Analysis of Snow Growth Process Based on High-Resolution X-band Polarimetric Radar Signature of a Severe Winter Storm in Korea

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Interpretation of the dual polarization radar data can play an important role in describing the characteristics of the winter storm. On 12th December 2013, a severe winter storm occurred in Korea. The onset of this storm took place at 02:00 UTC, intensified during 06:00 UTC to 08:00 UTC, and then weakened afterwards. This event exhibited interesting signatures of different types of snow crystals. This enabled study of development of various snow crystal habits, such as pristine particles to dendrites, then aggregates, after then rimed ice that finally transformed to graupel/snowflakes.

In this paper, high spatiotemporal resolution polarimetric radar observations such as reflectivity, Doppler velocity, differential reflectivity, and cross-correlation coefficient are described in horizontal and vertical plane. The data used for this storm event is obtained from the Korea Institute of Civil Engineering and Building Technology X-band dual polarization radar, which is located at Goyang province, approximately 20.6 km North-West of Seoul, South Korea. In addition, the observed polarimetric signatures of snow growth processes are compared with the WRF model microphysical species output and also validated with the ground observations.

The results of the radar signature analysis show that, at temperatures below -20 ° C, high Z_{dr} values indicate pristine ice crystals. The enhanced Z_{dr} and K_{dp} values observed at 2 to 3.2 km height, where the temperature varies from -11° C to -20° C, represents dendritic growth. Similarly for heights below 2 km, the temperature is greater than -15° C, associated with low Z_{dr} and high Z_h observations indicate the aggregation of ice crystals. For heights below 2.5 km, Z_h ~30 dBZ, mostly Z_{dr}<0 dB, K_{dp} <0° km^{-1} and high SW indicate the rimed ice crystals.

ACKNOWLEDGEMENT

This research is supported by a grant of the “Integration of electromagnetic wave precipitation gauge system and its performing testing” program.