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Evolution of Anthropogenic Pollution at the Top of the Regional Mixed Layer of the Central Mexico Plateau

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The concentrations of gases and properties of aerosol particles have been measured at the mountain site of Altzomoni approximately equidistant from Mexico City, Puebla and Cuernavaca, at an altitude of 4010 m. At this location there is a diurnal transition from local to regional mixed layer air whose properties depend on prevailing winds and larger scale circulation. Three days during March, 2006 have been evaluated during which time the synoptic scale air flow was from the east, southeast and southwest. In general the properties of gases and particles were similar when the regional mixed layer (RML) was below the research site, regardless of the direction of flow. When the RML reached the site, the highest concentrations of CO, O3 and aerosol particles were from the east, decreasing as the flow shifted to the southeast then to the southwest. The maximum concentration of condensation nuclei (CN) was greater than 25,000 cm-3 when winds were from the east. The highest mass concentrations of organic matter (OM), sulfate (SO4–), and Nitrate (NO3+) were 80, 4 and 8 μg m-3, at standard temperature and pressure in air from the east. The mass concentration of OM in the RML was greater than 70% of the total mass, regardless of the air mass origin. This compares to less than the 60% that has been reported for Mexico City.

At night, the mass fraction of sulfate went up by a factor of ten from the daytime value when air arrived from the east. The relationship between the CO and OM suggests that the majority of the daytime OM is from biomass burning and at night it is from wood burning.

Whereas the maximum CO at Altzomoni, 0.35 ppm, was approximately one tenth of the CO measured at the same time in the center of Mexico City, the maximum O3 of 120 ppb was approximately the same as in the city. The nighttime values of O3 was 60 ppb, indicating the presence of residual pollution.

From these results we conclude that even though Mexico City is the second most populated city in the world, with an associated high level of pollution, there are other significant sources of pollution in Mexico that contribute to the mixture of emissions that is dispersed throughout the region. This mixture rapidly erases the signature of a unique Mexico City ‘plume’ and suggests that the environmental impact of this region should be considered as one that stems a large area source rather than a single megacity.