

A Spatial Model of Urban Winter Woodsmoke Concentrations

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Abstract:

In many urban areas, residential wood burning is a significant wintertime source of $PM_{2.5}$. In this study, we used a combination of fixed and mobile monitoring along with a novel spatial buffering procedure to estimate the spatial patterns of woodsmoke. Two-week average $PM_{2.5}$ and levoglucosan (a marker for wood smoke) concentrations were concurrently measured at up to seven sites in the study region. In addition, pre-selected routes spanning the major population areas in and around Vancouver, B.C. were traversed during 19 cold, clear winter evenings from November, 2004 to March, 2005 by a vehicle equipped with GPS receiver and a nephelometer. Fifteen-second-average values of light scattering coefficient (b_{sp}) were adjusted for variations between evenings and then combined into a single, highly resolved map of nighttime winter b_{sp} levels. A relatively simple but robust ($R^2 = 0.64$) land use regression model was developed using selected spatial co-variates to predict these temporally adjusted b_{sp} values. The b_{sp} values predicted by this model were also correlated with the measured average levoglucosan concentrations at our fixed site locations ($R^2 = 0.66$). This model, the first application of land use regression for woodsmoke, enabled the identification and prediction of previously unrecognized high woodsmoke regions within an urban airshed.

