Attenuation correction of Ku-band broad band radar

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Rainfall observations using weather radar have the major advantage that it is possible to observe precipitation widely in a short time. However, the rain rate obtained by weather radar does not necessarily correspond to that observed by ground-based rain gauges. One of the causes of this disagreement is the nonuniformity distribution of raindrops in a rain scattering volume. Another cause is that most types of radar cannot obtain a rain echo at low altitude, because the radar beam overshoots by several kilometers in height due to the Earth's curvature or, in vertical pointing mode, the receiver is turned off while the pulse is being transmitted. Therefore, to identify how the reflectivity profile changes near the ground and to estimate precisely the causes of the reflectivity from near the ground with high resolution and high precision is needed.

A new high-resolution Ku-band Doppler radar for meteorological applications has been developed. With the new system design, the radar can accurately measure the radar reflectivity factor with 4-m resolution over a range from 40 m to several kilometers for 500-mW power using pulse compression technique. The frequency of this radar is 15.75 GHz. Details of the system design, signal processing algorithm, and data acquisition procedures are described.

The high frequencies in this radar enable us to have a high special and time resolution. However, because of the high frequencies, the precipitating particles cause high attenuation in this radar. An unacceptably large error may result in the attenuation correction unless the radar constant is accurately determined and the parameters chosen in the model very closely represent the actual rain. In this study the methods for attenuation correction has been demonstrated for the Ku band broad band radar in details.