Review of “Calibrating low-cost rain gauge sensors for their applications in IoT infrastructure to densify environmental monitoring network” by Krüger et al

The paper addresses the calibration of low-cost rain gauges in laboratory and field evaluation with referenced ones.

It is of interest for field application to enrich dataset and reducing instrumentation cost.

Thanks for time and effort to review our manuscript. We have replied inline in the text. Author comments are in black, reviewer comments are grayed out.

The part concerning low-cost data acquisition system could be shorten, as different publications are available in literature. Anyway, a paragraph focus on time synchronization versus the reference system used in the field test would be an interesting complement.

- **Time synchronisation of the low cost sensor system with the reference gauges was ensured as time for both type of systems was set through network time protocol (NTP). Will be clarified.**
- **We like to have the low-cost acquisition part in the manuscript to increase applicability of the rain gauges related findings and a better transferability for the final user. The source code will be added to appendix.**

Concerning the laboratory calibration, the lecturer would appreciate to have a plot of the distribution of results obtained for all your rain-gauges, supposed to be Gaussian. Is the median close to your mean value?

- **There is a plot on page 10 (fig. 1) showing the distribution of the two different types. A Boxplot for all Type A gauges combined will be added, further the single measurements will be visualized like in figure 5 (p12).**
- **Median Values will be added to the text. Median of all gauges (type A) is 0.1751mm (mean = 0.1737mm)**
- **Distribution of results is indeed Gaussian for all 4 groups (A – new, A – used, A – all, B) – tested with Kolmogorov–Smirnov test (alpha = 0.05)**

During laboratory experiments, the flatness and horizontality was supposed to be controlled, what about the field conditions.

- **Horizontality of the rain gauges was ensured by the usage of the built-in bubble level of the rain gauges and the usage of washers while fixing the gauges to the (levelled) frame.**
  I will add the explanation to the manuscript.

What was the confidence interval during your laboratory calibration?

- **Confidence intervals for a confidence level of 95% have been calculated as follows (A-new: 0.1680mm…0.1795mm; A – used: 0.1699mm…0.1795mm; A – all: 0.1704mm…0.1771mm; B: 0.1911mm….0.1972mm). Will be added to the text.**

The referenced station for field trials are not positioned at the same spatial location, how do you controlled the spatial homogeneity? It could add uncertainty to your field results to be taken into account for the analysis.

- **We agree, that small scale variability of precipitation could add uncertainty to the results. Nevertheless, we didn't control or account for spatial homogeneity as the gauges have been set up close to the reference (10m), well within the measurement site. Further, other gauges are also distributed to the measurement site.**
- **Other studies, f.e. the WMO Field Intercomparison of Rain Intensity Gauges (Lanza and Vuerich, 2009) used similar or bigger sized setups without accounting for spatial homogeneity.**

As the final aim is to enhance the amount of sensor using low-cost sensor, using opportunistic data from private owner of rain stations can be discussed by comparison with the knowledge acquired during your experiments.

- **It is true that this sensor type is widely used by local authorities and private users. Although precipitation data from that kind of sensors can be acquired through private weather networks like wunderground or else, analysing those datasets is difficult without further informations on the specific set up, and thus beyond the scope of this study.**

The research work presented is of importance for field experiments.

I hope that these few suggestions will help authors to improve their paper for publication in GI Journal.

References

Lanza, L. G. and Vuerich, E.: The WMO Field Intercomparison of Rain Intensity Gauges, Atmospheric Research, 94, 534–543, https://doi.org/10.1016/j.atmosres.2009.06.012, 2009.