Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2019-270-AC4, 2019

Atmospheric Measurement Techniques Discussions

Interactive comment on "In-flight calibration and monitoring of the TROPOMI-SWIR module" *by* Tim A. van Kempen et al.

Tim A. van Kempen et al.

t.a.van.kempen@sron.nl

Received and published: 1 November 2019

We would like to thank the referee for their time and effort in reading and reviewing our paper with constructive comments. Please find our answers to your comments below in italics

General Comments: As most of the issues in this paper were already covered by the comments of anonymous referees 1,2 and 3, I will mostly focus on issues not sufficiently covered by the other reviewers. I agree with referee 3, that the techniques discussed in this manuscript have already been presented elsewhere in the literature and therefore are not novel, but the docu- mentation of the TROPOMI instrument status is in itself a useful and important work. Therefore I also recommend publication after

minor corrections.

As however the manuscript seems largely to be extracted from a status report, I would suggest changing the title of the manuscript to "Technical Note: In-flight calibration and monitoring of the TROPOMI-SWIR module".

We have contacted the editor about this suggestion.

I also recommend adding consistent captions to all figures (e.g. figure 6: [e-/sec] is missing, figure 8: electronic offset is reported in V, rather than in [e-] and therefore magnitude and variation of the offset could not be compared quickly to the magnitude of the DC variation).

This was done, see also other Author comments

I also wonder, why the eclipse side of the Earth was assumed pre-launch as dark, as black body radiance at âĹij 293K is non zero in the spectral range > âĹij 1750 nm. There- fore it is not astonishing, that the TROPOMI-SWIR module detects thermal radiation of the earth with the FFM open.

Although it is indeed not surprising, the variation of the thermal radiation (i.e. the ease with which differences between 280 and 293 K could be detected, as well as the presence of point sources)

When discussing the DC, it should be mentioned that the DC consists of two primary components, Detector DC and DC introduced by the thermal radiation of the instru- ments optical bench itself.

This is included in a footnote now.

Reviewer 3 also asks if there is a mask implemented on the detector. Some literature research (i.e. Paul et al., Characterization and correction of stray light in TROPOMI-SWIR) reveals, that "In the grey area, the light is blocked by the entrance slit of the spectrometer (top and bottom) or a shield at the detector (left and right)", see caption

“Figure 2” of this manuscript. As shielded rows represent an excellent possibility to disentangle detector dark current from ambient dark current (produced from the optical bench), I would strictly recommend expanding the DC analysis including that dataset, given that such data is available. Such data could also reveal potential problems with dark signal shifts known to exist when illuminating larger parts of MCT-SWIR detectors, see for instance: Chapman et. al, “Spectral and Radiometric Calibration of the Next Generation Airborne Visible Infrared Spectrometer (AVIRIS-NG)”, and according explanation of pedestrial shift.

This was considered. However, the shields and areas around the entrance slit are kept at the similar temperatures as the optical bench and the detector DC was found to vary over larger or at least similar scales as any temperature difference (see Fig. 5, prey. Fig. 4). Hence disentangling the contributions from the detector dark current and ambient dark current has proven to be non-trivial.

As mentioned by Paul et al. light on the SWIR detector is also blocked by the entrance slit on top and bottom of the spectrometer. Typically, such measurement could be used to assess the In-Band stray light level of the instrument. Therefore I recommend to add an according analysis, if such data is available for the TROPOMI SWIR spectrometer module.

This was considered, but found to be beyond the capability of the available data. It was found that such an analysis would only work for straylight in the spectral directions and with the availability of only a diode laser (SLS) instead of a point source (as used in Tol et al.) this analysis would be unable to distinguish from purely spectral and spectral-spatial straylight. Also, the location of the nearest diode lasers to the edges of the spectral slit are still significant.

Can you furthermore give more explanation on the possible cause of the fringes observed in Fig. 12, top (DLED measurements) ?

This was added.

In addition I would recommend adding sketches of the optical path for the different measurement configuration as these will ease up to follow the different optical configurations mentioned in the manuscript.

A new figure 1 with accompanying text was added.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-270, 2019.