ABSTRACTS (MASTER THESIS)

Study on the extreme weather mechanism of urban area by combining a Doppler lidar and high-resolution numerical model

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In the summer season, the disastrous severe rain frequently occurs by Global warming in Japan. The small-scale convergence of humidity in the boundary layer is considered as one of the most important factor to determine the generation of such a disastrous rainstorm. The wind condition near the surface of the ground is affected by the ground condition so we cannot get the detailed information by direct observation. It is very difficult to capture the urban wind condition in complex surface.

In this study, to get the wind condition of the lower atmosphere, we successfully started observations using a coherent Doppler lidar (CDL) in May 26, 2015. CDL can observe air convergence of first stage because observing object is not raindrop but aerosol. We got the presence of wind strength in a small scale because the data of CDL is a 100-m resolution (Fig.1 (a)).

Using model is WRF (Weather Research and Forecasting) model which is non-hydrostatic weather forecast model. In the model, we analyzed some events which had heavy rainfall more than 5mm/10min in the urban area. We narrowed the calculation domain to 1 km and 200 m. Using initial data are that terrain data is 10-m grid DSM (Digital Surface Model) of the geospatial information authority of Japan, the ground surface data is 100 m of ministry of the environment and sea surface temperature of Tokyo bay is 1 km of NASA. We improved the results by using 3DVAR (Three-Dimensional Variational) data assimilation (Fig. 1(b)).

Future work, we will be able to observe more accurate data by setting some CDL at urban area and expect to improve weather forecasting.

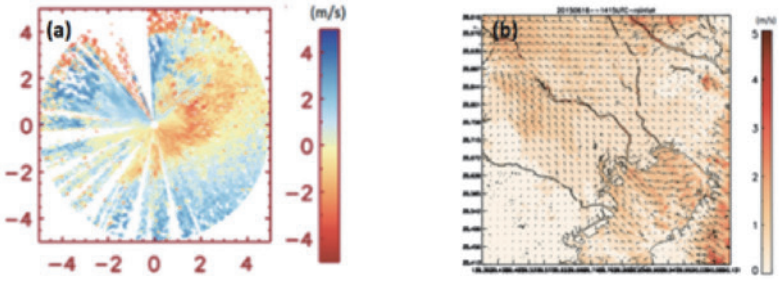

Fig .1 (a) Doppler lidar observation in Tokyo metropolitan area.
(b) Map of precipitation and wind distribution for numerical simulation.

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