Geophysical Research Abstracts
Vol. 17, EGU2015-5018, 2015
EGU General Assembly 2015

Azimuthal variability of trace gases and aerosols measured during the MADCAT campaign in summer 2013 in Mainz, Germany

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With the MAX-DOAS technique it is possible to retrieve vertical profiles of trace gases and aerosols in the lower troposphere. Often these instruments monitor the atmosphere in one azimuthal direction only. Therefore horizontal variability is not resolved. Especially the comparison to satellite data close to strong emission sources (one main application of MAX-DOAS) is possibly biased.
MADCAT (Multi-Axis DOAS Comparison campaign for Aerosols and Trace gases) took place in summer 2013 in Mainz, a city in the Rhine-Main region close to Frankfurt, with high population density and many industrial complexes.
The main focus of this campaign was on the comparison of the results from the different instruments. Therefore 16 MAX-DOAS instruments from 10 different institutes were operated on the roof of the MPI for Chemistry. In standard operation mode, vertical scans at one or several selected azimuth viewing direction were performed. In addition, 6 instruments scanned the sky also in azimuth direction every two hours. These scans were performed under a low elevation angle (2°) to capture the pollution close to the ground.
A comparison of the trace gas columns derived from these instruments will be shown for NO_2 and O_4, the latter is used to retrieve information about aerosols.
The observed variation for different azimuth angles does not only reflect a gradient in the trace gas, but also differences in the light path length, which is affected by sun and viewing geometry as well as aerosols. To distinguish between the different effects comparisons with radiative transfer models are performed.
The results of the azimuth scans are also compared to car-DOAS measurements around Mainz, which were conducted at least twice a day.