Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 9, 7325-7342, 2009
www.atmos-chem-phys.net/9/7325/2009/

Eddy covariance flux measurements of pollutant gases in urban Mexico City

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Abstract. Eddy covariance (EC) flux measurements of the atmosphere/surface exchange of gases over an urban area are a direct way to improve and evaluate emissions inventories, and, in turn, to better understand urban atmospheric chemistry and the role that cities play in regional and global chemical cycles. As part of the MCMA-2003 study, we demonstrated the feasibility of using eddy covariance techniques to measure fluxes of selected volatile organic compounds (VOCs) and CO_2 from a residential district of Mexico City (Velasco et al., 2005a, b). During the MILAGRO/MCMA-2006 field campaign, a second flux measurement study was conducted in a different district of Mexico City to corroborate the 2003 flux measurements, to expand the number of species measured, and to obtain additional data for evaluation of the local emissions inventory. Fluxes of CO_2 and olefins were measured by the conventional EC technique using an open path CO_2 sensor and a Fast Isoprene Sensor calibrated with a propylene standard. In addition, fluxes of toluene, benzene, methanol and C_2-benzenes were measured using a virtual disjunct EC method with a Proton Transfer Reaction Mass Spectrometer. The flux measurements were analyzed in terms of diurnal patterns and vehicular activity and were compared with the most recent gridded local emissions inventory. In both studies, the results showed that the urban surface of Mexico City is a net source of CO_2 and VOCs with significant contributions from vehicular traffic. Evaporative emissions from commercial and other anthropogenic activities were significant sources of toluene and methanol. The results show that the emissions inventory is in reasonable agreement with measured olefin and CO_2 fluxes, while C_2-benzenes and toluene emissions from evaporative sources are overestimated in the inventory. It appears that methanol emissions from mobile sources occur, but are not reported in the mobile emissions inventory.

Final Revised Paper (PDF, 2973 KB) Discussion Paper (ACPD)

Citation: Velasco, E., Pressley, S., Grivicke, R., Allwine, E., Coons, T., Foster, W., Jobson, B. T., Westberg, H., Ramos, R., Hernández, F., Molina, L. T., and Lamb, B.: Eddy covariance flux measurements of pollutant gases in urban Mexico City, Atmos. Chem. Phys., 9, 7325-7342, 2009. Bibtex EndNote Reference Manager