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Atmospheric Measurement Techniques Discussions

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

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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

Figure 4: There's no mention of the linear features in the radiances at indices 400 and 500 - are these dark flux or something else? Is there a mask on the detector for the top and bottom rows? The results look very different compared to the middle of the detector.

The line at index 400 is an unexplained higher dark flux (now referred to as dark current, see response to the other referee). Note the higher dark current is only 5-10%. The

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uncertainty in the dark current fit is much higher. The line at index 500 is the edge of the ADC, also causing a higher dark current. Note that both increases are significantly lower than the useful signal.
The top and bottow rows are indeed covered and not illuminated

Page 8, Line 3-4: Did they not have any thermal measurements for an actual comparison? This difference may be important.

The measurements during the on-ground calibration were taken at a slightly different instrument temperatures. This explains the small differences observed. measurements with different thermal conditions were scheduled for the in-flight E1 phase, but not executed.

Figure 7: There's a pretty distinct discontinuity in the offset at the middle of the detector, but I don't see any discussion of this in the text.

This is mentioned on page 12, lines 3-5. Note that the discontinuity is at the level of 0.3 mV, so less than 0.1% of the absolute offset.

Figure 8: There seems to be a linear trend in the median offset, but that could be an artifact of the statistics rather than a real thing. Which is it?

This is indeed an artifact of the statistics. The longer time period -as shown in figure 19- does not show a linear trend.

Figure 11: How is it possible that the number of bad/dead pixels decreases with time? Did your criteria change?

There are a few reasons. First, the thermal stability of the various components during on-ground calibration was much worse then it is now in-flight. This causes a much better characterization of the noise behavior of each pixel in-flight due to the better thermal stability in-flight. However the measurement uncertainty of the noise is worse due to fewer measurements. Second, noise/RTS behavior of individual pixel change after annealing of the detector. Annealing automatically occurs when the detector is

heated up to room temperature and subsequently cooled down again. Annealing occured between OCAL and launch and several times during E1 due to the specific commissioning planning. An additional annealing took place during orbit 3500 due to a spacecraft anomaly. The decrease seen in Fig. 11 is most likely caused by the start of nominal operations, which stabilized the thermal environment as no more 'exotic' calibration measurements were taken.

Figure 17 shows that this could be a 1% error, which is significant for trace gas retrievals.

There is a difference between a 1% error in the actual ISRF and a 1% change in the SLS response using a stationary or oscillating diffuser. A stationary diffuser introduces speckle patterns. It is these speckle patterns that introduce the difference shown here. This is not in the ISRF itself. Uncertainty in the ISRF is much lower and discussed in van Hees et al., 2018.

Page 17, Line 5-6: This is really only a measurement of a small area of the bandpass. Is there any reason to assume that this is representative of all of the other wavelengths as well? Please note that I realize this is a heroic effort to track stray light.

We can cover five small spectral regions of the bandpass, which are regularly spaced. These all show very similar patterns and all confirm the assumed uniform straylight behavior previously measured on-ground with external light sources (see Tol et al., 2018). As far as we can tell from these bandpasses it is representative for the entire detector. It is possible the straylight is not representative anymore for a small bandpass in between the five probed bandpasses, without affecting the measured bandpasses. However, we consider this effect to be highly unlikely. Given typical origins of changes in straylight most likely are large-scale (with the exception of ghosts).

What is the difference between Figures 16 and 17?

Figure 16 shows the range of measurements probing all the rows. This shows the

median and the 1 and 99% of each row. Figure 17 shows the two medians (which are indeed the same as the medians in Figure 16) and the residual. This was first presented in a single figure, but the figure became too information-dense.

Page 26, Line 2: I disagree, the offset image in Figure 7 shows a pretty clear difference.

Given the scales I respectfully disagree. We did rephrase it by adding the word 'significantly'.

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