In this paper the authors present a very nice laboratory-based experimental study to assess the utility of novel electrical methods for monitoring and quantifying root water uptake and plant stress under partial root zone drying and irrigation schemes in an effort to study plant phyisology. They use both electrical resistivity tomography and electrical current imaging, two geophysical techniques that through a computational inversion provide visual and quantifiable evidence for the distribution of changes in electrical resistivity as a proxy for water content and current source density as a proxy for active root pathways, respectively. This experiment was conducted using a single vine grown in a small rhizotron over the course of several months in 2022. In addition to repeated cycles of irrigation and geophysical data collections, the transpiration was monitored using the weight of the rhizotron. Stomatal conductance and leaf area were also measured during one cycle to capture plant stress during a partial root drying event. Aside from a few grammatical errors and some issues with figure quality, this paper is an important addition to the biogeosciences literature, in particular for scientists taking advantage of novel geophysical techniques for noninvasive methods.

We thank the reviewer for her words of appreciation and for her extensive review. We have carefully considered and addressed all of the reviewer's comments, which we believe have significantly enhanced the quality of the manuscript.

The main changes we have made include:

(i) improvement of figures' quality (consistent colours), proofreading the text for typos and rephrasing it when necessary.

(ii) Modifying the description and discussion of our experiment by replacing "PRD" with "root water limited availability," as indicated in the revised title. This change had only a minor impact on the actual results, as they were already aligned.

(iii) Responding to the reviewer's comment by incorporating new references in the introduction that briefly cover various methods used to measure root physiology, anatomy, and biomass. By discussing the assumptions associated with these methods, we are able to establish up-to-date parallels between current pathways and water pathways.

(iv) Completely reshaping figures 8 and 9 and discussing the observed current density in this experiment, considering it as a result of both higher transpirational demand and/or drier soil conditions.

These revisions and improvements have enhanced the manuscript, and we sincerely appreciate the reviewer's insightful comments that have contributed to its overall quality.

Major comments:

There are some major inconsistencies and errors in the labelling of 'left' and 'right' irrigation/PRD

that persists in most Tables and Figures which makes it difficult to understand the results. In addition to correcting these issues, interpretation would be easier if the same vertical blue arrows used in Figure 1 was added to the top axis of all the subsequent cross section figures (i.e. Fig. 5, 7, A2-A11). Some examples of the inconsistencies:
Numbering of irrigation cycles:
In Fig 1, 'Cycle 1' is depicted as left-side irrigation, yet in Table 1 the cycle numbering begins at 0, so that odd numbered cycles are actually right-side irrigation. I would make the initial wetting through all Holes Cycle 0 and then the first left-side irrigation on 2022-05-19 Cycle 1 etc.

Thanks for spotting this error. We corrected the figures and table accordingly.

Color coding of left vs right sided irrigations:
In Figs 4a and 6a, dark green is 'left' and orange is 'right'
In Fig A1 there is a legend at the top indicating the opposite of the caption - that dark orange is partial left and dark green is partial right.

Colors are now consistent between left and right:
-   Left = Green
-   Right = Orange

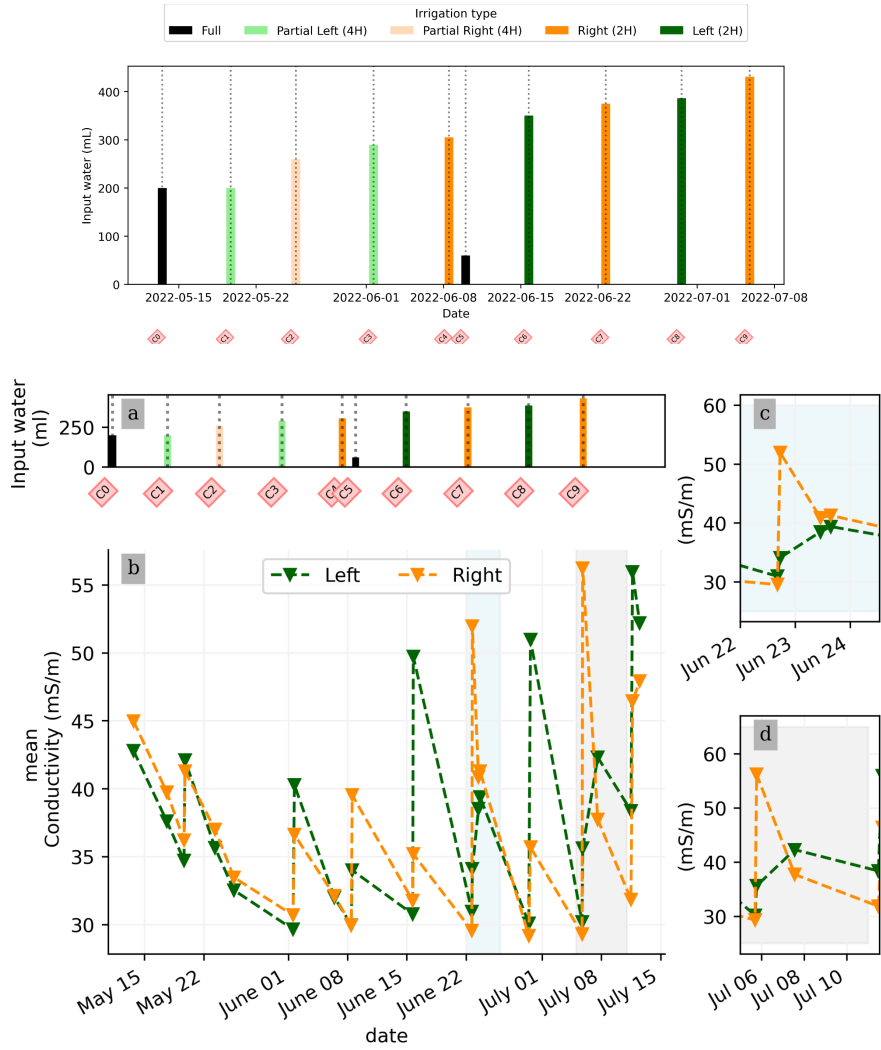| Date (YYYY-mm-dd HH:MM)	Hole (H) location (c.f. Fig. 1)	Quantity (mL)*	Cycle nb
2022-05-13 16:25	All		0
2022-05-19 17:00	H1;H2;H3;H4	200	1
2022-05-25 14:30	H5;H6;H7;H8	260	2
2022-06-01 15:50	H1;H2;H3;H4	290	3
2022-06-08 11:50	H7;H8	305	4
2022-06-10	All	60	(5)
2022-06-15 17:25	H1;H2	350	6
2022-06-22 16:45	H7;H8	375	7
2022-06-29 13:45	H1;H2	386	8
2022-07-05 18:10	H7;H8	431	9
2022-07-11 13:15	H1;H2	431	10
2022-07-12 16:00	H1-H8	200	-

Fig A1 was corrected accordingly.

In Table 1, while labelled correctly, it is also color coded the opposite to Figs 4 and 6, so that 'green is right' and 'orange is left'.

Table 1 colors were corrected accordingly. See the previous answer.

Erroneous Figure captions:
Table 1 cycle 2 Date column should be 2022-06-01 instead of 2022-05-01

Well spotted, thanks. Table 1 cycle 2 Date column was corrected accordingly.

Fig 5 and Fig A9 are the same - labelled time lapse between cycles 5 and 6 - however Figure 5 is captioned 'following partial right irrigation' while Figure A9 is captioned 'partial left-side irrigation'.

Fig 5 legend rephrased 'following partial left irrigation'. Note that this did not affect the core text description/interpretation.

The date/time formatting on the header row of the time lapse ERT figures (5, A2-A11) are inconsistent and I find the cycle number labels particularly confusing in this context because the 'background' is labelled as the end of the prior cycle and I don't intuitively think of background is the end of the old cycle. I thought 'between cycles 5 and 6' meant the start of 5 to just before the start of 6, as opposed to the very end of 5 to the very end of 6 which I believe is the intention.

Datetime are now consistent everywhere using the format: YYYY-MM-DD HH:MM, except for the figures 2,3,4,6 and 8 where we used Month-DD format.

Figures A2-A7 label the second image as the next cycle but A8-11 do not and that makes it seem like the cycle number is incorrectly labelled for that entire set of images. Since the time is shown in at least some of the timelapse figures, it would be helpful to have the time of the irrigation in Table 1 (as it is in Table A1) (and to use the same date formatting throughout all figures/tables). I think a combination of the headers would be best i.e. for Fig 5: Background (-1h) = 2022-06-29 16h20, Just After Irrig. (+1h) = 2022-06-29 17h20, Six days after Irrig. = 2022-07-05 17h20, and simple caption this is cycle 6 and add a title to the whole figure that says Cycle 6.

All the time-lapse ERT figures headers were renamed according to the reviewer's suggestion.

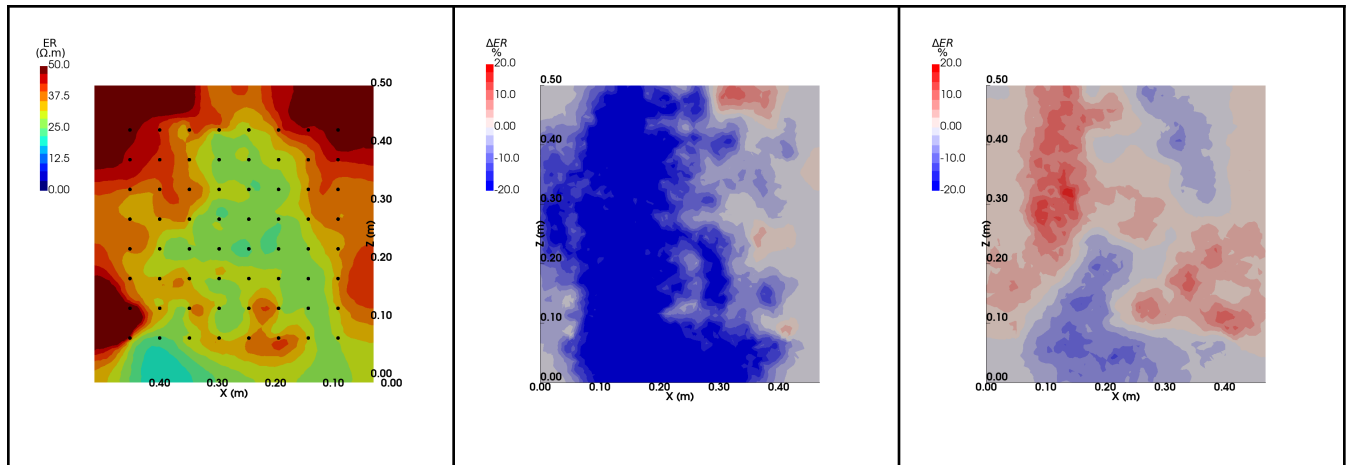| (a)	(b)	(c)
Background (-4h) = 2022-06-29 9:30	Just After Irrig. (+0h15) = 2022-06-29 14:15	6 days after Irrig = 2022-07-05 16:35

Figure 5: Spatial distribution of the resistivity (in Ωm) and changes (in %) in ER obtained by a time-lapse inversion for cycle 8 following partial left irrigation of the rhizotron (2022-06-29 13:45-14:00, 386 ml). Time steps correspond to measurements before (a), -4h min (b) just after irrigation (+0h15) (c) and 6 days after irrigation started.

The abstract is too technical and abbreviated in my opinion. It will probably be unclear to general readers why either ERT or ECI could be useful for understanding root water dynamics so I would advise adding a sentence that introduces the concept of Archie's law.

We added a sentence to introduce the concept of Archie's law: *"To estimate soil water content in the rhizotron during the experiment, we incorporated Archie's law as a constitutive model"*

Further, the term 'current source leakage' is only used twice in the paper, once in the abstract and once in the conclusion although much of the paper focuses on current source density/current density. Making the usage of the electrical methods terminology more consistent throughout the paper would be helpful to the reader.

The reviewer is right. All "current source leakage" occurrences are now replaced by "current source density"

Similar to the abstract, the title has an emphasis on specifically imaging 'the active root current pathway' but after reading the paper my takeaway was that the focus of the paper is more of an assessment of electrical methods for assessing root water uptake and observing the patterns of the PRD. To justify this in the title I think the introduction would need more background on the signifcance and meaning of the active root current pathway.

The reviewer is right. The title is rephrased considering also Reviewer 2 comments.
"*Imaging of the electrical activity in the root zone under limited water availability stress: A laboratory study for Vitis vinifera.*"
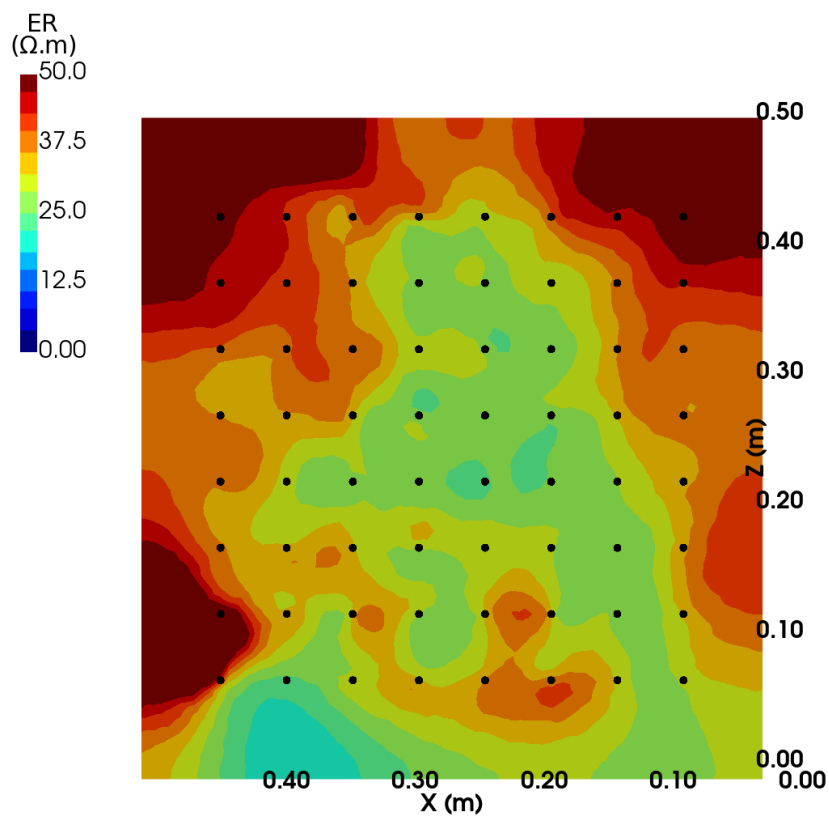
Minor comments:

Fig 1: the horizontal flux arrows are a bit confusing since I would expect at least some of the flux coming from the surface to be vertical. I would consider simply removing those arrows or replacing them with something more realistic.

The figure was improved accordingly.

Fig 5 (and A2-A11): the axes labels and legend are too small and low resolution to read clearly
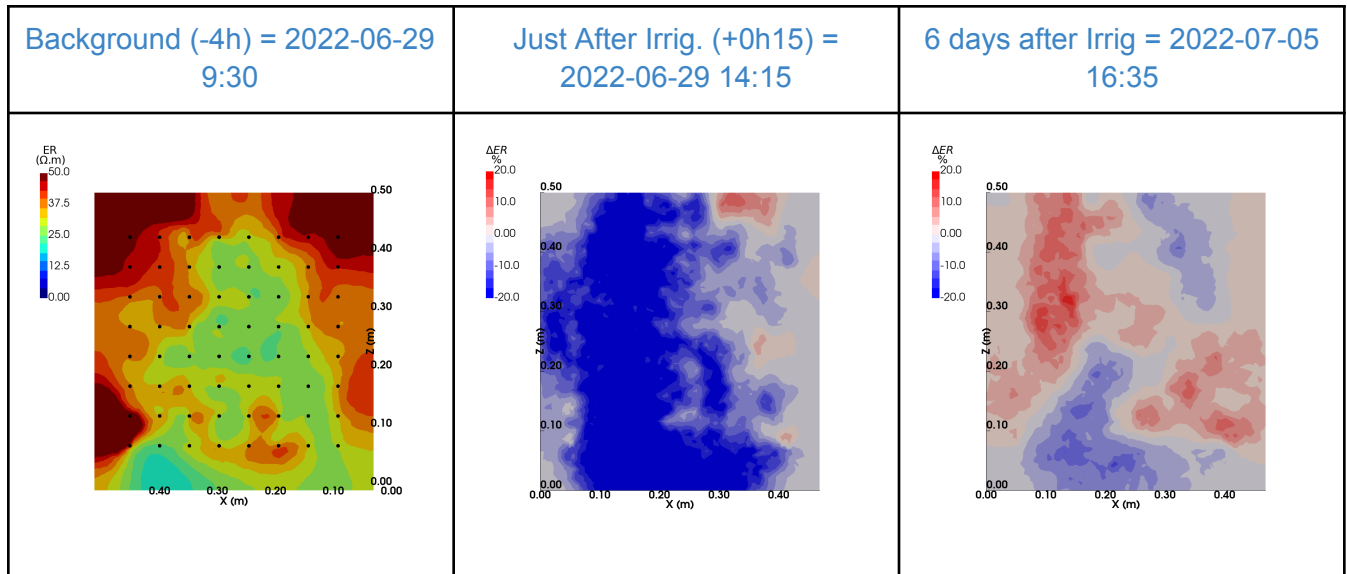
The reviewer is right. We improve the axis label and color bar quality.

| (a) | (b) | (c) |

Background (-4h) = 2022-06-29 9:30	Just After Irrig. (+0h15) = 2022-06-29 14:15	6 days after Irrig = 2022-07-05 16:35

Ln 20: Based on the other figures/tables it seems like there are only 4 or 5 PRD cycle pairs, not six as stated here

The sentence has been rephrased to make this clearer:
"*In controlled laboratory conditions, using a rhizotron built for geoelectrical tomography imaging, we monitored the spatio-temporal changes in soil electrical resistivity (ER) for more than a month corresponding to 8 alternating water input cycles.*"

Ln 23: 'Current Source Leakage Depth' is a very technical term that is not going to be understood by most readers without some explanation. I would consider rephrasing or adding some clarification.

The reviewer is right. We replaced *'Current Source Leakage Depth*' with '*Current Source Density spatial distribution*'

Ln 88: The concept of 'active roots' is very important for the paper but there is not really a definition of what makes roots 'active' vs inactive. The sentence on this line explains how water moves in active roots but doesn't make it clear whether inactive roots are those that will never take up water, or those that aren't taking up water at the moment.

The reviewer is right, the concept of active roots needs to be introduced further. We added 2 sentences to make it clearer:

"*The concept of active roots has been previously employed by several authors (Frensch and Steudle, 1989; Doussan et al., 1998; Garrigues et al., 2006; Srayeddin and Doussan, 2009) to characterize the spatial variability of root water uptake. In this context, plants adapt by reducing*

radial conductivity in dry regions, enabling them to redirect their uptake towards wetter areas with higher soil conductivity. This mechanism allows plants to maintain a consistent rate of water uptake while sustaining higher plant water potentials."

"Fine root connections and mycorrhiza facilitate the efficient transfer of injected current into the soil at contact points between roots and the soil, resulting in a distribution of current sources within the ground."

Lns 109-113: consider rephrasing this sentence to make it more clear

Sentence rephrased:

BEFORE: "Since then, contrasted experimental results opposed on the relationship between root capacitance ("ECroot") and root traits in various crops, particularly because of studies supporting the major contribution of the stem compared to the roots on the total ECroot measured and the possible current leakage at the proximal part"

AFTER: "Contrasting experimental results have challenged the relationship between root capacitance ("ECroot") and root traits in different crops, with studies highlighting the potential contribution of the stem, rather than the roots, to the overall measured ECroot and the occurrence of current leakage at the proximal part (Urban et al., 2011; Dietrich et al., 2018; Peruzzo et al., 2020)."

Ln 122: this is the first use of term 'electrical current leakage' which has not yet been explained, particularly as it relates to understanding root water dynamics or the electrical methods being used.

Sentence rephrased to explain the concept of current leakage defined by Peruzzo et al. (2020): *"Peruzzo et al. (2020) hypothesize that drought stress can also reduce electrical current leakage wherein the current exiting the plant root at the proximal part is decreased, particularly for woody species."*

Ln 132: this is the first use of EC abbreviation which has not previously been described but is used through page 6

All occurrences to EC were substituted by impedance to take into consideration reviewer 2 comment i.e. "The signal that is measured is also related to the electrical resistivity or conductance of the root tissue and of the soil and not only by the capacitance." Impedance combines both capacitance and resistance.

Ln 207: Rephase, i.e. For each irrigation event we regulated the amount of water supplied based on the information obtained from the scale data. The plant received 75% of the measured transpiration since the last irrigation cycle.

Sentence rephrased *"We controlled the water supply for each irrigation event based on the data obtained from the scale, ensuring that the plant received 75% of the measured transpiration accumulated since the last irrigation cycle."*

Ln 214: in Table 1 the cycles go from May 13th to July 12th

Corrected using Table 1 datetimes.

Ln 219: Cycle 9 in Table 1 says it uses holes H1-H8 and is not colored green or orange which conflicts with the statement here that 'From cycle number 3 to 9, we restricted the water input to the two lateral holes'. Also, although lateral does mean coming from the sides, it is not often used i in that context so I would consider changing it to something more descriptive, like left-most and right-most.

"Lateral" changed into "left-most and right-most"

Table 1: see Major comment 1 above

See response above

Ln 233: an abbreviation for electrical resistivity is defined on Ln 50 but then only used intermittently - make this more consistent throughout

Electrical resistivity was replaced by ER for all occurrences except the first one.

Ln 301: the abbreviation given here is ICSD, although subsequently only CSD is used

Corrected. ICSD abbreviation is now replaced by CSD inversion.

Ln 341: 'were' is typed twice in this sentence

Corrected thanks.

Fig 2b: the time series has a datetime mix up. Labelled August 6 (8/6) instead of June 8 (6/8). It would be helpful to remind the reader in this paragraph (~Ln 351) that the measurements shown come from the 26 leaves which is described back in the methods.

Figure label corrected and sentence rephrased: *"The measurements shown come from the 26 leaves (c.f section 2.5) and indicate that the plant is under high water stress at the end of the irrigation cycle (one week after the last partial irrigation, on June 8,2022), and under lower water stress one day after irrigation (on June 16, 2022)."*
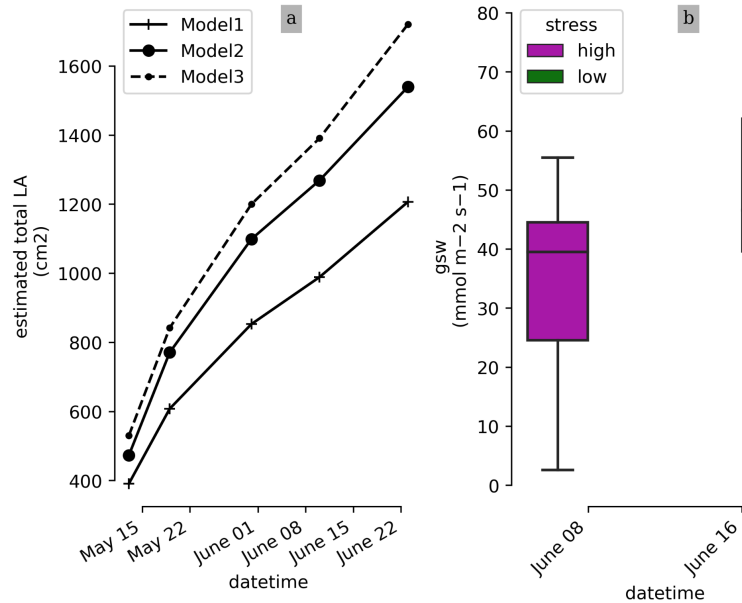
Fig 3: this transpiration data is really nice to see

Glad that you like it and hope to see it from other related studies again.

Ln 380: I would change this to say 'Fig 4 shows the trend for the irrigation cycles (-1 - 8) since cycle -1 was not PRD and cycles 0 and 1 were not the same as cycles 3-8. Also, here and in Fig 4, Cycle 9 is dropped, which conflicts with Ln 219 and Table 1.

Changed were made accordingly.

Ln 405: Reword to specify which side is the 'irrigated side'. Also, when you say the ER of the irrigated side had dropped by 20% how is that being calculated?

Sentence rephrased: "*One hour afterwards (+ 1H) the ER of the left irrigated side had dropped by 20% (estimated from the averaged values spanning from the middle of the rhizotron to the left boundary).*"

Fig 5: see Major comment 1

Changed were made accordingly.

Ln 426-427: It's not immediately clear why this confirms the quality of the estimated background values. Can you elaborate on what would be expected here and the underlying mechanism?

For the soil injection, considered punctual, we assumed that one single current source is responsible for the entire voltage distribution. Nevertheless, as the current is modulated by the

soil ER, a bias on the latest would create an error in the forward current source imaging and ultimately in the position of the current source. The soil CSD result showed that is always pinpointed to the location of the injection electrode whatever the irrigation pattern which is why we consider that our ER model is of good quality. More details can be found in (Mary et al., 2020)

We added a sentence to explain this:
"*Considering the modulation of current by soil electrical resistivity (ER), any bias in ER could introduce errors in forward current source imaging and, consequently, affect the positioning of the current source.*"

Fig 6: Rescaling the y axis on the center of mass to be narrower would help accentuate any slight variations. This graph should also have a unit (cm?). The caption mentions cycles 5 and 6 were used in Fig 7 but based on the dates it is actually cycles 6-7 (see my point in Major comment 1.3.3 above).

Ok figure improved (scale + unit) and legend corrected
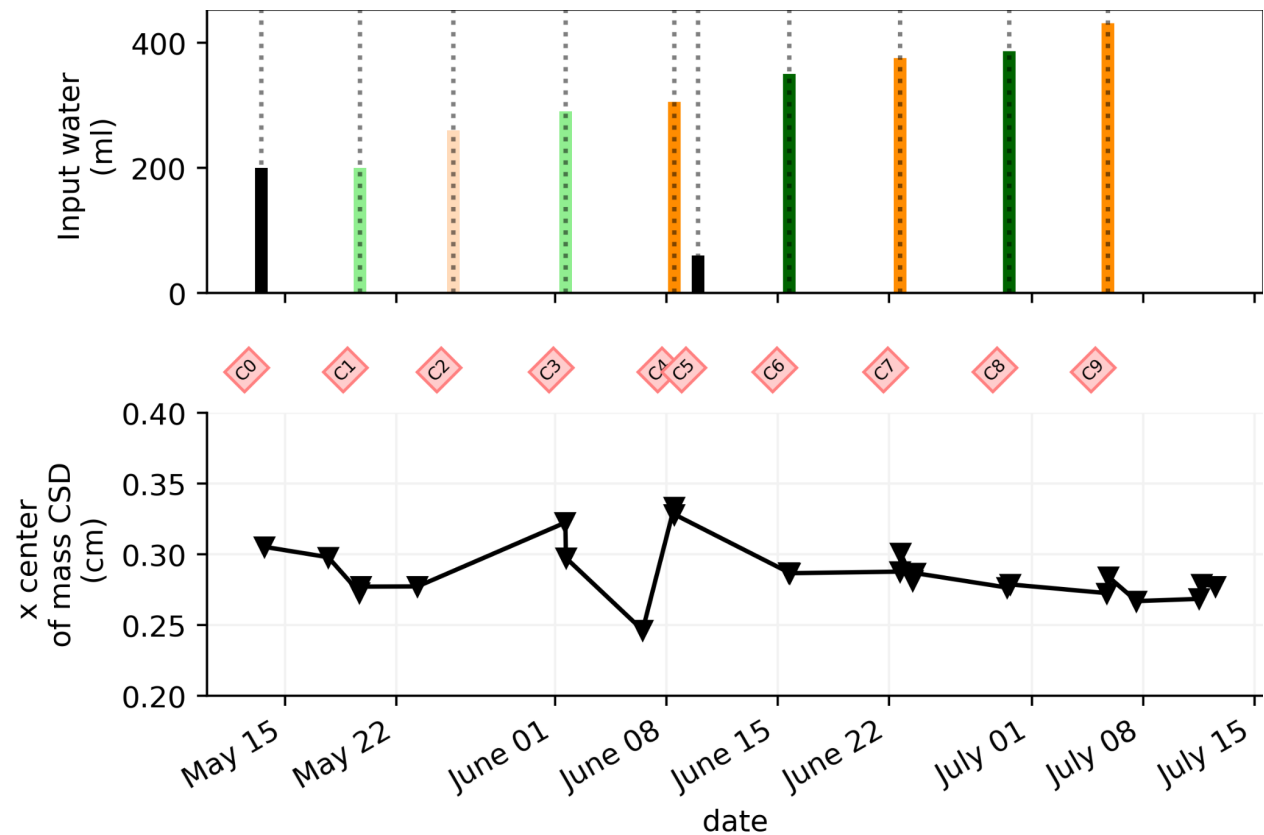
Ln 457: 'in' is typed twice

Corrected thanks.

Lns 460-47: it would be helpful to explicitly state how mean SWC was calculated for each side (i.e. all nodes left of center averaged). Were nodes on the edges excluded?

We added a sentence to explicitly state how mean SWC was calculated: "*Averaging is performed on the mesh nodes falling within each side, with the middle point being defined as half of the rhizotron width, equivalent to 0.25m.*"

Ln 499: The dates in Fig 3 and Table 1 suggest that the decrease in the rate of uptake is happening between July 5th and July 11th between cycles $7/8$

We are not sure why the reviewer considers that the rate of uptake is happening between July 5th to July 11th. Figure 3 shows that the curve of the measured weight flattens after July 11th i.e. for the last cycle as stated correctly in the manuscript.

Ln 537:539: consider rewording to use less colloquial language.

Sentence rephrase: "*In our experiment, the first criterion was met, but not the second. This provides an interesting piece of evidence, leading to the following considerations.*"

Ln 540:549: I like this discussion point regarding the potential impact of root growth over the course of the experiment

Thanks.

Ln 573: I would rephrase 'really good' to something more specific or to simply 'good'

Ok done

Ln 575-577: I'm finding this sentence unclear, please rephrase

Sentence rephrased: "*The algorithm has undergone testing in a rhizotron experiment and has demonstrated the ability to differentiate punctual sources, even when their current contribution is as low as 5% of the total current (Peruzzo et al., 2020).*"

Ln 581: 'the' is typed twice in this sentence

Corrected, thanks.