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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quality assessment of O_3 profiles measured by a state-of-the-art ground-based FTIR observing system" *by* M. Schneider et al.

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We would like to thank the referee for all their comments. All of them are very welcome and help to further improve the quality of our publication. Below we answer them in detail:

(Page 4980, Line 15) "Furthermore, the inversion on a logarithmic scale allows to constrain against isotopologue ratio profiles": This means that we combine a priori ratio information with spectral information about the ratio. Here we use a priori information from Johnson et al. (2000). What we do is a real optimal estimation of the ratio. All the details of this very innovative retrieval option are described in Schneider

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et al. (2006b).

(Line 21) We simultaneously retrieve H_2O profiles. This widely eliminates interference errors due to the H_2O absorption signatures.

(Page 4982, Line 3) "This procedure assures a very accurate error analysis": We make an individual analytic error analysis (Eq. (1)) for each ensemble member of a large ensemble consisting of 500 individual atmospheric states. Thereby we cover the whole range of naturally occurring atmospheric states. For each individual ensemble members we estimate the errors. Other authors only calculate the errors for one typical state. However, due to nonlinearities (matrices A, G, and K depend on the actual atmospheric state) such limited error analyses are less reliable than our extensive analysis.

(Line 3) Values of Table 1: These values are in deed critical to the following error estimation. They come from our experience (e.g. repeatability of modulation efficient or phase error parameter measurements) or from references (e.g. the HITRAN file also lists uncertainties of the parameters).

(Page 4985, Line 12) "[...] a simplified estimation of the O_3 residual introduces more noise than real information": One may think that the variability of O_3 at 30.5km is somehow correlated to the variability of the the residual O_3 above 30.5km. However, we found that this correlation is very weak and that an extension of the profile with the ECC value at 30.5km increases the scatter between the Brewer and ECC data

(Page 4986, Line 9) For the calculation of the ECC column amounts plotted in the right panel of Fig. 6 we assumed that the O_3 VMRs for all altitudes above 30.5km are the same as at 30.5km. This assumption is in disagreement to the Chapman theory and to measurements from satellite and research balloons. It is an unrealistic overestimation of the real typical O_3 VMRs. On the other hand, the data we used

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in Fig. 7 (Haloe climatology) seem to underestimate the real VMRs by more than 10%. As we pointed out Fig. 7 compares 3 experiments: ECC, FTIR and Haloe. Consequently its interpretation is difficult.

(Line 17) The grey shaded area indicates the standard deviation of FTIR-ECC, which is the the sum of ECC and FTIR random errors.

(Page 4987, Line 8) "Inverted profile" means simply a profile retrieved from measured spectra. Inversion refers to the analytic process which transfers the measured spectrum into the O_3 profile.

(Line 15) The Referee's question was about the meaning of "original ECC sonde data": For the comparison of Sect. 4.2.1 we smoothed the ECC sonde profiles (according to Eq. (2)). In this Section (Sect. 4.2.2) we use the same sonde measurements but do not smooth them. We use the original vertically highly resolved data.

(Page 4988, Line 2) "[Errors in the spectroscopic parameters ...] are more important for the TR and TP layer than for the MS layer.": Errors in the pressure broadening parameter produce an altitude shift of the concentration profile. Since the concentration gradients in tropopause region are very large it may cause large errors in the TR (surface - 10km) and TP (12.5 - 17km) layer. The MS layer (20 - 30.5km) always includes the O_3 concentration maximum, also in case of a wrong pressure broadening coefficient. The effects of the altitude shift below and above the maximum largely cancel each other.

(Page 4989, Line 25) "The application of a unique a priori facilitates the interpretation of annual cycles": We mean the same a priori for all seasons. If we were using a seasonally varying a priori, it would be difficult to decide how much of the retrieved annual cycle comes from the varying a priori and how much from the measurement itself.

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(Figure 1) Yes, 1σ variability. The a priori data are calculated from sonde data measured between 1996 and 2006.

We will consider all the other comments when preparing the final version of the paper. Many thanks!

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 4977, 2008.