

1. General comments

The paper is well written and gives a good overview of status of the SWIR module on board the S5P satellite. It is great news that the SWIR module is showing stable behaviour.

Although the overall quality of the paper is already high, there are a number of points where the structure and phrasing can be changed to improve the overall readability.

The structuring of the paper can be improved. The splitting of the paper into commissioning phase and monitoring appears forced and makes the paper longer than necessary. Some data seems to be duplicated over the various plots adding to the length of the paper.

Section 2 of this review lists specific comments and questions about the content and understanding of the paper. Section 3 gives specific suggestions to re-structure the paper. Section 4 contains suggestions where to edit the text and plots to allow for a smoother read. It also lists minor spelling and grammar errors and formatting issues.

Once the points in Section 2 and 3 are clarified, I would strongly recommend the paper for publication.

This review is based on the version amt-2019-270.pdf retrieved on the 5th of September from <https://www.atmos-meas-tech-discuss.net/amt-2019-270/>.

2. Specific comments

#	Page	Line	Section	Comment
SC1	1	20	1	Haven't smaller spatial pixels been implemented in the mean time? This might be worth mentioning.
SC2	2	17	1	"Derivations of the ISRF": Are the different derivation approaches for the ISRF reported in the cited article or is the plural form a typo? If there are multiple ways it might be good to write this more explicit.
SC3	2	19/20	1	This sentence is a bit confusing and seems not very accurate. Please specify the internal sources and maybe re-phrase the sentence by starting with transmission changes.
SC4	3	1	2.1	It is worthwhile to mention the two internal solar diffusers here.
SC5	3	4	2.1	"Background measurements": Later you introduce background measurement with an open and a closed folding mirror, it would be useful to already introduce the two different types here.
SC6	3	10/11	2.1	Are SLS and WLS following the complete optical path or not? The two sentences seem to contradict each other. What do you call the complete optical path? The path the radiance takes or the path the irradiance takes?
SC7	3	16	2.1	SLS passes over: Isn't the light reflected off the side of the solar diffuser? Or does it pass through it? Are both diffusers used with the SLS?
SC8	3	25	2.2	Are all detector pixels illuminated and used for science?

#	Page	Line	Section	Comment
SC9	4	Table 1	2.2	The terms static and dynamic are not explained. Are these terms relevant? If not, remove them.
SC10	4	7/8	2.2	So it doesn't depend on the exposure time but on co-addition if a correction is applied or not? The first sentence is confusing.
SC11	4	11/12	2.2	The figure is specific to a certain correction? This is not clear from the sentence.
SC12	5	Fig. 1	2.2	Are these all processing steps for the SWIR module? There seems to be no non-linearity, memory effect or exposure time correction. Please adapt the caption to make clear it's a simplified scheme or complete the flow chart.
SC13	5	1	3.1	The term "flux" is rather ambiguous and at least in physics associated with a current through an area. The term dark current might be less ambiguous.
SC14	6	9	3.1.2	Is this also visible in a geo-plot of the Earth? A plot would be nice to illustrate your point.
SC15	7/8	1/Fig. 4	3.1.2	The term dark flux is used for the background radiance that can be confusing.
SC16	7	10/11	3.1.2	This sentence is not entirely clear: I assume it is the signal that varies over time? The on-ground value is constant (I assume), so there is no need to refer to the difference, or is there?
SC17	8	Table 2	3.1.2	Is the orbit from nominal operations with open or closed FMM? What is meant by On-ground Diff.? On-ground minus in-flight or the other way around?
SC18	9	Fig, 5	3.1.2	"commissioning phase": shouldn't it be E2 phase according to the orbit range you specify in Section 1?
SC19	9	Fig, 5	3.1.2	Is the mapping between columns and spectral direction exact or is there a spectral smile? (Also Fig. 7)
SC20	9	Fig. 6	3.1.2	Why is there a gap in the plot?
SC21	10	6	3.1.3	Is temperature data available? Can you confirm your assumption?
SC22	10	12	3.1.3	This is not very clear, is it the same as in 3.1.1 line 9? Why the requirement of 40 %?
SC23	10	17	3.1.4	So there are no shielded or non-illuminated pixels on the detector which can be used for monitoring?
SC24	12	4/5	3.1.6	So there is a different ADC for the two sides of the detector? This should be mentioned. Are the ADCs located at different places? Is the effect included in the L1 offset correction?
SC25	12	9/12	3.2	The definitions in line 9 and 12 of in-flight noise are not the same.
SC26	12	29 ff	3.3	What are the criteria for 'proper' and 'excessive'? The explanation is not any clearer than 'sufficient quality'. Please provide quantitative criteria.
SC27	13	6/7	3.3	Why are non-illuminated pixels described as non-functional?
SC28	14	Fig. 11	3.3	Does this plot include the non-illuminated pixels?
SC29	15	Table 3	3.3	So the non-illuminated pixels are included in these numbers? Please list them separately.
SC30	15	Table 3	3.3	The number of bad and dead pixels decreased compared to on-ground. Is this caused by detector annealing during the de-gassing?

#	Page	Line	Section	Comment
SC31	15		3.4	It would be useful to make clear there are two solar diffusers, so “with two on-board diffusers” and “sources and the diffusers are...”
SC32	15	19/20	3.4.1	On page 3 line 9 it is described that the DLED light does not pass through the grating, and now the grating is seen as the cause for the feature. How is this possible?
SC33	16	3	3.4.2	What do you refer to as “the complete light path within the module”? Where is the primary mirror? From the TROPOMI L1 ATBD I get the impression, that the primary telescope mirror is included in all optical paths for all sources (apart from the DLED)
SC34	16	5/6	3.4.2	From the page mps.tropomi.eu/calendar measurement search I find 4 WLS modes with three different exposure times for SWIR using DIFM SLS (#4) or DIFM NOM (#1). The longest exposure time I find is 88ms; this isn't entirely consistent with your statement.
SC35	18		3.5	Please add that the stray-light is normalized to the peak value and that a spectral band as opposed to a spot (on-ground) is illuminated.
SC36	19	5	3.6	The measurements in Figure 5 are performed with oscillating diffuser?
SC37	21	11-12	4	There are no examples provided on the in-depth analysis, so I would either remove this sentence or provide the examples.
SC38	20	Fig. 18	4.1	All points of Fig. 6 are included in Fig. 18.
SC39	21	Fig. 19	4.1	All points of Fig. 8 are included in Fig. 19.
SC40	21	15	4.1	In the introduction you state that orbit 2818 is on the 30 th of April 2018, the plots start earlier.
SC41	21	17	4.1	Large scale variations...: It might be useful to show how the module behaves in non-nominal situations. The data could be shown in a different colour in the same plot. Or is this inflating the scale?
SC42	22	2-3	4.2	Please combine with Section 3.2.
SC43	22	2-3	4.2	In the introduction you state that orbit 2818 is on the 30 th of April 2018, the plots start earlier.
SC44	22		4.3	Are all the numbers on dead and bad pixels without the shielded pixels?
SC45	23	Fig. 21	4.3	It seems like all points from Fig.11 are included in this plot. Combine the two plots.
SC46	23	2	4.4	Why should a relative irradiance factor change over time? Shouldn't that show in a seasonal effect? This hypothesis should be explained better or be removed. Did you exclude heating up of the calibration unit or offset effects? Usually degradation effects are observed to be proportional to exposure; however both diffusers seem to show the same slope. So a change in diffuser reflectivity with the same slope for both is unexpected. Do you observe any change with a similar slope for radiance?
SC47	24	3	4.5	The DLED and the solar irradiance cover different optical paths, to exclude the detector responsivity cannot be concluded by the increase in solar irradiance. The increase could be much larger covering a decrease. Is there another means to exclude the detector? Maybe radiance data?

#	Page	Line	Section	Comment
SC48	25	2	4.5	Ok, the WLS confirms the DLED degradation. Does the WLS then exclude heating or degradation of the calibration unit?
SC49	24/25		4.5	Consider combining this section with Section 3.4
SC50	25		4.6	Combine this section with Section 3.6. The conclusions are the same as for the commissioning phase. Is it the stability or the accuracy with which the ISRF is determined?
SC51	25		4.7	Combine with Section 3.5. The plot and Table 4 could be put next to each other.
SC52	26	Fig. 26	4.7	Can the outlier around orbit 7000 be explained?
SC53	26		5	You have not shown any results on the SWIR behaviour during manoeuvres, yet you bring it up only in the conclusion. It is an important point and should also be discussed with the relevant CKDs.
SC54	26	12	5	You have not discussed changes to the key data or processor in the paper. Why do you then introduce “ample changes” in the conclusion? This is giving a rather disturbing impression considering that the module is so stable. Please clarify this. Or did you want to use a different word than “ample”?

3. Structure

There are a few sections which are overlapping quite a bit in content and part is duplicated in the monitoring sections. It is not entirely clear to me why the distinction between measurements from the commissioning phase and regular monitoring has to be made for the DLED and the WLS. These could be combined.

All points of Fig. 6 are included in Fig. 18, combine the plots. The same holds for Fig. 8 and 19. If you want to distinguish between commissioning and nominal operations you could add vertical lines.

Section 4.2 consists of a single sentence; this surely can be combined with the earlier section on noise?

Figure 11 seems to be fully contained in Fig.21. Please combine the plots, the start of nominal operations can be indicated by a vertical line.

The sections on ISRF and straylight could easily be combined with the earlier commissioning phase sections.

4. Technical corrections

4.1. Formatting of plots

Figures 2 and 3: The contrast of the plots is not very good; please consider using a different colour map.

Figures 4, 5, 7, 9, 10 and 12: please specify in the y-axis label what “value” is. Also make clear in the plot or the caption what is meant by difference.

Figure 6: There is no y-axis label.

Figure 11: What is the vertical line showing? Please add in the caption. Also add “dead (top plot) and bad (bottom plot)”.

Figures 16 and 17: The assigned colours for with and without oscillations are turned around between the plots. The caption of Figure 16 is not explaining the different plotted ranges. Figure 17 shows the median of the ISRF measurements? Please make this clear in the caption.

4.2. Typos and phrasing

For the following words, the spelling/capitalisation is not consistent throughout the article:

- Sun – sun
- Calibration Unit – calibration unit
- The word ‘data’ is used both in the singular and the plural, please pick one of the two
- Section – section

Note, that this list is not complete.

Please reconsider you capitalisation, either capitalise all new abbreviations or none, for example “Calibration Unit” but “folding mirror mechanism”. The AMT guidelines states “A capitalised abbreviation does not necessarily warrant the capitalisation of the written-out form”, so the recommendation is to not capitalise new abbreviations.

It also recommended to use only one variety of spelling, so either British or American English. In the manuscript the words maneuver (AE), hypothesize (AE) and analyse (BE) can be found.

The word “data” is used as a singular (p 14) and plural noun in the manuscript please use only one of the two forms.

Units are recommended to be formatted with exponent: es^{-1} instead of e/s.

#	Page	Line	Section	Comment
TC1	1	15	1	The Sentinel-5 missions
TC2	2	6	1	mean local solar
TC3	2	16	1	Corrections
TC4	2	16	1	calibration key data
TC5	2	28	2	... during the on-ground
TC6	2	29	2.1	Monitor the quality of these on-ground measurements: the instrument stability and performance is monitored with respect to the on-ground measurements. The on-ground measurements will surely not change?
TC7	2	32	2.1	For the night side the word backscattering is misleading.
TC8	3	17	2.1	Due to a limited
TC9	4	Table 1	2.2	... different lights → different light sources
TC10	4	10	2.2	... algorithm. The
TC11	6	Fig. 2	3.1.2	Basra. Any
TC12	6/7	Fig. 2/3	3.1.2	... sources on the Earth

#	Page	Line	Section	Comment
TC13	6	2	3.1.2	Figures 2 and 3 show
TC14	7	6	3.1.2	... difference in spreads
TC15	7	9	3.1.2	... methane is causing
TC16	8	2	3.1.2	... to the different
TC17	8	Table 1	3.1.2	FMM open, FMM closed, Nominal operations
TC18	9	Fig. 6	3.1.2	length of time or time span
TC19	10	24	3.1.4	... thus leading to ...
TC20	10	28	3.1.5	Land/sea → land–sea (en-dash (-- in latex))
TC21	10	31	3.1.5	Do you mean orbit correction or no orbital dependency is detectable?
TC22	11	Fig. 7	3.1.5	Is shown or can be seen not “is seen”.
TC23	12	17	3.2	Therefore
TC24	14	Fig. 10	3.3	Note that the ...
TC25	15	Table 3	3.3	210,000 pixels.
TC26	15	15	3.4.1	...reference.
TC27	16	2	3.4.2	... acts ...
TC28	16	3/4	3.4.2	The main...wavelengths. This sentence can be deleted; the next sentence has the same content.
TC29	16	11	3.5	...used, is described
TC30	16	13	3.5	... any location on the SWIR ...
TC31	17	2	3.5	, Section 3.
TC32	18	3	3.5	, shown in Table 4.
TC33	18	9/10	3.6	Consider re-phrasing this sentence to avoid having “van” at the beginning of the sentence. Or can the “V” be capitalised?
TC34	19	2	3.6	In this paper results ..., are presented, but all conclusions...
TC35	20	3/4	3.6	T_he
TC36	20	4	3.6	life limited
TC37	23	1	4.4	The however refers to the degradation not to the parallel usage for all channels. Change the order of the sentences or remove the however.
TC38	26	Fig. 26	4.7	... see Table 4
TC39	26	2	5	... Section 3
TC40	26	4	5	... Section 4
TC41	27	3		IA interacted with other... OR: IA formed the interface to other ...