

## ***Interactive comment on “Validation of ACE-FTS v2.2 methane profiles from the upper troposphere to lower mesosphere” by M. De Mazière et al.***

**M. De Mazière et al.**

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We thank both referees for their constructive comments.

Answers to Referee #1

Point 1: The referee questions whether we should talk about a validation - which he/she considers as a comparison against the truth - or rather about an intercomparison between various data sets from different sensors. In the same context, the referee estimates that the word bias also evokes the idea that there is a deviation from the truth. We believe that the word validation in the field of remote sensing of the atmosphere mostly points to a comparison of a new data set (e.g., from a new sensor or a new retrieval algorithm) versus data sets that have been evaluated (characterized) before and that are commonly used to do science. In almost none of the cases, the truth is

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known. So in the strict sense, one can never speak about a validation. Validation must be interpreted as a comparison against a known, previously characterized reference. We believe that this is the commonly adopted interpretation of the word validation in the literature in the field of atmospheric chemistry and physics. Similarly, 'bias' in our terminology refers to a systematic deviation from the reference, without any underlying statement as to what is right or wrong. We could also have used the word 'offset'. But we believe that bias is the more commonly used term.

To make sure that these interpretations are understood correctly by the reader, we will add this explicitly in the introduction (line 8, pg. 17979)

Point 2: Not all the stations use the same microwindows. Still several sites use the same ones. For example the same sets of microwindows are used at Toronto, Jungfraujoch, Kiruna, Izana, Wollongong and St Denis; another set is used at Thule, Lauder and Arrival Heights. Both microwindows sets include absorption lines from 2 methane absorption bands. It has not been verified explicitly that the different choices do not induce a small bias but it does not appear from the results of the comparison with ACE-FTS. We mustn't forget either that the ACE-FTS retrievals themselves use different microwindows at different altitudes, and here also it is supposed that these microwindows give internally consistent results. In the case of ACE-FTS this is even less verified as the microwindows span a much larger spectral range. There are other retrieval parameters that may have an impact on the results. As mentioned in the paper, the retrieval parameters are chosen at each station such as to optimize the retrievals and there is no best set that holds for all the stations simultaneously as these are located in very different situations (different atmospheric conditions, different station heights, ...). The station height itself does not have a direct impact on the comparisons: of course it affects the total column of methane, but the present comparisons only deal with upper troposphere - lower stratosphere partial columns which are not influenced by the height of the station.

At present, it is very difficult to estimate the impact of the assumption of the Voigt

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line shape: the actually used retrieval codes have very limited capabilities to simulate deviations from the Voigt line, and also the spectroscopic parameters for line mixing and Dicke narrowing are badly known. The present HITRAN database provides those parameters only for CO<sub>2</sub>, not yet for CH<sub>4</sub>. As soon as we will have more results from very high resolution laboratory experiments e.g., using very narrow diode laser sources, this kind of estimates should be made.

Point 3: See the answer to M. Lopez-Puertas and the associated additions in the paper.

Point 4: HALOE and ACE are both solar occultation instruments working in the infrared. But HALOE is not an FTS instrument; rather it has filter channels. In the case of CH<sub>4</sub> they use a gas filter correlation technique in the 3.3 micron region (whereas ACE-FTS uses higher wavelengths regions). So the techniques are still sufficiently different that there is no reason a priori that ACE and HALOE would be constrained to agree. More information about the HALOE instrument and retrieval technique and the validation of the HALOE CH<sub>4</sub> data can be found in Russell et al., JGR 98, 10777-10797, 1993 and Park et al., JGR 101, 10183-10201, 1996, respectively. A reference was made in the paper to the latter reference; we will add a reference to the former paper (by Russell et al.) as well. We will also add the above few sentences about HALOE at the beginning of the section about the HALOE versus ACE-FTS comparisons (Section 6).

#### Specific remarks

1. It is true that the introduction about the CH<sub>4</sub> budget could be shortened. But it would reduce the length of the paper by only half a page &#8211; which is not really significant. Also, this shortening was not asked for by the other referee. We believe that it does not make any harm to the paper to leave it in and that it may provide useful background information for the reader. So we prefer to leave it in.

2.

The referee is right. The lower altitude limit of a microwindow is chosen to avoid sat-

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uration (and in some cases to avoid interferences from other molecules). The upper altitude limit of the microwindow is governed by where the absorption lines for the target molecule in the window approach the measurement noise. For molecules like CH<sub>4</sub>, it is not possible to use a single set of microwindows that works over the entire altitude range of the retrieval. We will add this information in the paper, on page 17982, line 3.

Answer to Referee #2

See point 2 and Specific remarks (2) in the answers to referee #1

Additional Remark

We will add a correlation plot of the ACE-FTS versus ground-based FTIR partial column amounts of CH<sub>4</sub> for all the stations involved, in Section 3.2 (Comparison methodology). We believe that it provides a good basis to appreciate the statistical results summarized in Table 3 and discussed in Section 3.3 of the paper.

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Interactive comment on Atmos. Chem. Phys. Discuss., 7, 17975, 2007.

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