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NESL's Atmospheric Chemistry Division Seminar

Comparing Remote Sensing, Atmospheric Chemistry, and Ground-based Estimates of Fine Particulate Matter on Survival

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Tuesday, May 7th, 3:30 p.m.

3:00 p.m. – Refreshments & Socializing

Foothills Lab 2, Room 1022

Abstract

Background and Aims: Remote sensing (RS) and atmospheric transport (AT) modeling are increasingly used for exposure assessment in epidemiological and health burden studies. Here we aimed to assess whether modeled estimates of fine particulate matter from RS and AT differed from models based only on ground information in the health risks associated with exposure.
Methods: We geocoded the baseline residential address of 669,047 American Cancer Society Cancer Prevention II (ACS CPS-II) Cohort subjects and assigned several exposure models to them. These estimates included a $PM_{2.5}$ model based on RS retrievals (resolution ~ 9.8 km girds), an Environmental Protection Agency Hierarchical Bayesian Model (HBM) that combines atmospheric chemistry models with ground observations (~36 km), a gesotatistical kriging model based on ground observations (~ 9.8 km), a hybrid land use regression model using only ground-based inputs, and another land use regression model that combined ground-based information with the retrievals (assigned to the geocoded point). We used Cox proportional hazards regression to examine associations with mortality from diseases of the circulatory system (plus diabetes) while controlling for likely confounders (e.g., smoking history). Follow up went from 1982 to 2004. Exposure models were averaged for the years 2002-2004.
Results: Relative risks are reported over a 10 ug/m^3 exposure increment. Health effects differed between the models, with the smallest risks being observed for the remote sensing models (relative risks or RR = 1.05, 95% CI: 1.03-1.07) and the EPA model (RR = 1.09, 95% CI: 1.06-1.11). Results from the geostatistical model and the hybrid land use regression that included remote sensing information were larger and similar to each other (significant RR = 1.12). The largest risks were observed for the land use regression model that included only ground-based information and whose most significant predictor was traffic within 1 km of monitor (RR = 1.15, 95% CI: 1.13-1.18).
Conclusion: Those exposure estimates using ground-based information had larger risks that either the RS or the AT models, which both predicted over relatively large areas. Smaller effects from these models may have resulted from their inability to detect fine-scale variations from emission sources such as traffic.