ABSTRACTS (MASTER THESIS)

A study on the detailed boundary layer structure calculated by the Large Eddy Simulation in the real meteorological condition

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This research investigated the urbanization effect on the structure of atmospheric boundary layer by constructing the simulation environment of Large Eddy Simulation (LES) under the real meteorological condition.

Introduction

Several previous studies emphasized the importance of the detailed boundary layer structure on the generation of the severe meteorological phenomena. However, in the meso-scale numerical forecast model, the boundary layer structure is conveniently calculated by simple parameterization method. The LES has an advantage in the high-horizontal-resolution simulation by explicitly calculating the grid-scale eddy in the governing equations. However, the ideal cyclic boundary condition was used in the most of the conventional LES studies. For realizing the LES calculation in the real atmospheric condition, this study connected the result of the non-hydrostatic numerical forecast model into the initial and boundary condition of LES.

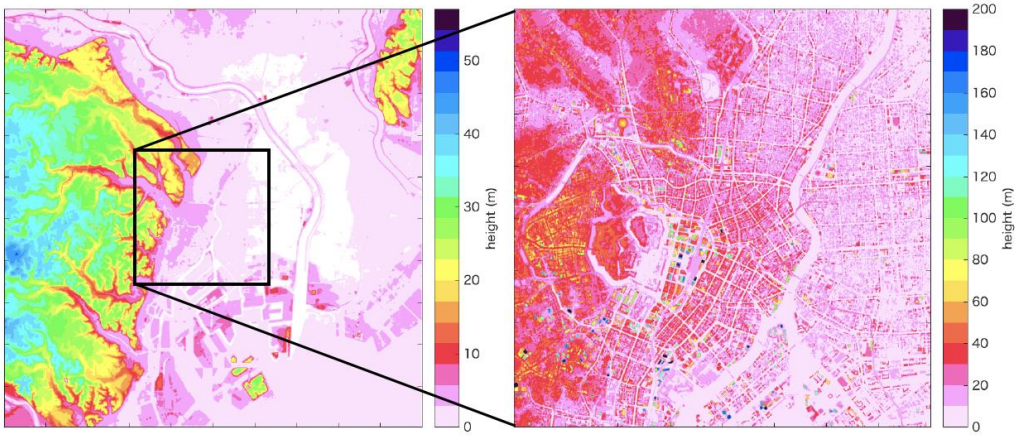

Figure 1. The simulation domain in Tokyo Metropolitan area of LES

Results

The LES environment with the excellent horizontal resolution of five meter was developed by using the high-resolution topographic data in the Tokyo urban regions (Fig. 1). The analysis period was selected on July 11, 2015 by considering the calm meteorological condition.

In the LES simulation, the weak wind region extending to several kilo-meter length was calculated behind the 200m-tall buildings. In this region, the strong vertical wind was analyzed, which implies the strong vertical transport of energy and minor constituent. The simultaneous coherent Doppler lidar observation successfully also showed the similar weak wind region behind the tall buildings. The LES environment in the real weather condition is very useful to elucidate the mechanism of the interaction between the atmospheric boundary layer and the upper free atmosphere.