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Quantifying impacts on air quality of vehicular emissions in Sao Paulo and Rio de Janeiro

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Vehicular emissions in megacities such as Sao Paulo and Rio de Janeiro are increasingly becoming a global issue. The São Paulo Metropolitan Area (SPMA), located in Southeast of Brazil, is a megacity with a population of 18 million people, with 7 million cars and large-scale industrial emissions. Rio de Janeiro is also a large city with different meteorology than São Paulo. All cars in Brazil runs gasohol, with 23% ethanol in gasoline, and for the last 10 years, flex cars that can run on gasohol, ethanol or any mixture dominate the market. Overall ethanol accounts for about 30-40% of fuel burned in both cities. To improve the understanding of vehicular emission impacts on aerosol composition and life cycle in these two large megacities a source apportionment study, combining online and offline measurements, was performed. Aerosols were collected for one year to capture seasonal variability at 4 sites in each city, with inorganic and organic aerosol component being sampled. Organic and elemental carbon were measured using a Sunset Laboratory Dual Optics (transmission and reflectance) Carbon Analyzer and about 22 trace elements has been measured using polarized X-Ray Fluorescence (XRF). Aerosol mass and black carbon were also measured, as well as trace gases to help in aerosol source apportionment. In Sao Paulo, the average PM2.5 mass concentration obtained varied from 9.6 to 12.2 μg m-3 for the several sites, and similar concentrations were measured in Rio de Janeiro. At all sites, organic matter (OM) has dominated fine mode aerosol concentration with 42 to 60% of the aerosol mass. EC accounted for 21 to 31% of fine mode aerosol mass concentration. Sulfate accounted for 21 to 26% of PM2.5 for the sites. Aerosol source apportionment was done with receptor analysis and integration with online data such as PTR-MS, Aethalometers, Nephelometers and ACSM helped to apportion vehicular emissions. For the 8 sites operated in Sao Paulo and Rio de Janeiro, vehicular emissions accounts for about 63% of PM2.5. Results are very similar for the different sites and cities.