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A possibility of retrieval of H_2O and CH_4 isotopologues concentration ratios from high resolution infrared measurements of atmospheric transmittance

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Monitoring of water vapour and carbon greenhouse gases isotopologues plays an important role in understanding airmass transport in the atmosphere and climate dynamics. Previous studies were focused on measuring isotopic composition of precipitation, air samples and surface air. High resolution modern Fourier infrared spectrometers (FTIR) using for remote sensing of the atmosphere makes it possible to distinctly resolve absorption lines of different isotopologues of water vapour and carbon gases. This study investigates potentiality of the ground-based FTIR spectral measurements for remote sensing of $H_2{}^{18}O/H_2{}^{16}O$, $^{13}CH_4/^{12}CH_4$ and CH_3D/CH_4 mean concentration ratios in total atmospheric column. Spectral signals containing clear features of $H_2{}^{18}O$, $^{13}CH_4$ and CH_3D have been identified in atmospheric transmittance measurements and precision of the retrieval as a function of signal-to-noise level of the measurement is estimated. Samples of atmospheric transmittance spectra with appropriate signal to noise ratio measured using ground-based FTIR at the Ural Atmospheric Fourier Station in Kourovka and in the Institute of Environmental Physics of Bremen University during 2009-2012 have been selected and processed in order to retrieve $H_2{}^{18}O/H_2{}^{16}O$ ($\delta^{18}O_{H2O}$), $^{13}CH_4/^{12}CH_4$ ($\delta^{13}C_{CH4}$) and CH_3D/CH_4 (δD_{CH4}) in the atmosphere. The obtained results are discussed.
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