

Interactive
Comment

Interactive comment on “First ground-based FTIR-observations of methane in the tropics” by A. K. Petersen et al.

Anonymous Referee #1

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General comments

The authors present a comparison of ground-based FTIR observations of methane total columns in Suriname with satellite observations and chemistry-transport model simulations. The FTIR observations are interesting and unique for this part of the world, and they deserve to be published. On the other hand, they also deserve a more thorough analysis. Here are some directions for such further analysis.

- The comparisons are very general and can hardly be called validation. Fig. 1 shows that ground- and space-based observations are approximately in the same 50-ppb range but there appears to be little correlation. In fact, during some episodes (LDS 2005 and SDS 2007) there is clear disagreement. Can the au-

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thors somehow convince the reader that the FTIR observations are really in line with the satellite observations and model results?

- The biomass burning events need more attention. Perhaps the authors could zoom into one of the episodes (e.g., LDS 2005), make comparisons with measured CO concentrations, present back trajectories, perform model simulations at higher resolution and with realistic biomass burning emissions, etc.
- The effect of the CO lifetime should be quantified in order to assess whether it could be significant .
- The ‘renewed growth’ of methane concentrations in 2007 is mentioned but not visible in the figures. A table should be added with annual mean concentrations for observations and model to clarify this feature.
- What can be concluded from the relatively good agreement between ground-based and space-based CH₄/CO₂ ratios?

Specific comments

P2305, L7-10: This is the other way round: Meirink et al. (2008a) used ‘unrevised’ retrievals and found higher tropical emissions.

Section 2: The retrieval description is not completely clear. What is actually used? The profile scaling technique or optimal estimation? Can the authors give an indication of the differences (in ppb)? Warneke et al. (2006) presented ship-based measurements including the tropics. Since they used a profile scaling technique, can we conclude that their retrievals are erroneous?

P2309, L9: Can you really claim a ‘good’ agreement? As stated above, there appears to be little or no correlation between space- and ground-based observations.

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P2309, L14-15: During the last part of LDS 2004, the FTIR observations are lower than SCIAMACHY.

P2309-2310: How does the CH₄ time series (e.g. for the LDS 2004) compare with CO? Is it likely that enhancements have been caused by the same source?

P2310, L6-7: Can the authors clarify where these numbers come from? Specifically, what value for the CO background column is used?

P2310, equations: The CH₄ column is denoted 'column(CH₄)' on the previous page, but here '(CH₄)'. This is not consistent. Actually, these equations are not really needed. I suggest adding the EF(CH₄)/EF(CO) ratios in Table 1, in kg/kg as well as in mol/mol. At the same time, the savanna/grassland values may be removed because they are not used or discussed in the paper. Otherwise, it should be noted that if part of the burning was from savanna fires, the resulting CH₄ enhancement would be even smaller.

P2310, L9-11: This was already done in the previous paragraph. Sentence can be removed.

P2310, L15-17: Based on estimates of the transport time and the CO lifetime it should be possible to assess the impact of chemistry on CO concentrations, and to account for this in the estimate of CH₄ enhancements.

P2310, L21-23: For savanna/grassland fires the ratio of CH₄ to CO₂ emission factors is 0.004 mol/mol, which is similar to the CH₄/CO₂ mixing ratio in the atmosphere. However, tropical forest burning, which is assumed to be relevant for this study, is characterized by a three times larger CH₄/CO₂ emission ratio. Hence, these emissions should to a large extent be visible in the observed CH₄/CO₂ column ratio.

P2311, L3-4: What can be concluded from the fact that ground-based and space-based CH₄/CO₂ ratios are relatively consistent?

P2311, L21-22: This statement is only valid if the model data are daily means (instead of running averages), which I could not find in the text.

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P2311, L21-22: The model is not only representing background levels, but also the effect of nearby emissions, be it at a rather coarse resolution.

P2311, L22 – P2312, L1: From Fig. 1 it is for none of the datasets (FTIR, SCIAMACHY, TM5) clear that methane concentrations are on the order of 10 ppb higher than in previous years. Please add a table showing annual mean (or dry-season-mean) concentrations for all years to clarify this point. Otherwise, the last sentence of this paragraph is not justified.

P2311, L25: I'm not sure 'anomaly' is the right word here. An anomaly implies that there is a reference. What is the reference in this case?

P2312, L2-5: Were the flask measurements all taken during the day? Otherwise, high concentrations may be the result of CH₄ build-up in the stable nocturnal boundary layer.

Fig. 1: The FTIR observations are daily means, whereas the SCIAMACHY data are at around 10h local time. Does diurnal variability influence the comparison?

Fig. 2: For completeness add that the unit on the vertical axis is mol/mol, and that these are column ratios.

Technical comments

Title: Remove hyphen between FTIR and observations

P2304, L16: yet not -> not yet

P2305, L8: Remove hyphen between TM5 and four

P2305, L15: Posteriori -> Posteriori

P2306, L1: apriori -> a priori

P2306, L2: with respect of -> taking into account (?)

P2305, L26: Maybe start new paragraph after (Fortuin et al. 2007)

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P2308, L21: an -> a

P2309, L13: Remove second 'fields'

P2309, L19: are -> were

P2309, L20: observe -> observed

P2311, L21: shows -> show

Caption Fig. 1, L5: errorbars -> error bars

Caption Fig. 1, L6: chanal -> channel

Caption Fig. 2, L4: chanal -> channel

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