

Interactive comment on “Long-term validation of total and tropospheric column-averaged CH₄ mole fractions obtained by mid-infrared ground-based FTIR spectrometry” by E. Sepúlveda et al.

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Dear Geoff Toon,

Many thanks for your comment and for placing the comment as non-anonymous.

Your comment is mainly about the “HF-procedure” we applied for estimating the stratospheric contribution to the total CH₄ column. You are concerned that we do not correctly apply this “HF-procedure”. You conclude that our “HF-procedure” has serious deficits and cannot be described as being similar to the one presented in Washenfelder et al. (2003).

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Your conclusion is a consequence of four differences that you have identified between our method and Washenfelder’s method (described in your statements 1-4). While we agree with some parts of your statements we first would like to list the aspects in which we disagree with you. We feel that important aspects of your statements 1 and 2 are not really justified. Furthermore, your statements 3 and 4 refer to differences between mid and near-infrared, which are however, not the subject of our paper.

Statement 1) you indicate that we would remove periodicity/variability from the HF time series. This is not true. We only remove the linear trend. This linear trend is a1t as obtained by fitting function (4) to the original HF time series. While this linear trend a1t is removed from the original HF time series, all other variability (small scale variability, annual cycles, etc) is not touched. We think that this is well explained in the paper.

Statement 2) you state that we would not show the relationship between HF and CH₄ and that we would not mention the b-value we use. This is not true, since in Appendix A we show the correlation of CH₄ and HF columns and mention the b-value we obtain. Please note that we use the correlation between CH₄ and HF total column amounts obtained by differently shifted profiles (this is a bit different than the Washenfelder method, for more details please see our extended revised Appendix A, attached to this reply).

Your statements 3 and 4 are about differences between the mid and near-infrared retrievals. We agree with these statements. However, please be aware that our work is exclusively about mid-infrared retrievals. We do not claim that our results can be directly transferred to the near infrared (TCCON CH₄ analyses). Instead we state that similar studies are needed for the TCCON CH₄ retrievals (conclusion section).

However, we must admit that our obtained b-value was apparently too low (leading to an increased bias with respect to CH₄GAW). There was an error in the calculation of our b-value. We simulated a shift in the tropopause altitude by a vertical altitude shift of the profiles. However, what is really needed is a shift on the pressure levels. This modification changed our b-value from -554 to -901. Now the performance of the “HF-

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procedure” improved. However, this does not significantly change our results, since the “HF-procedure” is still clearly outperformed by the direct retrieval of tropospheric CH₄ amounts.

In order to fully remove your concerns about deficits in our “HF-procedure” we carefully reviewed our procedure and made several tests with different methods for determining the b-value and we investigated the reasons for the relatively poor performance of the “HF-procedure” in the mid infrared. These studies are presented in the attached revised Appendix A, which will be inserted in the revised version of our manuscript. The studies can be summarized as follows:

(1) We calculate b-values applying CH₄ and HF profiles from different datasets (WACCM, KASIMA models and ACE satellite data). We calculated the b-value by correlating mixing ratios (like Washenfelder) and by correlating total columns obtained from differently shifted profiles. We find that the performance of the “HF-procedure” does only slightly depend on the applied b-value.

(2) We document that the problem is not so much the b-value, but the precision of the CH₄ total column: in the mid-infrared there is a lot of CH₄ profile information in the high resolution spectra. Simply scaling a climatologic profile produces imprecise total column amounts. The imprecise CH₄ total column amounts are the main reason why in the mid-infrared the “HF-procedure” cannot produce high quality tropospheric CH₄ amounts.

Best regards, Eliezer and Matthias

Please also note the supplement to this comment:

<http://www.atmos-meas-tech-discuss.net/5/C408/2012/amtd-5-C408-2012-supplement.pdf>

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