Spatiotemporal variations of source contributions to ambient fine particles in Seoul, Korea

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There has been considerable progress in understanding the specific components and sources of ambient fine particles ($PM_{2.5}$) responsible for observed adverse human health effects reported in many epidemiological and toxicological studies during the past decade (Heo et al., 2009; Sarnat et al., 2010; von Schneidemesser et al., 2010). However, estimating true population health risk of $PM_{2.5}$ exposure in urban environments is difficult due to considerable uncertainty regarding the spatial variability of the components and sources within urban settings.

This study evaluates spatial and temporal variations of source contributions to $PM_{2.5}$ in Seoul metropolitan area in Korea. Twenty four hour integrated $PM_{2.5}$ samples were collected on one in three day intervals over 2-year period (August 2007 to December 2009) at 11 sites in Seoul. The $PM_{2.5}$ samples were analyzed for major chemical components including organic carbon and elemental carbon, ions, and metals, and the results were used in a positive matrix factorization (PMF) model to estimate source contributions to $PM_{2.5}$ mass. Nine sources, including secondary sulfate, secondary nitrate, mobile, biomass burning, industry, roadway emission, soil, aged sea salt, and fuel oil combustion, were identified across the sampling sites. Secondary inorganic aerosol (i.e. secondary sulfate and nitrate) was a major source, contributing to approximately 40% of the total $PM_{2.5}$ mass, and showed relatively homogeneous temporal trends of daily source contribution over the study area. Mobile was found to be the second major source accounting for $PM_{2.5}$ mass, and other sources (i.e. roadway emission and industry) identified were largely related to local emissions of respective neighbourhoods. The spatial and temporal characteristics of each of sources resolved by the PMF model were examined using summary statistics, correlation analysis, and coefficient of variation and divergence analyses and the detailed results will be discussed in the presentation.

Due to the fact that developing meaningful and feasible solution to reduce burden of disease associated with the $PM_{2.5}$ exposure is required in urban environments, the findings provide an important information on the regional and local source contributions to the $PM_{2.5}$ mass.

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