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Atmospheric Measurement Techniques Discussions

Interactive comment on "Strategy for high-accuracy-and-precision retrieval of atmospheric methane from the mid-infrared FTIR network" *by* R. Sussmann et al.

Anonymous Referee #2

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This paper presents a strategy for the retrieval of column methane values from the NDACC FTIR network. The authors make the argument for calculating the column values from profile retrievals, describe the reasoning for their choice of constraints, and present a careful comparison of different microwindow combinations and different sets of spectroscopic line parameters. Three different NDACC sites, spanning a wide range of prevailing atmospheric conditions are considered in order to ensure the validity of the results for different locations.

The paper is, in general, well written and provides a clear description of the method and

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analysis. The subject matter is certainly appropriate for AMT. The paper raises important points about consistency of spectroscopic data across spectral regions. Enabling the use of NDACC data, with its long time record, to be utilized in source/sink studies will certainly bring benefit to ongoing efforts to better understand methane variations in our atmosphere.

I would recommend publication of this work, after addressing the issues raised below (and by other reviewers).

Major comments:

As someone not connected with these ground-based networks, it is not clear to me why minimum diurnal variation equals optimum precision. Is this related to the solar zenith angle and the atmospheric path viewed? How, exactly? The paper would benefit from further explanation on this topic.

It is not clear to me what the physical meaning of the ratio of the spectral residuals to the degrees of freedom for signal is. I think some further explanation is required of what this quantity actually means in order to understand why it is of benefit in this context.

Like M. De Maziere, I am not convinced that the work presented in this paper establishes the absolute accuracy of the retrievals. Therefore, unless the authors present a convincing argument otherwise, I would suggest that the title be changed.

Minor comments:

As Frank Hase has pointed out in his detailed comment, the five microwindows considered for this work are not the only possible set that could be used for NDACC methane retrievals. While the use of 3 of these 5 microwindows may be optimal for the set of five considered, perhaps even better results could be obtained by selection of an “optimal” set of microwindows selected from all available combinations. Have the NDACC community considered a microwindow selection procedure based on information content

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and minimization of systematic errors? (See, for example, Dudhia et al [2002], von Clarmann and Echle [1998].) I am not suggesting that such a study should fall within the scope of this paper, but I think that it would be relevant to note in this paper that methods for "optimal" microwindow selection have been considered by others.

Abstract:

The meaning of "seasonal bias" is not clear in this context. Does this refer to the systematic errors due to H2O/HDO interference? Section 1:

Page 2968, lines7-8: "the sources and sinks on the regional scales" should be "sources and sinks on regional scales"

Page 2969, line 23: "15 yr" should be "15 years".

Page 2970, line 1: "parameters compilation is subject" should be "parameter compilation is the subject"

Page 2970 Line 6: "errors in case a non-optimum" should be "errors in the case where a non-optimum"

Section 2:

Page 2972: Lines 1-2: Please expand all acronyms.

Section 3:

Could you state here what spectral region the SCIAMACHY retrievals are using? Which version of the spectroscopic parameters are used by the WFM-DOAS v2.0 retrieval? Obtaining good agreement between retrievals from very different spectral regions is a pleasing result.

It might be a good idea to emphasize in this section why the SCIAMACHY dataset is a good dataset for comparisons here. Would it be possible to comment on how the SCIAMACHY column averaging kernels compare to the ground-based column averag-

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ing kernels?

Page 2988, Line 15: “The reason for this is probably due to detector degradation in the spectral range used for the column retrieval and the corresponding availability of considerably fewer detector pixels”. There are other issues in this comparison besides an increase in scatter in the SCIAMACHY data. (1) FTIR data are just for Zugspitze, while SCIAMACHY data are for the whole Northern Hemisphere. (2) Zugspitze data for all years happen to show better agreement with SCIAMACHY 04/05 than for SCIAMACHY all years, but there is no information here about interannual variability in either dataset. It would be more of a fair comparison to show SCIAMACHY 04/05 against Zugspitze 04/05, although this comparison would still be subject to the uncertainties introduced by (1).

Section 4:

Page 2989, lines 9-10. This sentence should be corrected for grammar.

Page 2989, Line 12: “located at” should be “located in”.

Page 2989, Line 14: Unmatched bracket. Also, suggest changing “This is representative for the. . .” to “This spans the range of. . .”

Page 2990, Lines1-2: This sentence is awkward and the meaning unclear to me. I would suggest rephrasing it for clarity.

Page 2990, Line 6: Move quotation marks to encompass “internal tension” for consistency with other parts of the document.

Appendix A:

Are the authors saying that the non-uniformity of the column averaging kernel with respect to altitude is caused mainly by H2O and HDO interference errors? Presumably there are other reasons for non-uniformity of the column averaging kernels (like the shape of the temperature and CH4 profiles themselves?) I would suggest adding some

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clarification here.

References:

Anu Dudhia, Victoria L. Jay, and Clive D. Rodgers, "Microwindow Selection for High-Spectral-Resolution Sounders," Appl. Opt. 41, 3665-3673 (2002)

Thomas von Clarmann and Georg Echle, "Selection of Optimized Microwindows for Atmospheric Spectroscopy," Appl. Opt. 37, 7661-7669 (1998)

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 2965, 2011.