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

Atmos. Chem. Phys., 8, 4027-4048, 2008
www.atmos-chem-phys.net/8/4027/2008/

Fast airborne aerosol size and chemistry measurements above Mexico City and Central Mexico during the MILAGRO campaign

P. F. DeCarlo[1,2,*], E. J. Dunlea[1], J. R. Kimmel[1], A. C. Aiken[1,3], D. Sueper[1], J. Crounse[4], P. O. Wennberg[4], L. Emmons[5], Y. Shinozuka[6], A. Clarke[6], J. Zhou[6], J. Tomlinson[7], D. R. Collins[7], D. Knapp[5], A. J. Weinheimer[5], D. D. Montzka[2], T. Campos[5], and J. L. Jimenez[1,3]

[1]Cooperative Institute for Research in Environmental Science (CIRES) University of Colorado, Boulder, CO, USA
[2]Department of Atmospheric and Oceanic Science, University of Colorado at Boulder, Boulder, CO, USA
[3]Department of Chemistry and Biochemistry, University of Colorado at Boulder, Boulder, CO, USA
[4]California Institute of Technology, Pasadena, CA, USA
[5]National Center for Atmospheric Research, Boulder, CO, USA
[6]Department of Oceanography, University of Hawaii, USA
[7]Department of Meteorology, Texas A&M University, College Station, TX, USA
[*]now at: Laboratory of Atmospheric Chemistry, Paul Scherrer Institute, Switzerland

Abstract. The concentration, size, and composition of non-refractory submicron aerosol (NR-PM_1) was measured over Mexico City and central Mexico with a High-Resolution Time-of-Flight Aerosol Mass Spectrometer (HR-ToF-AMS) onboard the NSF/NCAR C-130 aircraft as part of the MILAGRO field campaign. This was the first aircraft deployment of the HR-ToF-AMS. During the campaign the instrument performed very well, and provided 12 s data. The aerosol mass from the AMS correlates strongly with other aerosol measurements on board the aircraft. Organic aerosol (OA) species dominate the NR-PM_1 mass. OA correlates strongly with CO and HCN indicating that pollution (mostly secondary OA, SOA) and biomass burning (BB) are the main OA sources. The OA to CO ratio indicates a typical value for aged air of around 80 μg m^{-3} (STP) ppm^{-1}. This is within the range observed in outflow from the Northeastern US, which could be due to a compensating effect between higher BB but lower biogenic VOC emissions during this study. The O/C atomic ratio for OA is calculated from the HR mass spectra and shows a clear increase with photochemical age, as SOA forms rapidly and quickly overwhelms primary urban OA, consistent with Volkamer et al. (2006) and Kleinman et al. (2008). The stability of the OA/CO while O/C increases with photochemical age implies a net loss of carbon from the OA. BB OA is marked by signals at *m/z* 60 and 73, and also by a signal enhancement at large *m/z* indicative of larger molecules or more resistance to fragmentation. The main inorganic components show different spatial patterns and size distributions. Sulfate is regional in nature with clear volcanic and petrochemical/power plant sources, while the urban area is not a major regional source for this species. Nitrate is enhanced significantly in the urban area and immediate outflow, and is strongly correlated with CO indicating a strong urban source. The

importance of nitrate decreases with distance from the city likely due to evaporation. BB does not appear to be a strong source of nitrate despite its high emissions of nitrogen oxides, presumably due to low ammonia emissions. NR-chloride often correlates with HCN indicating a fire source, although other sources likely contribute as well. This is the first aircraft study of the regional evolution of aerosol chemistry from a tropical megacity.

Final Revised Paper (PDF, 8640 KB) Supplement (208 KB) Discussion Paper (ACPD)

Citation: DeCarlo, P. F., Dunlea, E. J., Kimmel, J. R., Aiken, A. C., Sueper, D., Crounse, J., Wennberg, P. O., Emmons, L., Shinozuka, Y., Clarke, A., Zhou, J., Tomlinson, J., Collins, D. R., Knapp, D., Weinheimer, A. J., Montzka, D. D., Campos, T., and Jimenez, J. L.: Fast airborne aerosol size and chemistry measurements above Mexico City and Central Mexico during the MILAGRO campaign, Atmos. Chem. Phys., 8, 4027-4048, 2008. Bibtex EndNote Reference Manager