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Comment on hess-2022-370

Anonymous Referee #1

Referee comment on "Evaluation of precipitation measurement methods using data from a precision lysimeter network" by Tobias Schnepper et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-370-RC1, 2022

The paper by Tobias Schnepper et al. focuses on evaluating several precipitation measurement techniques based on data from the TERrestial Environmental Observatories (TERENO)-SOILCan lysimeter network as a reference.

The topic is important, and the paper is well-structured and written. I have, however, several concerns that require clarification and/or revisions, as described below:

1) Reliability of precipitation measurements from the lysimeters: The assumption of no ET during precipitation interval and vice versa seems valid only at very short time intervals. Within an hour interval, I assume precipitation and ET can co-occur, especially for very wet soil and high evaporative demands. I think the authors should support this assumption, which underlies the precipitation computation. Otherwise, the reliability of the reference data is questionable.

2) Eq. 2: I assume P here includes NRE? It is unclear why NRE is presented in Eq. 1 but ignored until section 2.5.1. How come? Please clarify this.

3) More on NRE: according to former studies, NRE is a primary source of error for standard gauges compared to lysimeter precipitation data. It is, therefore, crucial this component would be as accurate as possible. However, the rules to determine NRE cases are very “ad-hoc” and probably specific to a given site. Furthermore, is it reasonable to assume that within an hour interval, precipitation will be either NRE or not? Isn’t it possible to have rainfall and NRE together within the hour?

4) Spatial autocorrelation of rainfall: using the mean of all hexagon gauges as the precipitation reference for the other type of gauges ignores spatial variance of

precipitation within the hexagon area. There is no information about the size of the hexagon; maybe it is too small, and the variance is neglectable. Still, in principle, the difference between the lysimeter spatial average and the gauge measurement may be related to their spatial scale.

5) Uncertainty estimation: is computed based on the standard deviation between measurements for each hour. This computation is based on the assumptions: 1) the precipitation measurements (for a given hour) are normally distributed with the same mean and variance for all gauges (the text says the first part of this statement), and 2) the data from the different gauges are independent. How can these two assumptions be justified?

6) The highest observed precipitation rate is 20 mm/h. Can you provide some info about this value so the reader would know what part of the precipitation rate distribution the analysis is covering?

7) Section 2.8: Precipitation data corrections: This section proposes correction procedures that seem very empirical. How much can we trust these methods in the general case? How applicable are they for locations different than their development?

8) The following sentence appears in the conclusion section (L677): "The arithmetic mean of the lysimeter measurements has proven to be an almost unbiased reference for the precipitation measurement method". I don't think this was proved, but rather the assumption was the basis for the error analysis. Please clarify or correct.

More specific minor comments:

9) L151 – what is the hexagon area?

10) L225: "iii) summing the minutely to hourly values" – do you mean the raw data or after the application of Eq 1,2, 3?

11) Eq 4 + L247: "and ð□□□ð□□□ð□□□ is the number of lysimeters with missing data during time interval ð□□□ (-).". It is not clear to me what is the definition of nia here.

12) L255: you should state that it is assumed the measurements are from a normal distribution with the same mean and standard deviation

13) It would be good to show the CDFs of hourly values of precipitation and ET.

14) Eq. 9: index i is missing

15) I think something is wrong with Eq. 10; please correct

16) Eq. 8-10: Use either small or capital letters consistently.

17) L350: Eq. 13 – should it be Eq. 14?