

Response to comments #1:

Thanks very much for your comments, suggestions and recommendation with respect to publish this paper in AMT. Our response to all your comments are as follows. There is an extensive discussion among the authors regarding how to revise the content. So the response is delayed, and we are sorry for this.

The work under consideration here is a useful investigation of instrumental aspects of FTIR (Fourier Transform InfraRed) spectrometers and fits well in the scope of AMT. I recommend publication, but I think that the paper would benefit from major revisions.

Response: Thanks very much for your comments and recommendation. The revised paper has been subjected to a major revision based on your following comments and the comments from reviewer 2.

With respect to language, the text is in my impression penetrated with incorrect / awkward phrases. I am not a native speaker, therefore I did not attempt to correct all these flaws throughout the whole paper. Instead, I would recommend a linguistic revision of the whole text: I assume that either one of the coauthors with a good command of the English language or AMT can provide support for this task. In order to give an impression of the error density, I have compiled a list of important corrections for the abstract(see below).

Response: Actually, the language problem was also pointed out before AMTD and then we paid a copy-editing service to improve the language (<http://www.horizonproofreading.org>) in AMTD. Unfortunately, this company is rather slow and has bad quality. In order to sort out the remaining language problem, the revised version is subjected to a second copy-editing by one of the coauthors with a good command of English. I think this version would be much better. If the revised version still don't fulfill the AMT language requirement, we would like to use copy editing service offered by AMT.

Regarding the language problem in the abstract, we already corrected them as your recommendation.

With respect to content, the rather broad focus of the paper seems not particularly fortunate to me: the demonstration that the ILS (instrumental line shape)

characteristics derived from lamp (global, respectively) and solar measurements are in very good agreement seems to me the most interesting finding. This corroborates earlier work which dates back nearly two decades. However, because this consistency is a key assumption when ILS results from lamp measurements are applied for enhancing the analysis of solar spectra, additional empirical support is highly welcome.

Response: Yes, we found lamp and solar ILS results agree well regardless of without inserting attenuators, inserting attenuators at different positions or selecting different field stop. Although it is assumed that the ILS using a lamp, which corresponds to the line shape of the instrument alone, and using the sun, which corresponds to the complete system, such measurements are not a requirement of TCCON measurements. We are not sure, how many groups did actually performed such measurements.

The revised paper is more concise, as your recommendation, and only focus on the finding that lamp and solar ILS results agree well, ILS sensitivity study.

To my knowledge, geometric stops, adjustable irises, etc., are used by several groups in TCCON, but not widely within the IRWG (Infrared working group) of NDACC. In the context of NDACC IRWG, optical bandpass filters are preferred, reducing both the total radiant energy on the detector and significantly improving the SNR of the high resolution spectra. Remaining residual adjustments are typically made by selecting a proper field stop size.

Response: Yes, the TCCON prescribes a constant entrance field stop and insert an attenuator or iris in the light path to adapt the intensity. While the NDACC adapt the intensity by selecting a proper field stop size, together with an appropriate bandpass to reduce the intensity.

It is known from experience, that in the older Bruker instruments the field stops do not produce reproducible and consistent results. This is one of the reasons, why in the TCCON network the entrance aperture is fixed.

However, this paper includes all these situations. Keeping the field stop at 1mm size and inserting attenuators #1 ~ 4 in front of or behind the interferometer are for TCCON case. While changing the field stop size (i.e., using attenuator #5) and don't

insert geometric attenuators are for NDACC case.

The authors should be aware that their results with respect to the ILS effects introduced by stops of different shapes at different position are not of general validity: the effects critically depend on the alignment status of the spectrometer that has been used, especially the alignment status of the collimators inside the chamber containing the beamsplitter (off-axis collimators between input and exit fieldstop) and on the alignment of the optical elements in the detector branch and the positioning of the detector element itself. I agree that the results can be used to infer typical sensitivities, but I doubt that a conclusive recommendation concerning a certain position or shape can be made on these grounds.

Response: The revised paper is more concise, the new version keeps the sensitivity study and removed the content regarding a deduction of certain position or shape can be the best option to adapt the intensity. Now a more conservative conclusion of the sensitivity study is: the insertion of either of the attenuators #1~4 or its derivatives in front of or behind the interferometer could potentially taken to adapt the incident intensity. While selecting a smaller (bigger) entrance aperture to decrease (increase) incoming intensities is less optimal since the mechanical errors of different apertures may be non-negligible and inconsistent. This may be different from one instrument to the other, hence, the mechanical consistency of each field stop is recommended to be further checked before being used.

Even though the ILS effects critically depend on the alignment status of the spectrometer, especially the alignment status of the collimators inside the chamber containing the beam splitter (off-axis collimators between input and exit field stop) and on the alignment of the optical elements in the detector branch and the positioning of the detector element itself, all experiments in this paper were conducted on a well aligned instrument, we believe the study can provide a valuable reference for all TCCON and NDACC communities because all these FTIR networks nearly operate with the same or very similar hardware and software.

The effects of changing the field stop are surprisingly strong (Fig. 9, 10), so I wonder whether the change in field stop size has been updated accordingly in the LINEFIT

analysis?

Response: The results in the revised version has been updated to the proper field stop size. The effects of changing the field stop after updating are weaker than before, but still deviated obviously from other ILSs. So the conclusion of this study was the same as previous version.

For the TCCON ILS investigation the authors used the parameterized TCCON ILS model. This ILS model has been introduced for handling interferometers with dominant shear alignment error, for working out the subtle ILS effects introduced by different attenuators, use of the general ILS model would be more appropriate (demonstrated in the current version of the software).

Response: Already updated to the general ILS model. The results are very similar and do not influence the main point of this study. Actually, the NDACC ILS investigation always used the general ILS model. The deduction are the same as TCCON case.

The final discussion of effects on retrieved profile shapes of NDACC atmospheric species is useful, but previous work on this has been done and should be cited, e.g. the work by Duchatelet et al. on HF (JGR, 2010), or the work by Schneider et al. on O₃ (ACP, 2008).

Response: The two references have already been cited in the introduction section of the revised version.

Regarding the discussion of effects on retrieved profile shapes of NDACC HCl. On the one hand, we think the part about the HCl profile retrieval is a bit thin, and plan to do the study a bit more general, ideally to define maximum ILS variation for each NDACC gas, or take three cases (tropospheric, stratospheric--already done and constant) as examples in the future. On the other hand, we think this part contribute trivially to the main point of this study. Thus, we already removed this section in the revised paper. A more systematic investigation will be published separately.

In conclusion, I would recommend condensing the manuscript to match the format of a technical note, moving the focus towards the finding that lamp and solar ILS results agree well. In addition, a more systematic investigation of the ILS error propagation into partial columns of NDACC target species could be added.

Response: This paper has been condensed quite a lot to a technical note as your comments.

Regarding the investigation of the ILS error propagation into partial columns of NDACC HCl retrieval. On the one hand, we think the part about the HCl profile/column retrieval is a bit thin, and plan to do the study a bit more general, ideally to define maximum ILS variation for each NDACC gas, or take three cases (tropospheric, stratospheric--already done and constant) as examples in the future. On the other hand, we think this part contribute trivially to the main point of this study. Thus, we already removed this section in the revised paper. A more systematic investigation will be published separately.

Required corrections (abstract only): most NDACC : : : -> most NDACC sites take some intensities away -> reduce the radiant energy received by the detector element by using a smaller fieldstop or by inserting an attenuator we investigated the sensitivity of ILS monitoring -> we investigated the sensitivity of the ILS with respect to application of different kinds of stops profile deviations are shown -> the retrieved profile is disturbed resulting ILS errors propagation -> the propagation of the ILS disturbance into the gas retrieval

Response: All these have been done.