PREPARATION AND OPERATIONS OF THE MISSION PERFORMANCE CENTRE (MPC) FOR THE COPERNICUS SENTINEL-3 MISSION

S3 SLSTR Cyclic Performance Report

S3-A

Cycle No. 055

Start date: 11/02/2020

End date: 09/03/2020

S3-B

Cycle No. 036

Start date: 21/02/2020

End date: 19/03/2020



Mission
Performance
Centre

SENTINEL 3



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Changes Log

Version	Date	Changes
1.0	26/03/2020	First Version

List of Changes

Version	Section	Answers to RID	Changes



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1 Processing Baseline Version

IPF	IPF / Processing Baseline version	Date of deployment
	S3A	
SL1	06.17 / 2.56	CGS: 15/01/2020 11:36 UTC
		PAC: 15/01/2020 11:36 UTC
SL2	06.16 / 2.61	PAC: 15/01/2020 11:36 UTC

IPF	IPF / Processing Baseline version	Date of deployment
	S3B	
SL1	06.17 / 1.28	PAC: 15/01/2020 11:36 UTC
SL2	06.16 / 1.33	PAC: 15/01/2020 11:36 UTC

Note that more details of the processing baseline version can be found in the SLSTR Product Notice.

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2 Instrument monitoring

2.1 Instrument temperatures

As a thermal infrared instrument, thermal stability and uniformity of the optical mechanical enclosure (OME) is critical to the radiometric calibration. Figure 1 and Figure 2 show the orbital average temperature of the OME and instrument baffles for SLSTR-A and SLSTR-B during the cycle. The temperatures were stable (on top of a daily variation cycle).

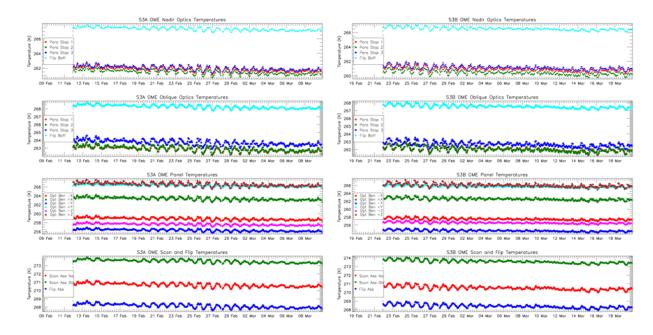


Figure 1: OME temperature trends for SLSTR-A Cycle 055 (left) and SLSTR-B Cycle 036 (right) showing the paraboloid stops and flip baffle (top two plots) and optical bench and scanner and flip assembly (lower two plots). The vertical dashed lines indicate the start and end of the cycle. Each dot represents the average temperature in one orbit.

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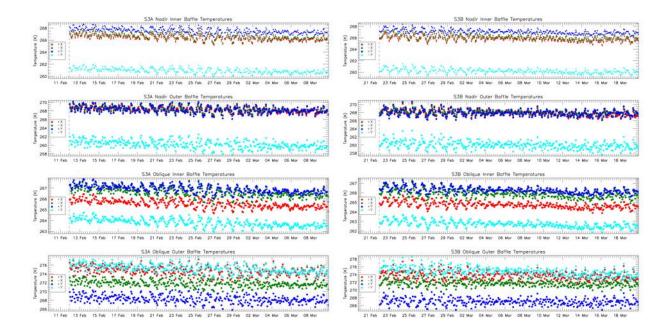


Figure 2: Baffle temperature trends for SLSTR-A Cycle 055 (left) and SLSTR-B Cycle 036 (right). The vertical dashed lines indicate the start and end of the cycle. Each dot represents the average temperature in one orbit.



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2.2 Detector temperatures

The detector temperatures for both SLSTR-A and SLSTR-B were stable at their expected values following the latest decontamination phases. Decontamination was performed for SLSTR-A in Cycle 054 between 3rd and 11th February 2020. Decontamination was performed for SLSTR-B in Cycle 030 from 19th to 25th September 2019. Decontamination involves warming up the infrared focal plane assembly (FPA) in order to remove water ice contamination from the cold surfaces. Figure 3 and Figure 4 show the SLSTR-A and SLSTR-B detector temperatures for the past year. The decontaminations are clearly visible as a rise in detector temperature.

A few orbits (Cycle 43, 49) show slightly lower average SLSTR-A detector temperatures due to instrument tests that were performed on those days. The detector temperatures for SLSTR-B show a few orbits in Cycle 29 with lower VIS channel temperatures corresponding to the start and end of the SLSTR-B blackbody crossover test.

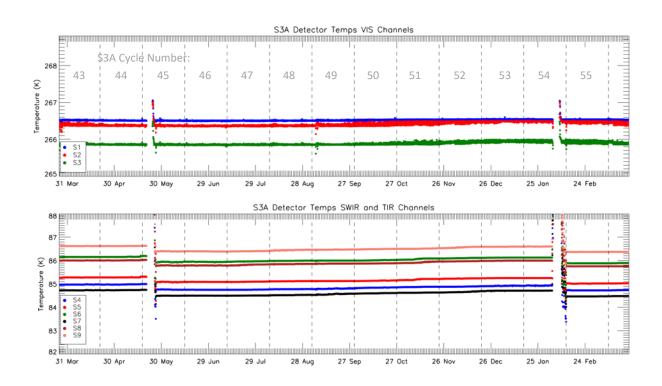


Figure 3: SLSTR-A detector temperatures for each channel for the last year of operations. Discontinuities occur for the infrared channels where the FPA was heated for decontamination. The vertical dashed lines indicate the start and end of each cycle. Each dot represents the average temperature in one orbit. The different colours indicate different detectors.

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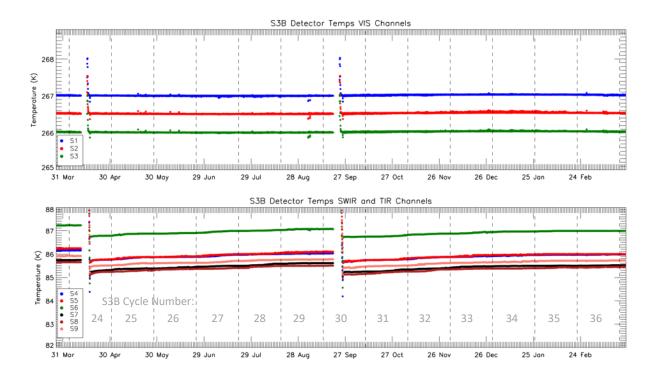


Figure 4: SLSTR-B detector temperatures for each channel for the last year of operations. Discontinuities occur for the infrared channels where the FPA was heated for decontamination. The vertical dashed lines indicate the start and end of each cycle. Each dot represents the average temperature in one orbit. The different colours indicate different detectors.



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2.3 Scanner performance

Scanner performance has been consistent with previous operations and within required limits for SLSTR-A and Figure 5 shows the trends in Cycle 055.

Figure 6 shows the trend for SLSTR-B in Cycle 036. Although the values are generally within the required limits, the scan and flip mirror deviations have larger variations than for SLSTR-A. This should be monitored carefully to make sure the jitter statistics do not get worse in the longer term.

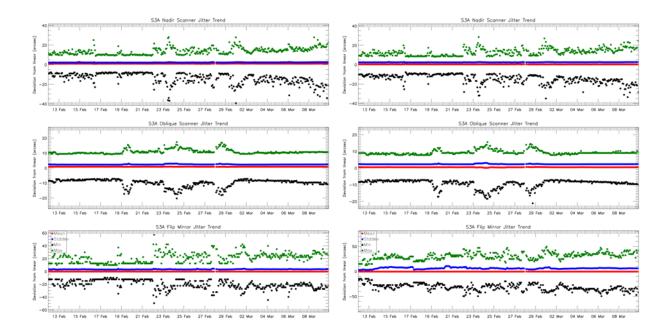


Figure 5: SLSTR-A scanner and flip jitter for Cycle 055, showing mean, stddev and max/min difference from expected position per orbit (red, blue, green and black respectively) for the nadir view (left) and oblique view (right). The plots show the nadir scanner (top), oblique scanner (middle) and flip mirror (bottom).

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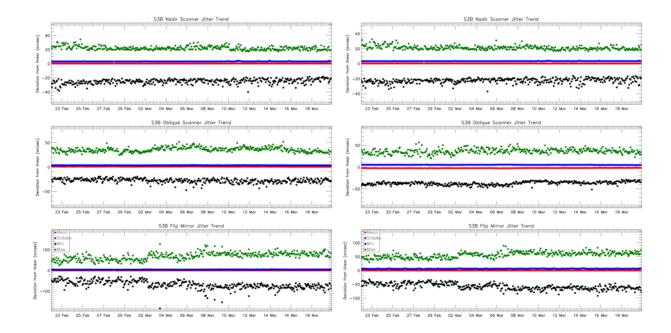


Figure 6: SLSTR-B scanner and flip jitter long term in Cycle 036, showing mean, stddev and max/min difference from expected position per orbit (red, blue, green and black respectively) for the nadir view (left) and oblique view (right). The plots show the nadir scanner (top), oblique scanner (middle) and flip mirror (bottom).



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2.4 Black-Bodies

The orbital average blackbody temperatures for SLSTR-A are shown in Figure 7, and SLSTR-B are shown in Figure 9. The temperatures were stable on top of a daily variation cycle. There are also longer term cycle-to-cycle trends which show a yearly variation, with temperatures rising as the Earth approaches perihelion at the beginning of January (see Figure 8 and Table 5). Figure 7 and Figure 9 show the gradients across the blackbody baseplate (i.e. each PRT sensor reading relative to the mean). The gradients are stable and within their expected range of ± 20 mK, except for the +YBB for SLSTR-B which has a higher gradient. This higher gradient is expected and consistent with measurements made before launch.

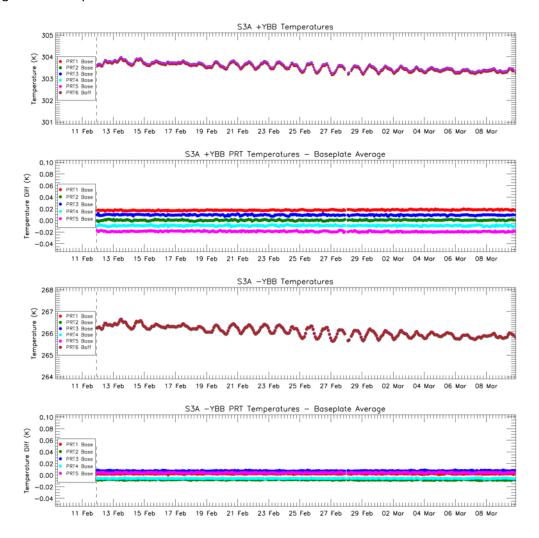


Figure 7: SLSTR-A blackbody temperature and baseplate gradient trends during Cycle 055. The vertical dashed lines indicate the start and end of the cycle. Each dot represents the average temperature in one orbit.

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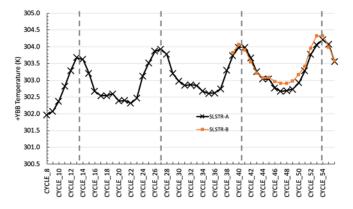


Figure 8: SLSTR-A and SLSTR-B long term trends in average +YBB temperature, showing yearly variation. The vertical dashed lines approximately indicate the 1st January 2017, 2018, 2019 and 2020.

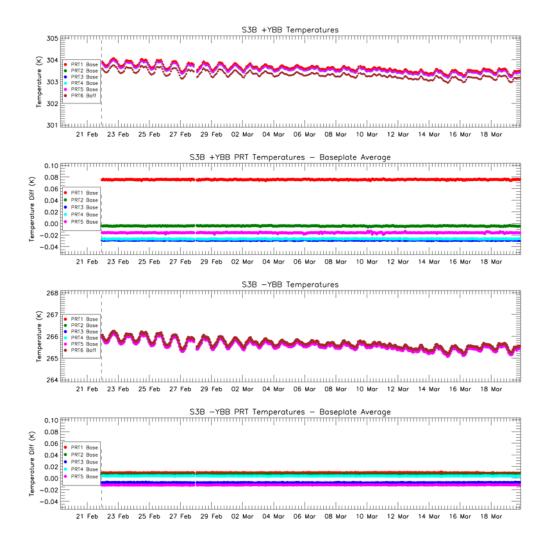


Figure 9: SLSTR-B blackbody temperature and baseplate gradient trends during Cycle 036. The vertical dashed lines indicate the start and end of the cycle. Each dot represents the average temperature in one orbit.



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2.5 Detector noise levels

2.5.1 SLSTR-A VIS and SWIR channel signal-to-noise

The VIS and SWIR channel noise for SLSTR-A in Cycle 055 was stable and consistent with previous operations - the signal-to-noise ratio of the measured VISCAL signal over the past year is plotted in Figure 10. Table 1 and Table 2 give the average signal-to-noise in each cycle (excluding the instrument decontaminations). These values average over the significant detector-detector dispersion for the SWIR channels that is shown in Figure 10.

Table 1: Average SLSTR-A reflectance factor, and signal-to-noise ratio of the measured VISCAL signal for the last 11 cycles, averaged over all detectors for the nadir view.

	Average	Nadir Signal-to-noise ratio										
	Reflectance Factor	Cycle 045	Cycle 046	Cycle 047	Cycle 048	Cycle 049	Cycle 050	Cycle 051	Cycle 052	Cycle 053	Cycle 054	Cycle 055
S1	0.187	236	241	237	244	242	244	248	242	242	248	240
S2	0.194	240	241	242	242	247	247	246	247	250	250	246
S3	0.190	230	229	234	234	231	234	238	240	237	235	235
S4	0.191	161	161	161	164	166	168	170	170	171	172	175
S5	0.193	280	279	279	280	283	285	286	286	288	293	291
S6	0.175	173	174	175	176	179	180	182	183	184	186	185

Table 2: Average SLSTR-A reflectance factor, and signal-to-noise ratio of the measured VISCAL signal for the last 11 cycles, averaged over all detectors for the oblique view.

	Average		Oblique Signal-to-noise ratio									
	Reflectance Factor	Cycle 045	Cycle 046	Cycle 047	Cycle 048	Cycle 049	Cycle 050	Cycle 051	Cycle 052	Cycle 053	Cycle 054	Cycle 055
S1	0.166	246	257	252	260	261	260	271	270	266	269	263
S2	0.170	250	256	260	257	264	269	268	270	274	273	267
S3	0.168	233	232	242	243	240	242	250	256	254	245	244
S4	0.166	134	134	136	138	139	140	141	141	141	141	140
S5	0.166	210	213	213	214	216	216	217	218	214	210	211
S6	0.155	131	131	131	133	134	134	136	136	136	134	133

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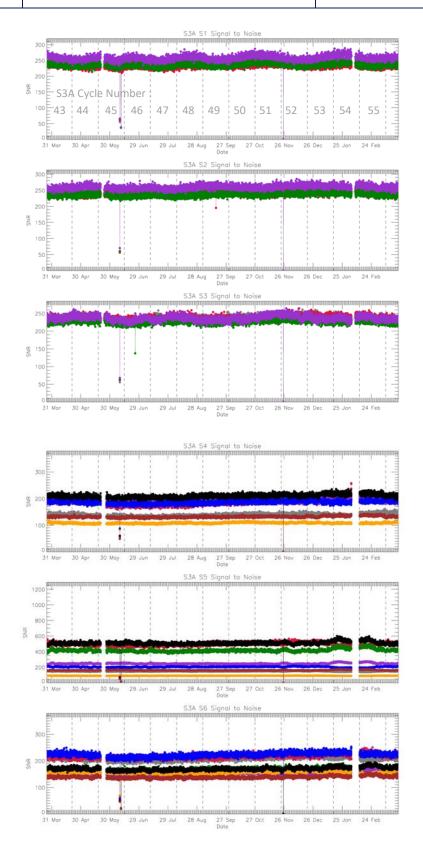


Figure 10: VIS and SWIR channel signal-to-noise of the measured VISCAL signal in each orbit for the last year of operations for SLSTR-A. Different colours indicate different detectors. The vertical dashed lines indicate the start and end of each cycle.



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2.5.2 SLSTR-B VIS and SWIR channel signal-to-noise

The average VIS and SWIR channel signal-to-noise ratios for SLSTR-B in Cycle 036 are shown in Table 3 and Table 4. These values average over a significant detector-detector dispersion for the SWIR channels.

Table 3: Average SLSTR-B reflectance factor, and signal-to-noise ratio of the measured VISCAL signal for the last 11 cycles, averaged over all detectors for the nadir view.

	Average		Nadir Signal-to-noise ratio										
	Reflectance Factor	Cycle 026	Cycle 027	Cycle 028	Cycle 029	Cycle 030	Cycle 031	Cycle 032	Cycle 033	Cycle 034	Cycle 035	Cycle 036	
S1	0.177	224	225	226	228	229	231	233	235	240	239	231	
S2	0.192	214	215	216	218	220	221	224	224	225	229	221	
S3	0.194	229	228	228	233	232	236	231	239	234	241	232	
S4	0.186	129	128	130	129	130	132	132	133	133	134	132	
S5	0.184	240	239	239	241	241	244	245	245	245	247	245	
S6	0.162	159	158	159	160	158	161	164	163	167	169	165	

Table 4: Average SLSTR-B reflectance factor, and signal-to-noise ratio of the measured VISCAL signal for the last 11 cycles, averaged over all detectors for the oblique view.

	Average	Oblique Signal-to-noise ratio										
	Reflectance Factor	Cycle 026	Cycle 027	Cycle 028	Cycle 029	Cycle 030	Cycle 031	Cycle 032	Cycle 033	Cycle 034	Cycle 035	Cycle 036
S1	0.157	218	217	218	220	224	228	228	230	230	229	225
S2	0.168	247	246	248	251	257	259	262	264	263	265	258
S3	0.172	261	261	258	264	263	270	268	276	269	272	263
S4	0.168	128	128	129	130	128	130	131	131	132	131	128
S5	0.172	251	249	250	251	250	251	253	255	253	253	252
S6	0.152	183	183	185	186	184	185	189	189	189	187	187



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2.5.3 SLSTR-A TIR channel NEDT

The thermal channel NEDT values for SLSTR-A in Cycle 055 are consistent with previous operations and within the requirements. NEDT trends calculated from the hot and cold blackbody signals are shown in Figure 11. NEDT values for each cycle, averaged over all detectors and both Earth views, are shown in Table 5.

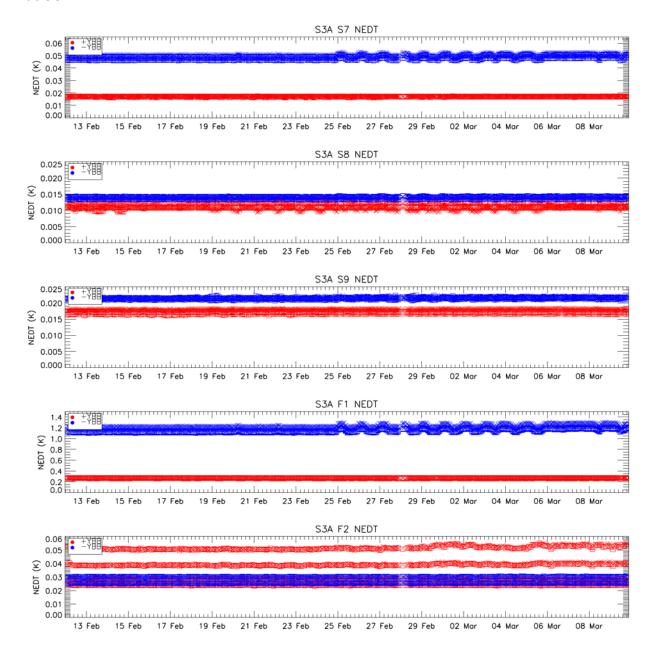


Figure 11: SLSTR-A NEDT trend for the thermal channels in Cycle 055. Blue points were calculated from the cold blackbody signal and red points from the hot blackbody. The square symbols show results calculated from the nadir view and crosses show results from the oblique view. Results are plotted for all detectors and integrators, which is why there are several different levels within the same colour points (particularly for S8 and F2).

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Table 5: NEDT for SLSTR-A in the last 11 cycles averaged over all detectors for both Earth views towards the hot +YBB (top) and the cold -YBB (bottom).

SLSTF	R-A	Cycle 045	Cycle 046	Cycle 047	Cycle 048	Cycle 049	Cycle 050	Cycle 051	Cycle 052	Cycle 053	Cycle 054	Cycle 055
+YBB t	•	302.773	302.672	302.691	302.732	302.931	303.284	303.775	304.059	304.206	304.073	303.560
	S7	17.6	17.6	17.6	17.6	18.0	17.2	17.1	16.8	16.8	16.8	17.2
NEDT	S8	11.5	11.4	11.4	11.5	11.5	11.4	11.4	11.2	11.2	11.4	11.2
(mK)	S9	17.7	17.7	17.7	17.8	17.9	17.8	17.9	17.8	17.9	17.8	17.4
(F1	280	281	282	281	296	273	271	266	265	261	271
	F2	33.7	33.9	33.9	33.9	33.6	33.8	35.2	35.5	35.7	34.9	35.8

SLSTF	R-A	Cycle 045	Cycle 046	Cycle 047	Cycle 048	Cycle 049	Cycle 050	Cycle 051	Cycle 052	Cycle 053	Cycle 054	Cycle 055
-YBB to	•	265.503	265.354	265.286	265.226	265.427	265.814	266.475	266.863	266.941	266.707	266.088
	S7	50.5	49.9	49.9	49.8	48.5	49.3	48.2	47.0	46.6	48.4	48.8
	S8	14.1	14.2	14.1	14.1	14.0	14.1	14.1	14.0	14.0	14.1	14.0
NEDT (mK)	S9	21.6	21.7	21.7	21.8	21.7	21.9	21.9	21.9	21.9	22.0	21.5
()	F1	1230	1233	1235	1234	1192	1212	1171	1134	1121	1141	1176
	F2	27.9	28.0	28.0	28.0	28.2	28.1	28.0	28.1	28.1	28.0	27.8

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2.5.4 SLSTR-B TIR channel NEDT

The thermal channel NEDT values for SLSTR-B in Cycle 036, calculated from the hot and cold blackbody signals are shown in Figure 12 and Table 6.

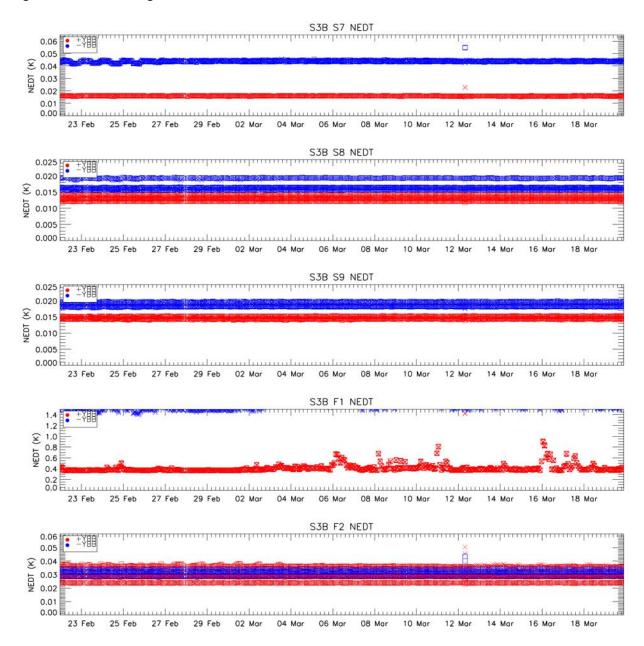


Figure 12: SLSTR-B NEDT trend for the thermal channels in Cycle 036. Blue points were calculated from the cold blackbody signal and red points from the hot blackbody. The square symbols show results calculated from the nadir view and crosses show results from the oblique view. Results are plotted for all detectors and integrators, which is why there are several different levels within the same colour points (particularly for S8 and F2).

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Table 6: NEDT for SLSTR-B in the last 11 cycles averaged over all detectors for both Earth views towards the hot +YBB (top) and the cold -YBB (bottom).

SLSTI	R-B	Cycle 026	Cycle 027	Cycle 028	Cycle 029	Cycle 030	Cycle 031	Cycle 032	Cycle 033	Cycle 034	Cycle 035	Cycle 036
+YBB t	•	303.972	302.907	302.910	302.974	303.171	303.412	303.962	304.326	304.334	303.991	303.566
	S7	16.2	16.3	16.2	16.8	16.0	16.0	15.9	15.7	15.7	15.9	16.1
NEDT	S8	13.0	13.1	13.2	13.3	12.9	12.8	12.9	12.9	12.9	13.0	13.1
NEDT (mK)	S9	14.4	14.6	14.7	14.9	14.3	14.1	14.2	14.3	14.5	14.6	14.7
(,	F1	378	390	379	403	376	372	370	364	357	369	412
	F2	30.0	30.0	29.9	29.8	29.9	30.0	30.2	30.2	30.1	30.0	29.9

SLSTF	R-B	Cycle 026	Cycle 027	Cycle 028	Cycle 029	Cycle 030	Cycle 031	Cycle 032	Cycle 033	Cycle 034	Cycle 035	Cycle 036
-YBB to	•	265.117	265.002	264.927	264.918	265.109	265.510	266.245	266.679	266.613	266.112	265.579
	S7	43.9	44.5	44.8	43.5	44.4	44.0	42.8	42.4	42.4	42.7	44.0
NEDT	S8	16.8	16.9	17.0	16.9	16.8	16.7	16.7	16.7	16.8	16.8	16.9
NEDT (mK)	S9	18.4	18.6	18.8	18.8	18.3	18.1	18.2	18.3	18.4	18.6	18.8
(F1	1615	1675	1633	1584	1618	1573	1538	1513	1481	1520	1762
	F2	30.7	30.9	31.1	31.1	30.7	30.5	30.5	30.6	30.7	30.9	31.0



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2.6 Calibration factors

2.6.1 VIS and SWIR radiometric response

The visible channels show oscillations in their radiometric response due to the build-up of ice on the optical path within the focal plane assembly (FPA). Similar oscillations were observed for the corresponding channels on ATSR-2 and AATSR. As described in Section 2.2, periodic decontamination of the infrared FPA is necessary to remove the water ice contamination.

The radiometric responses of the SWIR channels appear to be more stable and not affected by the buildup of water ice contamination, although there is a seasonal cycle of the response that could be caused by variations in the solar zenith angle on the diffuser or partial vignetting of the Sun's disc by the VISCAL baffle.

It should be noted that the data from the VISCAL unit and blackbodies calibrates the signal and counteracts the degradation of the optics and other variations in signal.

Figure 13 and Figure 14 show the variation of the radiometric gain derived from the VISCAL signals for SLSTR-A over the past year, and Figure 15 and Figure 16 show the variation of the radiometric gain for SLSTR-B since the start of the S3B mission. Note that the period of the oscillations depends on the rate of build up of the ice layer, which is faster for SLSTR-B because it has had less time to decontaminate.

Note that decontaminations for SLSTR-A were performed in Cycles 45 and 54. For SLSTR-B, a decontamination was performed during Cycle 24 and Cycle 30.



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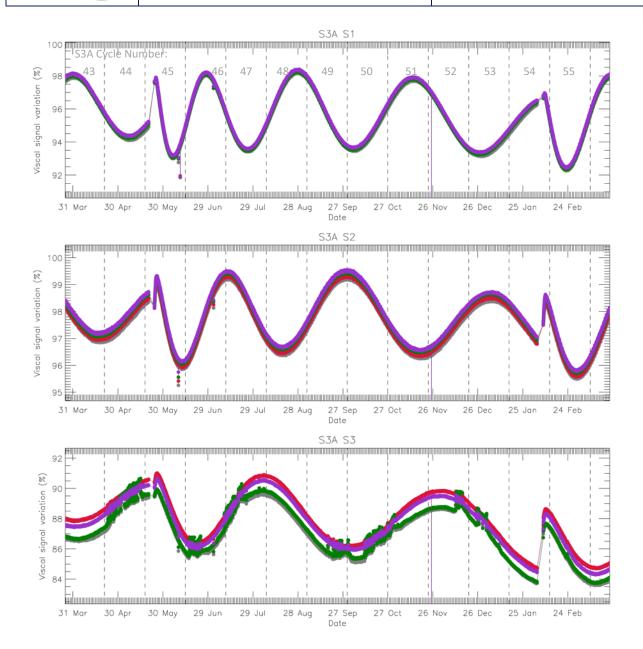


Figure 13: Variation of the radiometric gain derived from the VISCAL signals for SLSTR-A VIS channels for the last year of operations (nadir view). Different colours represent different detectors. The vertical dashed lines indicate the start and end of each cycle.



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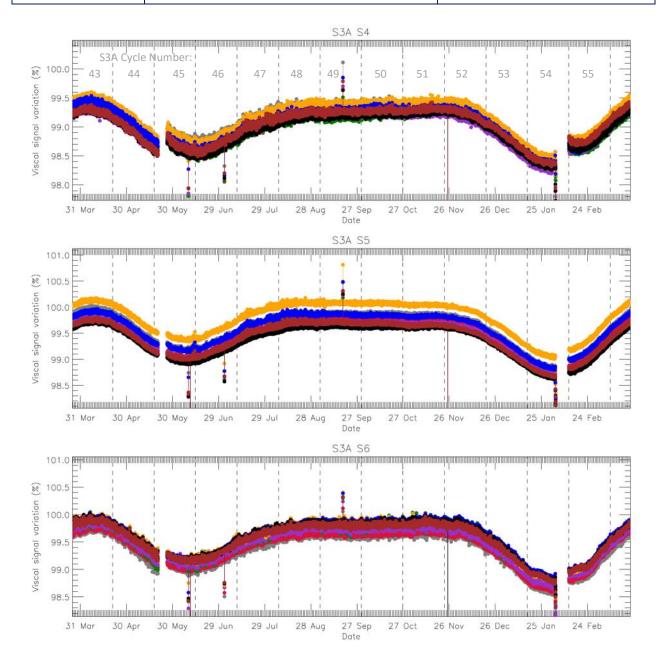


Figure 14: Variation of the radiometric gain derived from the VISCAL signals for SLSTR-A SWIR channels for the last year of operations (nadir view). Different colours represent different detectors. The vertical dashed lines indicate the start and end of each cycle.



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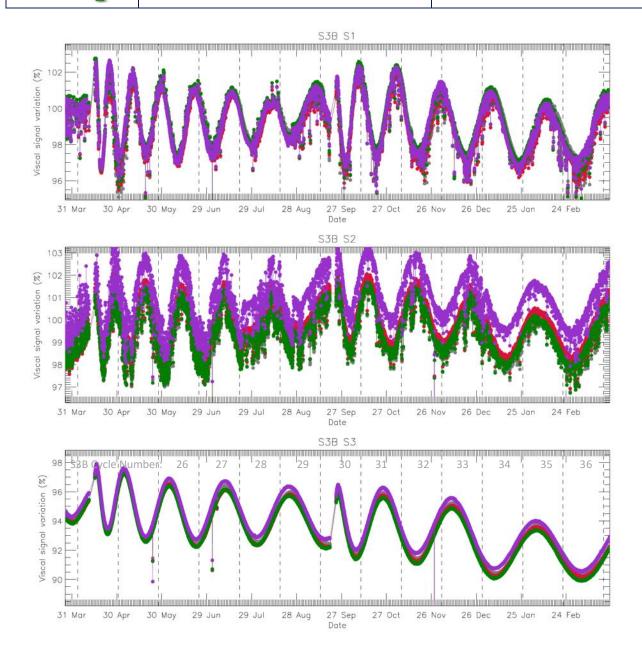


Figure 15: Variation of the radiometric gain derived from the VISCAL signals for SLSTR-B VIS channels for the past year (nadir view). Different colours represent different detectors. The vertical dashed lines indicate the start and end of each cycle.



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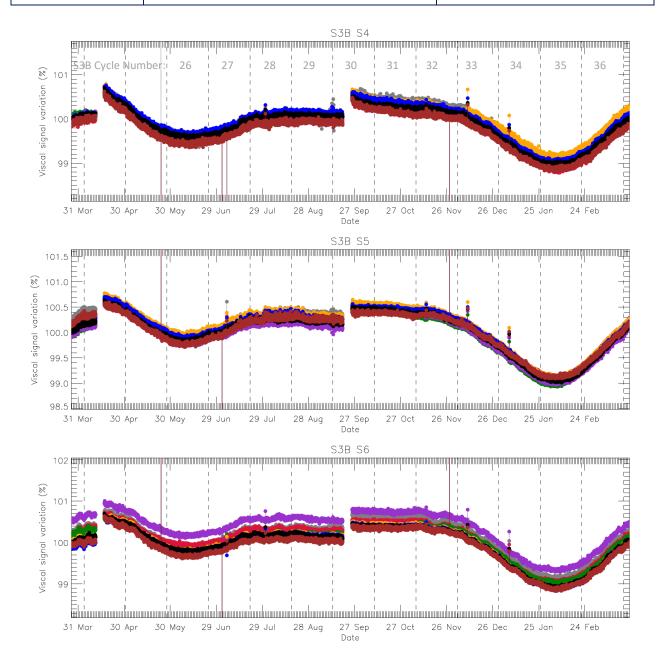


Figure 16: Variation of the radiometric gain derived from the VISCAL signals for SLSTR-B SWIR channels for the past year (nadir view). Different colours represent different detectors. The vertical dashed lines indicate the start and end of each cycle.



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3 Level-1 product validation

3.1 Geometric calibration/validation

Regular monitoring using the GeoCal Tool implemented at the MPC is being carried out. This monitors the geolocation performance in Level-1 images by correlation with ground control point (GCP) imagettes. Each Level-1 granule typically contains several hundred GCPs, which are filtered based on signal-to-noise to obtain a daily average in the across and along track directions. The results are plotted in Figure 17 for SLSTR-A in Cycle 055 and Figure 18 for SLSTR-B in Cycle 036, giving the average positional offsets in kilometres for Nadir and Oblique views.

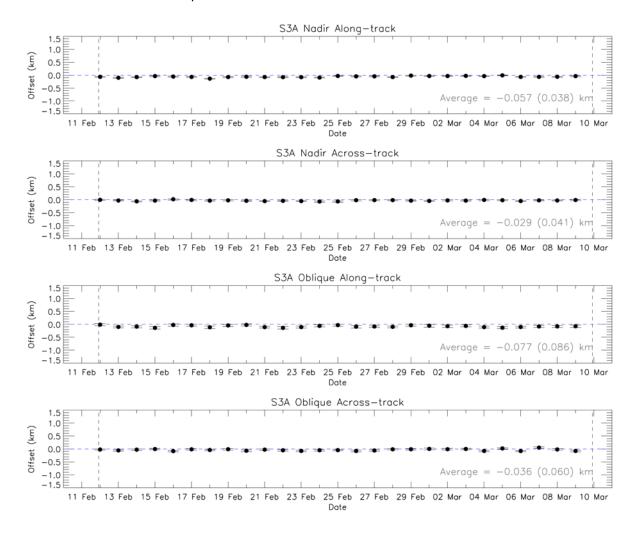


Figure 17: SLSTR-A daily offset results in km from the GeoCal Tool analysis for Nadir along- and across-track (top two plots) and Oblique along- and across-track (bottom two plots) for Cycle 055. The error bars show the standard deviation.

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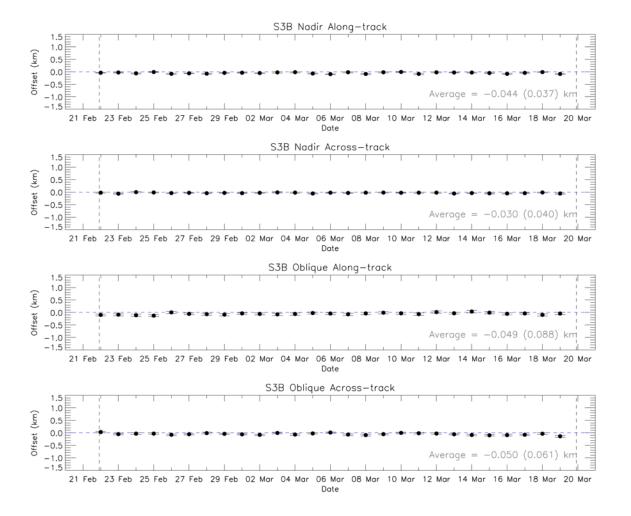


Figure 18: SLSTR-B daily offset results in km from the GeoCal Tool analysis for Nadir along- and across-track (top two plots) and Oblique along- and across-track (bottom two plots) for Cycle 036. The error bars show the standard deviation.



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3.2 Radiometric validation

The radiometric calibration of the visible and SWIR channels is monitored using the S3ETRAC service. The S3ETRAC service extracts OLCI and SLSTR Level-1 data and computes associated statistics over 49 sites corresponding to different surface types (desert, snow, ocean maximising Rayleigh signal, and ocean maximising sunglint scattering). These S3ETRAC products are used for the assessment and monitoring of the VIS and SWIR radiometry by the ESL.

Details of the S3ETRAC/SLSTR statistics are provided on the S3ETRAC website http://s3etrac.acri.fr/index.php?action=generalstatistics#pageSLSTR

- Number of SLSTR products processed by the S3ETRAC service
- Statistics per type of target (DESERT, SNOW, RAYLEIGH, SUNGLINT)
- Statistics per site
- Statistics on the number of records

Figure 19 and Figure 20 show the results of the inter-comparison analysis of SLSTR-A with OLCI-A and SLSTR-B with OLCI-B over desert sites. Figure 21 and Figure 22 show the results of an inter-comparison analysis of SLSTR-A and SLSTR-B with AATSR. Average ratios in each case are given in the figures.

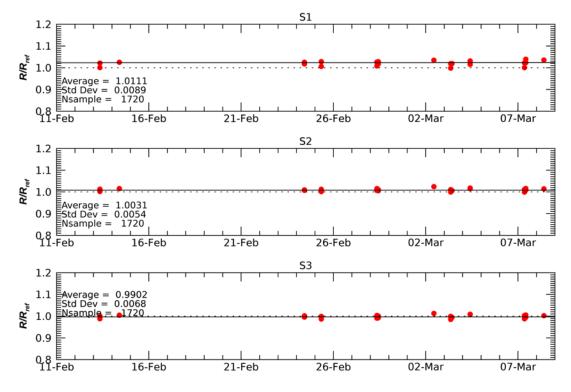


Figure 19: Ratio of SLSTR-A and OLCI-A radiances for the visible channels in Nadir view using combined results for all desert sites processed in Cycle 055.

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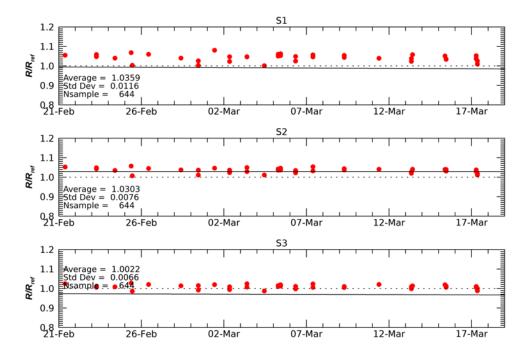


Figure 20: Ratio of SLSTR-B and OLCI-B radiances for the visible channels in Nadir view using combined results for all desert sites processed in Cycle 036.

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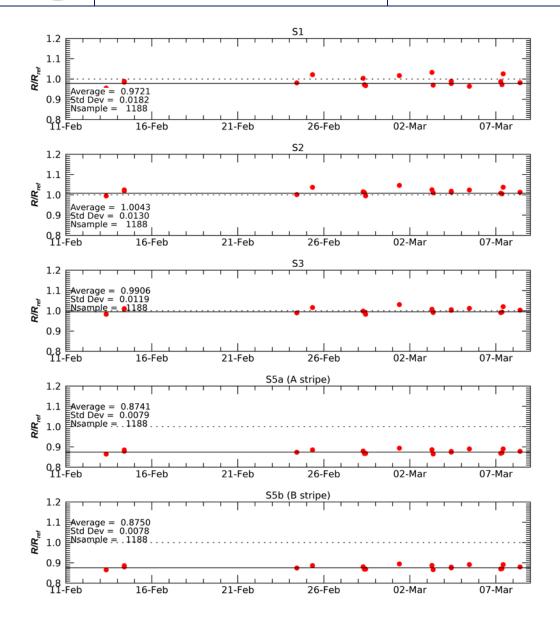


Figure 21: Ratio of SLSTR-A and AATSR radiances in Nadir view using combined results for all desert sites processed in Cycle 055.

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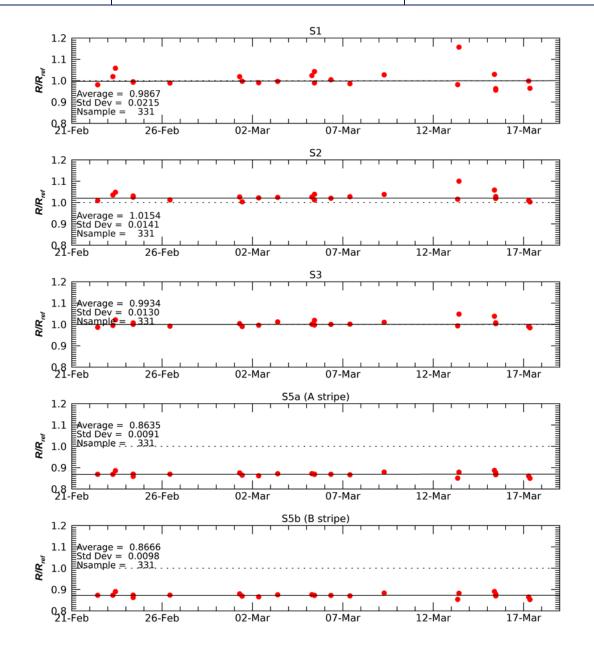


Figure 22: Ratio of SLSTR-B and AATSR radiances in Nadir view using combined results for all desert sites processed in Cycle 036.

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3.3 Image quality

The Level-1 image quality is assessed when data are available at the MPC. For example by combining all granules over one day into a single combined image. The S3A and S3B satellites are configured to be 140 degrees out of phase in order to observe complimentary portions of the earth. Figure 23 shows an example combined SLSTR-A/SLSTR-B image for the visible channels from 2nd March 2020 (daytime only).

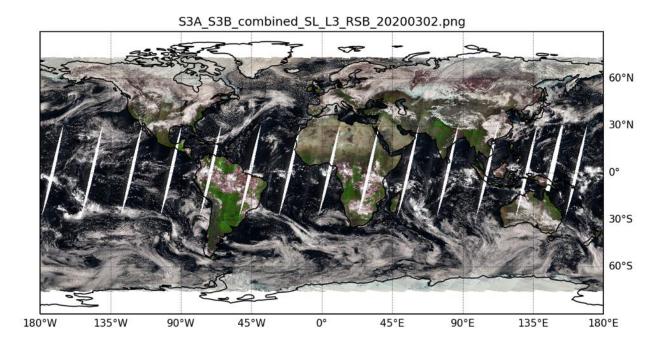


Figure 23: Daytime combined SLSTR-A and SLSTR-B Level-1 image for visible channels on 2nd March 2020.



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4 Level-2 LST validation

Level 2 Land Surface Temperature products have been validated against *in situ* observations (Category-A validation) from twelve "Gold Standard" Stations, and intercompared (Category-C validation) with respect to an independent operational reference product (SEVIRI from LSA SAF). In all cases it is the NTC products that are validated, and the Probabilistic cloud masking implementation is used for all cloud masking. Level-3C products for the full Cycles 055 for SLSTR-A and 036 for SLSTR-B are evaluated for identifying any gross problems. Both S3A and S3B L2 products are produced with the updated LST coefficients following the operational release on 25th February 2019. In each case the latest temporal interpolation for the probabilistic cloud mask is applied following the L1 operational release on 15th January 2020.

4.1 Category-A validation

Category-A validation uses a comparison of satellite-retrieved LST with *in situ* measurements collected from radiometers sited at a number of stations spread across the Earth, for which the highest-quality validation can be achieved. Here we concentrate on twelve "Gold Standard" stations which are installed with well-calibrated instrumentation: seven from the SURFRAD network (Bondville, Illinois; Desert Rock, Nevada; Fort Peck, Montana; Goodwin Creek, Mississippi; Penn State University, Pennsylvania; Sioux Fall, South Dakota; Table Mountain, Colorado); two from the ARM network (Southern Great Plains, Oklahoma; Barrow, Alaska); and three from the USCRN network (Williams, Arizona; Des Moines, Iowa; Manhatten, Kansas). The results can be summarised as follows:

Satellite	Average absolute accuracy vs. Gold Standard (K)							
Satemite	Day	Night						
S3A	0.9	0.6						
S3B	0.7	0.7						

For both SLSTR-A and SLSTR-B both the daytime and night-time accuracies are within the mission requirement of < 1K, even though they are impacted to some extent by very small number of matchups for some stations in the cycle due to actual cloud, or over-masking. The number of matchups across most stations for daytime are very low particularly during the day. This may be a case of the cloud coefficients ADF not being optimum following the introduction of the temporal interpolation to the probabilistic cloud mask.



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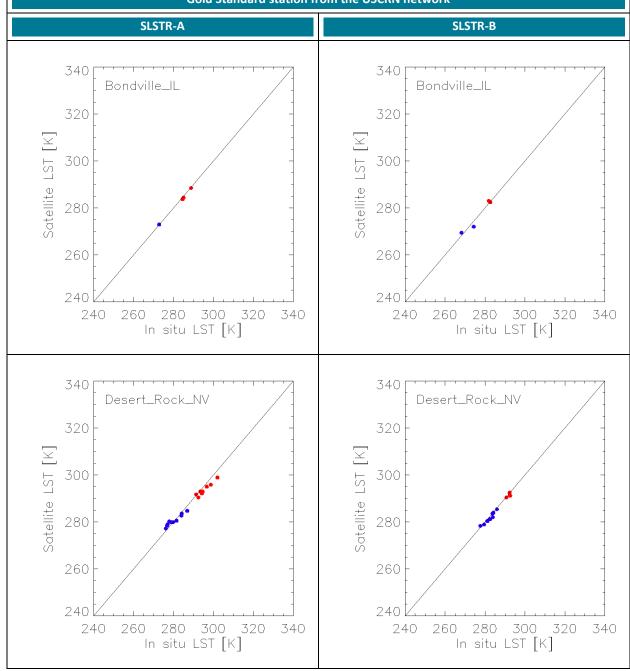
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Validation of the SL_2_LST product over Cycle 055 (SLSTR-A) and Cycle 036 (SLSTR-B) at seven Gold Standard in situ stations of the SURFRAD network plus two Gold Standard station from the ARM network, and two Gold Standard station from the USCRN network





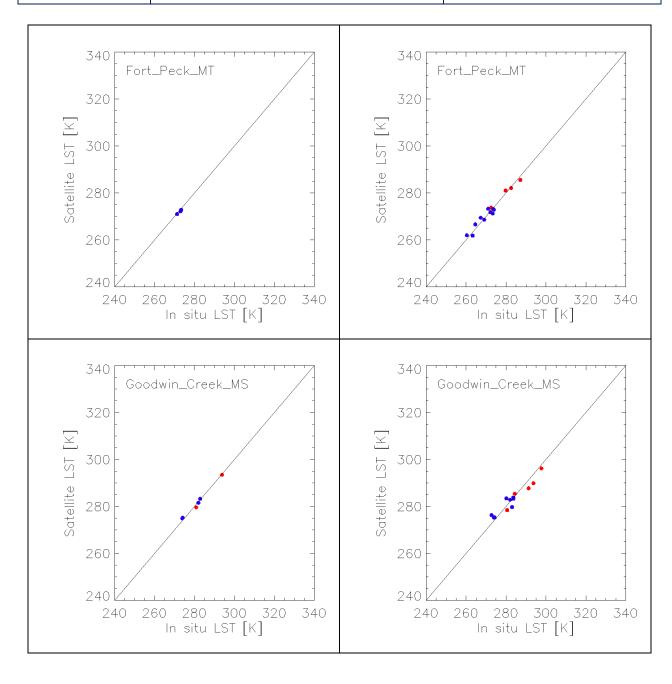
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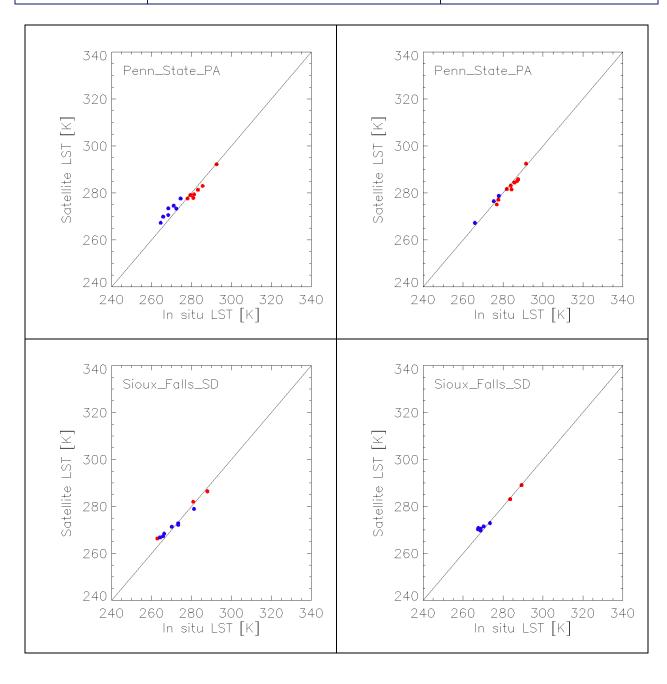
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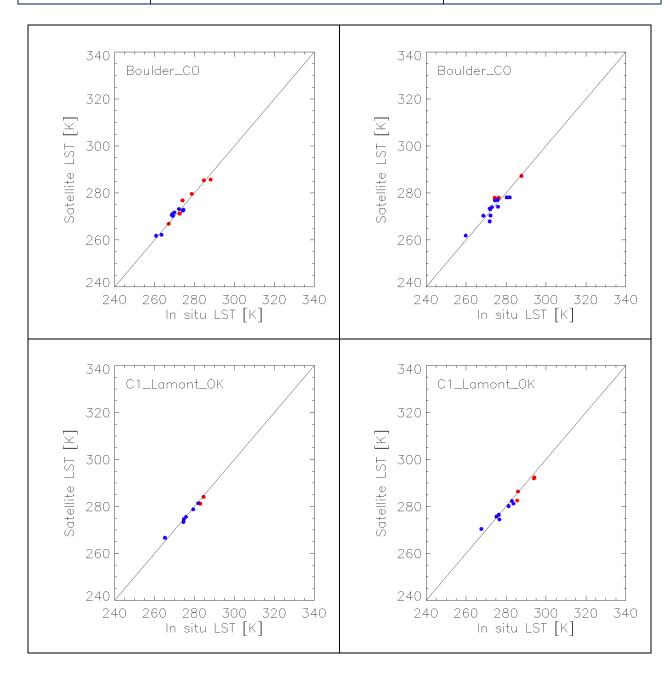
S3 SLSTR Cyclic Performance Report

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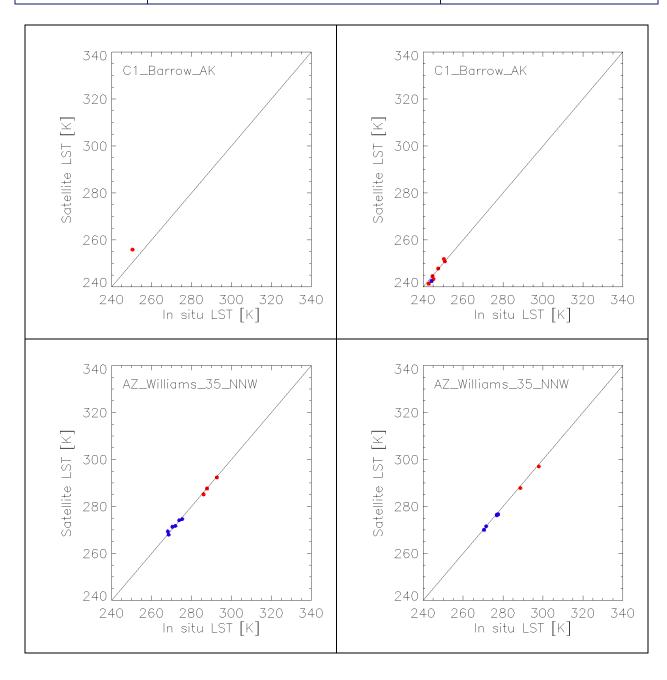
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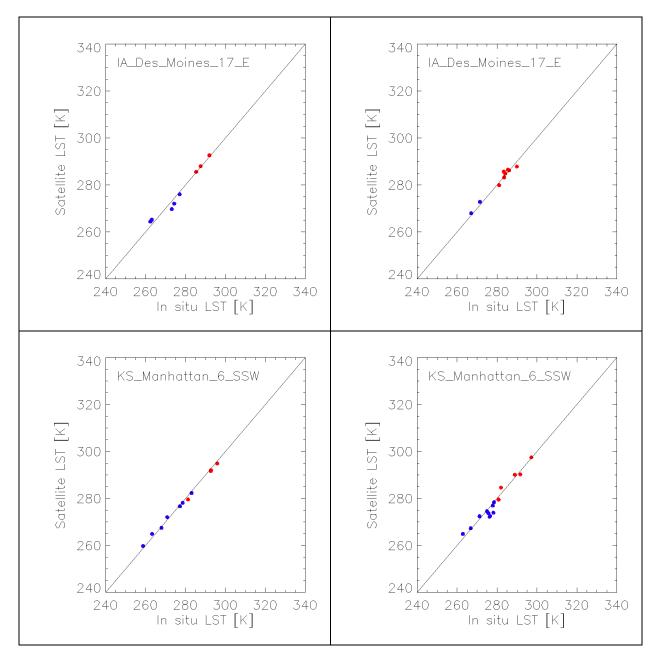
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As with past cycles cloud has reduced the number of matchups per station to single figures for most stations during day or night, with some missing statistics entirely. It is therefore challenging to determine robust statistics. Nonetheless, it can be seen that overall the matchups are in general close to the 1:1 line with very few outliers. No systematic bias is evident from these matchups.



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4.2 Category-C validation

Category-C validation uses inter-comparisons with similar LST products from other sources such as other satellite sensors, which give important quality information with respect to spatial patterns in LST deviations. Here we compare the SL_2_LST product from both SLSTR-A and SLSTR-B with the operational SEVIRI L2 product available from the LSA SAF. The results can be summarised:

Continent	Median differences in K from the intercomparison of the SL_2_LST product with respect to the operational LSA SAF SEVIRI LST product for the period of Cycle 055 (SLSTR-A) and Cycle 036 (SLSTR-B)			
	SLSTR-A		SLSTR-B	
	Day	Night	Day	Night
Africa	0.1	0.2	0.1	0.2
Europe	0.4	1.0	0.3	0.8

For both Africa and Europe, the differences across the continent for both SLSTR-A and SLSTR-B are relatively small, with very few locations with larger differences. This is the same for both SLSTR-A and SLSTR-B and is primarily driven by differences in viewing geometry between the SLSTR instruments and SEVIRI and is expected. Eastern matchups (such as over the Arabian Peninsula) are towards the edge of the SEVIRI disk and therefore represent large viewing angles. At these extreme viewing angles it is expected that SLSTR LST would be increasingly higher than SEVIRI LST. For both daytime and night-time the differences are mainly < 1K over both Africa and Europe for both SLSTR-A and SLSTR-B. Differences are not the same as previous cycles for both Europe and Africa which may indicate responses due to changing seasons.

Other analysis can be summarised as follows:

- Differences with respect to biomes tend to be larger during the day for surfaces with more heterogeneity and/or higher solar insolation
- Differences increase for both day and night towards the edge of the SEVIRI disk as the SEVIRI zenith angles become larger



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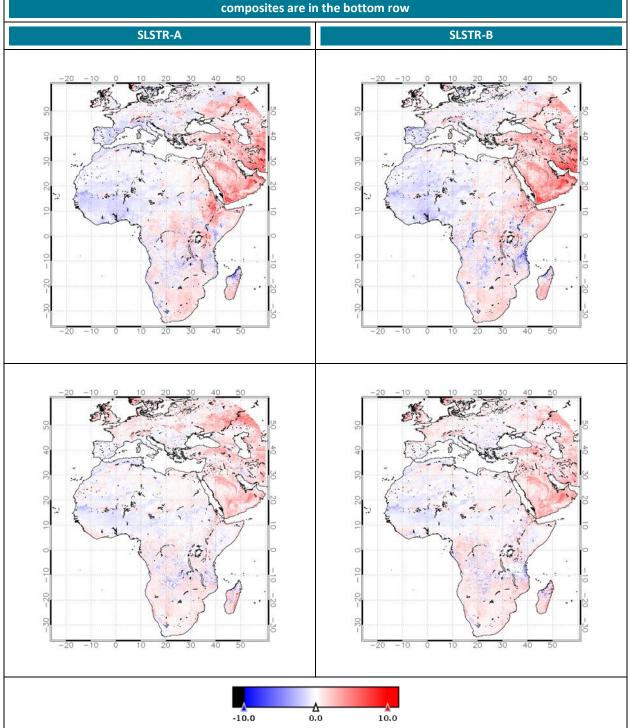
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Intercomparison of the SL_2_LST product with respect to the operational LSA SAF SEVIRI LST product for the period of Cycle 055 (SLSTR-A) and Cycle 036 (SLSTR-B). Daytime composites are in the top row and Night-time composites are in the bottom row



While some of these differences are > 1 K they are all within the corresponding uncertainty of SEVIRI at the pixel-scale (> 2K), and so the **two products can be assessed as being consistent**. It should also be noted that there are no significant differences between the two products in terms of biome-dependency - the differences are consistent across biomes. Some residual cloud contamination is evident from the large differences at the edge of cloud cleared features. While the cloud contamination is seen for both



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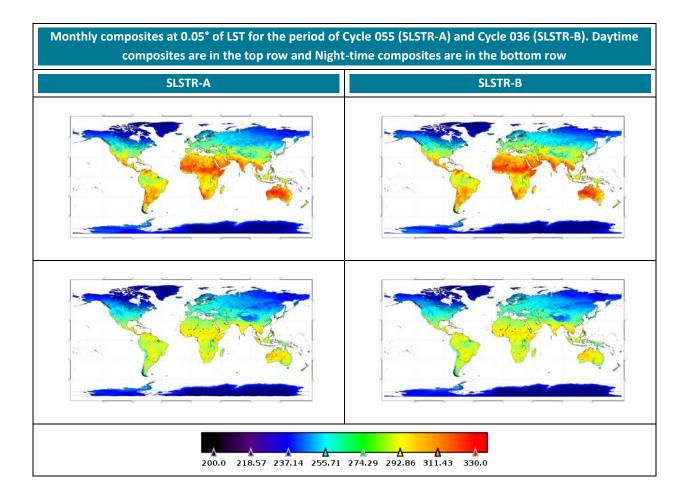
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SLSTR (strong negative differences) and SEVIRI (strong positive differences), compared with cycles where the basic cloud mask was used the contamination for SLSTR is lower indicating improved masking with the Probabilistic Cloud Mask. However, less matchups are evident which suggests the cloud masking could be slightly over conservative in some biomes. This will be monitored over the following Cycles to identify whether an optimisation to the cloud coefficients should be considered for some biomes.

4.3 Level-3C Assessment

To better understand the global product and identify any gross issues Level-3 evaluation is also performed. Here we generate monthly daytime and night-time 0.05° composites of the LST field and corresponding sampling ratios. The sampling ratios are derived as clear_pixels / (clear_pixels + cloudy_pixels).





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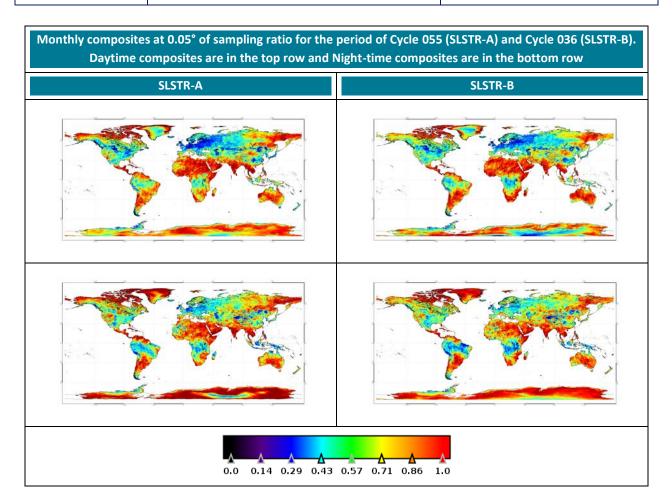
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The LST fields indicate the SL_2_LST product is producing values in line with expectations for both SLSTR-A and SLSTR-B. There are no distinct issues or non-physical values evident. The sampling ratio is now closer to what would be expected across the globe following the implementation of the temporal interpolation for the probabilistic cloud mask on 15th January 2020. Cloud contamination appears to be low, although there appears to be some excessive cloud clearing in some regions and undermasking in other, indicating the cloud coefficients ADF will need tuning for both instruments now the issue regarding the temporal interpolation has been resolved.

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5 Events

5.1 SLSTR-A

SLSTR-A was switched on and operating nominally during the cycle, with SUE scanning and autonomous switching between day and night modes, except for the following events:

- ❖ 28th February 2020, 04:12-04:17 data gaps due to radio frequency interference.
- ❖ 29th February 2020, 17:20-17:26 data gaps due to sequencing errors.

5.2 SLSTR-B

SLSTR-B was switched on and operating nominally during the cycle, with SUE scanning and autonomous switching between day and night modes, except for the following events:

- ❖ 23rd February 2020, 04:46-04:55 data gaps due to radio frequency interference.
- 27th February 2020, 23:02 28th February 2020, 02:12 possible pointing errors due to loss of data at the Svalbard station (NRT data only).



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6 Appendix A

Other reports related to the Optical mission are:

S3 OLCI Cyclic Performance Report, S3A Cycle No. 055, S3B Cycle No. 036 (ref. S3MPC.ACR.PR.01-055-036)

All Cyclic Performance Reports are available on MPC pages in Sentinel Online website, at: https://sentinel.esa.int

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