**Atmospheric
Measurement
Techniques
Discussions**

Interactive comment on "Source brightness fluctuation correction of solar absorption Fourier Transform mid infrared spectra" *by* T. Ridder et al.

Anonymous Referee #2

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General comment:

This paper presents a method of source brightness fluctuation (SBF) correction that can be applied to interferograms measured with MCT detectors, which were previously considered uncorrectable due to an unknown offset. The method is well explained and clearly presented, and the impact of the correction on retrieved ozone profiles is convincing.

There are, however, quite a few aspects of the correction method that should be discussed in more depth (see specific comments). In particular, I do not see a fundamental difference between the two methods that are compared in section 3.2. (see specific comments on this section for further explanations).

Specific comments:

Introduction, page 446, line 26ff: "We present a method of source brightness fluctuation correction, which is independent of the measured wavelength . . ."

I do not understand this sentence. Why should an SBF correction be wavelength dependent, apart from the fact that different wavelength ranges are covered by different detectors? If this is the point you want to make, then I suggest to replace "independent of the measured wavelength" by "independent of the used detector".

Page 446, line 29: "In addition, we compare our SBF correction method to the method presented by Keppel-Aleks et al. (2007)"

I do not agree with this statement. The SBF correction method presented in this paper deals with the unknown offset of MCT detectors, but the comparison is done for offset-free InGaAs detectors in both cases. See also comments on section 3.2 below.

Page 447, line 10ff: Please indicate which spectral range exactly is covered by which detector for the two spectrometers. A table would be helpful.

Section 2, Method:

How accurate is the determination of the offset? What are the requirements for the accuracy of the offset determination in order to get a good SBF correction? How accurate is the determination of A? Does the interferogram sampling have an impact of the determination of A (e.g. if the interferogram maximum and/or minimum is not hit by a sampling point)?

How do you determine B? Is it determined in the vicinity of the interferogram peaks? How do you make sure that B is measured at the same source brightness as A in presence of source brightness fluctuations?

I assume that the determination of O using equation (6) could be easily done with two different, but stable sources, e.g. by looking at the sun under clear sky conditions

and then looking at a room temperature target. What would be the result of such a characterisation measurement? How does it compare to the methods presented in the paper?

How stable is the offset in time? Is it sufficient to determine the offset once using dedicated measurements or must it be determined regularly during measurement campaigns?

Page 448, line 11ff:

Here you describe the SBF correction using Eq. 1. How do you handle the offset during the processing? Is it subtracted beforehand or is it subtracted within the OPUS software? This is not clear.

Page 448, line 14: "mean over n datapoints"

How large is n? Have you tried different values for n?

Page 448, line 15: "The procedure has the advantage that the correction is independent of the measured spectral region and it can be applied automatically and instantanously together with the measurement process."

1) Advantage: An advantage when compared to what?

2) Independent of the measured spectral region: Again, I guess you mean it is independent of the used detector (the dependency on the spectral region is then implicit, because different detectors are used in different spectral regions).

3) How do you handle the offset in this automatic application? Is the offset also determined automatically? If yes, which method is used?

Please clarify.

Section 3.1, Fig. 3, left (interferograms)

At page 447, line 10, you state that the instrument has measured in DC mode. In figure

3, however, you present AC and DC data. Please explain how the AC data has been generated. The interferogram intensity is given in %. What is the reference, i.e. what corresponds to 100 % (same question for Fig. 4)?

Section 3.1, Fig. 3, right (spectra)

Please indicate where the zero level is. A difference plot showing the residual between the two spectra may be instructive.

Figure 3 is densely packed with information. I suggest to enlarge the plots and to use the full width of the page for the interferograms as well as for the spectra (and to supplement the spectra by adding a difference plot).

Page 449, line 24: It is not obvious to me why the SNR should improve by the SBF correction. Some explanation for this improvement would be helpful. How has the SNR be determined? Is the increase from 156 to 164 significant or is it within the accuracy of the SNR determination?

Page 449, line 27: What is the explanation for the oversaturation in the spectral range between 990 and 1070 cm-1?

Section 3.1, figure 4: How has the offset been determined for these data? Has the same offset been used to correct all three interferograms?

Section 3.2 (page 451ff):

The new SBF correction method presented up to know determines and subtracts an unknown offset from the detector DC signal prior to the normalisation of the interferogram. This is in my opinion the essential innovation with respect to the method presented by Keppel-Aleks et al.

For offset-free detectors, the differences in the two methods are reduced to the application of different spectral lowpass filters that are once applied in the spectral domain (Keppel-Aleks et al.) and once in the interferogram domain (this paper). Smoothing

the interferogram is equivalent to a convolution with a rectangle, where the width of the rectangle is determined by the number of datapoints n over which the running mean is calculated. A convolution of the interferogram with a rectangle corresponds to a multiplication of the spectrum with a sinc function. This sinc function then serves as a lowpass filter.

So, in fact, the comparison presented in section 3.2 is not really a comparison between two methods but a comparison between two different ways of applying a lowpass filter while using, in principle, the same method. Since none of the filters is described in detail, the evaluation of this comparison is difficult.

It seems, however, worthwhile to evaluate the effect of the filter parameters on the accuracy of the method. Such a study should not only comprise two examples of lowpass filters as it is done in the present paper, but it should be performed in a more systematic way, investigating the effect of different filter widths and filter forms (and maybe also discuss the differences when the filter is applied in the interferogram or spectral domain, respectively).

Therefore I suggest to discuss the effect of the different filters in more detail and in a more systematic way in this section.

For the actual comparison of the different methods (SBF correction for detectors with an unknown offset vs. SBF correction for detectors without offset) it would be instructive to compare vertical profiles (or total column concentrations) of species that are measured with different detectors, preferably in the same spectral range. Is there a spectral overlap between InSb and MCT detector that would allow such a comparison? If not, is it possible to find one or more species where a comparison of total column concentrations derived from different spectral ranges with different detectors could be sensible? Such a comparison would enhance the value of this paper.

Technical corrections:

Page 447, line 9: "an increased appearance of clouds *was* expected"

Page 448, line 17: instantanously -> instantaneously

Page 450, line 16: identically -> identical

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 443, 2011.