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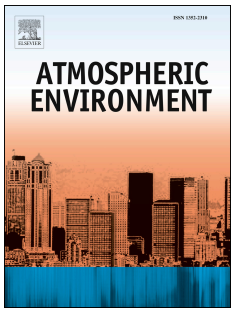

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Nichole Baldwin, Owais Gilani, Suresh Raja, Stuart Batterman, Rajiv Ganguly, Philip Hopke, Veronica Berrocal, Tom Robins, Sarah Hoogterp

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Nichole Baldwin,[a] Owais Gilani,[b] Suresh Raja,[c] Stuart Batterman,[d*]
Rajiv Ganguly,[e] Philip Hopke,[a] Veronica Berrocal,[b] Tom Robins,[d] Sarah Hoogterp[f]

[a]Institute for a Sustainable Environment, Clarkson University, Potsdam, NY, United States
[b]Biostatistics, University of Michigan, Ann Arbor, MI, United States
[c]Enercon Services, Inc., Dallas, TX, United States
[d]Environmental Health Sciences, University of Michigan, Ann Arbor, MI, United States
[e]Department of Civil Engineering, Jaypee University of Information Technology, Solan, Himachal Pradesh, India
[f]Southwest Detroit Environmental Vision, Detroit, Michigan, United States

*Corresponding author Email: Stuartb@umich.edu Tel: 734 763-2417 Fax: 734 763-8095

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Abstract

An improved understanding of traffic-related air pollutants is needed to estimate exposures and adverse health impacts in traffic corridors and near-road environments. In this study, concentrations of black carbon (BC), nitrogen oxides (NO, NO_2, NOx), sulfur dioxide (SO_2), and particulate matter ($PM_{2.5}$, PM_{10}, ultrafine particles, and accumulation mode particles, AMP) were measured using a mobile air pollutant laboratory along nine transects across major roads in Detroit, MI in winter 2012. Repeated measurements were taken during rush-hour periods at sites in residential neighborhoods located 50 to 500 m from both sides of the road. Concentration gradients attributable to on-road emissions were estimated by accounting for traffic volume and mix, wind speed, wind direction, and background concentrations. BC, NO, NO_x, and UFP had the strongest gradients, and elevated concentrations of NO_x, NO_2, $PM_{2.5}$ and PM_{10}, as well as decreased particle size, were found at the 50 m sites compared to background levels. Exponential models incorporating effects of road size, wind speed, and up- and downwind distance explained from 31 to 53% of the variability in concentration gradients for BC, NO, NO_x, UFP and particle size. The expected concentration increments 50 m from the study roads were 17.0 ppb for NO, 17.7 ppb for NO_x, 2245 particles/cm^3 for UFP, and 0.24 $\mu g/m^3$ for BC, and the expected distance to decrease increments by half was 89 to 129 m in the downwind direction, and 14 to 20 m in the upwind direction. While accounting for portion of the temporal and spatial variability across transects and measurement periods, these results highlight the influence of road-to-road differences and other locally-varying factors important in urban and industrial settings. The study demonstrates a methodology to quantify near-road concentrations and influences on these concentrations while accounting for temporal and spatial variability, and it provides information useful for estimating exposures of traffic-related air pollutants in urban environments.

Keywords

Mobile emissions; mobile monitoring; traffic; ultrafine particles, black carbon