COMPARISON OF METHODS FOR ESTIMATING PERSONAL BLACK CARBON EXPOSURES IN URBAN SETTINGS

Jing Cai, Lamont-Doherty Earth Observatory of Columbia University, USA; East China University of Science and Technology, China
Beizhan Yan, Lamont-Doherty Earth Observatory of Columbia University, USA
Pat Kinney, Mailman School of Public Health at Columbia University, USA
Matt Perzanowski, Mailman School of Public Health at Columbia University, USA
Kyung-Hwa Jung, Columbia University College of Physicians and Surgeons, USA
James Ross, Lamont-Doherty Earth Observatory of Columbia University, USA
Nathan Rollins, Lamont-Doherty Earth Observatory of Columbia University, USA
Cosette Olivo, Mailman School of Public Health at Columbia University, USA
Benedicta B. Obeng, Mailman School of Public Health at Columbia University, USA
Fareeha Hafeez, Mailman School of Public Health at Columbia University, USA
Rachel L. Miller, Columbia University College of Physicians and Surgeons, USA
Steven N. Chillrud, Lamont-Doherty Earth Observatory of Columbia University, USA

Background and Aims: Epidemiological studies have demonstrated that black carbon (BC) exposures are associated with adverse health effects. To date, studies have primarily conducted exposure assessment based on fixed-site monitoring, or a single integrated 24-48 hr personal sample. This paper uses repeat personal BC measurements to explore the difference in distribution of personal BC exposure in a cohort of 9-10 years old urban children to fixed-site BC monitoring data.

Method: Personal sampling (PS) for each subject comprised carrying a microaethalometer (Magee Sci), for 5 weekday and 1 weekend 24hr periods, spread over a 3-4 weeks. Fixed-site BC sampling (FS) employed a rack mount Aethalometer® with the inlet located outside of a 5th floor window in Washington Heights, NYC. Here we start with comparing descriptive statistics and univariate correlations for 24 hr average data for P and F.

Results: Linear regressions between PS (as y) and FS (as x) on 24hr average displayed large variability in correlation, slope and intercept for 27 subjects that had 4 or more valid data for BC measured for P and BC measured for F. 9/27 subjects show poor correlation ($R^2$: 0.02~0.38, N≥4) and 8/27 subjects show moderate correlation ($R^2$: 0.51~0.69, N≥5) with FS. However, 10 of the subjects displayed high correlation between P and F ($R^2$: 0.72~0.94, N≥4) but displayed variable slopes (-19 to 1.0) and intercepts (near zero to ~38,000 ng/m$^3$).

Preliminary Conclusion: Based on our study, ~1/3 subjects’ BC personal exposure could not be predicted by central site sampling, probably due to personal activities leading to BC exposures different from that of the fixed-site. Roughly, 1/3 subjects’ personal measurements highly correlate with fixed-site data, though the relationships vary as a function of the subject, consistent with spatial variability in ambient BC. Time activity recall diaries and GPS data are being investigated to see if they support these preliminary conclusions.