Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM10-12 Room:A01 Time:May 28 11:00-11:15

Spectral parameters estimation in precipitation using VHF atmospheric radars

GAN, Tong[1*] ; YAMAMOTO, Masayuki[2] ; OKAMOTO, Hajime[3] ; HASHIGUCHI, Hiroyuki[1] ; YAMAMOTO, Mamoru[1]

[1]Research Institute for Sustainable Humanosphere (RISH), Kyoto University, [2]National Institute of Information and Communications Technology (NICT), [3]Research Institute for Applied Mechanics (RIAM), Kyushu University

Quantitative measurement of spectral parameters (e.g., echo power, Doppler velocity and spectrum width) of the clear air echo is indispensable for clarifying interactions between dynamical and microphysical processes of cloud and precipitation. Atmospheric radars using VHF band have the ability to detect clear air echoes and hydrometeor echoes simultaneously. In order to minimize the interference of the hydrometeor echoes on calculating the spectral parameters of the clear air echo, we proposed two methods (top method and two-echo method).

The top method is used when raindrops or solid hydrometeors with small echo intensity exist. The top method sets an echo cut level (ECL) from the peak level of the clear air echo. The ECL is used for separating the clear air echoes from the hydrometeor echoes. The two-echo method is used when solid hydrometeors with large echo intensity exist. The two-echo method sets the ECL from the minimum echo level between the peak level of the clear air echo and that of the hydrometeor echo. Because parts of the Doppler spectrum points were not used for calculating the spectral parameters, we also proposed functions for correcting the underestimation of echo power and spectrum width. Numerical simulations were carried out for evaluating the performance of these two methods. From the simulation results, the optimum value of ECL is determined. Also, the simulation results indicated that the two methods can calculate the spectral parameters of the clear air echo with improved accuracy.

A case of simultaneous measurement by a 46.5-MHz atmospheric radar (MU radar) and a 1.3-GHz radar during a precipitation event on 26 October 2009 is shown. The 1.3-GHz radar can measure reflectivity-weighted Doppler velocity relative to the ground (V_{air+Z}) and radar reflectivity factor (Z_e) of hydrometeors. By subtracting the Doppler velocity of the clear air echo (W) measured by the MU radar from V_{air+Z}, reflectivity-weighted Doppler velocity relative to the air (V_Z) was retrieved. Correlation coefficient of Z_e and V_{air+Z} is 0.41. After removing the effect of W, correlation coefficient of Z_e and V_Z improves to 0.56. The result indicates that W estimated using our method has sufficient accuracy. The result also indicates that the accurate W measurement is useful for measuring hydrometer fall velocity.

Keywords: Atmospheric radar, Spectral parameters