

【Grant-in-Aid for Scientific Research(S)】
Science and Engineering (Engineering II)



Title of Project : Development of a meteorological information platform with high spatial resolution for the urban environment and disaster reduction

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Research Area : Environmental control engineering

Keyword : Building environment, Natural phenomenon analysis, Disaster reduction

【Purpose and Background of the Research】

The meteorological phenomenon is the primary environmental condition of human beings. It can give great influences and fatal damages to people's lives. Recently, the concentrated heavy rain in urban areas is getting much attention. The large number of heat stroke patients in 2010 and the damage due to the typhoon in 2011 are still fresh in our mind. The heat island phenomenon is well known for the increases of the energy consumption and the drought risk. The densely developed urban areas are suffered from localized air pollution because of the car exhaust running through low-wind space.

To address these problems, existing models for the meteorological prediction are not sufficient because these models usually resolve the space in the horizontal directions with grids of 10 km size. With the aim to aid the design of the healthy and safe urban space with low environmental load demanding, the present study develops a platform of meteorological information with the high grid resolution which accounts processes of multi-physics in multi-scales.

【Research Methods】

This research is consisted of three major steps.

1. Development of component models
To figure out the features of the urban atmospheric environment, we conduct field measurements in actual urban areas and wind-tunnel and chamber experiments. The data collected in these experiments are used for the validation of numerical models. Numerical analyses in micro-scale which employ LES (Large-eddy simulation) are also conducted to get basic data for the models in macro-scale analyses such as the canopy model and the generation/dissipation model of cumulus.
2. Integration of component models
The macro- and micro-scale models are integrated. For this, a study of methods to generate turbulent inflow in LES is conducted.
3. Development of pre/post interfaces and case studies
Interfaces of pre- and post-analyses are prepared

using GIS (Geographic information system) and BIM (Building information model).

【Expected Research Achievements and Scientific Significance】

The system developed in this research enables the prediction of various meteorological phenomena in urban area with high resolution. It also consists of interfaces to the GIS and BIM. This aids planners of urban space and buildings to assess the environmental applicability of their plans.

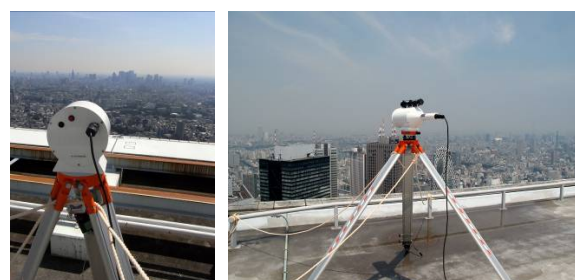


Figure 1 Measurement of sensible heat flux above an actual urban space

【Publications Relevant to the Project】

- M. Khiem, R. Ooka, H. Hayami, H. Yoshikado, H. Huang, Y. Kawamoto, Process analysis of ozone formation under different weather conditions over the Kanto region of Japan using the MM5/CMAQ modelling system, Atmospheric Environment 44, pp. 4463-4473, 2010
H. Kikumoto, R. Ooka, A numerical study of air pollutant dispersion with bimolecular chemical reactions in an urban street canyon using large-eddy simulation, Atmospheric Environment 54, pp. 456-464, 2012

【Term of Project】 FY2012-2016

【Budget Allocation】 156,800 Thousand Yen

【Homepage Address and Other Contact Information】

<http://venus.iis.u-tokyo.ac.jp>