Rain Microphysical Properties Based on Radar Observation in Korea

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As rain microphysical properties can vary with geographical change, analysis of rain drop shape distribution for local area is important to a radar based quantitative precipitation estimation. In this paper, we analyze rain microphysical properties comparing with KICT radar observation and theoretically simulated data. The KICT X-band dual-polarization radar is installed (Latitude: 37.6688, Longitude: 126.7389) close to Seoul metropolitan area to carry out especially urban precipitation study. In order to get the rain microphysical information in Korea, we investigated the scatter plots of Z_{dr} versus Z, K_{dp} versus Z, as well as K_{dp}/Z versus Z_{dr}. In addition, the theoretical relations between these dual-polarization parameters are also generated by simulation. In the simulation, a gamma DSD model is assumed with the ranges as $0.5 \le D_o \le 3.5$ mm, $3 \le \log_{10} N_w \le 5$, and $-1 < m \le 5$ for the parameters and with the additional constraint that $R < 300$ mm/hr. The parameters D_0, $\log_{10} N_w$, and μ are varying uniformly over their respective ranges to form a large table of D_0, N_w, and μ. Scattering calculations are performed at 9.4 GHz (X-band) for Z, Z_{dr}, and K_{dp}.

Figure 1 is the scatter plot of Z_{dr} (in dB) versus Z (in dBZ) for KICT radar observations at 02:20:40UTC, August 10, 2013. The theoretical observations from simulation are also showed in this figure. Similarly, Figure 2 shows the scatter plot of K_{dp} (in degree/km) versus Z (in dBZ) for KICT radar observations at the same time frame. The theoretical observations were also overlaid in this figure. Figure 3 is the scatter plot of K_{dp}/Z (in log scale) versus Z_{dr} (in dB) for the same observations from KICT radar. It should be mentioned that the reflectivity field here in Figure 3 is in linear scale. The simulated observations are again overlaid with the scatter plots. From the results of the figures, we can see the microphysical difference comparing with theoretical simulation. Preliminary results shows small size with rain particles. At this paper, we will investigate rain microphysical properties further using KICT radar observation and disdrometer data.

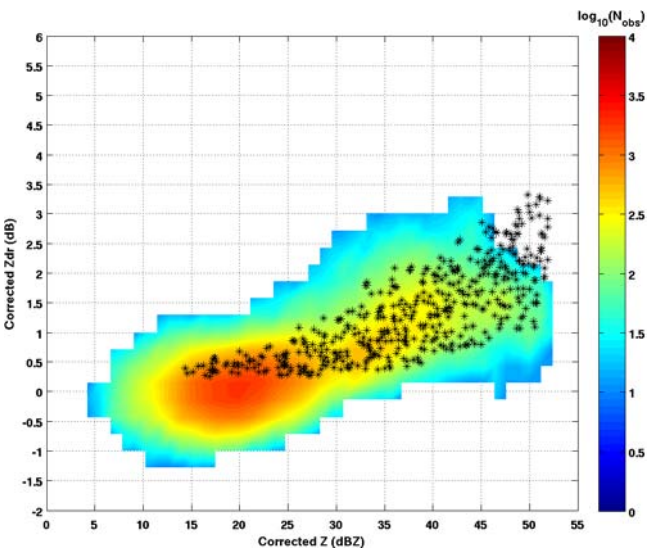

Figure 1. Scatter plot of $\boldsymbol{Z_{dr}}$ (in dB) versus $\boldsymbol{Z}$ (in dBZ) for KICT radar observations at 02:20:40UTC, August 10, 2013. The black stars * are the theoretical observations from simulation.

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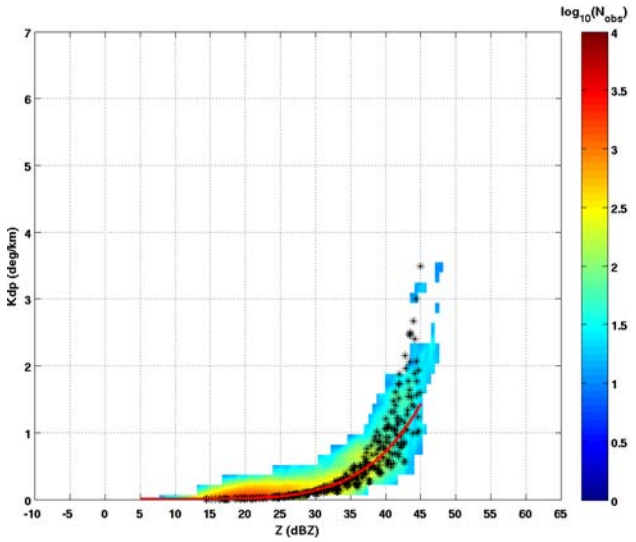

Figure 2. Scatter plot of $\boldsymbol{K_{dp}}$ (in degree/km) versus $\boldsymbol{Z}$ (in dBZ) for KICT radar observations at 02:20:40UTC, August 10, 2013. The black stars * are the theoretical observations from simulation, whereas the red line is the fitting curve based on the simulation data.

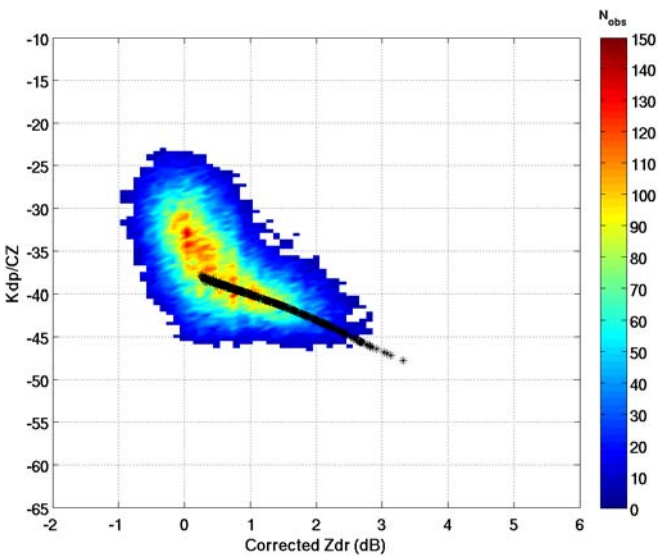

Figure 3. Scatter plot of $\boldsymbol{K_{dp}/Z}$ (in log scale) versus $\boldsymbol{Z_{dr}}$ (in dB) for KICT radar observations at 02:20:40UTC, August 10, 2013. The black stars * are the theoretical observations from simulation.