2D Video Distrometer drop size distributions

Raindrop size distributions are measured using a Joanneum Research 2D Video Distrometer [2DVD, see Schönhuber et al., 1994, Kruger and Krajewski, 2002]. The instrument is located at the remote sensing site at Cabauw. Data are available from 2008-07-01, with a temporal resolution of 1 minute. New data are added to the database every month.

Computation of drop size distributions

The 2DVD measures arrival times, diameters, and fall velocities of all particles falling through a 100 cm^2 plane. It is assumed that all particles falling through this plane are raindrops. For reasons described by (among others) Thurai and Bringi [2005], a filter is applied to the data: any drop with a fall velocity that is more than 40% larger or smaller than the theoretical fall velocity corresponding to the diameter of that drop is discarded. The velocity-diameter relation that is used for this purpose is that described by Beard [1976]. Drops with diameters larger than 6.0 mm are also discarded.

Drop size distributions are computed from the remaining drops by grouping them according to their arrival times (1-minute intervals) and drop sizes (0.1-mm diameter classes). For diameter class D_i (mm), the value of the drop size distribution $N(D)$ (mm^{-1} m^{-3}) is given by

$$N(D_i) = \sum_{j=1} M \frac{1}{v_j \Delta t A_j \Delta D},$$

where M is the number of drops in diameter class i, v_j (m s^{-1}) is the fall velocity of drop j, A_j is the effective area of the measurement plane at the time of the passage of drop j ($\sim 10^{-4}$ m^2 in this case), Δt is the measurement interval (60 s in this case), and ΔD is the diameter class width (0.1 mm in this case).

Drop size distributions are only computed for a given 1-minute interval if the instrument was operational for the entire minute. Otherwise $N(D_i) = -9999.0$ for all i.

References

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