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Experimental imaging DOAS observations over Bremen

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Ground-based Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) instruments are widely used for the detection of atmospheric trace gases. While current MAX-DOAS instruments are often capable to point in any direction (2D scanner) only one viewing direction can be applied at a time and therefore full hemispheric (i.e. vertical as well as horizontal) scans are not possible as they are much too time-consuming.

In this work, measurements of an experimental imaging DOAS instrument are presented. The use of an imaging spectrometer together with a special entrance optic and fibre bundle (separating the entrance optic from the spectrometer) allows simultaneous measurements of 35 vertical viewing directions. In addition, the entrance optic was mounted on a pan-tilt-head that moved the whole optics in azimuthal direction. As a result, whole hemispheric scans were achieved in 0° to 45° elevation and 0° to 360° azimuth (in 10° steps). A full scan was achieved every 6 minutes which is much shorter than lifetimes of anthropogenic pollutants like NO_2, therefore providing snapshots of atmospheric pollution scenarios.

The experimental imaging DOAS instrument was installed on the rooftop of the IUP building at University of Bremen, Germany, for two complete days from sunrise to sunset in summer 2014. The temporal evolution of NO_2 over Bremen during these days is presented as well as the identification of sources. The results of the imaging instrument are compared to those from a (routinely operated) MAX-DOAS instrument close by. Furthermore, slant columns of O4 are presented and compared to simulated O4 slant columns using the radiative transfer model SCIATRAN.