Introduction

The aim of this study is to figure out relationships between the urban warming rate and the wind speed increasing/decreasing rate, which are induced by land surface modifications, urban mesoscale atmospheric model.

Some expected effects of surface modification on changes of the air temperature (at 1.5m) and the wind speed (at 10m) are:

1. Shelter effect
   - When the surrounding roughness (trees and buildings) will grow higher at a meteorological observation, ...

2. Disturbance effect
   - When the additional heat will be provided to the surface layer caused by land use changes, anthropogenic heat etc. ...

Experimental Design

Season: Summer (15 July and August)
Winter (15 January and February)
Domain: Central part of Japan, including Tokyo Metropolitan area

Atmospheric conditions:
Initial & Boundary: JMA Operational Mesoscale Analysis Dataset

Anthropogenic heat, Local pressure gradient will be formed and it generates effect
(when there is no anthropogenic exhausted heat)

• Increase of wind speed can be seen in the center area of Tokyo.
• Increase of wind speed was induced by the temperature change along the convective area.

Results

Total effect
- Land use factors change (vegetation, water, albedo, thermal inertia, etc.)
- Anthropogenic heat

Building aspect ratio change (reflection, turbulent flux)

Summary

Total effect of land use change on the local surface temperature and horizontal wind speed

Summer: Positive correlation
Winter: Negative correlation (but positive in the center of Tokyo)

Heat load
- EXP2006: EXP2006H: The changed parameters are roughness, vegetation (thermal inertia, albedo, etc.)
- EXP2006HR: EXP2006H - 2006 (Summer)
- EXP2006HR - 2006H (Summer)
- EXP2006HR - 2006HR (Summer)
- EXP2006HR: EXP2006H (Summer)

Building effect (the effects in terms of radiation and turbulent heat fluxes)
- EXP2006: EXP2006HR - 2006H (Summer)
- EXP2006HR - 2006HR (Summer)
- EXP2006HR - 2006HR (Summer)
- EXP2006HR: EXP2006HR (Summer)

Time-of-the-day dependency of regression coefficient
- EXP2006: EXP2006HR - 2006H (Summer)
- EXP2006HR - 2006HR (Summer)
- EXP2006HR - 2006HR (Summer)
- EXP2006HR: EXP2006HR (Summer)