

Vertical profiles of ozone, VOCs and meteorological parameters in within and outside of Mexico City during the MILAGRO field Campaign

C. Márquez¹, J. Greenberg², E. Bueno¹, R. Bernabé¹, J. Aguilar¹, S. Blanco¹, A. Turnipseed², H. Wöhrnschimmel¹, A. Guenther², B. Cárdenas¹

¹Centro Nacional de Investigación y Capacitación Ambiental (CENICA-INE), México.

²National Center of Atmospheric Research (NCAR), USA.

High ozone levels with maxima over 250 ppb have been an air quality problem in Mexico City for more than a decade. This ozone is produced in the daytime by photochemical reactions, initiated by its precursors, nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of solar ultraviolet radiation. The objective of this work is to contribute to the understanding of the evolution of these air pollutants at different heights of the boundary layer by means of vertical profile measurements.

Ozone, VOCs and meteorological vertical profiles were determined in Northern Mexico City (T0 site) using a tethered balloon for 10 days during the MILAGRO field Campaign 2006, between 4 AM and 4 PM. Measurements were done up to 1000 meter above ground (ozone and meteorological parameters) and up to 200 m above ground for VOCs. VOCs samples were collected during 4 minutes in canisters and analyzed with GC-FID to identify 13 species (ethane, propane, propylene, butane, acetylene, pentane, hexane, heptane, benzene, octane, toluene, nonane and o-xylene). For 4 of the days, VOC integrated samples were also taken using personal pumps and absorbent cartridges at height between 200 and 1000 m. Sample cartridges were analyzed by GC-MS for volatile organic compounds (n-butane, i-pentane, n-pentane, benzene, toluene, ethyl-benzene, o-xylene, m&p-xylene, 1,2,4-tri-methyl-benzene and C3-benzenes).

Ozone vertical profiles, frequently presented high concentrations above 400 m in the early morning. During the daytime, more homogeneous profiles indicate an increased vertical mixing. VOCs profiles show similar concentrations for all heights at dawn. In the morning, highest concentrations were determined at a height of about 100 meter, whereas at noon and in the afternoon concentrations decreased with height. Comparing VOC concentrations during the course of a day, highest values are measured in the morning. The highest VOC concentrations were propane, butane, and toluene. For some days, VOC concentrations at T0 were compared with measurements done at surface levels in the southeast of Mexico City. Vertical profiles measured in the city at T0 were also compared with VOC and ozone concentrations measured at heights up to 700m using a tethered balloon system deployed at the T1 site north of Mexico City.