2. Retrieval Strategy

All retrievals have been performed with the SFIT-2 algorithm (v.3.91) (Rinsdorfer et al., 1998) in order to determine three ethane vertical partial columns (see Figure 3) from a series of about 13 000 spectra recorded between 1994 and 2011. The adopted settings are: (i) three spectral intervals ranging from 2796.66 to 2797.05 (Q’1), from 2893.2 to 2893.5 and from 2986.45 to 2986.85 cm⁻¹; (ii) the CH₃C₂H₃ volume mixing ratio (ν) versus a priori profiles and uncertainties issued from the CH₃C₂H₃ CASHER Model (Chemical ASCCM for Study of Chemistry, CASHER program) for the period 1994-2002; (iii) HITRAN 2008 line parameters including Harrison’s pseudo-lines, the two O₂ lines updated by P. Chelin (Personal Communication, 2004) and the updated CH₂Cl line (Bray et al., 2011) for target and interfering absorptions; (iv) temperature and geopotential height data sets provided by the National Centers for Environmental Prediction (NCEP, Washington, USA).

3. Time Series

The Figure 2 displays our retrieved CH₃C₂H₃ total and partial columns (low-tropospheric and UTLS) above Jungfraujoch. We computed an overall decrease in ethane concentrations since 1994 of ~74.4 and ~39% year for our three columns. Trends have been calculated using the bootstrap reampling tool developed by Gardner et al. (2008).

4. Information Content

Table 1 - The establishment of a complete error budget is still ongoing. Preliminary error analysis is displayed in this table.

5. Error Budget

- We have already accounted on our retrieved CH₃C₂H₃ columns of the uncertainty on the solar zenith angle, on the NCEP/NCAR meteorological fields and in the uncertainties in the line intensity data.

- In Table 2, the solar zenith angle uncertainties are estimated at 0.2° while error quantities associated with temperature uncertainties are provided by the NCEP.

- Error on line intensities is provided by uncertainty indices on SFIT-2. Bray et al. (2011) and references therein. These uncertainties include line parameters. In our retrievals modified by 2% for the CH₂Cl lines, by 2% or 5% for the CH₃C₂H₃ lines.

- An error of 4% on the intensity of CH₃C₂H₃ has been reported by Harrison et al. (2010) while the error issued from the conversion into UTLS columns is assumed to be 4% (Rinsdorfer et al., 2012). Therefore, a combined direct systematic bias of about 8% may affect our CH₃C₂H₃ column retrievals.

6. Conclusions and Perspectives

- Harrison’s new ethane parameters coupled to HITRAN retrievals should allow Bray’s CH₂Cl updates improve the retrieval of ethane in terms of spatial residuals and information content.

- We opted for the HITRAN-08 compilation for the interfering species (except CH₂Cl) as it showed better results than the HITRAN-98 compilation for the interfering species.

- Concerning the long-term trend of CH₃C₂H₃, we determined a significant decrease in its concentration over the 1994-2011 time period. We also characterized a seasonal trend in total and tropospheric columns of ethane greater than the previously mentioned increase.

- We expect to put more investigations into the study of the interannual variations as well as the seasonal change of ethane in the lower-stratosphere and in the UTLS region.