

Interactive comment on “Validation of ACE-FTS v2.2 measurements of HCl, HF, CCl₃F and CCl₂F₂ using space-, balloon- and ground-based instrument observations” by E. Mahieu et al.

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We thank the reviewer for his/her comments. Hereafter, we present the original comments/questions [RC] followed by our responses [AC].

[RC]. Pg 3452, line 2 reads "...the geophysical situation is suitable for direct comparisons [between ACE and SPIRALE]." I believe this is incorrect because the air measured by SPIRALE, as described in the following paragraph, likely underwent different chemical absorption/processing for HCl than the air measured by ACE. Thus, the meteorological situation may have been similar, but the geophysical_ situation was likely not. If the authors are going to compare HCl from ACE and SPIRALE under these different conditions, the different chemical processings could be accounted for, but they're

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not. Consequently, the ACE/SPIRALE comparison doesn't add much of value to the paper. I recommend that the ACE/SPIRALE comparison be removed for the sake of brevity, but I don't recommend rejection if it is not. At the very least, however, the line "...the geophysical situation is suitable for direct comparisons..." should be modified to make it clear the authors are referring to meteorology and not chemistry or phase changes.

[AC]. We agree with referee's comment that the sentence "...the geophysical situation is suitable for direct comparisons" needs to be modified to clarify the conditions characterizing the airmasses sounded by the two instruments. In part of the altitude range [20-23 km], geophysical conditions were probably different. The sentence has therefore been modified to "The meteorological situation was considered suitable to allow direct comparison between these two datasets." As to the removal of the comparison between ACE and SPIRALE, we are reluctant to do so since the largest discrepancies were noted between 20 and 23 km altitude, probably because the gondola crossed a PSC. As discussed in the manuscript, this is supported by the HYSPLIT model analysis, by the onboard aerosol counter measurements and by the very low HCl concentrations observed by SPIRALE in this range. At other altitudes (with the exception of the lowermost levels for which the quoted errors for SPIRALE are the largest, see section 3.2), a good agreement is observed between both sets of measurements and deserves to be reported, even if only one coincidence is available. Also, these are the only in situ measurements available for comparison with ACE-FTS.

[RC]. The ACE/FIRS-2 comparisons are troubling because they were taken in different meteorological contexts for which no corrections are made: ACE at the edge of the northern vortex, and FIRS-2 well inside the vortex. As noted in the paper (pg 3443, line 26), "atmospheric subsidence mismatches are anticipated." Under such conditions, altitude is not an ideal axis to show the comparisons, as they do in Figures 6, 11, 14, and 16. Can these not be done against some tracer of vertical subsidence (perhaps N₂O or potential temperature)? Given this, while I don't think it's misleading to present

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the comparison, it's not very informative. I recommend that the authors either correct for subsidence issues or remove the comparisons.

[AC]. Following the suggestion to redo the ACE-FTS FIRS-2 comparisons using another vertical coordinate, we have looked at the match between altitude and potential temperature coordinates. This has indicated that maximum vertical shift resulting from the use of potential temperature would never exceed 0.9km (corresponding to a potential temperature of 340K, around 12km). Over the whole range spanning available measurements from both instruments, the mean computed shift is equal to 0.3km. Hence, it was not anticipated that the use of potential temperature as the vertical coordinate would dramatically impact on the comparison results. This was verified for the four species under investigation here for which the pattern for the absolute and fractional differences are very similar to those initially presented. In order to keep the same vertical coordinate for all comparisons, we have decided to stick to the original figures but have added a brief discussion at the end of section 3.4. Hopefully in the future, it will be possible to identify the cause(s) for the observed discrepancies.

[RC]. Page 3436, line 6: "...have completed the picture for..." Such colloquial expressions, while useful, should be avoided where possible as the meaning may be lost for readers not fluent in English and its idioms.

[AC]. The sentence has been modified to "have provided complementary information for both the source and reservoir species (e.g. Sen et al., 1998)."

[RC]. Figures 1 and 2: It's hard to evaluate the ACE-MLS biases because they've put them on the same scale as the measurements. I suggest over-plotting the differences using a different scale on the right axes.

[AC]. Figures 1 and 2 have been adapted following the suggestion of the referee. Captions have been modified accordingly.

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