Evolution of particle properties and trace gas concentrations at the top of the Mexico City boundary layer

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The Altzomoni ridge is located in the Cortez Pass, in a national park, between the volcanoes of Iztaccíhuatl and Popocatépetl, at an altitude of 4010 m, and 60 km to the SE of the center of Mexico City. This region is isolated from local emissions from combustion yet there is a daily incursion of pollution from either the Mexico City basin, when winds are from the west or from the Puebla valley when winds are from the east. This was the motivation for setting up instruments at this site to measure the concentrations of trace gases and the physical, chemical and optical properties of aerosol particles. A 12 m tower was also erected to measure fluxes of momentum, heat, condensation nuclei (CN) and CO_2. Measurements were begun during the last week of November, 2005 and continued until early June, 2006. The concentrations of CN, CO_2 and CO clearly indicate that the site is in the free troposphere at night and early morning, but the regional boundary layer grows to altitudes above the site every day. Hence, this site is ideal for making observations of atmospheric chemistry at the interface between rural and urban regions.

The preliminary analyses have shown that the "free tropospheric" values of CN, particle bound polycyclic aromatic hydrocarbons (PPAH) and black carbon (BC) rarely decrease below 1000 cm^{-3} 4 ng m^{-3}, 100 ng m^{-3}, respectively, suggesting the presence of a residual layer of contaminants. Nighttime CO and O_3 are usually above 0.1 and 0.05 ppm. The CO concentration at the measurement site is a tenth of the Mexico City value and reached its maximum approximately six hours after the maximum in the city center. The maximum O_3 in Mexico City and Altzomoni are frequently the same concentration but with no repeatable pattern in the phase differences.

The highly linear relationship between BC and CO reflects the removal and dilution processes, i.e. the average ratio between BC and CO in Mexico City is 1000:1 whereas it is 3000:1 in Altzomoni. This relationship also depends on the origin of the boundary layer air, i.e. whether it comes from the east or west. The relationship between BC and PPAH is also sensitive to air mass origin and reflects secondary processes occurring between the sources and the measurement site. Sulfate and a large fraction of organic aerosols are removed by precipitation but very little of the BC or PPAH.