

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.

D. Griffith (Editor)

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This paper compares two methods to correct total column CH₄ measurements for stratospheric variability in order to retrieve and compare tropospheric mole fractions and compare with in situ measurements. The work is a valuable contribution to the accuracy and precision of remote sensing of CH₄ amounts and should be published. Neither referee has any problem with the profile retrieval approach, in which the authors are expert. But the comparison with the HF correction method, introduced by Washenfelder et al. (2003), is not comparing apples with apples, as pointed out by reviewer 1 (G. Toon) and supported by the second reviewer. In its current form the

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manuscript concludes (correctly) that the HF procedure as applied here is inferior to profile retrieval in the mid IR. But it does not and cannot in its present form make any conclusion about the HF correction as applied by Washenfelder et al., based on NIR spectra only, which appears to do significantly better. This must be addressed in the revised manuscript – it would be of considerable value to the ground based FTIR remote sensing community, especially TCCON stations where in many cases there are no MIR measurements and profile retrieval from the NIR spectra is not an option. So the HF correction procedure option becomes more important in TCCON, and this paper may unfairly impact confidence in its use. I think this point must be better addressed.

Following the reviewer comments and the author response to Toon, I specifically ask the authors to:

- address Toon's points 1) and 2) to clarify the differences between the two HF procedures and discuss in the main text why the results are so different.
- Consider the suggestion of referee #2, point 1. – there should be periods of overlap at Izana where both MIR and NIR spectra are available on the same day. To truly compare the two methods, the NIR spectra could be analysed following Washenfelder et al. (including O₂ normalisation, Toon point 3). The results should be compared with the MIR version as currently described. This valuable exercise would provide a fair comparison and clarify if the HF procedure results are truly due to its being an inferior method, or in the current MIR implementation. While the authors state this as desirable in the conclusions, I would very strongly recommend that at least a preliminary study be included in this paper, because it is a very important omission. I recognise that this will require some extra work on the part of the authors, but I also believe the paper will be much improved, more complete, and much more useful because of it.
- Include discussion of the authors response to Toon, final point (2) about the HF-CH₄ correlations in the main text
- address the specific minor points from referee #2.

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Please provide a description of the changes made to the revised manuscript when resubmitted.

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