Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
https://doi.org/10.5194/hess-2021-317-RC2, 2021


# Comment on hess-2021-317

Anonymous Referee #2

---

Referee comment on "Technical note: High-accuracy weighing micro-lysimeter system for long-term measurements of non-rainfall water inputs to grasslands" by Andreas Riedl et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-317-RC2, 2021

---

The paper introduces a microlysimeter for the specific purpose of measuring the deposition of water on the surfaces of the soil and the vegetation by means other than rain (dew, fog, etc.). The deposited amounts of water are quite small, yet the paper argues that they could be important for the vegetation during dry periods. The design of the set-up, with its high observation frequency and high-resolution mass measurements is explained in some detail. The instrument has been in operation in the field. Its performance is reported and evaluated.

General comments

Overall, the paper gets across the relevance of MLs and the improvements the authors have made to earlier designs. The material fits the HESS mission and its readership.

That being said, the paper is wordy and tedious at times. The authors go in so much detail that is hard to follow the line of thought. In contrast, Figure 1 leaves out many technical details, and photographs of the ML and its components are not given.

The Introduction is comprehensive but incoherent, and would benefit from a careful revision. It can be shortened a little perhaps.

In Materials and Methods, there is no information at all given about the soil of the experimental site. The technical details of the ML setup and its installation and operating procedures need to be described better. The rest of the Methods are very detailed, sometimes about well-established techniques. You can shorten the text there.

The authors make a point about separating the various NRW modes, but given the small total flux, I do not understand why this is so important. On the other hand, the differences in soil temperature between the ML and the surrounding soil is downplayed, even though its various effects may linger into the night, when NRW occurs.

The material on which the paper is based is solid, but the presentation is not so good. The paper would benefit from a thorough rewrite that increases its coherence and clarity, and reduces its size a little.

The paper mentions a supplement but I could not find that, other than the data set.

Detailed comments

L34: The sentence introducing the new ML looks out of place here. You are still developing the argument for its necessity, only moving from general terms to a specific ecosystem.

L39: If rainfall ('RW') is absent, NRW necessarily IS the only atmospheric source of water, because RW and NRW are mutually exclusive and complementary.

L43: 'another temperate site' You did not mention the first one.

L51: What do you mean by plant water status?

L56 and 320: You mention dew deposition on soil, but earlier you stated that does rarely occur.

You need to have a careful look at the Introduction. Although I agree with the arguments it presents, they are presented in a confusing order. Above I mentioned the Introduction of a lysimeter in the middle of a discussion about NRW. Elsewhere too you jump between general statements and location-specific arguments without a logical connection between the two. This compromises the coherence of the text and disrupts the flow of thought. All the elements the Introduction needs are there, but please present them in a more coherent order and use more paragraphs as compartments for different focal points of the Introduction.

Section 2: Some subsections are not directly important to understand the ML setup. Perhaps the very detailed material can be placed in the supplement.

Section 2.1: Please give some information about the soil.

L124: What is FluxNet? Do we need to know?

L154: Instead of the width and the thickness it is probably better to give the outer and inner diameter of the ML tube.

L173-174: How do you level the load cell and the ML during installation in the field? I cannot see the adjustment screws in the figure or how you can reach them during the installation process.

Fig. 1: What are the structures on either side of the load cell that look like an H on its side? The text mentions machine screws (bolts?) but I cannot find these in the figure. I also think it would be helpful to add a photograph of the instrument to the figure, as well as a scale or a set of dimensions within the drawing.

Section 2.2.3: I estimate a filled ML weighs about 100 kg. How did you handle it when you excavated the monolith and when you installed the monolith in its field setup?
The ML pots were closed on one side. In order to transfer the monolith from the sampling pot to its ML pot you need to place both pots with the open sides against each other, so you end up with a cylinder that is closed on both sides. How did you transfer the monolith from one half of that cylinder to the other?

L240: What was the size of the averaging window?

Section 2.2.6: it is helpful to mention here somewhere what the resolution of the load cell is converted to mm water layer.

L279: Why the < sign in the sensitivity of the temperature sensor? Now we still do not know its sensitivity.

L283-284: ‚we considered standard deviation to account for spatial variability.' I do not understand this.

L327: Accuracy of what? In the section that follows you use the term accuracy a lot, but I believe you sometimes mean precision (e.g., https://www.mccdaq.com/TechTips/TechTip-1.aspx).

L328: Please give more significant digits for the correlation coefficient.

L365: with your measurement frequency, individual eddies in the near-surface atmosphere can affect individual measurements. How did you use wind speed readings to correct for the effect of wind on the readings? Or do you mean you can only discard wind effects if the wind speed is low? In that case, do your data allow to place an upper limit in the wind speed below which its effects can be ignored?

Table 1: In the two right-most columns, are the signs of the table entries reversed if the visibility exceeds 1000 m and the temperature is above freezing, respectively? The minus sign could be interpreted as leading to water loss from the ML, but it only signals an absence of the corresponding mode of water deposition. Perhaps explain this in the table heading.

L393: Do you know what effect the closed lysimeter bottom has on the temperature profile inside the ML, compared to in situ values? Also, the ML was 4 degrees warmer at the end of the afternoon (Fig. 5), which you discuss in detail later on. Were you able to determine the cause of the temperature difference? Correction: I see that you discuss this later on.

L426-436: The MLs had a lower soil water content than the surrounding soil. You state that this die not affect the NRW. However, it does affect the level of water stress experienced by the plants. In combination this leads to the conclusion that MLs can be used to measure NRW as long as the difference in water stress inside and outside the ML does not lead to changes in soil temperature, canopy architecture, plant height, etc., but cannot be used to study the effect of NRW on the water stress of the vegetation. For that you need deeper lysimeters. Is this correct?

Section 3.6: You present many numbers in the text, which is rather tedious. This information can better be organized in tables.

Section 4.1: I believe you mean resolution instead of accuracy.

L505: stable decimal place: the meaning of this depends on the units you choose, which you specify elsewhere. I think it is better to rephrase and state the resolution you achieved, compared to that of earlier instruments.

L516: According to the dimension (L105), the ML pots have a volume of 67 liters. They cannot possibly weigh not even 20 kg at that size.

L521: I have the impression this confusion in terminology also appears in this paper.

L550: The grass, not the grasslands, grow.
L550: The claim that NRW is highly relevant is a bit too fast. To validate that claim you have to show that it can substantially reduce water stress and/or significantly increases actual transpiration.

L558-559: 'However, the NRW inputs of the potential water vapor adsorption events were with <
1 mm' I do not understand this, please rephrase.

L588: But you did not measure the plant mass (impossible to do non-destructively) or the leaf area index, so you may, in fact, have had reduced plant growth that you did not see.

L625: ...on plants... Just above you limit yourself to grass. I believe you demonstrated that you system works for short vegetation. For high plants (Maize, shrubs) I am less sure. Also, for vegetation with interlocking leaves, or plants that can be flattened by wind (e.g., barley) and then get back up again, your very sensitive mass measurements may be comprimised. Later you claim your system works for plants up to 120 cm. What is the rationale for this value?

L689: You reported a diameter of 45 cm above, yet here you state that its area is comparable to 25 by 25 cm, which is 0.4 times your ML-area.

L694: 'simulate' is not really the right word here. 'Represents', 'reproduce', or 'mimick' are all better, depending on what you want to convey.

Section 5: You leave out the discrepancy in soil temperatures inside and outside the ML, but it worries me. The temperature difference affects the heat balance of the soil. Liquid water is less viscous in warmer soil, so the hydraulic conductivity increases for a given water content, which will have an effect on the vertical distribution of water and water

uptake by roots. A change in the soil temperature affects the partitioning of the incoming energy between heating up the soil and generating evaporation. It also changes the microclimate near the soil surface. Even if the temperature difference vanishes at night, its effects on the soil hydrology may linger.

I cannot offer a remedy, and I do not believe it invalidates your measurements, but it is an issue that deserves attention and hopefully can be improved if you continue your work.

Appendix A: It will be challenging to measure drainage with the accuracy necessary for reliable NRW quantification. A few droplets in the outlet tube may have a sizeable effect on the estimated NRW. This appendix is too detailed and wordy. Please condense it to get the message across better.