Geophysical Research Abstracts, Vol. 9, 11581, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-11581

Single-, dual- and triple-moment rain rate retrieval using vertically pointing Doppler radar

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The Cabauw Experimental Site for Atmospheric Research (CESAR) is the national atmospheric remote sensing facility of The Netherlands. Several major Dutch universities and research institutes involved in atmospheric and land surface research have formed a research consortium and carry out collaborative research at CESAR (about 25 km SW of Utrecht). One of the focal points of CESAR is the long-term monitoring of the macro- and microstructure of precipitation, with a view to an improved process representation in regional weather and climate models, and to provide a ground validation site for planned satellite precipitation missions (e.g. GPM). The development of improved rainfall retrieval algorithms for operational weather radars and atmospheric research radars is one of the central activities in this endeavour.

Here we focus on detailed comparisons of time series of Doppler spectral moments as measured by the 3 GHz doppler-polarimetric Transportable Atmospheric Research Radar (TARA) and several types of disdrometers (impact-, optical-, and video-) and a local rain gauge network during rainfall experiments organized at CESAR, in particular the CESAR Rainfall Experiment 2002 (C-Rex'02, Fall 2002) and the Baltex Bridge Cloud campaign, phase II (BBC-2, May 2003). We employ the measured time series to test a recently proposed rainfall retrieval algorithm based on Doppler spectral moments. This algorithm bypasses the need for estimating drop size distribution parameters on a spectrum-by-spectrum basis. It is based on theoretical relationships between rain rate and the low-order moments of the Doppler spectrum, i.e. the radar reflectivity factor (0th order moment), the mean Doppler velocity (1st order moment), and the Doppler spectral width (2nd order moment).