DROP SIZE DISTRIBUTIONS IN OKINAWA, JAPAN, FROM 2D-VIDEO DISTROMETER AND C-BAND POLARIMETRIC RADAR

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In November 2003, a 'low-profile' 2D-video distrometer manufactured by Joanneum Research was installed at the CRL-Okinawa wind profiler site. The distrometer recorded DSD data for a number of shallow rain events in Dec '03-Jan '04. The data analyses of these events showed that their DSDs were characterized by unusually low median volume diameters (D_0 near 1 mm) with large values of normalized intercept parameter (N_w near 40,000 per mm per m^3). This is in contrast with typical 'maritime' rain which is often characterized by D_0 values centered around 1.6 mm and N_w centered around 20,000. This would result in different values of the multiplicative coefficient 'a' of the corresponding $Z=aR^{1.5}$ relation, i.e., 'a' would be a factor of (approximately) 2 less for the warm shallow rain as compared with maritime tropical rain.

CRL-Okinawa operates an advanced C-band polarimetric radar (referred to as COBRA) with 2 Klystron transmitters and 2 digital receivers enabling the measurement of the full polarimetric covariance matrix. In this paper we utilize the copolar measurements of Z_h, Z_{dr} and K_{dp} to retrieve the DSD parameters of a normalized (by water content) gamma distribution and demonstrate that the retrieved D_0 and N_w values for the shallow rain events are consistent with those derived from the video distrometer. These retrievals include attenuation-correction based on a self-consistent, ϕ_{dp}constraint algorithm. The COBRA data from a typhoon event of 6 August 2003 was also analyzed in terms of the DSD characteristics, which, unlike the shallow rain events, showed mean $D_0$and N_w values more consistent with tropical 'maritime' rain alluded to above. The polarimetric data clearly shows the difference between the shallow rain events (predominantly warm rain microphysics) and the typhoon event (predominantly ice phase microphysics).