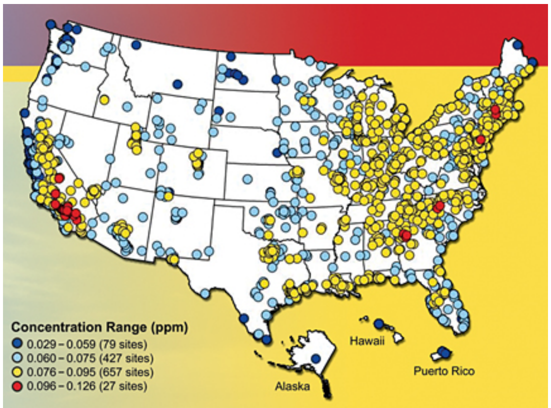
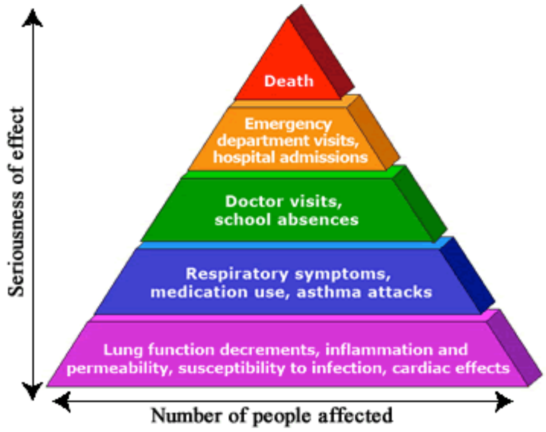
Environmental Sciences and Engineering ~ ENVR 400 ~ In-house Seminar





Integration of observation and air quality model data for improved exposure estimates

Yadong Xu
PhD Candidate, ESE

Wednesday, February 12, 2014
0001 Michael Hooker Research Center
12:00 - 12:50 p.m.

Abstract: The uncertainty of local-scale ambient ozone concentrations has been an important factor that hinders our ability to study the associations between the exposure levels of ozone and a wide range of adverse health outcomes. Accurate estimates of ambient ozone concentrations are needed for many epidemiological studies to obtain a better assignment of personal exposure. Spatiotemporal estimation approaches based on only observational data recorded in the U.S. Environmental Protection Agency's Air Quality System (EPA AQS), which were often used for many previous epidemiological studies, suffer from missing data issues due to the scarce monitoring network across space and the inconsistent recording periods at different monitors. Although chemical transport models (CTMs) provide good spatial and temporal coverage for ambient ozone concentrations, direct use of the modeled outputs from CTMs can be problematic because of the substantial predictive bias in their model performances.

This seminar presents a geo-statistical model approach using the Bayesian Maximum Entropy (BME) Framework that can combine these techniques and take advantage of the strength from both data sources, the accuracy of the observational data, and the good spatial / temporal coverage of CTM outputs. An investigation of the spatial heterogeneity and temporal variability of ozone model performances in the CTMs across the U.S. is described together with methods to obtain soft information from CTM model outputs based on how well the CTM model predictions reproduce the observed values. This approach is demonstrated in the U.S. using hourly ozone measurements from the EPA AQS network in combination with outputs from a Community Multiscale Air Quality (CMAQ) Modeling System.

Through visual mapping of ozone concentrations and also quantitative assessment with cross-validation statistics, the integration of soft information by the BME method is shown to effectively increase the estimation accuracy. The improved exposure estimates for ambient ozone concentrations can provide crucial information for studying associations between exposure to air pollution and adverse health effects in the U.S.