

## ***Interactive comment on “Long-term analysis of carbon dioxide and methane column-averaged mole fractions retrieved from SCIAMACHY” by O. Schneising et al.***

### **Anonymous Referee #1**

Received and published: 5 January 2011

This paper discusses the long-term trends, seasonal cycles and gradients of  $X_{CO_2}$  and  $X_{CH_4}$  from SCIAMACHY, compared with CarbonTracker, TM5 and MBL. The paper carefully documents the changes to WFM-DOAS used to produce the results, and generates some interesting  $X_{CO_2}$  results and comparisons with CarbonTracker.

This paper is suitable for publication, pending minor corrections.

### **Minor Corrections and Comments**

A very interesting result of this paper is the discussion of the Boreal forest uptake and the relative strengths of the Russian and North American regions. This should be mentioned in the abstract.

C11923

The “irregular sampling” of SCIAMACHY discussed in section 4.1 could be investigated by comparing with the seasonal cycles at various TCCON ground-based FTS stations. I recognise that the averaging kernel problem described in section 5 is a hindrance to direct comparison of the two measurements, but both SCIAMACHY and TCCON could be compared with CarbonTracker using the method employed in this paper.

P27480, line 21. It would be nice to have the errors listed for all important numbers mentioned in the text. (For example, the annual mean increase ( $1.8 \pm X$  ppm/yr and  $1.9 \pm X$  ppm/yr).)

P27485, line 15. Does your O<sub>2</sub>-A band spectroscopic forward model include the effects of line-mixing? If not, how much of a difference is this likely to make? Does the “Change of full width at half maximum (FWHM) used for the O<sub>2</sub> reference spectra calculation ...” described a few points lower down compensate for line mixing or some other spectroscopic bias? What is the effect of changing the widths on the retrieved O<sub>2</sub>?

P27485, lines 12-13. How do the M-factors change over time and how do they affect the  $X_{CO_2}$  growth rate and seasonal cycle (if they do)?

P27486, section 3.2. Why do you normalize CH<sub>4</sub> with CO<sub>2</sub> instead of with O<sub>2</sub>? How do the results compare when you normalize CH<sub>4</sub> by O<sub>2</sub>?

P27487, lines 20-22. Why do you require the same number of retrievals for each of the three periods, instead of requiring the same quality of the retrievals? Could you please explain this further?

P27489, lines 10-11. To what do you attribute the 0.3% bias between SCIAMACHY and CarbonTracker? This is very small compared with the GOSAT bias, which is on the order of 2% (see Morino, I. et al., Atmos. Meas. Tech. Discuss., 3, 5613-5643, doi:10.5194/amtd-3-5613-2010, 2010). Is this related to changing the widths of the O<sub>2</sub> spectroscopy?

C11924

P27489, lines 19-20. I'm not sure you can claim that the annual increases between CarbonTracker and SCIAMACHY are different, since they all agree within error (according to Table 1). It seems from Table 1 that the largest differences are seen in the annual increases in the 30S-30N region, where SCIA and CT just barely agree within error. Further discussion/investigation of this point might be interesting.

P27492, lines 17-20. Please elaborate on the statement: "Due to the fact that the prevailing wind direction in mid- to high-latitudes is from west to east, one would expect a negative west-to-east longitudinal gradient for the considered region because the air masses are mainly moving according to this wind direction over the uptake region." This seems like an interesting approach, but it is not discussed fully enough.

P27493, first paragraph. This is an interesting result. It would be good to mention whether any other paper has noted this phenomenon. Could the difference between CarbonTracker and SCIAMACHY be due to a timing error (phase lag) in the onset of the forest uptake in CASA, such as that described in Keppel-Aleks et al. (Atmos. Chem. Phys. Discuss., 10, 30569-30611, doi:10.5194/acpd-10-30569-2010, 2010)? Why do you average over May through August? What do the results look like when averaging over shorter time periods (say, only July and August)?

Figure 1. It would be useful to include in the caption that the shaded regions indicate "bad" pixels, and that the last remaining usable (not "serviceable") pixel is located at 896 (if that is correct, of course).

Figure 2. Could you show the error bars on the Global Mean bar graph? (The same question applies to Figure 10.)

Figure 9. Middle panel. Are the shaded regions the data themselves? What are the solid red and black lines? Are they the linear combinations? It would be useful to have these described in the caption.

### Technical Corrections

C11925

Abstract, sentence 2 (also on P27482, line 8-12). This sentence is too long. I would suggest splitting it into a few shorter sentences.

P27481, lines 15-21. Run-on sentence. I would suggest splitting it up into a few shorter sentences.

P27482, line 13. Change "relative" to "relatively". Similarly for P27488, line 7.

P27482, line 24. Is the word "afore" a typo?

P27483, line 10. "Each spectral channel comprises a grating focusing optics and ..." should read "Each spectral channel is comprised of grating focusing optics and ..."

P27484, line 4. I would remove "One exception is" and replace it with "There is, however,". The phrase "one exception" seems incorrect when there are two channels affected.

P27485, line 5-6. Remove "the" before "time t" and "time t0".

P27487, line 15. I don't think "serviceable" is the correct word, here. Perhaps "usable"?

P27487, line 19. Change "less" to "fewer". Also on P27494L17 and in other instances.

P27489, lines 21-25. Run-on sentence. I would suggest splitting into a few shorter sentences.

P27490, lines 2-8. Run-on sentence.

P27490, line 9. The word "unrealistic" should be "unrealistically". The phrase "on the Southern Hemisphere" should be "in the Southern Hemisphere" (there are other instances of this typo in the manuscript). Are you referring to the unrealistically large seasonal cycle of CO<sub>2</sub> or some other type of cycle?

P27490, line 10. The sentence beginning with "First" should begin with "The first".

P27490, line 26. A reference to Table 1 would be helpful here.

C11926

P27492, line 11. Replace “plant’s” with “the” and in all subsequent places.

P27492, line 14. Replace “(period between maximum and minimum” with “(the period between the maximum and minimum”.

P27492, line 15. Change “signal” to “signals”.

P27495, line 15. Replace “the lesser number of” with “the decreased number of”.

P27495, line 17. Remove “furthermore” and replace “lead” with “leads”. Replace “a considerable less amount of” with “considerably fewer”. Replace “relative” with “relatively”.

---

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 27479, 2010.

C11927