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Comparison of emissions from on-road sources using a mobile laboratory under various driving and operational sampling modes

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Abstract. Mobile sources produce a significant fraction of the total anthropogenic emissions burden in large cities and have harmful effects on air quality at multiple spatial scales. Mobile emissions are intrinsically difficult to estimate due to the large number of parameters affecting the emissions variability within and across vehicles types. The MCMA-2003 Campaign in Mexico City has showed the utility of using a mobile laboratory to sample and characterize specific classes of motor vehicles to better quantify their emissions characteristics as a function of their driving cycles. The technique clearly identifies "high emitter" vehicles via individual exhaust plumes, and also provides fleet average emission rates. We have applied this technique to Mexicali during the Border Ozone Reduction and Air Quality Improvement Program (BORAQIP) for the Mexicali-Imperial Valley in 2005. We analyze the variability of measured emission ratios for emitted NO_x, CO, specific VOCs, NH_3, and some primary fine particle components and properties by deploying a mobile laboratory in roadside stationary sampling, chase and fleet average operational sampling modes. The measurements reflect various driving modes characteristic of the urban fleets. The observed variability for all measured gases and particle emission ratios is greater for the chase and roadside stationary sampling than for fleet average measurements. The fleet average sampling mode captured the effects of traffic conditions on the measured on-road emission ratios, allowing the use of fuel-based emission ratios to assess the validity of traditional "bottom-up" emissions inventories. Using the measured on-road emission ratios, we estimate CO and NO_x mobile emissions of 175±62 and 10.4±1.3 metric tons/day, respectively, for the gasoline vehicle fleet in Mexicali. Comparisons with similar on-road emissions data from Mexico City

indicated that fleet average NO emission ratios were around 20% higher in Mexicali than in Mexico City whereas HCHO and NH_3 emission ratios were higher by a factor of 2 in Mexico City than in Mexicali. Acetaldehyde emission ratios did not differ significantly whereas selected aromatics VOCs emissions were similar or smaller in Mexicali. Nitrogen oxides emissions for on-road heavy-duty diesel truck (HDDT) were measured near Austin, Texas, as well as in both Mexican cities, with NO_y emission ratios in Austin < Mexico City < Mexicali.

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