EMS Annual Meeting Abstracts
Vol. 14, EMS2017-368, 2017


# Real-time data assimilation of ground-based microwave radiometer network for short-range rainfall forecast in Tokyo

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This study aims the improvement of initial condition for short-range rainfall forecast using various kinds of ground-based observations around Tokyo, Japan.[U+3000]Our main target is a localized rapidly-developing severe storm in metropolitan region. To issue the warning in a limited time, rapid update cycle of short-range forecast with the observation for the early stage of developing cumulonimbus storm (Cb) should be developed.
We have developed a dense real-time observation network over[U+3000]Tokyo metropolitan region (200 km x 200 km) since 2015:
1) 10 microwave radiometers (MWR) to observe vapor and temperature environment,
2) three Doppler lidars to observe low-level wind convergence,
3) five dual-pol Ka-band radars to observe early developing stage of Cb,
4) two dual-pol X-band radars to observed developing stage of Cb.

We have developed rapid update forecast cycle using 3DVAR assimilation system with incremental analysis update filter (3DVAR+IAU) to provide two hours forecast with 10 minute intervals since 2015. In this study, assimilation impacts of precipitable water (PW) from MWR, radial velocity from lidars and X-band radars, and reflectivity from X-band radars were investigated for a severe local storm observed on 24th July 2015.

We will show 1) the evaluation of initial vapor field from the assimilation system by comparing with dense GPS observations, and 2) the comparison of the predictability of rainfall with traditional nowcasting system.

Many improvements of initial conditions in vapor field were found in the correlation (from 0.58 to 0.71), the RMSE (from 2.23 mm to 2.16 mm), and the Bias error (from -0.82 to 0.11) by assimilating PW. In rainfall forecast, the forecast by the 3DVAR+IAU outperformed the traditional extrapolation nowcasting forecast around 40 minutes
after the initial time. These ground-based observations aiming for the detection of early stage of Cb and real-time assimilation system with high computation efficiency would be powerful tool to provide early warning and forecast of severe storm.