



## **3DVAR analysis for the 13 June 2014 Hailstorm Event around the Tokyo Metropolitan Area using Radial Velocity from Doppler Radar and Lidar**

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In this study, we will present a preliminary analysis of assimilating radial velocity observation for the hailstorm event on 13 June 2014 around Fuchu City, the Tokyo Metropolitan Area, Japan, using the Cloud Resolving Storm Simulator (CReSS) 3DVAR. The hail with a diameter of 3 centimeters and wind gust were reported with this event. This hailstorm was observed by multiple X-band polarimetric Doppler radar and a Doppler lidar, simultaneously. For this case, the CReSS 3DVAR with Meso-Scale Model (MSM, NWP operated by the Japan Meteorological Agency) for background was used to analyze the wind structure of this hailstorm.

On that day, there was a cold low in the northern part of Japan and a trough was laid on the Tokyo Metropolitan Area. The duration of the hailstorm is about 3.5 hours (from 1000 LST, Local Standard Time: UTC + 9 hours, to 1330 LST), and hail fell around 1210 LST. The analysis of the X-band polarimetric Doppler radar shows that the region of hail was located the southern edge of the storm and was indicated large specific differential phase ( $K_{dp}$ ) value ( $\sim 8$  degree  $\text{km}^{-1}$ ) at 1 km AGL. This large  $K_{dp}$  region also corresponded to strong downdraft region ( $\sim 4$   $\text{m s}^{-1}$ ) at 1 km AGL. The reported wind gust might be caused by this strong downdraft. The Doppler lidar, which was located on the warm sector of the hailstorm, completely succeeded to capture the radial velocity of the inflow toward the hailstorm.

The 3DVAR analysis of horizontal wind field at 500 m AGL shows that the horizontal wind field is greatly improved the flows into the hailstorm around the observation range of the Doppler lidar. The 3DVAR analysis also improve the flows out to the hailstorm around the observation range of the X-band polarimetric Doppler radar, and the boundary of the outflow and inflow of the hailstorm is clearly analyzed. For a future work, it is planned to carry out the forecast experiment of the hailstorm using the analyzed fields.