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

Atmos. Chem. Phys., 8, 1559-1575, 2008
www.atmos-chem-phys.net/8/1559/2008/

The time evolution of aerosol composition over the Mexico City plateau

L. I. Kleinman[1], S. R. Springston[1], P. H. Daum[1], Y.-N. Lee[1], L. J. Nunnermacker[1], G. I. Senum[1], J. Wang[1], J. Weinstein-Lloyd[2], M. L. Alexander[3], J. Hubbe[3], J. Ortega[3], M. R. Canagaratna[4], and J. Jayne[4]
[1]Brookhaven National Laboratory, Upton, NY, USA
[2]SUNY, Old Westbury, NY, USA
[3]Pacific Northwest National Laboratory, Richland, WA, USA
[4]Aerodyne Research Inc., Billerica, MA, USA

Abstract. The time evolution of aerosol concentration and chemical composition in a megacity urban plume was determined based on 8 flights of the DOE G-1 aircraft in and downwind of Mexico City during the March 2006 MILAGRO field campaign. A series of selection criteria are imposed to eliminate data points with non-urban emission influences. Biomass burning has urban and non-urban sources that are distinguished on the basis of CH_3CN and CO. In order to account for dilution in the urban plume, aerosol concentrations are normalized to CO which is taken as an inert tracer of urban emission, proportional to the emissions of aerosol precursors. Time evolution is determined with respect to photochemical age defined as $-Log_{10}$ (NO_x/NO_y). The geographic distribution of photochemical age and CO is examined, confirming the picture that Mexico City is a source region and that pollutants become more dilute and aged as they are advected towards T1 and T2, surface sites that are located at the fringe of the City and 35 km to the NE, respectively. Organic aerosol (OA) per ppm CO is found to increase 7 fold over the range of photochemical ages studied, corresponding to a change in NO_x/NO_y from nearly 100% to 10%. In the older samples the nitrate/CO ratio has leveled off suggesting that evaporation and formation of aerosol nitrate are in balance. In contrast, OA/CO increases with age in older samples, indicating that OA is still being formed. The amount of carbon equivalent to the deduced change in OA/CO with age is 56 ppbC per ppm CO. At an aerosol yield of 5% and 8% for low and high yield aromatic compounds, it is estimated from surface hydrocarbon observations that only ~9% of the OA formation can be accounted for. A comparison of OA/CO in Mexico City and the eastern U.S. gives no evidence that aerosol yields are higher in a more polluted environment.

Final Revised Paper (PDF, 2988 KB) Supplement (314 KB) Discussion Paper (ACPD)

Citation: Kleinman, L. I., Springston, S. R., Daum, P. H., Lee, Y.-N., Nunnermacker, L. J., Senum, G. I., Wang, J., Weinstein-Lloyd, J., Alexander, M. L., Hubbe, J., Ortega, J., Canagaratna, M. R., and Jayne, J.: The time evolution of aerosol composition over the Mexico City plateau, Atmos. Chem. Phys., 8, 1559-1575,

2008. Bibtex EndNote Reference Manager