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Application of Coherent Doppler Lidar in Boundary Layer Observation

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As part of the National Institute for Earth Science and Disaster Resilience (NIED, Japan) efforts to improve detection of storm clouds forming and weather forecasting through data assimilation, it has established a ground base remote sensing network in great Tokyo area. This includes 5 radars, 3 Lidars, and 10 micro wave radiometers (MWR). These instruments however, provide other possibilities, including continuous observation of the boundary layer which can enhance our understanding. The Lidars are Large-scale Coherent Doppler Lidar (LCDL) manufactured by Mitsubishi Electric, which have high power laser amplifier using Er, Yb:glass planer waveguide and output Doppler velocity, Doppler velocity width and signal-to-noise rate. Since these Lidars have a maximum measurable range of about 30 km with the range resolution of 150 m, it has been proved helpful for wide range wind monitoring and data assimilation. While the application of these Lidar in observing urban boundary layer structures was not investigated properly yet. The MWRs installed are Humidity And Temperature PROfilers (HATPRO) fourth generation manufactured by Radiometer Physics GmbH. This study focuses on the application of LCDL in boundary layer observations and discusses the results of an intensive observation carried out from 18:00 Japanese Standard Time (JST) 9 July 2016 to 19:00 JST 11 July, which started after a rainfall caused by a front 200 km to the south, and followed by hot summer days. The LCDL was operated at a combination of Doppler Beam Swinging (DBS) mode and Range Height Indicator (RHI) mode with the scan cycle repeated every 120 s. The range resolution was set to 30 m. Various boundary layer characteristics were observed in these two days. The measurements of LCDL and MWR was compared to radiosonde sounding data obtained at Tateno, 60 km to the northeast of Tokyo, and approaches of estimating mixing height from LCDL observations were discussed in this study.