Hydrometer Classification and Rainfall Estimation Using Multi-Palameter Phased Array Weather Radar

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In recent years, meteorological disasters caused by rainfall such as typhoons and guerrilla torrential rains have increased, causing damage to various parts of Japan. For the purpose of observation that clouds develop to a high altitude in short time, high-resolution Multi-Parameter phased array radar (MP-PAWR) have been developed and installed at Kanto region. MP-PAWR is meteorological dedicated phased array radar which has a dual polarization function to simultaneously transmit and receive for horizontally polarized wave and vertically polarized wave and equipped with a real-time processing function of digital beamforming that can be observed simultaneously in the elevation direction.
This radar uses two horizontal and vertical polarizations, in addition to the radar reflectivity factor (Zh) that can be obtained with the conventional radar, and uses the differential reflectivity (Zdr)the specific phase difference (Kdp), correlation coefficient between polarizations (Rhohv) can be obtained.
In this study, the purpose of this study is to consider the effect of particles other than raindrops such as hail in the sky, which could not be observed by conventional radar, on the intensity of precipitation on the ground.
The analysis data used in this study is a case where a hail fell around 15:00 on May 4, 2019 near Fuchu, Tokyo. First, using the MP-PAWR data to verify classification method using fuzzy logic used in this study [1] is useful, and then discuss the relationship with the rainfall intensity on the ground. In order to discuss the relationship between the classification results and the rainfall intensity, this study investigated the transition of graupel, hail and large particles in particular. In the analysis case, a total of 120 radar information was used every 30 seconds for one hour from 15:00 to 16:00 on May 4, 2019. In this case, hail was confirmed, and heavy rain was observed between 15:25 to 45. It was focused on the cumulonimbus which seems to have caused this.
Therefore, the transition of high-density graupel, hail, and large particles in each time series is illustrated. First, high-density graupel increases and reaches a peak. It could be confirmed. When the results of the actual rain gauge at the Fuchu meteorological station were superimposed on this, it was confirmed that the peak of rainfall came about 10 minutes after the hail peak came. The time interval between high density graupel, hail and rain were about every 10 minutes. Therefore, it was confirmed that it was possible to predict local torrential rain etc. by discriminating particles in the cloud and observing the transition of hail and hail.
[1] V.N.Bringi, and V.Chandrasekar, “Polarimetric Doppler Weather Radar: Principles and Applications”, Cambridge University Press, pp.379-380, 2001.

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