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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Validation of ACE-FTS v2.2 measurements of HCl, HF, CCl_3F and CCl_2F_2 using space-, balloon- and ground-based instrument observations" *by* E. Mahieu et al.

Anonymous Referee #2

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This paper compares the results of the ACE-FTS v2.2 measurements of HCl, HF, CCl3F and CCl2F2 with a series of satellite, balloon-borne in-situ and remote, and ground-based FTIR measurements. Overall it provides a useful and comprehensive set of comparable datasets that would enable a potential user of the ACE-FTS data to judge whether the measurements of these gases met their requirements.

General Comments

Spatial Variability : a crucial aspect of any intercomparison exercise of this type is the coincidence criteria. A number of different criteria are used for the different instruments with spatial separations of up to 1200 km. A quantified assessment of the natural

variability over these scales would provide both justification for the criteria used, and an indication of the contribution of the natural variability to the uncertainties in the comparisons.

Expected / required performance levels : at no point is the expected performance of ACE-FTS discussed. Does the performance demonstrated in this paper meet the original specification of the instrument and/or the scientific requirements for atmospheric studies ?

Common presentation of results : it would help the reader if all the results were presented in a common format. For example, Figures 3, 5 6 and 7 all compare HCl profiles, but each one has a different format and gives different information. A common style that gave VMR, difference in ppbv and difference in % would greatly help the interpretation.

Conclusions : The general conclusion that the level of agreement is better than 5-10% for HCl and HF needs stronger justification, particularly as this is one of the headline results from the paper. As a minimum, the appropriate altitude range should be given, as this is clearly not the case at lower altitudes. Also, taking HCl as an example, half of the comparisons (3 out of 6) show the ACE-FTS results to have a significant positive bias. Although the bias to the HALOE results is justified by reference to previous exercises this is not the case for FIRS-2 or SPIRALE, and the possible reasons given in the conclusion are not really consistent with the discussions in the main body of the paper. A quantification of the spatial variability (as discussed above) may help with the justification.

Specific Comments

Pg 3447, lines 28-29 state that the impact of uncertainites in spectroscopic parameters can be neglected. This is only true if the same pressure and temperature profiles are used in both analyses, and this is not the case. Some comment of the impact of using different p-T profiles should be made here or at the end of Section 3.

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Pg 3448, lines 26-27. The extrapolation of the ACE-FTS results to the height of the ground-based site using the FTIR a priori could lead to an artificial correlation of the ACE-FTS and FTIR results. A justification of this procedure should be given.

Pg 3449, lines 4 to 7. What was the objective basis for the altitude range, and is this the sensitivity range given in Table 3 ?

Pg 3450, line 26. Why are 5 sunrise coincidences not enough to give statistical significance ? If the instruments are well characterised and the coincidence criteria are appropriate then there is no reason that even a single profile intercomparison should not provide useful data, as is case with the SPIRALE data.

Pg 3451, lines 5-9. What is the significance of the comparison of the standard deviations ? Presumably the important question is whether both instruments are capturing the same natural variability. If this is the case, then it is the degree of correlation between the two datasets that is important rather than the level of variability, which could just reflect a similar instrumental uncertainty behaviour for the two instruments.

Pg 3454, lines 25-29. What are the uncertainties in the linear fit parameters ?

Pg 3455, lines 1 to 5, the conclusion given here would be better demonstrated by restricting the comparison by latitude rather than by spatial proximity.

Pg 3457, lines 8 to 10. Why shouldnt a direct comparison be made ? Although the HCl and HF measurements are not simultaneous they are presumably often made within 12 hrs of each other, which is within the temporal coincidence criteria used for the intercomparison implying that the HCl and HF fields do not change significantly in this time.

Corrections

Pg 3436, line 23. Section 2 should read Section 3

Pg 3436, line 26. Section 2 should read Section 4

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Interactive Comment

Pg 3448, line 23. Xd in equation 1 is not defined.

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Interactive Comment