Altitude variation of Drop Size Distribution and their parameters

N V P Kiran Kumar, T Narayana Rao and D Narayana Rao

National Atmospheric Research laboratory, P.B.123. Tirupati-517502 (A.P)

Knowledge of raindrop size distribution (DSD) is very crucial to understand the microphysics of cloud systems as well as for retrieving the integral rain parameters. Vertically pointing wind profilers are excellent tools for retrieving rain drop size distribution. Indian MST radar operating at 53 MHz (VHF) is highly sensitive to Bragg scattering from the radio refractive index fluctuations, while Lower Atmospheric Wind Profiler (LAWP) operating at 1357.5 MHz (UHF) is sensitive to Rayleigh scattering from hydrometeors during rain. At UHF, it is possible to resolve echoes from clear air and precipitation during light rain, however, the precipitation echo masks the clear air echo during moderate to heavy rain. This problem is solved by using a dual frequency algorithm. i.e., the information of the ambient air motion and turbulence is retrieved from a VHF profiler and used in UHF spectra to delineate the precipitation part of the spectra. A Gamma model is then, fitted to the observed precipitation spectra to derive the model parameters. From the retrieved DSD, integral rain parameters (rain rate, reflectivity factor, liquid water content, median volume diameter etc) are derived and compared with Disdrometer derived parameters. A reasonably good agreement is found between these measurements, although radar measurements are volume integrated and Disdrometer is only a point measurement. Further, variations of DSD as a function of altitude in different rain regimes are studied to understand the microphysics of cloud system. During convection, the shape parameters (μ) changed significantly with altitude, whereas, such a variation is not seen during stratiform rain. DSD parameters have been retrieved for about 100 profiles collected in 22 rain events. A statistical study has been done on slope, shape and integral rain parameters separately for stratiform and convective precipitating systems.