

Interactive comment on “SCIAMACHY CO over the oceans: 2003–2007 interannual variability” by A. M. S. Gloudemans et al.

Anonymous Referee #1

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General Comments:

The paper describes an interesting new method for the retrieval of CO over cloudy ocean scenes. By the combination of land and ocean data it is possible to produce global maps of CO based on SCIAMACHY data. The analysis of several years of data allows for the investigation of interannual changes. The paper is scientifically sound, clearly written and contains all relevant information. However the following general aspects should be taken into account in the revised version:

1. What is the impact of a wrong cloud top height on the CO partial column above clouds?

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2. Are the interannual changes described in the paper affected by potential instrument performance changes / degradation? What is the influence of different/changing cloud statistics?
3. No trends are shown in the paper, so the corresponding sentences in section 4 and 5 should only mention the interannual variability. In any case, 5 years are probably too short for the derivation of trends; if to be mentioned at all, “changes” may be a more appropriate term here.

Overall, the paper fits well within the scope of ACP and may be published after considering these general comments and some specific corrections described in more detail below.

Specific Comments:

1. p. 5587, 2nd paragraph, and Fig. 1:
How have the simulated spectra been generated? The units (BU/s) on the y-axis of Fig. 1 indicate that some kind of instrument model has been used. Please explain.
2. p. 5588, line 25:
The SCIAMACHY equatorial crossing time is 10:00 a.m.. Why have model data been sampled at 10:30 a.m.?
3. p. 5590, last paragraph of section 2.3, and Fig. 4:
The sign of the bias seems to be systematically different for different years. Is there any explanation for that?
4. p. 5591, line 9–11:
The CO column above the cloud is not independent of the cloud fraction for low

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cloud fractions. Later in the paper, it is stated that only data with cloud fractions above 0.2 are used. This should already be mentioned here.

5. p. 5592, line 8 (and related paragraphs):
It is stated that the CO/CH₄ ratio method is not used. However, later in the paper (p. 5595) the CO/CH₄ ratio is used for the selection of data.
6. p. 5592, line 13–14: It is unclear how the sentence: “Note that Frankenberg et al. (2005) investigates maximum observed CO columns over oceans, not average CO columns.” belongs to the context. The sentence could be omitted.
7. p. 5594, lines 18–20
It is stated that “... the FRESCO+ cloud top height provides the optical mid-level of the cloud (Wang et al., 2008), while the SCIAMACHY cloud top heights based on the CH₄ are representative for the cloud top.” Does this difference explain the (small, but systematic) differences between the FRESCO+ and CH₄ cloud pressures shown in Fig. 6? How far do the derived partial CO columns depend on this differences, i.e. the thickness of the cloud?
8. Caption of Fig. 2:
“Global distribution of the SCIAMACHY CO monthly-mean instrument-noise error ... for the year 2004 ...”: Are the shown data monthly or annual means?
9. Captions of Fig. 3 and 4:
It should be mentioned that the plots are based on data over land, only.
10. Fig. 8:
For higher errors the differences over sea are systematically positive whereas the differences over land are negative. Is there an explanation for that?
11. Fig. 12:
It seems that there are fewer data for the years 2006 and 2007, or maybe the
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scatter is smaller?

Technical Corrections:

1. p. 5585, lines 6–9:
The unabbreviated instrument names should be separated from the corresponding reference by a “,”.
2. p. 5586, line 13:
There should be a bracket around the two references.
3. p. 5590, line 6:
The reference is probably to Fig. 3b, not 3a.
4. Caption of Fig. 9:
Replace “Note that most CO emissions occur over land, while over the oceans only the column above the cloud partial column is shown” by “Note that most CO emissions occur over land, while over the oceans only the partial column above the cloud is shown”.

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