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On the volatility and production mechanisms of newly formed nitrate and water soluble organic aerosol in Mexico City

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Abstract. Measurements of atmospheric gases and fine particle chemistry were made in the Mexico City Metropolitan Area (MCMA) at a site ~30 km down wind of the city center. Ammonium nitrate (NH_4NO_3) dominated the inorganic aerosol fraction and showed a distinct diurnal signature characterized by rapid morning production and a rapid mid-day concentration decrease. Between the hours of 08:00–12:45, particulate water-soluble organic carbon (WSOC) concentrations increased and decreased in a manner consistent with that of NO_3^-, and the two were highly correlated (R^2=0.88) during this time. A box model was used to analyze these behaviors and showed that, for both NO_3^- and WSOC, the concentration increase was caused primarily (~75–85%) by secondary formation, with a smaller contribution (~15–25%) from the entrainment of air from the free troposphere. For NO_3^-, a majority (~60%) of the midday concentration decrease was caused by dilution from boundary layer expansion, though a significant fraction (~40%) of the NO_3^- loss was due to particle evaporation. The WSOC concentration decrease was due largely to dilution (~75%), but volatilization did have a meaningful impact (~25%) on the decrease, as well. The results provide an estimate of ambient SOA evaporation losses and suggest that a significant fraction (~35%) of the fresh MCMA secondary organic aerosol (SOA) measured at the surface volatilized.

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