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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Three years of greenhouse gascolumn-averaged dry air mole fractionsretrieved from satellite – Part 1:Carbon dioxide" *by* O. Schneising et al.

Anonymous Referee #2

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The paper describes improvements to the SCIAMACHY XCO_2 products retrieved using the WFM-DOAS scheme. The work represents a culmination of extensive analysis and evaluation of SWIR spectra from SCIAMACHY using FTS data and model calculations. It is a clear, well-written paper that is suitable for publication in ACP provided the authors address the following comments.

General comments

- In very few places there are double negatives that stem the flow of the text, e.g., "not unproblematic". I suggest restructuring these sentences.

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Discussion Paper

- I found the introductory text a little long. I suggest the authors briefly describe previous work and focus on new material.
- The SCIAMACHY data appear very smooth in the figures. Smoothing data is fine but for the reader please explicitly state the method used to plot these data. Data downloaded and plotted data from the Bremen website (albeit the old XCO_2 version) does not look like the plot available on their website.
- Plotting the model and data on different color scales makes it difficult for the reader to get a quantitative sense of the comparison.

Specific comments

- For the benefit of the reader of this paper, I suggest the authors expand a little on the XCO_2 retrieval error due to surface elevation.
- The OPAC database of aerosols is very limited, only accounting for a small subset of possible aerosol types (and associated optical properties). More importantly, it does not account for airmasses that are internally mixed (optical properties will change compared with external mixtures of the same composition). Also, the SCIAMACHY product does not account for scenarios where desert dust and biomass burning aerosols are externally mixed such as over equatorial Africa early in the burning season. I appreciate this is a difficult subject but the authors might be able to offer some further insight into this issue - at the very least offer directions for future research. Certainly, XCO_2 uncertainties due to aerosols are probably higher than stated in this paper.
- The authors state that error in the variability in CO_2 vertical profiles represents the largest error source for XCO_2 and state that applying the averaging kernel will reduce this error source. Application of the averaging kernel could make this situation worse: surely it depends on where in the vertical the profile is in error?

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- The authors have applied a 1.5% correction to the SCIAMACHY CO_2 data based on evaluation with CarbonTracker. If it is a constant bias then fine but what is the origin of this constant bias? I am uncomfortable reading about scaling data to fit models, especially when we know the model will likely have errors larger than 1%.

- How is the XCO_2 anomaly calculated? As a function of latitude? What time mean is used? Does the mean account of the observed trend? Does the spatial and temporal distributions of the observed and model means differ by much?

- If one assumes that errors in CarbonTracker and SCIAMACHY are uncorrelated, errors may compensate/reinforce over different geographical regions. In which case the systematic differences between SCIAMACHY and CarbonTracker cannot necessarily be assumed to represent an upper limit of the relative accuracy.

- What are the spatial correlations between CarbonTracker and SCIAMACHY on a global scale, and over Europe, Asia, Africa, and Germany? This can be calculated after the observations have been regridded on the model resolution.

- Comment: If we assume anthropogenic emissions are reasonably constant over Europe then a cloud-free sampling bias should not matter, especially if the model has been sample in a similar fashion.

- I am unconvinced about the ability of SCIAMACHY XCO_2 to directly provide robust distributions of anthropogenic emissions of CO_2 based on the evidence shown. What is the reason for the better agreement between model and data over western Germany? I suggest expanding this little study further, perhaps showing vegetation distributions as well.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 5477, 2008.