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Methods of retrieval of $^{13}CH_4/^{12}CH_4$ and $^{13}CO_2/^{12}CO_2$ ratio in atmosphere using ground-based FTIR spectral measurements

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High resolution IR spectra of atmospheric transmittance measured with ground-based FTIR are successfully used for retrieval of many atmospheric trace gases including isotopomers of water vapor. Super high resolution of modern Fourier IR spectrometers (up to 0.001 cm^{-1}) used for remote sensing of the atmosphere makes it possible to distinctly resolve absorption lines of different isotopomers of the trace gases.

This paper presents methods and very first results regarding retrieval of $^{13}CH_4/^{12}CH_4$ and $^{13}CO_2/^{12}CO_2$ ratio in atmosphere using ground-based FTIR spectral measurements with resolution of 0.005 cm^{-1}. Synthetic atmospheric transmittance spectra in the range of 2200-3100 cm^{-1} were analyzed in order to find clear features of isotopomers of carbon greenhouse gases. Good signals of the isotopomers $^{13}CH_4$ and $^{13}CO_2$ have been found within this spectral range.

Several atmospheric transmittance spectra measured with ground-based FTIR in Bremen during March-August 2011 have been processed in order to retrieve $^{13}CH_4/^{12}CH_4$ ($\delta^{13}C_{CH4}$) and $^{13}CO_2/^{12}CO_2$ ($\delta^{13}C_{CO2}$) in the atmosphere. The suggested methods and obtained results are discussed.