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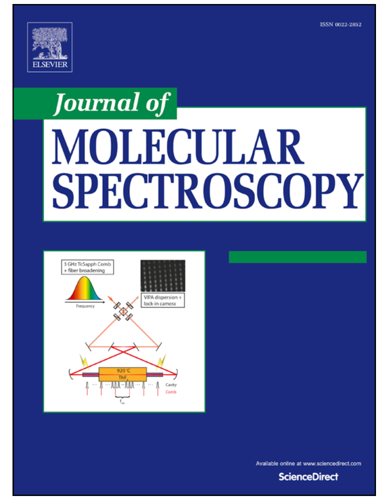

Remote sensing of methane with OSAS-lidar on the $2\nu_3$ band Q-branch: experimental proof

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Title

Remote sensing of methane with OSAS-lidar on the $2\nu_3$ band Q-branch: experimental proof

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Abstract

Optical sensors based on absorption spectroscopy play a central role in the detection and monitoring of atmospheric trace gases. We here present for the first time the experimental demonstration of OSAS-Lidar on the remote sensing of CH_4 in the atmosphere. This new methodology, the OSAS-Lidar, couples the Optical Similitude Absorption Spectroscopy (OSAS) methodology with a light detection and ranging device. It is based on the differential absorption of spectrally integrated signals following Beer Lambert-Bouguer law, which are range-resolved. Its novelty originates from the use of broadband laser spectroscopy and from the mathematical approach used to retrieve the trace gas concentration. We previously applied the OSAS methodology in laboratory on the $2\nu_3$ methane absorption band, centered at the 1665 nm wavelength and demonstrated that the OSAS-methodology is almost independent from atmospheric temperature and pressure. In this paper, we achieve an OSAS-Lidar device capable of observing large concentrations of CH_4 released from a methane source directly into the atmosphere. Comparison with a standard in-situ measurement device shows that the path-integrated concentrations retrieved from OSAS-Lidar methodology exhibit sufficient sensitivity (2 000 ppm.m) and observational time resolution (1 s) to remotely sense methane leaks in the atmosphere. The coupling of OSAS-lidar with a wind measurement device opens the way to monitor time-resolved methane flux emissions, which is important in regards to future climate mitigation involving regional reduction of CH_4 flux emissions.

Keywords
