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Atmospheric Measurement Techniques Discussions

Interactive comment on "Methane cross-validation between three Fourier Transform Spectrometers: SCISAT ACE-FTS, GOSAT TANSO-FTS, and ground-based FTS measurements in the Canadian high Arctic" *by* G. Holl et al.

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1 Introduction

We thank the anonymous reviewer #2 for their feedback. Below, we include the comments indicated by the anonymous reviewer along with our response.

2 Anonymous Referee #2

General comments:

The authors present a validation study of methane data from two satellite sensors with ground-based FTIR in the Arctic. In order to study Arctic methane emissions satellite data are required. Before doing so a comprehensive data validation is needed. Therefore, the subject of the paper is an important topic. In this paper the crossvalidation is conducted carefully and described in detail. The subject is fully appropriate for publication in AMT.

I recommend publication after minor revisions as listed below.

Specific comments:

- The data products used are described in some detail in Section 2. However, the spectroscopic data set used for the retrieval is not specified. If different spectroscopic data have been used for the different sensors a sensitivity study of these data sets based on ground-based retrievals might be useful.

We have added the spectroscopic data sets used: HITRAN 2004 for ACE-FTS and TANSO-FTS, and HITRAN 2008 for PEARL-FTS. While we agree that a sensitivity study for the data sets to spectroscopic data would give valuable insights, we believe it is beyond the scope of this cross-validation study.

- In Section 3.3 the influence of different potential vorticity (PV) on the inter-comparison is investigated. For this study profiles have been compared. Given the limited vertical resolution (partial) column amounts might be a better choice to look for influences of PV. In particular, a correlation plot of differences in (partial) columns with difference in PV might show such an influence more clearly.

We agree that it is valuable to look at partial column differences as a function of scaled potential vorticity directly. However, we also believe there is added value in looking at profiles of potential vorticity, such as included in the manuscript, because it shows at what altitude we might look for differences. Figure 1 (shown at end of response) shows partial column differences similar between ACE–FTS and PEARL–FTS, similar to Figure 16 in the article. The figure illustrates that there is no significant correlation between methane partial column differences and potential vorticity differences. We have not added this figure to the manuscript.

- In case of TANSO-FTS the number of DOFs is very limited (see Fig. 3). In this case a validation of (partial) columns as presented in Section 3.4 might be more appropriate as compared to a validation of profiles (Section 3.5). So, maybe Figs. 3, 11-14 might be omitted in favor of correlation plots, see next comment.

Currently, we are showing both a profile difference and a partial column difference (see below). Considering that all products are released nominally as profile products, we think it is appropriate to show a profile comparison, with the warning that the information content is insufficient to resolve these vertically.

- I miss a correlation plot of satellite versus ground-based partial column data to investigate whether those instruments show a similar response to variability.

Figures 16–18 are correlation plots, including figures 16–17 that are satellite versus ground-based. A visualisation of y vs. x tends to have points concentrated along the line of equality. This is an inefficient visualisation, as most of the graph will be empty. Moreover, deviations from the 1:1-diagonal are more difficult to read from a graph than

deviations from zero. Therefore, our correlation plots are shown as (y $-$ x) vs. x, as shown in Figures 16–18.

- In Chapter 4 Kiruna and Poker Flat are specified as sub-Arctic sites. (‘. . . at the only other Arctic site, Thule, . . . Kiruna and Poker Flat, which exist in different climatic zones’). At least Kiruna is located within the polar circle.

The referee has a good point. One can interpet “Arctic” by climate or by geography. The climate at Poker Flat and Kiruna is quite similar, even though one is outside and the other inside the Arctic Circle. But for the purposes of methane, the actual latitude is probably more relevant. We have reformulated the text to avoid confusion.

The ’inconsistency’ with an earlier study (DeMaziere et al., 2008) is probably not really due to ‘different climatic zones’ but more likely due to different data versions or spectroscopic data sets used in the retrievals.

In the article, there is already a comment that the version used by DeMaziere et al. is different from the version used in our study. Both retrieval parameters and climate zone are relevant. Therefore, we believe the current text is appropriate.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 13199, 2015.

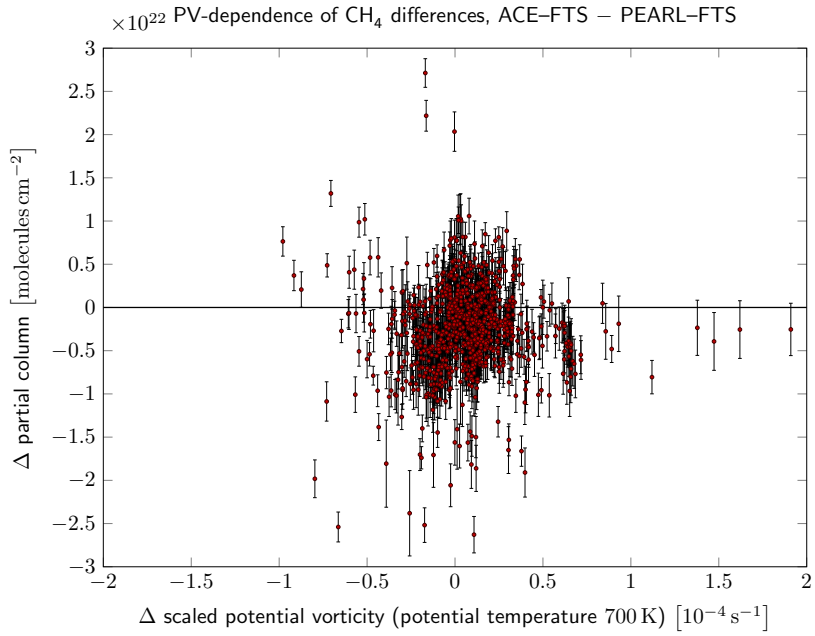

Fig. 1. Partial column differences between ACE–FTS and PEARL–FTS as a function of differences in scaled potential vorticity. Please refer to the main article for details about the origin of the sPV values.