利用特高頻雷達反演空中雨滴粒徑分布參數

陳孟遠[1]　　任維崧[2]　　蘇清論[2]　　朱延祥[2]

中央研究院環境變遷研究中心[1]
國立中央大學太空科學與工程學系[2]

摘　　要

In contrast to in situ instruments located at the surface, radar remote sensing provides indirect measurements and can be used to investigate the spatial evolution of precipitation. Typical physical parameters such as rainfall rate, liquid water content, and mass-weighted mean drop diameter, can be derived from the drop size distribution (DSD) of precipitation particles. Atmospheric radars or wind profilers can be used to measure the DSD through the Doppler spectrum, which are inherently linked. This is achieved by mapping the Doppler spectrum from velocity space into diameter space directly. In this study, the Chung-Li very high frequency (VHF) radar was used to obtain the aloft precipitation particle size distribution parameters. Previous literature has shown that the DSD can be well described as a Gamma distribution. The shape and slope parameters of Gamma DSD are retrieved with the approximate analytical solution, and the mass weighted mean drop diameter (D_m) is further obtained. In order to verify the applicability of this method in radar observation data, numerical simulations were performed and compared with the set DSD. The results showed that the retrieval method is applicable for 0.7 mm $< D_m <$ 4 mm. It is also found that the error is reduced with the increase of the signal-to-noise ratio (SNR). In addition, simultaneous disdrometer observation showed that the precipitation parameters at 1.65 km obtained from the VHF radar keep moderate correlations with the ground observations. Regardless of stratified or convective precipitation, reasonable precipitation parameters aloft can be obtained with this retrieval method.

Key words: Drop size distribution; VHF radar; Doppler spectral moments; Air motion