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Retrievals of ethane from ground-based high-resolution FTIR solar observations with updated line parameters: determination of the optimum strategy for the Jungfraujoch station.

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Ethane (C_2H_6) is the most abundant Non-Methane HydroCarbon (NMHC) in the Earth's atmosphere, with a lifetime of approximately 2 months. C_2H_6 has both anthropogenic and natural emission sources such as biomass burning, natural gas loss and biofuel consumption. Oxidation by the hydroxyl radical is by far the major C_2H_6 sink as the seasonally changing OH concentration controls the strong modulation of the ethane abundance throughout the year. Ethane lowers Cl atom concentrations in the lower stratosphere and is a major source of peroxyacetyl nitrate (PAN) and carbon monoxide (by reaction with OH). Involved in the formation of tropospheric ozone and in the destruction of atmospheric methane through changes in OH, C_2H_6 is a non-direct greenhouse gas with a net-global warming potential (100-yr horizon) of 5.5.

The retrieval of ethane from ground-based infrared (IR) spectra is challenging. Indeed, the fitting of the ethane features is complicated by numerous interferences by strong water vapor, ozone and methane absorptions. Moreover, ethane has a complicated spectrum with many interacting vibrational modes and the current state of ethane parameters in HITRAN (e.g. : Rothman et al., 2009, see http://www.hitran.com) was rather unsatisfactory in the 3 μm region. In fact, ^{P}Q branches outside the 2973–3001 cm^{-1} range are not included in HITRAN, and most P and R structures are missing.

New ethane absorption cross sections recorded at the Molecular Spectroscopy Facility of the Rutherford Appleton Laboratory (Harrison et al., 2010) are used in our retrievals. They were calibrated in intensity by using reference low-resolution spectra from the Pacific Northwest National Laboratory (PNNL) IR database. Pseudoline parameters fitted to these ethane spectra have been combined with HITRAN 2004 line parameters (including all the 2006 updates) for all other species encompassed in the selected microwindows. Also, the improvement brought by the update of the line positions and intensities of methyl chloride (CH_3Cl) in the 3.4 μm region (Bray et al., 2011) will be quantified. The ethane *a priori* volume mixing ratio (VMR) profile and associated covariance are based on synthetic data from the chemical transport model (CTM) of the University of Oslo.

In this contribution, we will present updated ethane total and tropospheric column retrievals, using the SFIT-2 algorithm (v3.91) and high-resolution Fourier Transform Infrared (FTIR) solar absorption observations recorded with a Bruker 120HR instrument, at the high altitude research station of the Jungfraujoch (46.5°N, 8°E, 3580 m asl), within the framework of the Network for the Detection of Atmospheric Composition Change (NDACC, visit http://www.ndacc.org).

We will characterize three microwindows encompassing the strongest ethane features after careful selection of *a priori* VMR profiles, spectroscopic parameters, accounting at best for all interfering species. We will then present the retrieval strategy representative of the best combination of those three characterized micro-windows in order to minimize the fitting residuals while maximizing the information content, the precision and the reliability of the retrieved product. The long-term C_2H_6 column time series will be produced using the Jungfraujoch observational database. Comparisons with synthetic data produced by two chemical transport model (CHASER and the one of the University of Oslo) will also be presented and analyzed, aiming at the determination and interpretation of long-term trends and interannual variations of ethane at Northern mid-latitudes.

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