away from such narrative and focus more on the potential causes and implications/opportunities of the observed dynamics for the broader scientific community.

**\*\*Thank you for this important comment. You are absolutely right, the UGS narrative is rather speculative and tangential in this study. We have dropped the link between stable water isotopes (SWI) in plant and atmosphere to a cooling effect of urban green spaces. The introduction and discussion are now more straightforward focussing on the insights from high-resolution in situ monitoring of SWI for plant physiology and water cycling to improve SWI monitoring and ecohydrological modelling. For detailed changes see:**

- Introduction rows: 64–78, 130-139
- Discussion rows: 469-474, 614-617, Section 5.3
- Conclusion rows: 747-756

#### Minor comments

[Introduction] Several of the paragraphs in the introduction can be removed or shortened when the authors step away from the UGS narrative, making the introduction more concise.

**\*\*We have deleted the parts of the UGS narrative in the introduction for more conciseness related to plant physiology and water isotopic assessment. (r 41-64)**

[r24] The PET abbreviation is not necessary since it is not repeated in the abstract.

\*\* We have removed the abbreviation.

[r26] Evapotranspiration should be written in full. Providing an ET abbreviation is not necessary since it is not repeated in the abstract.

\*\* agreed, we have written evapotranspiration in full.

[r44-45] Tree xylem water is the sap moving through the xylem tissue of a plant. Because multiple water flow paths exist within a plant (i.e., xylem, phloem and in-and out water storage tissue), the provided description is imprecise.

\*\* thank you for this suggestion, we have deleted this part together with the narrative improvements (r51).

[r46] ET has been introduced in line 40, no need to reintroduce it here.

\*\* We have removed this.

[r50] Be more concrete on what is understood under “water fluxes”. Specifically, does this concern temporal patterns, source water partitioning, ... This is important because the stable water isotope analysis is generally used to inform on water uptake depth and the contribution of different water sources. Quantifying the amount of water lost to the atmosphere can more easily be obtained using other, logistically more convenient tools (i.e., porometer, gas exchange monitor such as a Licor or Ciras, flux towers, ...).

\*\* We have added a more specific explanation of sub-daily water fluxes by giving examples. (r. 70-72): “Differentiating between morning, afternoon and nighttime temporal patterns, including source water partitioning of water fluxes such as hydraulic redistribution, transpiration cycling and relative humidity gradients brings a novel perspective to ecohydrology (Nadezhdina et al., 2010; Konarska et al., 2016; Kim et al., 2021; Stevenson et al., 2023).”

[r73] Given the study approach presented in this study, it is important to credit the work of Volkmann et al. (2016) who pioneered in the development of the borehole technique.

\*\*thank you for pointing this out, we have quoted the work of Volkmann et al. (2014, 2016a,b). (r. 92-99)

[r103-104] The study currently does not live up to this claim. The true mechanisms underlying the emergence of these patterns and how these mechanistically link to UGS functionalities are not clear. Forecasting or trying to curtail the impact of a changing environment on UGS is therefore speculative at most, especially because the monitored trees do not show strong proof of being subject to water limitations (see comment below). Such goals require monitoring under clear water limitations as further climate change expects to exacerbate droughts. Following my main comment, the authors should thus very clearly explain how their insight informs concrete UGS guidelines or should step away from this narrative.

\*\*We have rephrased our main research goal as follows: “The work was intended to give valuable insights into the mechanistic links of sub-daily water cycling at the SPAC during summer drought and autumn rewetting. It was also expected that the sub-daily signals help to explain previously unexplained short-term variations in daily SWI datasets.” (r.136-139)

[r118-119] The authors should use the more recent reference (DWD, 2023) used in their proceeding study (Ring et al. 2024).

**\*\*We have changed this. (r. 167)**

[Table 1] With readers only skimming the paper in mind, full names of each parameter abbreviations should be provided in the table or its caption (i.e., GRnet, WS, ...). For consistency within the table, provide the units for the stable water isotopes (‰) behind the respective parameters, and remove it from the subtitle. Where relevant, consistently write: *A. platanoides* and *B. pendula*. (i.e., at 'and' between species, and family can be abbreviated). Finally, consider moving the table to the supplementary to make the paper more concise.

**\*\*that's a great suggestion. We have implemented your formatting suggestions and have consistently written "*A. platanoides*" and "*B. pendula*" throughout the text. Also, we have moved the table to the supplementary material (Table S1).**

[r190] Provide values for a, b, and c in the supplementary for completeness and reproducibility of the study.

**\*\*We now provide the a,b and c values in the supplementary as "Additional information to Eq 1. (Majoube, 1971)"**

[Fig 1 & 2] These figures can be combined.

**\*\* We have combined figures 1 and 2 as Figure 1 (a,b,c).**

[r214] Given that samples are obtained on the same tree, and present repeated measurements, assuming independence and randomness of observations is inappropriate. A Friedman test might be more appropriate.

**\*\*Thank you for the suggestion. We agree, a Friedman test is an appropriate alternative for more than 2 observations. We have reexplored our statistical assumptions, performed the Friedman test and corrected the data analysis chapter based on your comment. (r. 261-266)**

[r220] Provide the values for a and b here for completeness and reproducibility of the study.

**\*\*We have provided the values for a and b in the LMWL where a = 7.37 and b = 4.249. (r. 273)**

[r235] Since this specific data has been published before, best practice requires to cite that the figure is adapted from Ring et al. (2024).

**\*\*You are correct, apologies, we have included the missing information for best practice. (r. 287)**

[Fig4 & 5] These are excellent figures, clearly showing the main insight from this study. Can a similar figure be provided in the supplementary for 18O? (supplementary figure S3 suggests that such data might be available).

**\*\*Thank you, we now provide a similar figure in the supplementary for d18O values as Figs. S2, S3.**

[r269] Consider adding this information to the abstract as this hammers down a very important insight which has huge implications for the interpretation of stable water isotope assessments based on point sampling. This is an excellent argument why the community should shift toward in-situ, high resolution measurements (i.e., like Volkmann et al. 2016; Kühnhammer et al. 2021, 2023), or to try to adopt a more adequate sampling protocol and/or interpretation strategy (i.e., similar to Magh et al. 2020; De Deurwaerder et al. 2020). (for the latter citation, note that part of the author's name, i.e., 'De', is missing in [r465]).

\*\*Thank you for your suggestion; we have added all values of sub-daily amplitudes to the abstract in ‰ of  $\delta^2\text{H}$ . We have further expanded our discussion on the importance of in-situ high resolution measurements and adequate sampling protocols (e.g. r. 541-547, r. 657-662). We apologise for the miss-spelling of Mr. De Deurwaerders name and have revised this throughout the manuscript.

[Fig 6 & Fig 7]

- The x-axis is not great and should be redone.

- What is the black dark line in the VPD graph? (if this is simply to highlight zero, a similar marking should be considered in all other panels, although that would confound with the soil depth line of 70cm and the maple growth line)

\*\*We have improved the x-axis in both figures 6 and 7, which are now merged together as one Figure 5 (a,b), including improved VPD panels.

- Redirect the left panels (boxplots) to the supplementary

\*\* We have redirected the panels displaying antecedent conditions of Figure 6 and 7 to the supplementary Figure S4.

- Combine all lines belonging to a specific category (general ecohydrology, soil depths, sap flow & growth, and water isotopes). There is no reason to have temperature as a standalone panel.

\*\* We have improved the panel layout in updated figure 5 (a,b).

- Redirect the lc-excess panel to supplementary and provide the delta  $^{18}\text{O}$  in the supplementary for completeness. These adjustments will support larger panels, which benefit improved readability as this figure contains a lot of information. In addition, there are interesting patterns in the figures that have not received much attention in the manuscript: (i) Figure 6 shows stronger fluctuations in  $\delta x_{yl}$  amplitude at 1.5m compared to 2.5m, suggestive of a dampening effect at 2.5m. When looking at Figure 7, (ii) this amplitude dampening seems to be gone, however, now a consistent shift in isotope depletion establishes at 2.5m. While this setup might not support characterizing what exactly underlies these patterns, they are interesting and deserve some attention in the document.

\*\*These are great suggestions, thank you! We have redirected the lc-excess panel to supplementary including a panel displaying  $d^{18}\text{O}$  for completeness in figure S4 (a,b). We now give more reference in the results (r. 354f,376f) and included a discussion on the particularly interesting amplitudes in  $dx_{yl}$  of the two birch boreholes displayed in the specific sub-daily resolved time-series plots of figure 5 (r.541-547).

[r325-326] This is very interesting. Any reasons why this might be, and how the proposed hypothesis should be verified?

\*\*As the location of *B. pendula* was closer to a building and growing on a slope, we assume precipitation did not percolate and soil replenishment was potentially composed of more fractionated waters. We have added this relevant information to the text (r.394-396).

[Fig 8.] While interesting and important, this figure could be moved to the supplementary materials. In addition, do the same observations also hold for  $^{18}\text{O}$ ? Provide this analysis for  $^{18}\text{O}$  in the supplement.

\*\*We have moved this figure to the supplementary materials as Fig S7 and added a Figure S8 which includes an analysis of  $d^{18}\text{O}$ .

[Fig 9 & 10] These figures can be combined. Similarly to the comment on figure 8, while an important visualization, this paper can be provided as a supplement, and the analysis should be repeated with  $^{18}\text{O}$ .

**\*\***We have moved figures 9 and 10 to the supplementary materials and merged them as figure 9 (a,b) and added figure 10 (a,b), which includes an analysis of  $\text{d}^{18}\text{O}$ .

[Fig 11] This is an excellent and beautiful summary of the findings. Make certain that all the abbreviations are clarified in the caption (i.e., define  $\delta_{\text{xy}l}$ ,  $\delta v$ , and  $\delta^{2H}$ ) to benefit readers skimming the paper.

**\*\***We highly appreciate the positive and constructive feedback. We have clarified all abbreviations in the improved figure 11 which is now figure 6 (r. 453-458).

[r383-388] That midday water potential at the twig level is more negative than the morning leaf water potential is expected from a plant physiological perspective. In the morning, the driving force of water movement through the plant is low, as stomates are generally closed with no photosynthetic activity as there is no light. At midday, the need for water is greater because sunlight allows photosynthesis. This might suggest water limitations if leaf (or twig) water potentially drops below the P50 value, which could trigger stomatal closure. However, having a minimal twig water potential around  $-1.2\text{MPa}$ , and no clear reduction in sapflow activity ( $10\text{L/h}$ ), there seems to be no obvious indication that the trees suffer water limitation. The observed isotopic signature dynamics suggest that the plant water needs are met by tapping different soil water sources. Similarly, a shift between radiation, sapflow, and VPD have been observed in the plant physiological research and are not sufficient proof that a tree experiences drought stress. Additionally, it is unclear how the provided reference (Kraemer and Kabisch, 2022) is in any way supporting such a statement, as that study does not monitor sapflow. In conclusion, the presented physiological/mechanistic drivers of the observed isotopic trends within the trees are not well laid out, obscuring a clear link between observations and how this might inform UGS decision making. This paragraph should be made stronger and provided arguments should be supported with plant physiological theory.

**\*\***Thank you for this clear explanation and summary. We have rephrased this paragraph, including evidence from plant physiological theory, removed the inadequate discussions on drought stress and provided more adequate reference (r. 463-473).

[paragraph 5.3] Following my main comment, it remains unclear how the authors envision their presented observations to guide UGS planning and management efforts. For instance, in [r594] the authors' state: 'Our findings provide novel insights on the cooling potential of urban vegetation.' What specific insights are implied here, and, how exactly do the presented observations link to UGS cooling capacity? This sentence remains rather cryptic. Besides, restricting the importance of this study in support of UGS planning almost feels like an injustice to the likely broader importance of the observations for the fields of stable water isotope assessments, and plant physiology and ecology. As such, I suggest refocusing the storyline to reflect a broader picture, which would (i) attract a wider scientific interest, and (ii) would strengthen conveying the key observations to the reader.

**\*\*** We agree that the phrasing in the first manuscript (e.g., in [r594]) may have overstated the direct applicability of our observations to UGS cooling potential, without providing a sufficiently detailed mechanistic link. We have substantially reduced the emphasis on immediate implications for UGS planning, in line with the reviewer's suggestion. Instead, we highlight potential future applications of isotopic monitoring in vegetated environments as a complementary tool to assess water source dynamics. We have expanded the discussion for a broader scientific context to underscore the relevance of our results for understanding plant hydraulic functioning, ecohydrological partitioning,

and stable isotope method development. This broader framing now aligns with the reviewer's insight that the study's primary contributions lie in advancing knowledge in plant physiology and isotope ecology. See in revised manuscript:

- Discussion rows: 469-474, 614-617, Section 5.3
- Conclusion rows: 747-756

## Response to Referee Comment 2:

We thank the reviewer for their thoughtful and constructive feedback. We appreciate the positive recognition of the diverse results and acknowledge the concern regarding the clarity of the overall narrative. We have revised the manuscript to improve focus and flow, while acknowledging the limitations of our study, including reorganizing and shortening the Materials and Methods section as suggested. Below, we address the reviewer's comments, outline our revisions in detail and give reference to exact line numbers in the attached revised manuscript, which includes track changes.

Sincerely,

Ann-Marie Ring (on behalf of all co-authors)

#####

The here presented study by Ring et al. assesses the impact of plant water use and other environmental drivers on the dynamics of atmospheric water vapor isotope signatures in an urban landscape, comparing two distinct periods: a drought and a rewetting period.

The study was well conducted and comprehensive, including many interesting and different results, which make it challenging to follow the story's "red string". Based on figure 11 (which is a really nice summary), I suggest streamlining your whole story: what is needed in the main text to understand the patterns observed in figure 11.

The link to urban green spaces is interesting, but the relevance of isotope measurements for assessing the cooling impact of vegetation seems a bit far-fetched. Other parameters, such as actual transpiration flux, provide better means to determine the actual cooling effect on the studied area.

I recommend reorganizing and revising your manuscript based on the Fig. 11 so that you focus primarily on results that explain or support your findings there. It seems that large parts of the Material and Method section are based on the author's previous studies, resulting in unexplained acronyms throughout the main text and paragraphs not optimally organized. I suggest rewriting and reorganizing the Material and Method section to make it shorter and more concise, ensuring that important information is included in the main text while moving or deleting unnecessary details.

11 figures in the main text is too much, consider merging or moving some to the supplement. Moreover, you only measured two trees. This limitation should be mentioned. Given the limited representative of two single trees and a patch of grass, caution needs to be taken to transfer this to larger green spaces. This point needs to be raised as well (see e.g., line 600).

All in all, a very nice study! Please find below my line-by-line comments.

\*\* Thank you for the constructive and encouraging review! We have reorganized the manuscript based on Figure 11 (now Figure 6) to strengthen the clarity and coherence of the narrative (especially see: the general abstract, section 5.1). We have stepped away from the urban green space and cooling connection and revised this by streamlining the main text for a broader scientific context to underscore

the relevance of our results for understanding plant hydraulic functioning, ecohydrological partitioning, and stable isotope method development. Please see:

- Introduction rows: 64–78, 130-139
- Discussion rows: 469-474, 614-617, Section 5.3
- Conclusion rows: 747-756

**\*\***We have revised the Data and Methods section for conciseness and clarity, and ensured that all acronyms are introduced properly and prioritized relevant information. We addressed the limitations of our small sample size of two trees in the discussion to clarify the scope and transferability of our findings (r. 530-532, 756).

#### Line-by-line comments

##### Title

I would suggest here a better link to the "water stable isotope" topic, as this is the focus isotope dynamics?

**\*\***We have included a link to water stable isotopes in the title.

##### Abstract

- L15: Specify "natural summer drought." How long was the drought? When did the rewetting occur?

**\*\***We have added the exact dates of the defined summer drought to the abstract (01.07.-14.08.).

- L18: "dv values were characterized."

**\*\*** We have changed this.

- L19: Consider "i.e., entrainment" (perhaps better phrasing).

**\*\*** We have improved the phrasing accordingly (L21).

- L19: add "values" or similar when using delta abbreviations (e.g., "enrichment  $\delta xyl$  values")

**\*\***We have improved this throughout the manuscript by adding "values" or similar.

- L20: "enriched soil water at the topsoil" ?

**\*\*** Thank you, we have specified this accordingly (L24).

- L24: How was PET during the summer drought? You only mention it for the rewetting period.

**\*\*** We have added the information about PET during the summer drought to the abstract (L23f).

- L26: ET was not introduced yet (only PET).

**\*\***We have added an introduction of ET as evapotranspiration(L32).

The abstract could highlight more the main results.

**\*\***We have amended the abstract to highlight the main results based on Figure 11 (now Fig. 6).



## Main text

- L73: See also publications from Till Volkmann and Markus Weiler (see references below).

\*\*We have added these important publication references (L93f).

- L93: It would be more interesting if it was the hottest summer in Berlin.

\*\*We have specified the information as for the weather conditions during summer in Berlin, 2022, were among the top 5 hottest since recording began (2024 was hottest) (L125f).

- L97: here it is written again xylem and water vapor isotope, I would stick to dxyl and dv values once introduced (especially in the same section)

\*\*We have changed this throughout the manuscript to stick to the introduced abbreviations.

- L101: would also talk about sub-daily values here

\*\* We have rephrased this accordingly (L134).

- L110: Add the full name for CRDS.

\*\* We have included the full name cavity ring-down spectroscopy.

- L112: Write the full name for SE.

\*\*We have written southeast in full.

- L121: Compare the amount of rain received during the study period to the long-term mean.

\*\*We compare the amount of rain received during the study year (403 mm) to the long-term annual mean (579 mm) in the paragraph of L165-171. In section 4.1 "Hydroclimatic conditions during 2022" we give detailed values for the study period (L298f).

- Lines 124-129: Merge these paragraphs with lines 113-116, as they both discuss the study site.

\*\* We have merged these paragraphs (L159).

- L145: maybe add the distance from the rooftop to your site.

\*\*We have added the distance from rooftop to the study site (315 m; L194).

- L167: Introduce CRDS once, including the full name, company, etc.

\*\*We have added the information to introduce cavity ring-down spectroscopy (CRDS; L2130-i, PICARRO, INC., Santa Clara, CA) to L209.

## Table 1: Explain the acronyms.

\*\*As per suggestion of reviewer 1, we have this table to the supplementary to make the paper more concise (now Table S1). Full names of each parameter abbreviation are now provided there.

Figure 2: Consider writing "Atmosphere Tubing" to avoid confusion, as technically, xylem tubing also samples vapor. Mention standards in the caption.

\*\*We have improved the naming in the legend and mentioned the standards in the caption of Figure 2, which is now Figure 1c.

- L159: Provide details on how you accounted for temperature dependencies and corrected them (e.g., Wassenaar 2008, Haberstroh 2024).

\*\*We have included this information in L226-229. Please also see our detailed answer on your detailed comment below which included your question if we can rule out that the daily cycle in dD is not affected or driven by temperature/concentration changes in your isotope measurements.

- L198: Include the spatial resolution of the sampling (e.g., depths).

\*\* We have included information on the spatial resolution of soil sampling (L249f).

- L206: Introduce SPAC
- \*\* We have introduced the SPAC in the introduction of this manuscript (L79) and provided an additional introduction it in sub-chapter 3.5 (L254).
- L218: "the line..."
- \*\*We have corrected this. (L266)
- L240: Compare to long-term mean.
- \*\*We now provide this information (paragraph L 288-293).
- L241: mm in summer? and provide the long-term mean.
- \*\* We now provide this information (paragraph L 288-293).
- The order is confusing: first, it mentions dryness with some numbers, then introduces temperature and PET values, and finally mentions precipitation values in L245 (which is an indicator for dryness). Consider reorganizing for clarity.
- \*\*We have reorganized this to improve the clarity (L. 288-303).
- L268: Specify which tree.
- \*\*We have added the information that the value is a mean of all measured tree boreholes (L324).

One possible reason for the enrichment in the xylem during the day could be water loss through the bark (see e.g., Lintunen et al. 2021). Do you have xylem/leaf water data from grassland vegetation? Can you rule out that the daily cycle in  $\delta D$  is not affected or driven by temperature/concentration changes in your isotope measurements? How much did the concentration change during the day in the trees? Was full saturation always reached? (You can check this by calculating the saturation point for the respective temperature and comparing it to your value.)

The isotopic signature of transpiration, which significantly influences  $\delta_{\text{vap}}$  values, can deviate substantially from the xylem isotopic signature due to stomatal regulation and non-steady state transpiration (see Simonin et al. 2013; Dubbert et al. 2017; Kübert et al. 2023). During drought and periods of high VPD, stomates may be closed. Since the isotopic signature of transpiration was not measured directly, discuss the possible deviation between xylem and transpiration isotopic patterns.

\*\*Thank you for this clear explanation and concise methodological suggestion. Unfortunately, we did not measure plant stable water isotopes of the grassland vegetation. To correct for isotopic offsets and vapour concentration dependency, we calculated for all the xylem data the values of temperature dependent equilibrium fractionation from vapor to liquid with the correction formulated by Majoube (1971). Temperatures were measured within the boreholes. During the automated calibration, water vapor concentrations and isotopic compositions of known standards in the headspace of the glass containers were measured and linear regressions of temperature dependency slopes added. We also included regular checking for stable values of both standards to avoid headspace depletion. We have checked the sub-daily water vapor concentration change and calculated the saturation point for the respective temperatures. Water vapor concentration was always close to full saturation during the measurements. Thus, we can rule out evaporation effects and kinetic fractionation of measurements. We have added this insight to the method section (L226-229). Further, we have given reference to water loss through the bark as a possible reason for xylem water enrichment (L570-572) and have explained the possible deviation between xylem and transpiration isotopic patterns (L574-579), especially during drought in the discussion chapter.

- L278: Add p-value.

\*\*We have added the p-value = 0.031. (L335)

Figure 6: VWC of 5-7% is very low; were the sensors calibrated? Why is the VWC so low between 6 and 20 cm? What happened on 28.7. at 00:00?

\*\* Yes, the values are very low, which is typical for sandy soils during drought conditions. The upper 5 cm lose more water through ET processes during the chosen timeframe. In Figure 5b, you can see the typical patterns, when precipitation changes soil moisture in the different depths. The soil moisture

sensors were calibrated in the factory with 3% precision (included in Table S1). The drop in the  $\delta^{18}O$  values after 28.7. at 00:00 can be explained by stronger entrainment processes during that night, meaning an intensified turbulent flux of water vapor that occurred between the relatively dry air in the free troposphere above and the moister air within the surface boundary layer (cf. Lai & Ehleringer, 2011; Lee et al., 2006).

-> Lai, C.-T. and Ehleringer, J. R.: Deuterium excess reveals diurnal sources of water vapor in forest air, *Oecologia*, 165, 213–223, doi:10.1007/s00442-010-1721-2, 2011.

-> Lee, X., Smith, R. and Williams, J.: Water vapour  $\delta^{18}O/\delta^{16}O$  isotope ratio in surface air in New England, USA. *Tellus B*, 58: 293-304. <https://doi.org/10.1111/j.1600-0889.2006.00191.x>, 2006.

- L287: Note that you do not show radiation. Provide numbers for this "drive."

\*\* We have provided numbers for the amounts of radiation input: daily maxima between 500-900 W m<sup>2</sup> (L348f).

- L289: Did you do a zero  $\delta^{18}O$  correction for sap flow? Unit missing for  $\delta^{18}O$ -excess.

\*\* We provide the following information in the methods section: "Sap flow rates were assessed via the monitored sap velocity (heat ratio method by Marshall (1958) with the softwares implexx (SFM-4 meters, UGT) and Sap Flow Tool (SFM1, ICT International) including data of sap wood, heart wood and bark depths from drilled tree cores." We have provided the missing unit for  $\delta^{18}O$ -excess throughout the text and Figures.

Consider merging Figure 6 and 7 to save space, as the legend can be used for both. Also Figure 9 and 10.

\*\*Thank you for these important suggestions for figure improvements. We have merged Figures 6 and 7 to Figure 5 (a,b). As per suggestion of reviewer 1, we have improved the x-axis of both figures, including improved VPD panels and also redirected the panels displaying antecedent conditions of Figure 6 and 7 to the supplementary Figure S4. We have moved figures 9 and 10 to the supplementary materials and merged them as Figure S9(a,b). We have also added a Figure 10 (a,b), which includes an analysis of  $\delta^{18}O$ .

- L321-326: This paragraph is very descriptive; could you add some numbers?

\*\* We have added numbers as evidence for the descriptive part for the paragraph (L. 387-396).

Figure 11: Consider summarizing the day-night change. How was day/night defined? Add information to the legend.

\*\*We have added information about our definition of day (8 am – 8 pm) and night (8 pm – 8 am) to the legend (L455). Also, we have thoroughly summarized the day-night change including numbers in the paragraph 5.1 (L443-450) which introduces former Figure 11 (now Figure 6) to make the findings clearer.

- L381: that is very general, maybe: "Sub-daily changes in isotopic signatures of... and ..."

\*\*Yes, we have improved this sentence (L461f).

- L384: Midday LWP is usually more negative than in the morning, which is not necessarily related to drought.

\*\*This is an important comment. Reviewer 1 added similar suggestions to this part. We have rephrased this paragraph, including evidence from plant physiological theory, removed inadequate discussions on drought stress and provided more adequate reference (L466-473).

- L385: "Indicating stomatal control which..."

\*\*We have included this detail (L468).

- L565: Add "direct measurement of transpiration."

\*\*We have added this (L654).

- L575: "which did not infiltrate"

\*\*We have corrected this (L725).

- L582: maximum

\*\*We have changed this (L732).

- L600: Include "and sample size," as the studied area and the number of plants were quite limited.

\*\*Thank you, we have added this important aspect (L754).

General comments:

- Check for British vs. American English spelling, e.g., "vapor" vs. "vapour."
- Write *in situ* or in-situ
- Consistently use "water stable isotopes" (see L160, "stable water isotopes").
- Define delta notation.
- Use "value" or a similar term with  $\delta$  or  $\delta$ taxyl
- $\delta$ -excess unit is missing

\*\*Thank you for these important general comments. We have provided consistent spelling according to HESS regulations, used the term "value" for the isotopologues and added the missing  $\delta$ -excess unit. HESS house standards say that "Common Latin phrases are not italicized (for example, et al., cf., e.g., a priori, in situ, bremsstrahlung, and eigenvalue).", therefore we write "in situ".

## References

Dubbert, M., Kübert, A., and Werner, C.: Impact of Leaf Traits on Temporal Dynamics of Transpired Oxygen Isotope Signatures and Its Impact on Atmospheric Vapor, *Front. Plant Sci.*, 8, 2017.

Haberstroh, S., Kübert, A., and Werner, C.: Two common pitfalls in the analysis of water-stable isotopologues with cryogenic vacuum extraction and cavity ring-down spectroscopy, *Anal. Sci. Adv.*, 5, 2300053, <https://doi.org/10.1002/ansa.202300053>, 2024.

Kübert, A., Dubbert, M., Bamberger, I., Kühnhammer, K., Beyer, M., van Haren, J., Bailey, K., Hu, J., Meredith, L. K., Nemiah Ladd, S., and Werner, C.: Tracing plant source water dynamics during drought by continuous transpiration measurements: An in-situ stable isotope approach, *Plant Cell Environ.*, 46, 133–149, <https://doi.org/10.1111/pce.14475>, 2023.

Simonin, K. A., Roddy, A. B., Link, P., Apodaca, R., Tu, K. P., Hu, J., Dawson, T. E., and Barbour, M. M.: Isotopic composition of transpiration and rates of change in leaf water isotopologue storage in response to environmental variables, *Plant Cell Environ.*, 36, 2190–2206, <https://doi.org/10.1111/pce.12129>, 2013.

Volkmann, T. H. M. and Weiler, M.: Continual in situ monitoring of pore water stable isotopes in the subsurface, *Hydrol. Earth Syst. Sci.*, 18, 1819–1833, <https://doi.org/10.5194/hess-18-1819-2014>, 2014.

Volkmann, T. H. M., Haberer, K., Gessler, A., and Weiler, M.: High-resolution isotope measurements resolve rapid ecohydrological dynamics at the soil–plant interface, *New Phytol.*, 210, 839–849, <https://doi.org/10.1111/nph.13868>, 2016.

Wassenaar, L. I., Hendry, M. J., Chostner, V. L., and Lis, G. P.: High Resolution Pore Water  $\delta^2\text{H}$  and  $\delta^{18}\text{O}$  Measurements by  $\text{H}_2\text{O}$  (liquid) –  $\text{H}_2\text{O}$  (vapor) Equilibration Laser Spectroscopy, *Environ. Sci. Technol.*, 42, 9262–9267, <https://doi.org/10.1021/es802065s>, 2008.