Source apportionment of ambient particle number concentrations in central Los Angeles using positive matrix factorization (PMF)

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October 28, 3:00pm, SLH 102

Abstract:
In this study, the Positive Matrix Factorization (PMF) receptor model (version 5.0) was used to identify and quantify major sources contributing to particulate matter (PM) number concentrations, using PM number size distributions in the range of 13 nm to 10 µm combined with several auxiliary variables, including black carbon (BC), elemental and organic carbon (EC/OC), PM mass concentrations, gaseous pollutants, meteorological, and traffic counts data, collected for about 9 months between August 2014 and 2015 in central Los Angeles, CA. Several parameters, including particle number and volume size distribution profiles, profiles of auxiliary variables, contributions of different factors in different seasons to the total number concentrations, diurnal variations of each of the resolved factors in the cold and warm phases, weekday/weekend analysis for each of the resolved factors, and correlation between auxiliary variables and the relative contribution of each of the resolved factors, were used to identify PM sources. A six-factor solution was identified as the optimum for the aforementioned input data. The resolved factors comprised nucleation, traffic 1, traffic 2 (having a larger mode diameter than traffic 1 factor), urban background aerosol, secondary aerosol, and soil/road dust. Traffic sources (1 and 2) were the major contributor to PM number concentrations, collectively making up to above 60% (60.8-68.4%) of the total number concentrations during the study period. Their contribution was also significantly higher in the cold phase compared to the warm phase. Nucleation was another major factor significantly contributing to the total number concentrations (an overall contribution of 17%, ranging from 11.7% to 24%), having a larger contribution during the warm phase than in the cold phase. The other identified factors were urban background aerosol, secondary aerosol, and soil/road dust, with relative contributions of approximately 12% (7.4-17.1), 2.1% (1.5-2.5%), and 1.1% (0.2-6.3%), respectively, overall accounting for about 15% (15.2-19.8%) of PM number concentrations. As expected, PM number concentrations were dominated by factors with smaller mode diameters, such as traffic and nucleation. On the other hand, PM volume and mass concentrations in the study area were mostly affected by sources having larger mode diameters, including secondary aerosols and soil/road dust. Results from the present study can be used as input parameters in future epidemiological studies to link PM sources to adverse health effects as well as by policy makers to set targeted and more protective emission standards for PM.

Understanding the Role of Urban Heat Islands in affecting Residential Electricity Consumption through High Spatiotemporal Resolution Observations and Models

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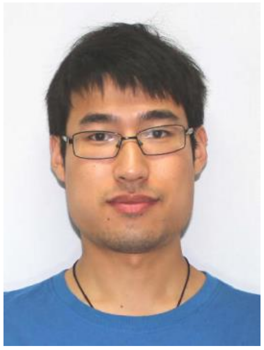
October 28, 3:30pm, SLH 102

Abstract:



The residential sector accounts for about 37% of total electricity consumption in the United States, more than any other end-use sector. Space cooling and heating, the largest electricity end-use in buildings, is driven primarily by local weather conditions. Increased warming in cities from urbanization and global climate change are expected to lead to significant increases in cooling demand. Predicting how increases in urbanization and climate change will affect residential electricity use requires detailed understanding of relationships between energy use and site meteorology. This research aims to assess the question, how do urban heat islands (UHI) impact residential electricity consumption? More specifically, the proposers will investigate (1) how urban heat islands impact diurnal residential electricity consumption; (2) the extent to which cool roofs can mitigate the impacts of UHIs on residential electricity consumption through cooling of the urban climate; and (3) whether vulnerable populations are more susceptible to the impacts of urban heat islands, and climate change, more generally. The proposed research targets the Los Angeles (LA) metropolitan area and the San Francisco (SF) Bay area because they provide the opportunity to observe how the UHI impacts electricity use across relatively small spatial extents with widely varying microclimates, building stocks, and population vulnerabilities. The research methods developed in the proposed research will be applied to other cities in the United States and around the globe in future work.