Eddy covariance measurements of trace gases and energy fluxes from an urban district of Mexico City

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Direct measurements of emissions of trace gases that include all emissions sources are necessary to improve our understanding of the atmospheric chemistry in urban areas. As part of the MCMA-2003 study we measured for the first time fluxes of CO_2 and selected VOCs in a residential district of Mexico City using the eddy covariance technique (EC). For the MILAGRO campaign we extended these flux measurements from a rooftop tower erected in a busy district surrounded by congested avenues close to the center of the city. Diverse instruments coupled with micrometeorological methods were used to measure fluxes of different trace gases and energy. Fluxes of CO2 were measured by EC and an open-path infrared gas analyzer; fluxes of olefins by EC and a Fast Olefin Sensor; fluxes of toluene, benzene, C_2-benzenes and methanol by a Proton Transfer Reaction Mass Spectrometer and the disjunct eddy covariance technique; fluxes of selected VOCs by the disjunct eddy accumulation technique and GC-FID analysis; and fluxes of CO by a modified gradient method and a commercial analyzer by infrared photometry. Overall, fluxes of VOCs and CO_2 show similar diurnal patterns to those observed in 2003 with a strong influence on traffic emissions, but with higher magnitudes. The difference on fluxes of olefins, methanol, C_2-benzenes and CO_2 were between 24 and 70 % higher due to the different characteristics of the monitored footprints rather than an increment of the emissions in a period of 3 years. The toluene flux was twice than the observed in 2003. This was because of the application of a toluene based resin to the sidewalks of the area around the tower during the experiment. Fluxes of latent and sensible heat and momentum have shown similar patterns and magnitudes to those observed in 2003 and previous studies in Mexico City.