Atmos. Chem. Phys. Discuss., 11, C2645–C2649, 2011
www.atmos-chem-phys-discuss.net/11/C2645/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Application of SCIAMACHY and MOPITT CO total column measurements to evaluate model results over biomass burning regions and Eastern China" *by* C. Liu et al.

C. Liu et al.

thomas.wagner@mpic.de

Received and published: 3 May 2011

This is a valuable and interesting paper and should be published after revision. Previous comments have dealt with some of the issues with the manuscript. In particular the correspondence between J. de Laat (1/3/2011) and the authors (6/3/2011) deals with some of the things that I would have raised, although probably in more detail than I would have done. The authors are already putting a lot into this one paper, and if

much more were attempted I would recommend splitting it into several submissions. In concert with the other comments, the major point that I would like to see dealt with in the final manuscript is the degree to which the cloud-corrected, bias-corrected SCIAMACHY data can be trusted. With each of these corrections, there are significant potential improvements in the measurement, but with the added complexity comes more potential for things to go wrong. As others have pointed out, a wider set of comparators than just the MOPITT data would be advisable.

Author comment: We agree that more information on the effects of the normalisation and cloud correction should be added to the paper. The following new figures have been added:

New Fig. 3: Spatial patterns: The figure shows global mean CO VCDs for four years (2003-2006) for different stages of the normalisation and cloud correction: a) without normalisation and cloud correction, b) with normalisation but without cloud correction, and c) with normalisation and cloud correction. While the absolute values of the CO VCDs change after each processing step, the spatial patterns remain almost unchanged. This indicates that the spatial patterns of the SCIAMACHY CO VCD are independent from the normalisation with MOPITT data (and also from the cloud correction).

New Fig. 7: Validation and temporal variation: This figure shows validation results using ground based FTIR stations at different latitudes. Again results for different stages of the normalisation and cloud correction are shown: a) without normalisation and cloud correction, b) with normalisation but without cloud correction, and c) with normalisation and cloud correction. The comparison results indicate that: a) similar seasonal patterns are already found in the uncorrected data for most stations b) in general the agreement of the seasonal patterns improves after the normalisation with MOPITT data (and also after the cloud correction). c) also the absolute values show better agreement after the normalisation with MOPITT data (and also after the cloud correction).

ACPD

11, C2645–C2649, 2011

New Fig. A2 in the appendix: Temporal variation for selected areas: Like in new Fig. 7 the seasonal variation for some of the areas is shown, which were also used for the comparison with MOPITT and model results. In contrast to the results in new Fig. 7, here SCIA data are averaged over larger areas. Thus, the scatter of the data is smaller and the seasonal patterns are more obvious. The comparison is again shown for different stages of the normalisation and cloud correction: a) without normalisation and cloud correction, b) with normalisation but without cloud correction, and c) with normalisation and cloud correction. It is seen that the seasonal patterns are already obvious in the uncorrected data.

We are convinced that the new figures provide sufficient evidence that the relative spatial and temporal patterns of the new SCIAMACHY data set are almost independent from the MOPITT normalisation. In addition it is shown that both corrections lead in general to a substantial improvement of the agreement with independent data sets.

Some specific comments: 1. Page 1268 Line 17-22 There is an impression in the text that the SCIAMACHY data have an enhanced sensitivity to CO concentrations near the surface. “Thus, in contrast to observations in the thermal IR (...), SCIAMACHY measurements have a substantially higher sensitivity even for the atmospheric layers near the surface.” It might be just a point of language but Fig. 4 shows clearly and correctly that SCIAMACHY has a reduced sensitivity to near-surface layers, but nowhere near as severely reduced as MOPITT. There is no “higher sensitivity” near the surface, only lower sensitivity in varying amounts.

Author comment: We corrected the text to avoid misunderstandings. It reads now: ‘SCIAMACHY observes scattered and reflected sunlight. Thus, its sensitivity to trace gases close to the surface is larger than for observations in the thermal IR (like from the Measurements of Pollution in the Troposphere (MOPITT) instrument, see e.g., Drummond and Mand, 1996; Deeter et al., 2003).’

2. Page 1270 line 17 ... in order to correct for the remaining biases... I believe that this

ACPD

11, C2645–C2649, 2011

phrasing better reflects the authors' intentions.

Author comment: Many thanks! We corrected the text accordingly.

3. Page 1280 line 15 Not sure what is meant by the statement "about half of that in the red spectral range", nor sure what the motivation or significance of the changed value would be.

Author comment: The cloud top albedo changes with wavelength and is typically systematically smaller at 2300nm compared to 760nm, where the cloud properties are retrieved by to the FRESCO algorithm. We changed the text to: 'For the cloud top albedo we assumed a value of 40%, which is about half of the value at 760nm (see e.g., Nakajima and King, 1990), at which the FRESCO cloud algorithm is applied.'

4. Page 1285 line 16 "Over the biomass burning regions very similar seasonal cycles are found in both data sets. In most cases the SCIAMACHY CO VCDs are systematically higher than the MOPITT CO VCDs indicating the higher sensitivity of SCIAMACHY towards the surface." That is certainly one interpretation of the data, but since the datasets are not totally independent, some other evidence would make the case more compelling.

Author comment: Of course we can not rule out that the deviations are caused by other errors or one or both data sets. Also, as stated in the manuscript, no absolute agreement can be expected, because different a-priori assumptions are used for both satellite sensors, while the true atmospheric CO profile is not known. We changed the text to: 'In most cases the SCIAMACHY CO VCDs are systematically higher than the MOPITT CO VCDs PROBABLY indicating the higher sensitivity of SCIAMACHY towards the surface.'

5. Page 1295 Line 8 – see comment #1 above.

Author comment: To avoid misunderstandings we changed the text to: 'Compared to MOPITT observations, SCIAMACHY observations are more sensitive to the atmo-

ACPD

11, C2645–C2649, 2011

spheric layers directly above the surface.'

6. Page 1311 Figure 7 The attribution of the variations in the apparent values of CO over Si Chuan province to cloud effects needs more justification than "is probably related to the effect of clouds". It is a significant variation that needs some significant explanation.

Author comment: The effect of the cloud correction in Fig. 5 (Fig. 6 in the revised version) shows a rather strong effect (about 40%), which indicates that differences between our data and the results of other studies might be caused by cloud effects. However, since this is no proof that the differences are indeed caused by the cloud effect, we removed this statement from the text.

7. Page 1324 the Figure 11 panel on this page is the same as that on Page 1317.

Author comment: Many thanks for this hint. We replaced the figure with the correct o

---

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 1265, 2011.