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Inhomogeneous distribution of metalliferous aerosols in the Mexico City atmospheric pollution plume

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The pronounced atmospheric pollution cloud over the Mexico City metropolitan area, which currently has close to 20 million people, is cause for concern not least for the potential human health effects arising from breathing high concentrations of PM. The metalliferous component of the MCMA pollution plume is particularly relevant because it is by now strongly implicated not only in acute responses but also in long term degenerative conditions such as Parkinson´s and Alzheimer´s diseases. Around 30,000 industries have been reported in MCMA, many of which emit metalliferous aerosols. In this context we report on PM data obtained during the 2006 MILAGRO project. Most of the metallifeous aerosols are $<$2.5 μm in size, and SEM study demonstrates a wide range of PM morphologies and the dominance of Fe, Ti, Ba, Cu, Pb and Zn (but also the presence of Sn, Mo, Sb, W, Ni, V, As, and Bi). Study of the CuPbZn content of PM_{10} and $PM_{2.5}$ samples collected from three sites (urban T0, suburban T1 and rural T2) show daytime $\Sigma CuZnPbPM_{10}$ city centre concentrations are much higher (T0$>$450 ng m^{-3}) than in the suburban site (T1$<$200 ng m^{-3}). Rural site (T2) $\Sigma CuZnPbPM_{10}$ exceeded 50 ng m^{-3} when influenced by the MCMA plume but dropped to 10 ng m^{-3} during clean northerly winds. Nocturnal metal concentrations more than doubled at T1, due to the trapping of pollutants in the nightly inversion layer, whereas at the rural site they decreased. Anomalous transient spikes in concentrations of different metals, e.g. a "copper event" at T0 ($CuPM_{10}$ 281 ng m^{-3}) and

a “zinc event” at T1 ($ZnPM_{10}$ 1481 ng m^{-3}) on the night of March 7-8, indicate the influence of nearby industrial pollution sources which create localised chemical inhomogeneities in the fresh pollution plume above the city. Metal aerosol concentrations do not change in concert with total PM_{10} mass, which is more influenced by wind and traffic resuspension than industrial emissions, so that PM composition is probably more important than PM mass with respect to negative health effects. Better control of industrial point sources emitting large quantities of metalliferous particles into the MCMA atmosphere would likely produce significant improvements in air quality.

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