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Total column and diurnal trend of carbon monoxide in the boundary layer of Mexico City determined by ground-based solar and lunar infrared spectroscopy

W. Stremme (1), I. Ortega-Martínez (1), R. Harig (2) and M. Grutter (1)

(1) Centro de Ciencias de la Atmósfera, Universidad Nacional Autónoma de México, Mexico City, (2) Institut für Meßtechnik TU Hamburg-Harburg, Germany

Carbon monoxide (CO) plays a key role in the chemistry and composition of the global atmosphere. In Mexico City 98% of CO is generated by cars. CO is continuously monitored at the surface by a network of in-situ stations around the metropolitan area which show strong variations that are a result of the variability of the emissions and traffic activity. However the vertical extend of the mixing layer is not well documented. Column measurements of CO (and other species) provide information about the abundance in the boundary layer of Mexico City and could help link the mean local pollution of this megacity to the regional and global scales. We present total column measurements and diurnal changes of CO and other trace gases retrieved from ground-based solar and lunar spectra. The measurements were taken at the UNAM campus located in Mexico City (2260 masl, 19.33˚N, 99.18˚W) during October 2007 and March 2008 with a Fourier-transform infrared spectrometer at 0.5 cm^{-1} resolution. Spectra of the clean atmospheric background at a high altitude site located only 60 km southeast of the city (Altzomoni, 4000 masl, 19.12˚N, 98.65˚W) were collected to improve the estimation of the hight of the boundary layer and the vertical distribution of different species. An automatic scanner system was used to align the spectrometer to the sun or moon, respectively. The spectra were analyzed with the SFIT2 retrieval code. The results are presented with error estimation and sensitivities (averaging kernels) for the particular species and the composition of the boundary layer with respect to the surface observations is analyzed with the available information. A discussion is presented of the relevance of such measurements to satellite validation

and as input for models, as well as the limitations and advantages of ground-based solar/lunar spectroscopy with comparably low resolution.