**Atmospheric Chemistry and Physics Discussions**

Interactive Comment

# 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.

**M. P. Barkley et al.**

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Response to Referee 1

The authors would like to thank the Referee 1 for his/her very useful suggestions and comments which have resulted in an improved manuscript. All technical corrections have been performed.

Specific Comments:

Abstract, line 17: Changed 'good' to 'reasonable' agreement as requested.

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Abstract, line 27: The 1% precision refers to monthly gridded data. We have clarified this point.

Page 5394, line 11:

Test retrievals have been performed using both the calibrated ESA and the Level 1 v5.04 solar reference spectrums.

The authors use the calibrated ESA solar spectrum, in preference to that in the Level 1 v5.04 product, as the quality of the FSI spectral fits are much improved with the errors associated with the corresponding retrieved $CO_2$ vertical column densities (VCDs) being smaller.

Page 5395, line 2: Both sentences have been changed in line with the referee's suggestions.

Page 5395, line 24:

The authors agree with the referee that averaging kernels of the FTIR and SCIAMACHY will be different. Unfortunately, the averaging kernels of the FTIR instrument are not available. Hence, we are unable to them into account in this comparison.

Page 5395, line 14: We have removed the 'ideal location' statement as requested and commented on the influence of contamination from local sources (because of the proximity to Toronto).

Page 5396, Equation 4: The bias is calculated by dividing by the polynomial $PF_i$. We have corrected this.

Page 5397, line 14: The referee makes a valid point. Hence, we changed this sentence to the suggestion.

Page 5403, line 3: We have removed this statement from the paper in accordance with the referee's comment.

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Page 5403, line 6: This is a typographic error, the formula should be $\sigma/\sqrt{(N)}$.

Conclusions, page 5403, line 26: The first paragraph has been revised according to the referee's suggestion.

Conclusions, page 5405, line 1: The calibration version of the SCIAMACHY Level 1 data has been added.

Table 1: The table has been revised with the number of observations for both the large and small grids added. Furthermore, the correct values for the $CO_2$ **VCDs** retrived by WFM-DOAS$_{IUP}$ over the Egbert station have been inserted. These values are taken from Dils et al. (2005). The biases presented in Dils et al. (2006), which correspond to mean volume mixing ratios, have been calculated using a slightly different method, hence they cannot be directly compared.

Table 2: The correlation is between the monthly gridded data. We have added this to the table caption.

Caption, Figure 1: The averaging kernel formula has been corrected and the suggested reference inserted. We have verified that $V^{ru}$ the retrieved unperturbed column is numerically equal to the true unperturbed column $V^{tu}$.

Figure 2: The $CO_2$ retrievals which either have (a) errors greater than 5% or (b) do not fall within the accepted range quoted within the paper (i.e. which acts, in essence, as a secondary cloud filter) are discarded. Observations which fall into either category are classified as **failed retrievals** which is why they are not included in any $CO_2$ averages.

We have added a sentence in Section 3 to clarify this:

"Column VMRs lying outside this range are classed as failed retrievals and are likely to originate either from aerosol scattering, undetected clouds or partially cloud contaminated pixels."

The FTIR data set is quite small with significant scatter, thus a polynomial fit through

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the data is obviously worse than if a larger set of measurements (with less spread) had been considered. However, comparing the SCIAMACHY observations to the polynomial is the only way of performing any type of meaningful comparison.

Caption, Figure 3: Corrected accordingly.

Figure 10: We have replaced the original figures with two new ones that more clearly show the general change in surface vegetation against the $CO_2$ distribution. Additionally, we have amended the figure caption and included an additional comment in section 5.

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

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