

## ***Interactive comment on “Automated precipitation monitoring with the Thies disdrometer: Biases and ways for improvement” by Michael Fehlmann et al.***

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Received and published: 7 February 2020

Dear authors,

Thanks for making your work open to comments. I might be able provide a couple of useful comments hereby, having worked with Thies LPM Clima instruments recently. I find your paper very well written and organised, and easy to follow. A couple of comments below are listed as dot points in no particular order of importance:

1. I find that your introduction might benefit from adding further explanations, in particular when it comes to the use of laser disdrometers outside of precipitation amounts measurements; e.g. gathering of DSD for parameterisation of models and retrievals. Typically line 20, you mention the “verification of dual-pol radars” but it is not reduced

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to this, and you could possibly mention all the different usage of the DSD (not only for the Thies) but for disdrometers in general.

2. Lines 21 and 22: “not many studies have assessed uncertainties of disdrometers” – this is not really correct, and quite perilous to state this without including a succinct literature review. There are plenty of studies assessing uncertainties of disdrometers (usually by comparing disdrometers of different make-up / manufacturers / principles, or/and co-located instruments), but they often investigate the OTT Parsivels (both versions) and 2DVD in their majority. For the Thies in particular, you could mention here Angulo-Martinez et al. (2018) and Guyot et al. (2019), both published in the companion EGU-journal HESS.

Angulo-Martínez, M., Beguería, S., Latorre, B., & Fernández-Raga, M.: Comparison of precipitation measurements by OTT Parsivel 2 and Thies LPM optical disdrometers. *Hydrology and Earth System Sciences*, 22(5), 2811, <https://doi.org/10.5194/hess-22-2811-2018>, 2018.

Guyot, A., Pudashine, J., Protat, A., Uijlenhoet, R., Pauwels, V. R. N., Seed, A., and Walker, J. P.: Effect of disdrometer type on rain drop size distribution characterisation: a new dataset for south-eastern Australia, *Hydrol. Earth Syst. Sci.*, 23, 4737–4761, <https://doi.org/10.5194/hess-23-4737-2019>, 2019.

In these two studies, measurements of rainfall are evaluated using respectively OTT Parsivel1 and 2 and Thies LPM. This could serve as well for your discussion, in particular when it comes to the uncertainties and systematic under-estimation of rainfall by Thies instruments. We find in Guyot et al. (2019) that Thies underestimated liquid precipitation when compared to the OTT Parsivels (1 and 2).

3. Line 28 to 30. I believe these findings have been revisited in Thurai et al. (2016) and later Thurai and Bringi (2018), Raupach et al. (2019)? The 2DVD seems to underestimate droplets in the lower range of diameters (< 0.5 mm), meaning that their use as reference can be questionable in some circumstances in particular over that range.

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Overall, it would be great to mention that there is no perfect reference that one can use, and each instrument will be affected by uncertainties. For the 2DVD, it would be great to mention that the literature is evolving and previous findings might not hold anymore or only partially.

Thurai, M. and Bringi, V. N.: Application of the generalized gamma model to represent the full rain drop size distribution spectra, *J. Appl. Meteorol. Clim.*, 57, 1197–1210, <https://doi.org/10.1175/jamc-d-17-0235.1>, 2018.

Thurai, M., Gatlin, P., Bringi, V. N., Petersen, W., Kennedy, P., Notaroš, B., & Carey, L. (2017). Toward completing the raindrop size spectrum: Case studies involving 2D-video disdrometer, droplet spectrometer, and polarimetric radar measurements. *Journal of Applied Meteorology and Climatology*, 56(4), 877-896.

Raupach, T. H., Thurai, M., Bringi, V. N., & Berne, A. (2019). Reconstructing the drizzle mode of the raindrop size distribution using double-moment normalization. *Journal of Applied Meteorology and Climatology*, 58(1), 145-164.

4. In your manuscript, it would be great to differentiate the two types of Parsivel (1 and 2) using a superscript, as in the second version; the manufacturer has corrected some issues in particular in the lower range of diameters.

5. In terms of rainfall, we have found in Guyot et al. (2019) that the Thies starts to underestimate the number of droplets from 0.75 mm onwards towards larger diameters (instead of 0.5 mm as mentioned in your paper) when compared to Parsivel1. Since we do not use the same reference (in your case 2DVD), this might explain the difference but again here I think it is good to keep in mind that 2DVD is not an absolute reference and has been questioned for his accuracy in the recent literature.

6. Data availability: It adds a great value to the work to make the data accessible openly on a repository (and possibly the code as well, mentioning libraries having been used if any to give credits to the authors). One of the strengths of open-access articles is

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also to promote that accessibility of data and code so that work can be re-produced, and data shared easily.

Thanks for making it possible to read and comment on your work, I enjoyed the reading.

With kind regards,

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Interactive comment on *Atmos. Meas. Tech. Discuss.*, doi:10.5194/amt-2019-466, 2020.

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