Response Letter:

Dear Editor and Reviewer,

Thank you for your help in improving the manuscript.

Since reviewer #1 accepted the manuscript as is, we have only addressed reviewer #2's comments and made necessary minor changes. We also thank Reviewer #2 for bringing the Introduction to our attention. We used the second round of the review process to improve and revise the Introduction and the Abstract beyond what the reviewer requested. In the revised version, the introduction is improved in terms of guiding the reader about the research question and emphasizing that the research objective is about root water uptake patterns rather than investigating throughfall patterns.

In addition, we address all of the reviewer's recommendations and comments below.

Sincerely,

On behalf of the authors,

Gökben Demir

Reviewer(s)' Comments to Author:
Comments to Reviewer Report #2:
MS#: hess-2023-91

" Root water uptake patterns are controlled by tree species interactions and soil water variability" by Demir et al.

Throughfall is the largest source of water entering the soil in forests, and its spatial distribution depends on several biotic and abiotic factors. This study explored the influencing factors that affect root water uptake, including throughfall rainfall, soil water, and tree species abundance. It seems reasonable and meaningful, but there are minor problems that need to be modified. The specific issues are as follows:

Thank you for reading the revised manuscript and providing feedback to improve it. We have tried to understand the essence of each comment, thoroughly addressed each comment, and made the necessary changes to the document. In the following, we respond to all questions and recommendations, which are written in blue.

Introduction:

There are too many descriptions of factors affecting root water uptake, please simplify it.

We are not sure what the reviewer means. However, we understand that the introduction could be improved and simplified for clearer communication. Therefore, we have taken the comment into account to revise the introduction. We worked on it to better guide the reader to the research questions and made necessary changes, which are highlighted in the following comments. For example, to simplify it, we shortened it by removing explanations on the effect of tree species on water uptake, as this is well covered in the discussion section.

In addition, we have revised the abstract to improve clear communication of the take-home message of the paper. Nevertheless, we would like to draw attention to the previous reviewer reports that requested more details on the influence of abiotic factors on water uptake patterns. Thus, we have incorporated the previous reviewer requests for more information on abiotic factors affecting water uptake, such as soil properties, and kept them in the revised version.

Lines 62-75: This paragraph focuses on the impact of throughfall rainfall on soil moisture dynamics, and then points out that there has been no research on the effect of throughfall rainfall on root water uptake. However, the last sentence confuses me. "Therefore, it is unclear how water uptake patterns play a role in translating throughfall patterns into spatio-temporal variation of soil water and vice versa". This seems to mean that root water uptake affects the impact of throughfall on soil water, which is not consistent with the title.

Thank you for your attention, we see that this part may confuse the reader, so we have revised the paragraph to improve communication, please see lines between 52-80 in the revised version that provides the current state of knowledge on what are the proposed reasons for the short and weak impact of spatial variability of throughfall on soil moisture patterns.

Although throughfall patterns have the potential to alter soil moisture patterns both in the wetting phase and in the drained state, the field studies observed that the impact of throughfall distribution on soil moisture patterns ceases rapidly and weakens in the drained state. However, the potential effect of throughfall patterns on root water uptake is lacking in experimental studies.

Furthermore, we think that this paragraph does not conflict with the title of the manuscript because the title mentions the main drivers of root water uptake patterns, as our results showed that throughfall variability does not translate into root water uptake patterns and soil water patterns.

Lines 84-85: I think caution needs to be expressed here. Variations in soil moisture do not reflect water uptake by the roots. There may be other reasons.

We agree. This is what we refer to with the surrounding text. In line with the comment, we revised to improve the text in an inclusive way for all possible reasons, please see Lines 71-95 in the revised version. Moreover, we restructured this part of the introduction to improve introduction together with the former comments.

Table 2: Why are the dates out of order?

As stated in the table caption, the throughfall data is ordered by the size of the gross precipitation. As the spatial variation of throughfall changes according to the size of the event (Levia and Frost, 2006; Levia et al., 2019; Metzger et al., 2017; Keim and Link, 2018). In this study, the spatial variation of throughfall is more important than the chronological order of the field data. In this study, we investigated how the variation in water input affects the variation in root water uptake. Therefore, the data is listed according to the gross precipitation amount, and we decide to keep it as is.

Figure3: Why are the abscissas in Figure 3 inconsistent?

Thank you for the comment, we revised the caption to avoid further confusion for future readers. Figure 3 shows the spatial deviation of different variables (throughfall, soil water, and root water uptake). Since the spatial patterns of these values are different, the ordered values are different at each sensor location. However, the coloring scheme (light to dark) is kept the same based on throughfall (water input) as written in the figure caption. The darker colored throughfall locations are also dark in the other plots, showing that more water input than the spatial average does not necessarily correspond to more water uptake or more water stored in the soil. If we saw the same patterns across all variables in this plot, the x-axis would be identical. However, the plot shows that neither soil water and throughfall, throughfall and root water uptake, nor variations in soil water and root water uptake are directly related, which was also communicated in lines 390 - 398.

Result:

What is the relationship between section 3.2 and 3.3? Where is section 3.4?

Thanks for the point out, there is a typo in the section header, so section 3.5 should be 3.4, we have changed the number in the section title.

We are unsure what reviewer requested or questioned regarding the relationship between section 3.2 and 3.3.

In the first round of discussion, reviewers (see previous reviewers' reports) found the separate sections in the results part nice to read and stated that the structure helped them to follow the results. Furthermore, in the first round, we provided a short summary of the main results at the beginning of the discussion, as requested by the reviewers. Here, if the reviewer request on a short, small introductory paragraph at the beginning of the results, we think that it could make the text repetitive because of the small introductory paragraph in the discussion section. So we decided to leave it as it is for now. If the editor and reviewer think that we should combine these two sections, we can make this small change during the proofreading stage, but we do not think that it would greatly improve the text. Because here:

Section 3.2 gives the spatial average of soil water storage, potential evapotranspiration, and root water uptake along with the water holding capacity, which is how much water is available to root systems and what the atmospheric demand is, so it gives a background picture of the temporal changes in the values along with the quartile-based variation of the values.

Section 3.3, on the other hand, presents the results of the spatial deviation from the mean, which is also used in the literature to estimate the temporal stability of patterns, and is different from the quartile coefficient of variation.

Figure 4 and 5: What is the difference between the two figures, and is it necessary if it is just for visualization?

While Figure 4 shows the significant drivers, Figure 5 explains the interaction terms, which provide detailed information about how one fixed effect changes the impact of the other fixed effect on the estimated variable, so Figure 5 adds information to Figure 4. The plot type changes because interactions are best interpreted visually. Therefore, we decided to keep Figure 5 in the main manuscript.

Lines 488-490: Regarding the impact of throughfall on root water uptake, the manuscript mentioned that the lower soil contains more clay particles in the Material and Methods and should be difficult to drainage, and the discussion also mentioned that local rainfall input increases the preferential flow path. Is this contradictory? Will the roots utilize deeper soil water?

Relatively higher clay content in the subsoil does not prevent the occurrence of preferential flow (e.g., Jarvis et al., 2016; Nimmo, 2021), so it is not inconsistent that despite the higher clay content, the locally increased water input facilitates preferential flow particularly after dry spells. The linear mixed effects model suggests that trees may shift water uptake to deeper layers, depending on the average wetness of the site, as discussed in section.

References:

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