Improved QPE by mitigating partial beam blocking in Seoul metropolitan area: Use of radar reflectivity statistics

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Korea Ministry of Environment (MOE) conducts various meteorological and hydrological researches for sudden flood monitoring and forecasting in the Seoul metropolitan area. As a part of these researches, two dual polarimetric X-band radars are installed in the Seoul metropolitan area to detect local heavy rainfall and flash flood with high spatiotemporal resolution. For accurate rainfall estimation using X-band radar network, quality control of non-meteorological echoes (ground clutter, AP, beam blockage, bright band, etc.) is essential. A typical beam blockage simulation is difficult to detect partial beam blockage and anomalous propagation (AP) from complex building and terrain. To improve limitation of typical beam blockage simulation a statistical method has been developed based on frequency of occurrence of reflectivity (FOR, Chang et al. 2009). Compared with typical beam blocking simulation, the statistical method can detect additional ground clutter, partial beam blockage, and seasonal variation of AP. In this study, we estimated further accurate rainfall from X-band radar network measurements using reflectivity statistics (FOR, vertical gradient of FOR, etc.).

Attenuation and hardware corrections of X-band radar are adapted using self-consistency of polarimetric variables (A_H-K_{DP}, A_{DP}-K_{DP}, Z_H-K_{DP}, and Z_H-Z_{DR}). Rainfall estimation are performed at every elevation angles ($R(Z_H)$, $R(Z_H, Z_{DR})$, and $R(K_{DP})$). The lowest available rainfall estimation results are selected by Hybrid Surface Rainfall (HSR, Lyu et al. 2015). In the overlapped area, composition with simple averaging are adapted to fill gaps. All relationships are derived from two-dimensional video disdrometer data using T-matrix simulations (Thurai et al. 2007). Rainfall estimation results are validated with surface rain gauges within radar observation range.

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Keywords: Hybrid Surface Rainfall estimation, Frequency of occurrence of reflectivity, X-band radar

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