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<u>Title</u>

High-resolution Fourier transform measurements of air-induced broadening and shift coefficients in the 00°2-00°0 main isotopologue band of nitrous oxide

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Abstract

In the present study, we report highly accurate air-induced broadening and shift coefficients for the nitrous oxide (N_2O) 00°2-00°0 band at 2.26 µm of the main isotopologue retrieved from high-resolution Fourier transform infrared (FTIR) measurements with metrologically determined pressure, temperature, absorption path length and chemical composition. Most of our retrieved air-broadening coefficients agree with previously generated datasets within the expanded (confidence interval of 95 %) uncertainties. For the air-shift coefficients our results suggest a different rotational dependence compared to literature. The present study benefits from improved measurement conditions and a detailed metrological uncertainty description. Comparing to literature, the uncertainties of the previous broadening and shift coefficients are improved by a factor of up to 39 and up to 22, respectively.

Keywords

Nitrous oxide, Fourier transform infrared spectroscopy, spectral line parameters, air-broadening, airshift, gas metrology

1. Introduction

In our recent studies, we have determined self-induced broadening and shift coefficients [1] as well as line strengths [2] for the R_0 to R_{40} lines of the 00^02-00^00 -band of the main isotopologue of nitrous oxide ($^{14}N_2^{16}O$) using the Voigt-line shape model. The examined band of this greenhouse and major ozone-depleting gas is used by the Total Carbon Column Observing Network (TCCON) [3] to monitor its atmospheric abundance. For its retrievals TCCON utilizes [4] spectral line parameters for the Voigt-profile from the HITRAN-database [5]. The HITRAN line data for air-induced broadening and shift coefficients are based on an extensive FTIR spectroscopy laboratory study of Toth [6] with a nominal spectral resolution of 0.011 cm⁻¹ performed over a partial pressure range of air between 389 hPa and 655 hPa.

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