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Atmospheric Measurement Techniques Discussions

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

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Please find below a revised answer to comment 1.2:

Comment 1.2 Section 2: Did the Authors applied any filtering method to eliminate the so called "spurious drops" due to win, splashing, or mismatch? Several studies that used disdrometer measured DSD applied a filter criterion based on fall velocity such as the one adopted in Tokay et al. 2001 and valid only for rain.

Response: Thank you very much for this comment. Indeed, this effect exists and several studies apply filter algorithms to remove spurious measurements of mostly larger particles from 2DVD or other video disdrometer measurements by applying a filter based on the combined velocity-diameter information (e.g., von Lerber et al., 2017;

Raupach and Berne, 2015). However, as shown by Friedrich et al. (2013) for the Parsivel disdrometer such effects mostly occur at high wind speeds (exceeding 20 m/s). Although the effect of splashing might differ for different disdrometer types because of the different shape (in particular the two arms of the Parsivel vs. the two rails of the Thies disdrometer), Friedrich et al. (2013) is also cited in the context of Thies disdrometer analyses (e.g., Chen et al., 2016). As our study is extremely wind sheltered we did not see the need of applying such a filter in this study.

Furthermore, to investigate the potential effect of applying a similar filter than Chen et al. (2016) at our study site, we did the following exploratory analysis: We filtered out from the binned V-D data all particles corresponding to bins which have a centroid outside +-60% of the theoretically expected velocity using the empirical V-D relationship for all precipitation types (see Fig. 3, red bins are excluded). We then calculated total volume for all particles during the 2 years of measurement, assuming a spherical shape for simplicity. The percentage of the invalid particles volume to total volume is 2.3% for the whole time period and a little bit higher in summer (months Apr-Sept: 4.7%) than in winter (Oct-Mar: 1.8%). Although the application of such a filter might have an effect on PSD correction factors for small volumes, the effect of on precipitation intensity, which is the focus of the study, will be rather small. Also, we might filter out too many particles as the disagreement of the Thies disdrometer with respect to the OTT pluviometer for liquid precipitation will even increase.

Chen, B., Wang, J., & Gong, D. (2016). Raindrop size distribution in a midlatitude continental squall line measured by Thies optical disdrometers over East China. Journal of Applied Meteorology and Climatology, 55(3), 621-634.

Changes in the manuscript (section 2.1): Note that in some studies using optical disdrometer measurements, additional filters are applied to remove spurious measurements due to splashing or margin faller effects (e.g., Chen et al., 2016; Friedrich et al., 2013; Raupach and Berne, 2015; von Lerber et al., 2017). Usually, such filters are based on a validity check of the combined diameter and fall velocity information, e.g. excluding data that are more than 60% above or below the fall velocity-diameter relationship for rain (Jaffrain and Berne, 2011). However, as investigated in detail by Friedrich et al. (2013) for Parsivel disdrometers, such spurious measurements mostly occur at wind speeds exceeding 20 m/s. As our study is extremely wind sheltered, we thus did not see the need of applying such a filter in this study. This is further supported by an exploratory analysis of applying the filter proposed by Chen et al. (2016) to the Thies disdrometer measurements over the full time period, which revealed that the volume contribution of the filtered particles is only very small (in the order of 2 – 3 %) in our case.

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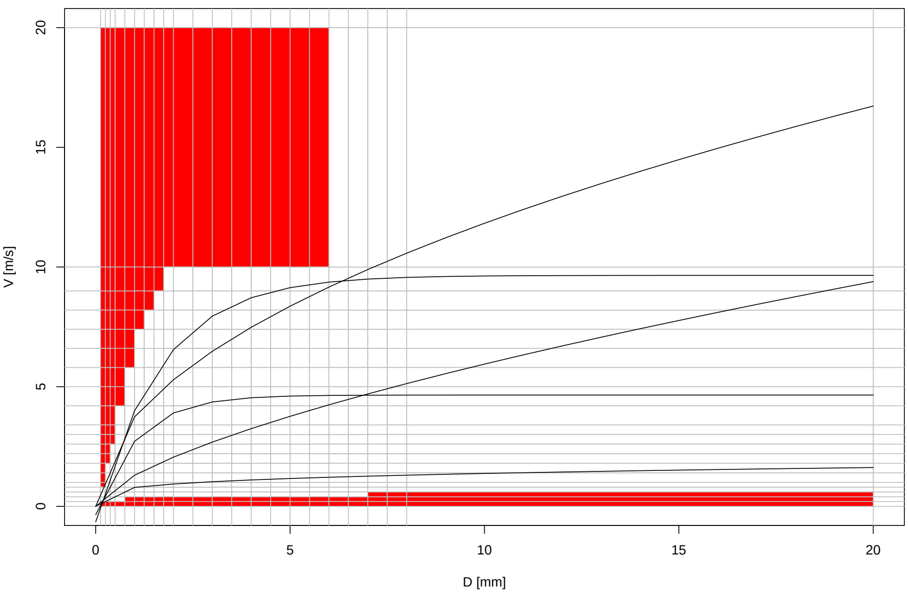

Fig. 1.