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Rain Drop Size Distribution Model Parameters With and Without Accurate Measurements of Small Drops

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Unique datasets of the full rain drop size distribution (DSD) were collected from the high resolution (50 microns) Meteorological Particle Spectrometer (MPS) and moderate resolution (170 microns) collocated 2D-video disdrometer (2DVD), both installed inside a DFIR wind-fence, at two locations in Greeley, CO and Huntsville, AL both in the United States. By combining the MPS measurements for drops with less than 0.8 mm diameter with those from 2DVD for greater than 0.8 mm, the full DSD spectra were constructed for a variety of rain types.

Model representation of the full DSD spectra was accomplished by previously published formulation which makes use of two suitable reference moments combined with the corresponding underlying shape function based on the generalized gamma model (GG), with two shape parameters, μ and c.

In this paper, we examine the effect of incorporating the more accurate MPS measurements of the small drops (concentration) on the GG fitted parameters. If 3rd and the 4th moments (M3, M4) are chosen as the reference moments, then the ratio (M4/M3) becomes the mass-weighted mean diameter (Dm), and the scaling factor No' will be related to the normalized intercept parameter, Nw, via a simple scaling factor.

Our analyses have shown that if the MPS data are not incorporated, then (a) No' will be underestimated; (b) Dm will be overestimated; (c) μ will be highly variable; and (d) values of c will be largely confined to 0 – 2 range. Note the standard gamma model (SG) will correspond to c=1 for reference moments (M3, M4), and hence will appear to be suitable if the MPS measurements were not included in the fitting process.