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Atmospheric Measurement Techniques Discussions

Interactive comment on "Tropospheric CH_4 signals as observed by NDACC FTIR at globally distributed sites and comparison to GAW surface in-situ measurements" *by* E. Sepúlveda et al.

Anonymous Referee #1

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In this investigation, a lower/middle tropospheric mole fraction product of CH4 is proposed based on solar absorption measurements performed by high resolution FTIR spectrometers, which are part of the NDACC international network. The retrieval strategy offers several benefits to minimize the influence of the UTLS region and to improve the information of the free tropospheric variability. Data from nine stations have been analyzed and the FTIR derived mole fractions were compared to GAW in situ measurements.

The work and effort to obtain a more reliable product from this remote sensing technique is relevant especially since it will provide valuable information focused in

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source/sink investigations and also to validate satellite data as they become available both from polar orbits and geo-stationary platforms. Even though GAW stations in remote areas provide excellent data sets to derive background and seasonal CH4 levels, the use of a column integrated product is important and could help improve the global models.

General comments

The blue area shown in Fig. 1 (commented in page 636 line 20) is said to represent a variability in the profile VMR due to shifts in the tropopause. The explanation for this variability is not clearly stated. For example if the tropopause should drop as it does during some cases, one would expect larger total columns but the VMR values above the tropopause should remain fairly similar. Tropopause altitude can for instance be monitored from potential temperature time-series. The variability shown in blue is therefore more likely related to seasonal changes in the UTLS which includes the photochemical processes and OH availability.

It is not clear in Page 641 line 26 if the HDO/H2O retrieval is done separately and the results are used afterwards for the CH4 retrievals.

In Page 642 line 3, by tropospheric here do you mean the boundary layer or lower tropospheric. . .? The 100 m considered in Fig 1 and the error calculation (Page 644 line 4) seems very low for a boundary layer height, and is certainly not true for all sites.

In the filters deployed for in situ data, like when using only nighttime data, how does extraordinary events like those during biomass burning, can be discriminated? The Eureka filter of >0.5% of its stander deviation might not do depending on the duration of such an event.

I would strongly recommend to put all of Sect. 3 (Pairing the ground-based FTIR and surface in-situ datasets) into the appendix. Although the information is important for obtaining an appropriate reference for the background CH4 concentrations and for the

AMTD
7, C243–C246, 2014

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comparison, these criteria do not belong to the main contribution of the paper.

Pg 661 line 11 and Pg 664 line 15. The authors demonstrate with a solid statistical analysis that the remote sensing results, using the method described in this and a previous paper, need to be corrected by a factor of 0.98. Based on which arguments do the authors state that the 2% difference between the remote sensing and the in situ measurements comes from the spectroscopic parameters? UTLS influence on the tropospheric product is, as mentioned by the authors, a good possibility and would also represent a systematic error. The a posteriori correction is shown to improve this UTLS dependency but might not be enough to account for the stratospheric influences.

Technical corrections

Abstract. This sentence does note make much sense here. "The theoretical assessments are complemented by an extensive empirical study."

Pg 636 line 2. Sentence structure: move coma to after ". . .places," and put one after ". . .time,".

Pg 636 line 11. Remove coma after "means"

Pg 638 line 12. General explanation needed: "technique, which is based on recording solar absorption spectra in the infrared region and in the detection of the absorption signatures of the atmospheric gases."

Pg 638 line 13. Should say "In some stations, the older . . ."

Pg 639 line 13. ". . .Table 1 and their location . . ."

Pg 640 line 1. specify the number of layers

Pg 640 line 18. a priori, two words, italics (throughout the manuscript)

Pg 641 line 11. Word usage "We use the HITRAN 2008 spectroscopic data base for the forward simulations, except . . . , for which we use. . ."

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Pg 642 lien 15. analytical

Pg 642 line 17. eliminate “the error”

Pg 652 line 26, numbers can be rounded to whole numbers (also for the other stations)

Fig. 9 Y-axis. label “Difference. . .”

Pg 662 line 24. Eliminate “this”

Pg 663 line 4. “consistency in the correlations of all. . .”

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 633, 2014.