KIKUMOTO LAB.

[Modeling of Wind and Environment in Cities]

Department of Human and Social Systems

Control Engineering of Complex Environmental System

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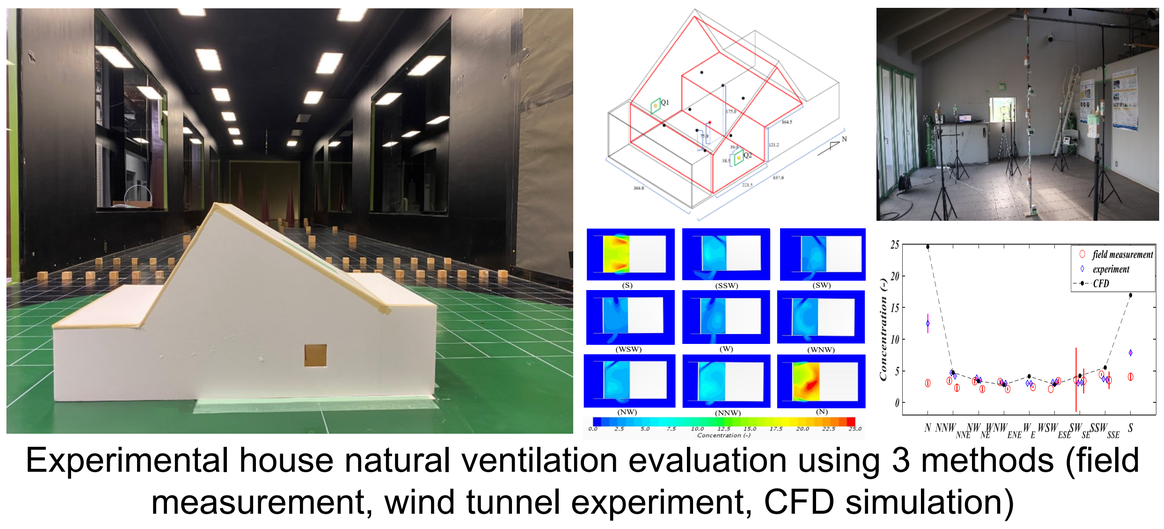
This laboratory makes researches to understand, predict and control urban and building environment. The main research interest is the wind, air and thermal environment. We have been developing monitoring and simulation technologies for each environmental element, and also studying environmental control technology that integrates measurement and prediction techniques by mathematical/statistical methods.

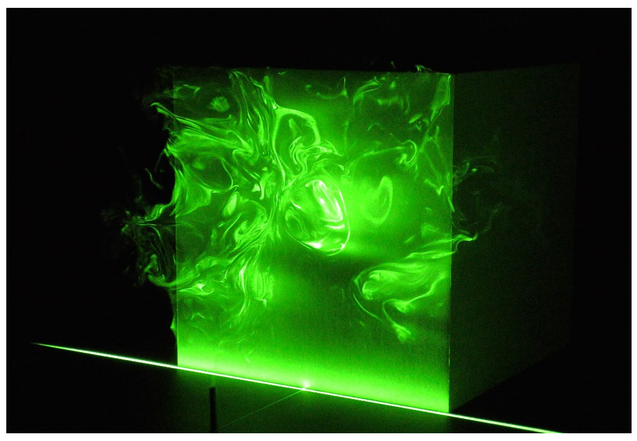
➢ Fluid phenomena in the environment

■ We are analyzing the air flow formed in cities and around buildings using observational method, wind tunnel experiment and computational fluid dynamics (CFD).



Experimental house natural ventilation evaluation using 3 methods (field measurement, wind tunnel experiment, CFD simulation)

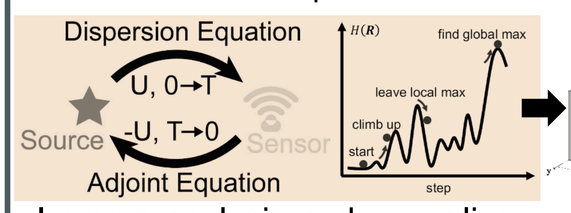
Wind tunnel experiment of city airflow



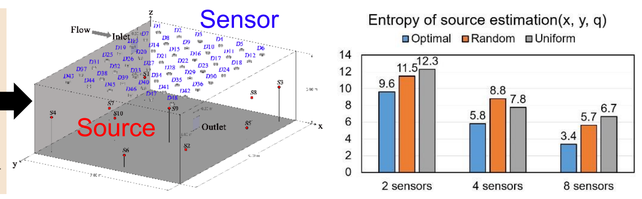
Visualization of pollutant dispersion in wind tunnel

➢ Inverse analysis method

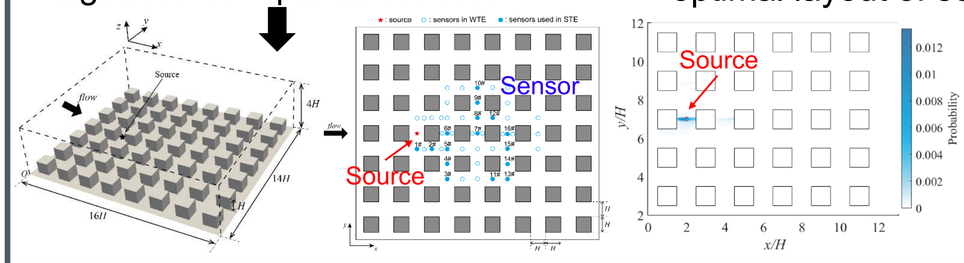
■ Using methods of stochastically estimating the environmental factors such as unknown air pollution sources by physical and statistical models.



Inverse analysis and annealing algorithm for optimal sensors



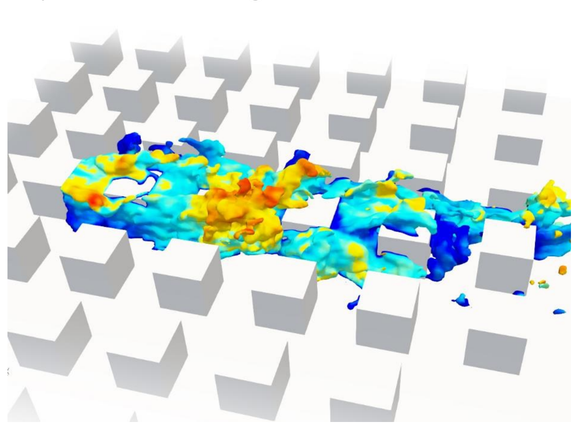
Indoor space: Source estimation by optimal layout of sensors



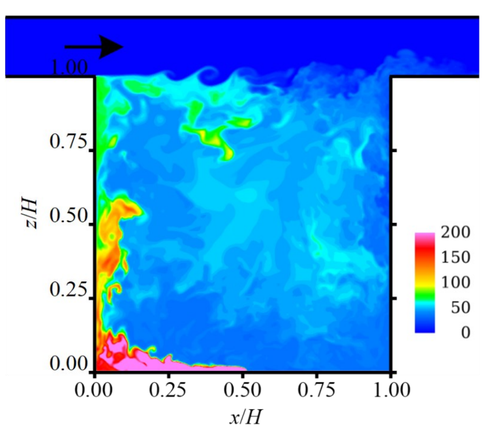
Urban space: Source estimation by optimal layout of sensors

➢ Dispersion modeling of air pollutants

■ We are developing analysis technologies for the dispersion phenomenon of air pollutants using wind tunnel and turbulence models.



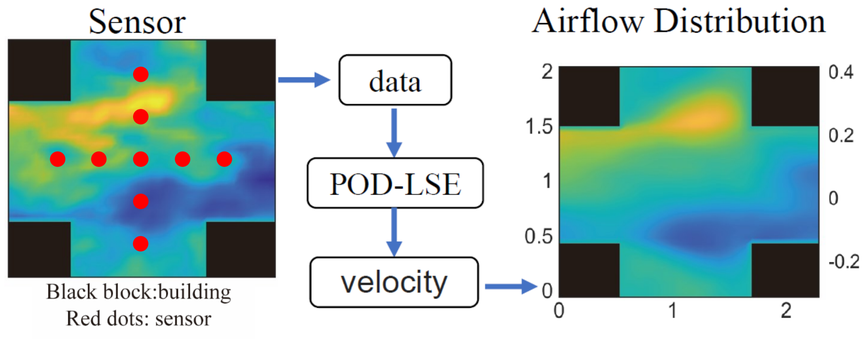
CFD prediction of pollutant dispersion in block-arrayed urban model



CFD prediction of pollutant dispersion in a cavity using LES method

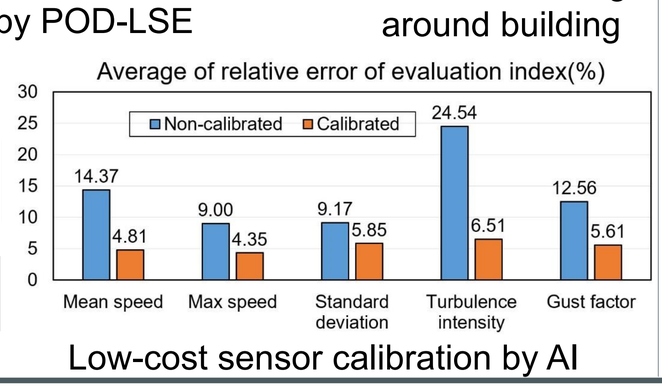
➢ Monitoring of urban environment

■ We are developing technology to measure the urban atmospheric environment with high resolution. We are also studying resolution enhancement technique applying statistical models or AI techniques to the measurement data.



Estimation of Airflow in an urban area with limited observation information by POD-LSE

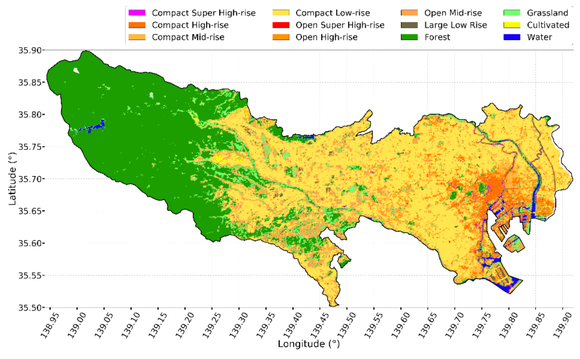
Wind measuring around building



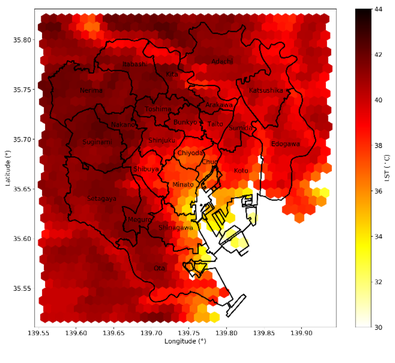
Low-cost sensor calibration by AI

➢ Remote sensing of urban environment

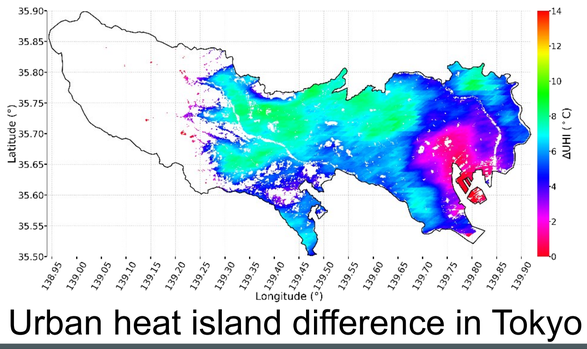
■ As the city grows, we study the local climate zone and heat island phenomenon in Tokyo, and the surface temperature (LST) and heat stroke incidence (HSIR) in Tokyo 23 wards.



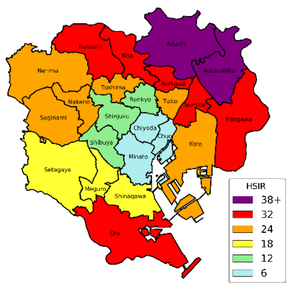
Local climate zones in Tokyo



LST in Tokyo 23 ward



Urban heat island difference in Tokyo



HSIR rates in Tokyo 23 ward