Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 8, 3093-3105, 2008
www.atmos-chem-phys.net/8/3093/2008/

Spatial and temporal variability of particulate polycyclic aromatic hydrocarbons in Mexico City

D. A. Thornhill[1,4], B. de Foy[2,4], S. C. Herndon[3], T. B. Onasch[3], E. C. Wood[3], M. Zavala[4,5], L. T. Molina[4,5], J. S. Gaffney[6], N. A. Marley[6], and L. C. Marr[1]

[1]Dept. of Civil and Environmental Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA
[2]Dept. of Earth and Atmospheric Sciences, Saint Louis University, St. Louis, MO, USA
[3]Aerodyne Research Inc., Billerica, MA, USA
[4]Molina Center for Energy and the Environment, La Jolla, CA, USA
[5]Massachusetts Inst. of Technology, Cambridge, MA, USA
[6]Dept. of Chemistry, University of Arkansas, Little Rock, AR, USA

Abstract. As part of the Megacities Initiative: Local and Global Research Observations (MILAGRO) study in the Mexico City Metropolitan Area in March 2006, we measured particulate polycyclic aromatic hydrocarbons (PAHs) and other gaseous species and particulate properties, including light absorbing carbon or effective black carbon (BC), at six locations throughout the city. The measurements were intended to support the following objectives: to describe spatial and temporal patterns in PAH concentrations, to gain insight into sources and transformations of PAHs and BC, and to quantify the relationships between PAHs and other pollutants. Total particulate PAHs at the Instituto Mexicano del Petróleo (T0 supersite) located near downtown averaged 50 ng m^{-3}, and aerosol active surface area averaged 80 mm^2 m^{-3}. PAHs were also measured on board the Aerodyne Mobile Laboratory, which visited six sites encompassing a mixture of different land uses and a range of ages of air parcels transported from the city core. A combination of analyses of time series, back trajectories, concentration fields, pollutant ratios, and correlation coefficients supports the concept of T0 as an urban source site, T1 as a receptor site with strong local sources, Pedregal and PEMEX as intermediate sites, Pico Tres Padres as a vertical receptor site, and Santa Ana as a downwind receptor site. Weak intersite correlations suggest that local sources are important and variable and that exposure to PAHs and BC cannot be represented by a single regional-scale value. The relationships between PAHs and other pollutants suggest that a variety of sources and ages of particles are present. Among carbon monoxide, nitrogen oxides (NO_x), and carbon dioxide, particulate PAHs are most strongly correlated with NO_x. Mexico City's PAH/BC mass ratio of 0.01 is similar to that found on a freeway loop in the Los Angeles area and approximately 8–30 times higher than that found in other cities. Evidence also suggests that primary combustion particles are rapidly coated by secondary aerosol in Mexico City. If so, their optical properties may change, and the lifetime of PAHs may be prolonged if the coating protects them against photodegradation or heterogeneous reactions.

Final Revised Paper (PDF, 1038 KB) Discussion Paper (ACPD)

Citation: Thornhill, D. A., de Foy, B., Herndon, S. C., Onasch, T. B., Wood, E. C., Zavala, M., Molina, L. T., Gaffney, J. S., Marley, N. A., and Marr, L. C.: Spatial and temporal variability of particulate polycyclic aromatic hydrocarbons in Mexico City, Atmos. Chem. Phys., 8, 3093-3105, 2008. Bibtex EndNote Reference Manager