



Column measurements and vertical profiling of CO₂ and CH₄ based on high resolution ground-based NIR heterodyne spectro-radiometry

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A compact, lightweight heterodyne NIR spectro-radiometer suitable for ground-based atmospheric sounding by direct spectro-radiometry of Sun spectrum with spectral resolution $\sim 0.0006 \text{ cm}^{-1}$ has been used for column measurements and vertical profiling of methane and carbon dioxide. Highly stabilized DFB laser was used as local oscillator. Radiation mixed in the single mode fiber was detected by InGaAs photodiode within the bandpass of $\sim 20 \text{ MHz}$. Wavelength coverage of spectral measurement was provided by sweeping local oscillator frequency in the range $1\text{--}1.5 \text{ cm}^{-1}$. With the exposure time of 3 minutes, the absorption spectrum of the atmosphere over Moscow has been recorded with $S/N \sim 300$.

The retrieved methane profile demonstrates higher abundances in the lower scale height compared to the assumed model profile, well expected in the megalopolis center. The retrievals sensitivity is limited by 10 ppb, with the exception of the lower part of the profile where the tendency to lower values is revealed. Thus the methane abundance variations may be evaluated with relative accuracy better than 1%, which fits the requirements of greenhouse gas monitoring. The CO₂ column measurements was provided an accuracy 0.4%