

Atmos. Meas. Tech. Discuss., referee comment RC3
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Comment on amt-2021-121

Anonymous Referee #2

Referee comment on "Introduction to the ringing effect in satellite hyperspectral atmospheric spectrometry" by Pierre Dussarrat et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-121-RC3>, 2021

The paper under discussion now at AMT, "Introduction to the ringing effect in satellite hyperspectral atmospheric spectrometry" by Dussarrat et al. is a novel and important contribution to the field of FTS.

The typical approach when specifying the Instrument LineShape (ILS) of an FTS sensor is to provide the Maximum Optical Path Difference (MOPD) value and the beginning and ending wavenumbers of the useful parts of the output (radiance) spectrum, and the calibration algorithm/process then removes various other artifacts, such as ILS distortions due to the off-axis effects, re-sampling to a standard output wavenumber scale and other effects specific to a given sensor. When simulating a spectrum (for example using a radiative transfer algorithm), the user therefore typically does not need to know anything other than the MOPD and spectral output range, and in the process of computing the spectrum an artificial function is typically used outside the wavenumber range of interest to smoothly scale the spectrum down to zero in order to limit in-band Gibbs effect ringing. For sensors which produce unapodized (or lightly apodized) spectra, this paper introduces an effect due to the non-flatness of the uncalibrated spectra which has an effect on the ILS which is typically not accounted for in the calibration process, and which is important to understand for sophisticated users of the data.

Individual comments, suggestions:

Paragraph beginning on line 25: Suggest that the authors should clarify what Revercomb meant by "true rining", as my interpretation is that he did not represent this as a hardware error but rather the same ringing effect described in this paper and not

accounted for (yet) in the calibration algorithm/processing of CrIS data.

The description of the effect starting on line number 75 is very good.

The paper includes two important cases of a linear gradient in $R(\nu)$ (section 2.4) and an etalon effect (section 2.5). While not required, another important and common case is that where $R(\nu)$ goes to zero at a spectral distance which is not far from the spectral output range. This is an important case, and also a case which may require additional information in the correction process, as there is missing information in the original observations.

In Section 3 (Simulation), the simulations are performed for a MOPD of 1 cm. Suggest also considering case where the MOPD is 0.8 cm, because this is closer to real world examples (CrIS and MTG-IRS). In the Longwave Band, and with the interferogram resonance at 0.64 cm due to the near constant line spacing of CO₂ absorption lines, the interferogram amplitudes at MOPD are larger than at 1 cm, so the resulting ringing effects may be larger.

Line 220: Suggest confirming with Tobin and Taylor on the status of conclusions for a correction algorithm for CrIS. In addition, aside from a correction algorithm to produce spectra which have this ringing effect removed, it is also a consideration to include $R(\nu)$ in the Line-by-line and Fast Model radiance calculations, such that calculated and observed spectra have the same ringing effect, and a correction algorithm may not be needed.