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Atmospheric Measurement Techniques Discussions

Interactive comment on "Effect of sampling variation on error of rainfall variables measured by optical disdrometer" *by* X. C. Liu et al.

Anonymous Referee #1

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General Comments

The subject of this paper is the sampling error in disdrometers due to the finite size of their measurement area. This is a well known problem that in most instruments it is reduced by increasing the measurement area up to the limit that other factors (like system dimensions in 2DVD, which can measure many particles at a time, or the need for narrow sampling laser beam in Parsivel, which measures one particle at a time) impose. The paper uses only simulated data and no actual measurements, in order for example to compare the various disdrometers. The number (six) of tables is too large (almost equal to the number of figures) and the number of pages is small for a normal paper. Also, unrealistic huge number of reflectivity values (close to 100 dBZ)

are reported, which are obviously due to calculation errors. The conclusion that the reflectivity (sixth order moment of diameters, for which the large droplets are more important) has lower relative sampling error than other estimated rainfall variables should be explained. Probably, calculation errors are involved in this conclusion. The authors should verify their calculations, add results from actual measurements from available disdrometers and resubmit the paper.

Specific Comments

Page 2, line 5: "to measure precipitation" should be changed to "to measure the drop size distribution of precipitation". Rain gauges are the typical instruments to measure precipitation, while disdrometers give information on the precipitation spectrum.

Page 2, lines 19-22: more recent studies about non-homogeneous models should be referenced, too. The homogeneous model fits better to the less frequent stationary precipitation.

Page 4, line 1: the correct term is "equivolumetric" instead of "equivalent" diameter. The parameter No is an "intercept" parameter and it is not the total drop concentration (the integral of the drop size distribution). The parameter μ is not the order of the gamma distribution but a measure of its shape (shape parameter).

Page 4, line 17: the term "two categories" should be changed to "two steps". In addition, a third step in the simulation process is to specify the arrival time.

Page 4, Eq. (4): this equation is valid for the arrival time of individual drops. But, in 2DVD the measurement area is on purpose quite large (10 x 10 cm) and simultaneous drops can be measured. Also, the description of the process of arrival time needs more details according to Smith (1993).

Page 6, section 2.3: The error in the estimation of the parameters No, μ and most important of rainfall rate should also be examined. Also, the right side of Eq. (14) is in error. A normalization by ΣN(D) is needed.

Page 6, line 21: The 2DVD can measure the full shape (from two orthogonal views) of the particles.

Page 7, line 1: Is not clear where in the paper Eq. (15) for the axis ratio of drops is used.

Page 7, lines 5-10: A similar method for the margin area treatment is used in 2DVD. What about the errors, for example in Parsivel, when two or more drops pass simultaneously though the laser beam.

Page 7, lines 25-26: A clear definition of marginal drops is needed.

Page 8, line 1: the correct term “water content” instead of “water concentration”. The huge value of 100 dBZ of reflectivity is obviously in error.

Page 8, lines 5-9: Higher moments depend on larger drop diameters and are expected to have higher error. The reflectivity units should be linear units (mm6 m-3) when the relative error is computed.

Page 9, line 4 and Tables 4 and 5: The convective (named cumulonimbus) rain is a highly non-stationary rain and the homogenous model used in the simulation process is not valid.

Page 10, lines 19-21: 2DVD measures the fall velocity directly by the difference of the time of arrival between the levels of the two orthogonal optical beams.

Page 11, Conclusions: Conclusions should have more discussion of results than the Abstract.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 8895, 2012.