Evaluation of uncertainty in future urban climate prediction in prefectural scale

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Tokyo Metropolitan area (i.e., southern part of Kanto district) is known for one of the hottest areas in summer in Japan. Especially in Saitama prefecture (north of Tokyo), the daily maximum surface air temperature (SAT) at screen height sometimes reached in 40 ℃. In the last decade, the summer heat environment in Japan is getting worse, and the number of emergency transportations due to heat stroke is rapidly increasing.

The japan meteorological agency reported that increase in annual mean SAT from 1931 to 2015 is 3.2 ℃ in Tokyo, while the one averaged over 15 suburban cities is only 1.5 ℃. Increase in SAT is caused by both the global warming and urban heat island.

The increase in temperature widely discussed in COP21 (such as +1.5 and/or 2 ℃ world), is globally-averaged SAT. Under the +1.5 and/or 2 ℃ world, the increase in SAT in local scale is not 1.5 and/or 2 ℃ because of the global warming and urban heat island. We need to perform downscaling to estimate the increase in prefectural- (or provincial-) scale SAT under +1.5 and/or 2 ℃ world.

Moreover, in making environmental policies in local government, prefectural (or provincial) scale future climate information is required to estimate the cost and benefit affected by climate adaptation strategies. So, policy maker requires the climate prediction, including its uncertainty information. But the future climate information provided by climate scientists contains uncertainty from various sources.

In this study, we evaluate the due to global climate change, regional climate change and land use change. To evaluate the uncertainty in regional climate prediction, we performed a series of present climate simulations using the Weather Research and Forecasting (WRF) model with high horizontal resolution, including an urban canopy sub-model. We also analyze global future climate predictions of CMIP5 CGCMs to evaluate the uncertainty in global climate change prediction.

Keywords: urban heat island, climate change, uncertainty, adaptation strategy

