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Initial results of Hydrometeor Classification with X-band Dual-Polarized 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. The X-band Dual-Polarized phased array weather radar (DP-PAWR) has been developed by Osaka University, Nagoya University, National Institute of Information and Communications Technology (NICT), and Toshiba infrastructure systems & solutions corporation. The DP-PAWR has installed at Saitama University in Dec. 2017. The purpose of the radar is to observe cumulonimbus clouds that evolve to high altitudes in a short time. The DP-PAWR provide us the radar reflectivity factor (Z_h), the differential reflectivity (Z_{dr}), the specific phase difference (K_{dp}), correlation coefficient between polarizations (ρ_{hv}), Doppler velocity and spectrum width (V and W) . The observation range and temporal resolution of the DP-PAWR are 60 km and 30 sec, respectively. In every 30 sec, 3 dimensional and dual polarization observations of the precipitation cores become possible.

In this presentation, a case study will be shown. The analysis data is a case where hail fell on the ground at 15:00:00 (JST) on May 4, 2019 in Fuchu city, Tokyo, Japan. First, we use the DP-PAWR data to verify whether the hydrometer classification method [1] used in this study is useful, and then discuss the relationship with the rain rate observed on the ground. We applied the hydrometer classification method to the DP-PAWR data, and confirmed the effectiveness of the method comparison with the ground observations.

In order to discuss the relationship between the results of hydrometer classification and rain rate on the ground, the present study especially investigated the transition of particles such as hail, hail and big drops. The 1-hour data, which consists of 120 samples, from 15:00 to 16:00 on May 4, 2019, are used. During the analysis time, short-term heavy rain was observed from 15: 25-35 at the ground-based rain gauge installed in Fuchu City. From the results of hydrometer classification in time series, an amount of hail was increased after high density graupel increased. Particular, high density graupels were sharply increased about 20 min before the heavy rain on the ground. It is indicated that the information of the three-dimensional hydrometer classification should be one of the important factors to predict a severe weather.

References

[1] H. Liu and V. Chandrasekar, “Classification of Hydrometeors Based on Polarimetric Radar Measurements: Development of Fuzzy Logic and Neuro-Fuzzy Systems, and In Situ Verification,” *J. Atmos. Oceanic Technol.,* **17**, pp. 140–164, 2000.