Geophysical Research Abstracts
Vol. 19, EGU2017-7279, 2017
EGU General Assembly 2017

Unidentified atmospheric absorption structure observed by DOAS near Hamburg harbour, Germany

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Within a six week campaign in July and August 2016, Long Path (LP)-DOAS measurements were performed near the harbour of Hamburg to monitor ship emissions of NO_2 and SO_2. LP-DOAS instruments retrieve information about the composition of ambient air using active spectroscopy. Therefore, an absorption light path was set up between the northern and the southern riverside of the river Elbe with a total length of ca. 5.7 km. The light of a laser driven Xenon arc lamp was sent to a retro reflector mounted on a light house on the opposite riverside. By comparing the spectrum of the Xenon lamp before and after being sent through the atmosphere, spectral absorption structures of several molecules can be identified and their mixing ratios can be quantified.

Besides the well-known trace gas species such as NO_2, SO_2, O_3 and HCHO, a so far unidentified, strong absorption structure could be observed regularly throughout the measurement period. The structure is similar to other known absorption structures in the UV-vis range and can be most likely associated with a molecular absorption cross section. The absorber features a progression of absorption bands in the range of 280 nm to 330 nm with an average band distance of 3 nm to 4 nm. These bands were observed with optical densities of up to 2 per cent along the absorption path. The absorber predominantly occurs during daylight indicating that photolytic processes are most likely to play an important role. Further, direct emission from ships could be excluded by the comparison with NO_2 peaks, which serve as a proxy for ship plumes.

The respective LP-DOAS instrument was deployed at multiple other measurement sites at the past including rural, urban and remote areas. However, the discussed absorption structure has never been detected before and instrumental errors can be excluded. Currently, MAX-DOAS measurements performed at the same site are evaluated. We will present the spectral features of the putative absorber as well as an overview of the time series and correlations to other known trace gases.