



Estimation of NO_x emissions from the Megacity of Lahore, Pakistan using car MAX-DOAS observations and comparison with OMI satellite data

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Lahore, megacity of Pakistan is home of about more than 10 million people and thus a strong emission source of atmospheric pollutants. Unlike bottom-up inventories where the estimation of these emission sources is done by summing up of the emissions of individual emission sources for all relevant emission categories, we present results of a top-down emission inventory for Lahore. Results are based on car multi-axis differential optical absorption spectroscopy (car-MAX-DOAS) observations. We performed such measurements around the city of Lahore on six days in December 2015. From the measured spectra we derive the vertically integrated concentration of NO_2 along the driving route (the so called tropospheric vertical column density, VCD).

We combine these observations with wind data and estimate the total NO_2 emissions from the city. Measured spectra give us only NO_2 (but not NO) and so we convert the NO_2 emissions to total NO_x (NO_2 plus NO) emissions. We calculated influx and out flux of NO_2 and the difference between both values gave us total flux of the city. Finally we apply corrections for the decay of NO_x on the way between the emission source and the location of the measurements. In principle out flux values for an emission source like a megacity are higher than the influx ones, but for two out of total six measurement days, we observe the opposite pattern and get negative fluxes. This needs to be clarified and understood. In our work we discuss these cases in detail and suggest possible explanations for the anomalous results.

Furthermore we also compare the spatial distributions of the tropospheric NO_2 VCDs observed by car MAX-DOAS with collocated results from satellite observations of the Ozone Monitoring Instrument (OMI).