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"Drop size distribution – based separation of stratiform and convective rain"

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Abstract Text:
For applications in hydrology and meteorology, it is often desirable to separate regions of stratiform and convective rain from meteorological radar observations, both from ground-based polarimetric radars and from space-based dual frequency radars. In a previous study by Bringi et al. (2009), dual frequency profiler and dual polarization radar (C-POL) observations in Darwin, Australia, had shown that stratiform and convective rain could be separated in the log10(Nw) versus Do domain, where Do is the mean volume diameter and Nw is the scaling parameter which is proportional to the ratio of water content to the mass weighted mean diameter. Note, Nw and Do are two of the main drop size distribution (DSD) parameters. In a later study, Thurai et al (2010) confirmed that both the dual-frequency profiler based stratiform-convective rain separation and the C-POL radar based separation were consistent with each other. In this paper, we test this separation method using DSD measurements from a ground based 2D video disdrometer (2DVD), along with simultaneous observations from a collocated, vertically-pointing, X-band profiling radar (XPR). The measurements were made in Huntsville, Alabama.

One-minute DSDs from 2DVD are used as input to an appropriate gamma fitting procedure to determine Nw and Do. The fitted parameters – after averaging over 3-minutes - are plotted against each other and compared with a predefined separation line. An index is used to determine how far the points lie from the separation line (as described in Thurai et al. 2010). Negative index values indicate stratiform rain and positive index indicate convective rain, and, moreover, points which lie somewhat close to the separation line are considered ‘mixed' or ‘transition' type precipitation.

The XPR observations are used to evaluate/test the 2DVD data-based classification. A ‘bright-band' detection algorithm was used to classify each vertical reflectivity profile as either stratiform or convective, depending on whether or not a clearly-defined melting layer is present at an expected height, and if present, maximum reflectivity within the melting layer as well as the corresponding height are determined.

We will present results of quantitative comparisons between the XPR observations-based classifications and the simultaneous 2DVD data-based classifications. Time series comparisons will be presented for thirteen events in Huntsville.

References:

Bringi, V. N., C. R. Williams, M. Thurai, P. T. May, 2009: Using Dual-Polarized Radar and Dual-Frequency Profiler for DSD Characterization: A Case Study from Darwin, Australia. J. Atmos. Oceanic Technol., 26, 2107–2122.

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