**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Assessing the near surface sensitivity of SCIAMACHY atmospheric CO$_2$ retrieved using (FSI) WFM-DOAS" *by* M. P. Barkley et al.

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Response to Referee 2

The authors would like to thank Referee 2 for his/her useful suggestions and comments on this manuscript.

All technical corrections have been performed, with ambiguous definitions corrected and sentences rephrased where appropriate. Several figures have also been enlarged to make the text readable (see also comments to Referee 1).

Specific Comments:

Page 2480, lines 10-12:

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The 1% precision is taken from O'Brien and Rayner (2001). We have added the reference accordingly.

The SCIAMACHY CO_2 retrievals are not (yet) well characterized enough for inverse modelling. Thus, we have been careful with our choice of words (i.e. "... is approaching the 1% requirement...") to reflect this uncertainty.

Page 2483, line 14:

We use operational ECMWF analysis within the retrieval, which we acknowledge may change if the ECMWF model is upgraded. However, all the ECMWF data used in the SCIAMACHY retrievals is from the same ECMWF model version.

Page 2484, lines 13-16:

Values of the CO_2 column outside 340-400 ppmv are unrealistic. As the O_2 column is not co-retrieved, imposing this cut off range is the only means of applying a (sensible) constraint to the light path.

Page 2485, line 19:

Removed 'small' from sentence to indicate bias is non-negligible.

Page 2487, lines 3-4:

The averaging kernel depends on the retrieval set-up, which includes the spectral fitting window which is different from the simulations used to create the WFM-DOAS averaging kernels as generated by Buchwitz *et al.*, 2004, 2005.

Page 2487, lines 11-16:

See comments to Referee 1.

Page 2487, bottom paragraph:

The plots in Fig. 3 were incorrect. We have now inserted the correct figures. This no longer shows any separation between the columns and their anomalies.

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Page 2491, lines 11-15:

In this paper, as a first step, we only focus on the ability of SCIAMACHY to track changes in CO_2 mixing ratios that occur in the lower atmosphere. This is important because if the algorithm cannot at least detect the CO_2 variability then there is a significant problem.

Examination of the biases is therefore the next step, as we agree that a constant bias between the surface and column observations is more useful than one that varies between locations.

Why this bias varies between different sites requires considerable further investigation (outside the scope of this current work).

Page 2491, lines 23-25:

We are aware of this contradiction and highlight the problem in Section 5.4. The difference between the simulations (which are used as only a first approximation) and the retrievals is that the FSI algorithm does not use a fixed a priori CO_2 profile (which improves its performance). This may account for the better agreement between SCIAMACHY and the surface data.

Section 6.2

Both the NDVI and EVI were used as a safeguard against a possible site specific bias or error in either vegetation index.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 2477, 2007.

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