Microphysical and Kinematic Characteristics of Precipitation Systems derived from Quasi-Vertical Profiles of Radar Measurables

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Dual-polarization parameters provide detail information on microphysical processes in precipitation systems. The vertical structures of precipitation systems vary with the different microphysical processes, such as size sorting, evaporation, melting, freezing, riming, aggregation, etc. The upward air motion within the precipitation system is also related to the development of precipitation systems. The studies on precipitation systems have been carried out to estimate the linear wind field synthesis (wind direction, speed, vertical air motion, horizontal divergence, etc.) using the radar-observed velocity-azimuth display curve.

Detail microphysical processes can be obtained by high resolution vertical pointing radars but kinematic parameters cannot be retrieved from this measurement. A quasi-vertical profile (QVP) method that azimuthally averaged profile using highly elevated observations in operational radars is used to analyze the microphysical and kinematic structure of precipitation (Ryzhkov et al. 2016). The QVPs of deformation and horizontal divergences of the linear wind field are retrieved using the measured Doppler velocity of the Yong-In testbed (YIT) dual-polarized radar.

The precipitation systems are classified into rain, snow, and mixed region using the vertical profiles of reflectivity (Z_H) and the horizontal divergences are calculated within each region. The fall velocity (V_t) of rain is calculated using the V_t-Z_H relationship derived from 2D-video disdrometric measuremnt. The calculated fall velocity and vertical air motion are verified with a Doppler velocity from wind profiler located about 60 km from YIT radar.

Five precipitation systems such as cloud cluster, convection band, squall line, stratiform system embedded convective cell, and transition system, are selected. The temporal variations and vertical structure of dual-polarization parameters are investigated and compared with previous studies. The following figure shows the QVP profiles for the cloud cluster.

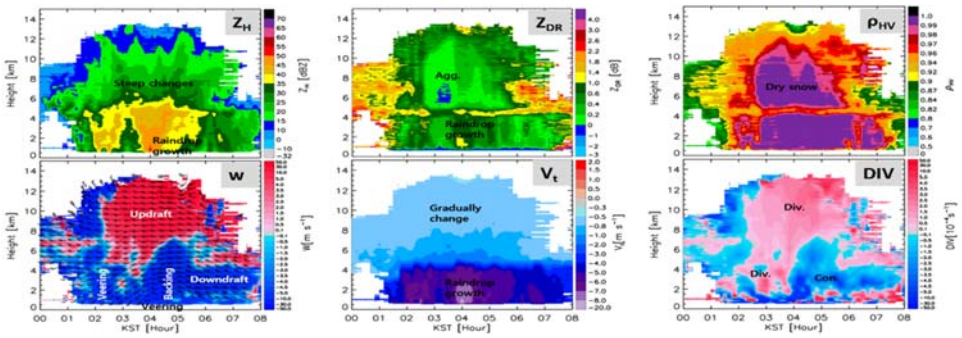

Figure 1. QVPs of dual-polarization variable and wind variables about cloud cluster case