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Comparison of ground-based FTIR measurements and EMAC model simulations of trace-gases columns near St. Petersburg (Russia) in 2009-2013

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The comparison of simulated atmospheric gases abundances with various experimental data is the very important stage of the numerical models validation and improvement process.
In this study, we compare and discuss the observational data obtained from ground-based direct solar absorption measurements of high spectral-resolution FTIR spectrometer Bruker 125 HR operated at the Peterhof station (59.82 N, 29.88 E) with the 3-dimensional model EMAC (ECHAM5/MESSy Atmospheric Chemistry) calculations.
The FTIR spectrometer has a maximum optical path difference of 180 cm, yielding a spectral resolution of unapodized spectra up to 0.005 cm-1. Two detectors, MCT (Mercury-Cadmium-Telluride) and InSb (Indium-Antimonide), cover the spectral range of 650–5400 cm-1 that includes many distinct and overlapping absorption lines, and allow the retrieval of a large number of atmospheric constituents. We applied two inversion codes using within NDACC infrared community: SFIT2 and PROFFIT for the retrieval of atmospheric gases column amounts from FTIR recorded spectra.
The EMAC model is a numerical chemistry and climate simulation system that includes sub-models describing troposphere and middle atmosphere processes and their interaction with oceans, land and human influences. The simulation includes a comprehensive atmospheric chemistry setup for the troposphere, the stratosphere and the lower mesosphere. We applied the EMAC (ECHAM5 version 5.3.01, MESSy version 1.10) in the T42L39MA-resolution, i.e. with a spherical truncation of T42 (corresponding to a quadratic Gaussian grid of approximately 2.8 by 2.8 degrees in latitude and longitude) with 39 vertical hybrid pressure levels up to 0.01 hPa.
The model simulation allows the comparison of the tropospheric gases (H_2O, CO, CH4, and N2O) as well as the stratospheric gases (HCl, HNO_3, NO_2, O_3 and $ClONO_2$) that have been being continuously retrieved at the Peterhof station since 2009. In the study, we analyze the daily and monthly means of the retrieved and calculated gases total columns.
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