

## Validation of DPR products by using MP-PAWR data - thunder storm case on August 27, 2018 –

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Validation of dual-frequency precipitation radar (DPR) onboard Global Precipitation Measurement (GPM) core observatory is aimed to evaluate not only the surface precipitation ratio and corresponding Z value but also three-dimensional structure of precipitation including cloud physical properties. Because of dual-frequency observation, GPM/DPR can estimate drop size distribution and rain/snow classification. Recently, GPM/DPR product added the information of the hail/graupele existence. These values are hard to be evaluated because of lack of the observation. A ground-based multi-parameter phased array weather radar (MP-PAWR) has advantages on the simultaneous three-dimensional observation and estimation of cloud physical properties. Since the MP-PAWR operates electrical scan in elevation and mechanical scan in azimuth, it completes the three-dimensional observation within 30 seconds. In addition, by using dual-polarization observation, cloud physical properties such as particle type classification can be achieved.

This study aims to evaluate the cloud physical properties estimated by GPM/DPR are evaluated ground-based multi-parameter weather radar. This study shows a case on August 27, 2018 when the GPM flew over Kanto area at 18:20 JST. Unfortunately, MP-PAWR was not operated because of power shutdown in this time frame (17:40-19:35). The X-band MP radar network (XRAIN) data are used for analysis. Even XRAIN consists of conventional multi-parameter radar, there are 5 radars over Kanto area and therefore the three-dimensional structure of precipitation system is retrieved by combining multiple radar. Three-dimensional wind field is estimated by the dual-Doppler analysis by using all combinations of radars.

The flagHeavyIcePrecipitation in GPM/DPR product, which indicates the existence of large particles above -10-degree Celsius height, were observed at the target area. The ground-based radar also caught the signature of mixed-phase precipitation indicating the existence both rain and ice particles. The precipitation system is sustained by the updraft less than 4 km in height. Note that hail storm was reported 30 to 20 minutes before the GPM observation. At that time, the precipitation system is characterized by the strong updraft above melting level ( $> 5$  km) and mixture of rain and ice particles even above the melting layer.

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