Development of precipitation attenuation correction technique in a dual-pol radar network

*Shigeharu Shimamura¹, Tomoo Ushio¹, Eiichi Yoshikawa³, V. Chandrasekar³

¹.Subarea of Electromagnetic Compatibility. Division of Electrical, Electric and Information Engineering. Graduate School of Engineering, Osaka University, ².Japan Aerospace eXploration Agency, ³.Colorado State University

Dense radar network systems with low power transmitters at X-band has been proposed which can fill in observation gaps in low altitudes and have good accuracy and resolution. An X-band dual polarization radar network is the main stream of weather observation to make rapid scanning at low altitude. The dual polarization products such as differential reflectivity ($Z_{DR}$), specific differential phase ($K_{DP}$) and correlation coefficient ($\rho_{hv}$) provide us with detailed information about drop size distribution (DSD) and rainfall rate estimation. $K_{DP}$ can be calculated from differential phase $\Phi_{DP}$.

On the other hand, a weather radar, especially with transmitting short-wavelength pulses, is affected by precipitation attenuation. Various attenuation correction techniques for horizontal reflectivity ($ZH$) and $Z_{DR}$ using $\Phi_{DP}$ and $K_{DP}$ were proposed. However, measured differential phase $\Psi_{DP}$ consists of $\Phi_{DP}$ and backscattered phase shift $\delta_{co}$. Especially at C-, or X-band, contamination due to delta cannot be ignored. Some $\delta_{co}$ removing techniques were proposed. Scarchilli et al. (1993) suggested recursive algorithm to remove delta from $\Psi_{DP}$ in an individual radar using $\delta_{co} - Z_{DR}$ relationship. They assumed coefficients in the power-law relationship. However, the relationship actually depends on DSD. In this paper, probabilistic attenuation correction technique based on the Bayesian theory in multiple dual polarimetric radar network, is proposed. The proposed technique considering $\delta_{co}$ effects also derive coefficients of relationships.

Keywords: meteorological radar, rain