Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2016-1-RC1, 2016

Atmospheric Measurement Techniques Discussions

Interactive comment on "Sensitivity of instrumental line shape with respect to different optical attenuators and resulting error propagation into atmospheric trace gas retrievals" *by* Y. W. Sun et al.

Anonymous Referee #1

Received and published: 31 March 2016

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. 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).

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 (globar, 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.

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.

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. The effects of changing the field stop are surprisingly strong (Fig. 9, 10), so I wonder whether the change in fieldstop size has been updated accordingly in the LINEFIT analysis? 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 attentuators, use of the general ILS model

would be more appropriate (demonstrated in the current version of the software). 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).

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.

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

---

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-1, 2016.