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Investigating the spatial distribution of trace gases and aerosols with the 4-Azimuth-MAX-DOAS in Mainz, Germany

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MAX-DOAS measurements are mainly used to retrieve vertical profiles of aerosols and trace gases in the lower troposphere. Due to the measurement principle these observations are sensitive for horizontal distances of about 3-30km, depending on wavelength and atmospheric conditions.
Up to now horizontal homogeneous distributions of trace gases and aerosols are usually assumed within the MAX-DOAS profile retrievals. This leads to systematic over and underestimation of the aerosol and trace gas load in the atmosphere, especially close to cities or other sources, where strong horizontal gradients are typically present. Here we show a novel method which considers and retrieves horizontal gradients of aerosols and trace gases from multi-azimuth MAX-DOAS observations.
We use the 4-Azimuth MAX-DOAS located in Mainz, Germany, at the Max Planck Institute for Chemistry. This instrument measures simultaneously in four azimuth directions and performs elevation scans. The measurements at the fixed azimuth angles are used together in a combined profile inversion algorithm, which yields a profile above the location of the instrument together with horizontal gradients for every viewing direction.
Additionally, the horizontal sensitivity range can be retrieved, animportant information especially when the results are compared to other datasets.
The main focus of this presentation are trace gas distributions, namely NO_2 and H_2O. MAX-DOAS measurements are a perfect link between the satellite measurements, which have typically coarse spatial resolution and the local in situ measurements, which are performed on a regular basis to monitor the air quality. We show comparisons to both datasets. Furthermore, a comparison to a high resolution regional model is performed.