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Detection of water vapour absorption around 363nm in measured atmospheric absorption spectra and its effect on DOAS evaluations

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Water vapour is known to absorb light from the microwave region to the blue part of the visible spectrum at a decreasing magnitude. Ab-initio approaches to model individual absorption lines of the gaseous water molecule predict absorption lines until its dissociation limit at 243 nm.

We present first evidence of water vapour absorption at 363 nm from field measurements based on the POKAZATEL absorption line list by Polyansky et al. (2016) using data from Multi-Axis differential optical absorption spectroscopy (MAX-DOAS) and Longpath (LP)-DOAS measurements.

The predicted absorptions contribute significantly to the observed optical depths with up to 2×10^{-3}. Their magnitude correlates well ($R^2 = 0.89$) to simultaneously measured well-established water vapour absorptions in the blue spectral range from 452-499 nm, but is underestimated by a factor of 2.6 ± 0.6 in the ab-initio model. At a spectral resolution of 0.5nm this leads to a maximum absorption cross-section value of 5.4×10^{-27} cm^2/molec at 362.3nm.

The results are independent of the employed cross-section data to compensate for the overlayed absorption of the oxygen dimer O_4. The newly found absorption can have a significant impact on the spectral retrieval of absorbing trace-gas species in the spectral range around 363 nm. Its effect on the spectral analysis of O4, HONO and OClO are discussed.