

Characteristics of vertical velocities estimated from drop size and fall velocity spectra of a Parsivel disdrometer

by

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This paper deals with the estimation of vertical (fall) velocities of rain drops from Parsivel measurements, assuming that the rain drop fall speeds follow the Gunn-Kinzer (G-K) variation (using Atlas et al. 1973 equation) and some minor altitude adjustment for air density. The estimates are compared with anemometer measurements in several different locations. Disdrometer data are also used to derive Z-R relationships and the mass-weighted mean diameter. The paper contains reasonable results and is suitable for publication in AMT, but some changes need to be made, as follows:

Line 162, and Fig. 2: It might be easier to follow this flow chart if some pertinent equations are added, corresponding to each step.

Lines 164-169, and the use of Fig. 3: Please note that although G-K formula is a good representation for the 'most probable' velocity - diameter variation (especially for > 1 mm drops), it is well known that for a given drop size, there will be a distribution of velocities associated with it (but narrow). For example see a very recent paper by Bringi et al., 2018: <https://www.atmos-meas-tech.net/11/1377/2018/> in particular their Fig. 1 and 3.

Also note that for small drops, the most suitable formula is in Foote and DuToit (1969), eq. (10), with the coefficients given in their Table 1 for $N=9$.

Lines 186-189: The authors say "Also a dual-Doppler radar analysis (Liou et al., 2012) was also conducted to obtain 3-D wind components from radial velocity data of two Doppler radars as well as vertical structure of radar reflectivity in this mountain area." However, I don't see those results in the manuscript. It would be advisable to incorporate or make use of, at least qualitatively, velocity information from the dual-Doppler analyses.

Lines 217-218: "they just pointed up or downward, depending on w signs and magnitudes". This statement is not clear. Certainly, drop horizontal velocities will cause errors and some discussion on this needs to be included.

Please also note Appendix A of Thurai JAOT, 2017, along with their Fig. A1, which shows drop horizontal velocities, both in terms of magnitude and direction, derived from 2D video disdrometer measurements, and the excellent comparisons with the 10 m wind sensor data.

Last para in Section 4.1: Can the authors include a discussion on the role of DSDs in the calculated Z-R relationships?

Around lines 243-245: For $R > 10$ mm/h, Fig. 7a shows very different histograms between Parsivel-based and wind-sensor based. This should be pointed out, and explained, if possible.

Lines 255-256: "In the downward w group, the largest percentage (69%) is found at D4 (Fig. 7f)" .. So why is this? Can this be explained?

Modest amount of revision is required.