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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparisons between SCIAMACHY atmospheric CO_2 retrieved using (FSI) WFM-DOAS to ground based FTIR data and the TM3 chemistry transport model" *by* M. P. Barkley et al.

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The authors would like to thank Referee 3 for his/her useful suggestions and comments.

General Comments:

'Excellent' agreement has been changed to 'reasonable' as requested.

A reference to the CO_2 climatology has been added. A detailed description of the construction of this data base (which is based on NOAA/ESRL data!) may be the core of a future paper, which is outside the focus of this current work. Similarly, qualitative

comparisons of the FTIR data and TM3 data to the NOAA/ESRL network are also considered to be outside the scope of this paper. Please note however, for example, that the TM3 model has already been compared to some NOAA/ESRL data (see Tiwari et al, JGR, 2006).

The coincidence of the CO_2 distributions with vegetation type is not believed to be biased by the surface reflectance as an a-priori surface albedo (which is determined from the mean radiance within the fitting window) is used to generate a reference spectrum for each individual SCIAMACHY ground pixel. Furthermore, we have verified that whilst the CO_2 distribution changes significantly over the North American scene during 2003, the surface reflectance does not vary greatly.

The (column) weighting functions give the change in radiance (at the top of the atmosphere) for a relative scaling of the associated vertical trace gas profile and each SCIAMACHY ground pixel (i.e. spectrum) is processed individually. A brief outline of the FSI algorithm is (intentionally) only given in this work as a thorough description is given in the cited reference: Barkley et al., 2006. Similarly, a detailed discussion of the WFM-DOAS retrieval method and its formulation is given in the cited reference: Buchwitz et al., 2000.

Specific Comments:

Abstract, line 20: The factor 2-3 is with respect to the model, this has been corrected.

Page 5389, line 2: The approximate 30% increase is with respect to the year 2001, not 2006.

Page 5390, line 2: The authors agree that the NOAA/ERSL network will still provide the main observational constraints. However, satellite data may yet yield 'supplementary' information about the carbon cycle.

Page 5392, Eqn 1: The natural logarithms are taken (a) to be consistent with Beer's Law and (b) so that if the radiance has a multiplicative error, this can be taken into

ACPD
6, S2633–S2635, 2006

EGU

account by the polynomial.

Page 5393: Simulations reveal that incorrect parameterization of the aerosol conditions are likely to create the largest error in the retrieved CO_2 vertical column. The surface pressure is also significant. For actual SCIAMACHY retrievals, the calibration of the raw spectra is also very important. Please see Barkley et al. (2006) for a more detailed error analysis.

Page 5395: Apodization is a mathematical technique which smoothes the truncated edges of the FTIR interferogram in order to minimize the Gibbs phenomenon (or ringing) which is produced in the resultant spectrum.

Page 5393, line 23: Correction performed

Page 5396: The analysis is most sensitive to the scatter of the FTIR data, which determines the quality of the polynomial fit and thus the bias associated with the SCIAMACHY retrievals. It is difficult to gauge the error (of the bias) caused by the scatter of the ground based data but an estimate of approximately 1-2% is probably sensible.

Page 5401, last paragraph: The low CO_2 VMRs around the Canadian Shield correspond, we believe, to greater uptake by the evergreen needle-leaf forest. This is indicated in the first paragraph of page 5402.

Page 5403, line 23: This is simply the error in the monthly scene averages. We have removed 'precision' from the sentence to make this clearer.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 5387, 2006.