Geophysical Research Abstracts, Vol. 8, 03213, 2006
SRef-ID: 1607-7962/gra/EGU06-A-03213

Rain microstructure from dual-polarized radar and 2D-video disdrometer

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The remote sensing of rain microstructure, which includes drop size, shape and fall velocity distributions, is of fundamental importance for weather radar-based rainfall retrieval methods. Recent advances in polarimetric radar techniques have shown its capability for monitoring intense rainfall events that often cause serious flooding. These techniques (based on differential reflectivity and phase between horizontal and vertical polarizations) are now being considered by operational weather agencies in the US and Europe for use at S and C-bands, as well as at X-band for short range applications.

In this study, we investigate the variation of rain microstructure in different rain regimes and locations using in-situ 2D-video disdrometer (2DVD) measurements. The 2DVD database is used to develop the necessary radar retrieval algorithms which include attenuation-correction schemes (for C and X-bands) as well as rainfall estimation. Limited testing has already been carried out at C-band and algorithm performance has been shown to be accurate within expected error bounds. The radar used for testing is the dual-polarized radar in Okinawa, Japan, operated by the National Institute for Information and Communications Technology (NICT). Drop size distributions from three distinctly different rain regimes (shallow warm rain, typhoon and 'Baiu' front) are compared and shown to have different characteristics, particularly in terms of D_o(median volume diameter) and N_w(normalized intercept parameter) histograms. Also investigated is the variation in the drop axis ratio distributions in different locations and rain intensities. The 2DVD locations include mid-latitude as well as sub-tropical sites. Drop axis ratio distributions are used to infer the dominant oscillation mode as well as the range of oscillation amplitudes which can have second-order effects on rain retrieval algorithms.