Comparing the X-band multi-parameter phased array weather radar with a Doppler weather radar using a parabolic dish antenna

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In Japan, a weather radar network, known as the extended radar information network (XRAIN), is operated to provide regular observations of rainfall and wind distribution. The network is comprised of 16 C-band radars and 39 X-band multi-parameter (X-MP) radars that are capable of conducting dual-polarization observations. X-MP radars have parabolic-type antennas, and they require about 5 min to complete a volume scan because both the azimuth and elevation angles are scanned mechanically [1]. Only ten elevation angles (approximately) are scanned, and areas covered at high elevation angles are limited. The Multi-Parameter Phased Array Weather Radar (MP-PAWR) has been developed as the next generation dual-polarized weather radar to address the limitations of X-MP radars. When conducting a volume scan, the MP-PAWR uses electronic and mechanical scanning in the elevation and azimuth angles, respectively, to achieve observation within a radius of 60 km and an altitude of about 15 km in 30 sec. Although the effectiveness of the MP-PAWR has been demonstrated in case studies [2], its observation accuracy is yet to be quantitatively analyzed.

To verify the observation accuracy of the MP-PAWR, this study compared MP-PAWR data with X-MP radar using 2,818,584 data samples obtained over 14 hours. X-MP radar (Kanto site) is located approximately 4 km from the MP-PAWR and can make simultaneous observations within a time lag of 15 sec. Figure 1 shows the comparison results of radar reflectivity factor with rainfall attenuation correction. In this case, the regression coefficient is 0.90, the intercept point of the regression line is 2.09 dBZ, the correlation coefficient is 0.88, the mean difference is -0.89 dBZ, and the standard deviation is 2.93 dBZ.

In the presentation, we will show the rainfall attenuation correction method applied to MP-PAWR, the analysis results of each parameter comparisons and the effect of the temporal resolution on the observation accuracy and discuss the advantages of high-density and high-frequency dual-polarization observation by MP-PAWR.

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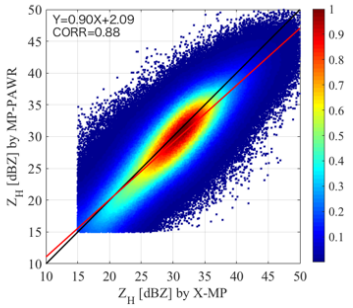

Figure 1. Scatter plot of the radar reflectivity factor with rainfall attenuation correction, and the color bar shows the normalized point density calculated with grid sizes of 1 (dBZ). The black line represents the one-to-one line, and the red line represents the regression line.

References

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