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Interactive comment on "Atmospheric methane and carbon dioxide from SCIAMACHY satellite data: initial comparison with chemistry and transport models" *by* M. Buchwitz et al.

Anonymous Referee #5

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Review of MS-NR: acpd-2004-0135

Title: Atmospheric methane and carbon dioxide from SCIAMACHY satellite data: Initial comparison with chemistry and transport models Author(s): M. Buchwitz, R. de Beek, J. Burrows, H. Bovensmann, T. Warneke, J. Notholt, A. Schulz, and THE MODELLING TEAM

This paper is the first publication of satellite measurements of the well-mixed greenhouse gases CO2 and CH4, retrieved from spectra in the near-IR/visible wavelength regions. Such measurements are the target of US and Japanese instruments now

being developed. They have been the focus of intense scientific interest, for their potential to allow determination of the surface/atmosphere flux of these gases and also to critically assess vertical mixing in atmospheric transport models.

Therefore this paper, while a preliminary assessment of a limited data set, is unusually important as a developmental step in this new field. The paper is soundly reasoned and well written, and I recommend publication.

Scientific issues:

p. 7227 line 25 'no a priori information' A priori information is in fact contained in the shape of the profile used for the radiative transfer calculation, on which the least squares retrieval is based. The illustration of the meaning of the averaging kernel, on p. 7228, line 18, implicitly requires this: in the example given, if 100 molecules are added to the a priori profile at 5 km as well as to the true profile, clearly 100 molecules will be retrieved, rather than the 120 of the example. Thus the result does depend on the a priori.

p. 7228 line 14. The column averaging kernel is the derivative of the retrieved column with respect to the true profile. I.e. it is a vector (as shown in Figs. 2 and 3), not a scalar, as given by the equation in the text. Also, the numerator is a difference of retrieved quantities (perturbed minus unperturbed), not a difference of retrieved and true columns.

p. 7229, line 6. The estimate of smoothing error given in Connor et al, 2003 is calculated for an optimal estimation retrieval, not for the operational, WFM-DOAS algorithm. For the operational algorithm it will be larger. This is implied in the following paragraph, which cites the changes in the averaging kernels (thus smoothing error) due to different retrieval methods.

p. 7237, line 28. The discussion of Tables 1 and 2, for CH4, raises the question why there are not also Tables for CO2. Analogous Tables would be helpful to the reader.

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Sec 9.2. I am excited to see the apparent detection of a seasonal CO2 sink in Southern Africa. The statement that the variation in XCO2 is 4 times greater in the data than in the model (also in the Abstract) is intriguing. However closer examination (e.g. Figs 28 and 29) show that the systematic variations in the data are larger everywhere than variations in the model. This is disturbing, and should be discussed more explicitly.

Stylistic issues:

Figures. There are too many. They make the text longer and more difficult for the reader without conveying substantial information. For example Figs 9, 17, 20, 21, and 22 could be eliminated. If some figures were put in a separate appendix, the paper would be more accessible.

p. 7241, line 16 ‘reasonable’

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 7217, 2004.