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Employing observational VOC:CO ratios from megacities to improve VOC emissions inventories

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Since 2007, more than half of the world's population lives in urban areas. Megacities, urban agglomerations with more than 10 million inhabitants, are rapidly increasing in number: in 1950 there were only two, New York and Tokyo with ∼12 million; by 2005 there were 20, with Tokyo at about 35 million. The urban atmospheres of these megacities are dominated by pollutants associated with vehicular emissions, as well as the formation of secondary pollutants responsible for photochemical smog.

A comparative assessment of emissions estimates and measured concentrations of volatile organic compounds (VOCs) to carbon monoxide (CO) ratios in some megacities are hereby presented. The work is based on three recent studies by Baker et al. (2008), Parrish et al. (2009) and von Schneidemesser et al. (2010) where concentrations of these compounds were analyzed in different cities in North and South America, Europe and Asia. These studies found that even though concentrations of VOCs varied greatly among cities, the ratio with the combustion tracer CO, a good indicator of traffic emissions, remained rather constant and was very useful for city comparisons. VOC:CO ratio patterns in ambient air concentrations were observed to be similar in most cities.

Within the European Project CityZen we have built an updated global emissions inventory with the best available datasets of anthropogenic, biomass burning, and natural sources. Nevertheless, the representation of VOCs emissions in global inventories has large uncertainties. Therefore we have compared the trends in emissions inventories and observations for a given number of VOCs as well as their ratios to CO to observe their behavior. We found that the distribution of total VOCs into the different species in the emissions inventories do not follow the ambient air distribution of species. For some species the difference was of a factor of 5 (ethyne and ethene) while for others, mainly benzene, toluene and xylenes, the difference was a factor of 50 or more. We are therefore proposing a proxy, using the VOC:CO ratios, to create a better, more realistic distribution of speciated VOCs in the emissions inventories.