

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

**S3-A SLSTR Cyclic Performance Report**

**Cycle No. 020**

**Start date: 11/07/2017**

**End date: 07/08/2017**



*Mission  
Performance  
Centre*



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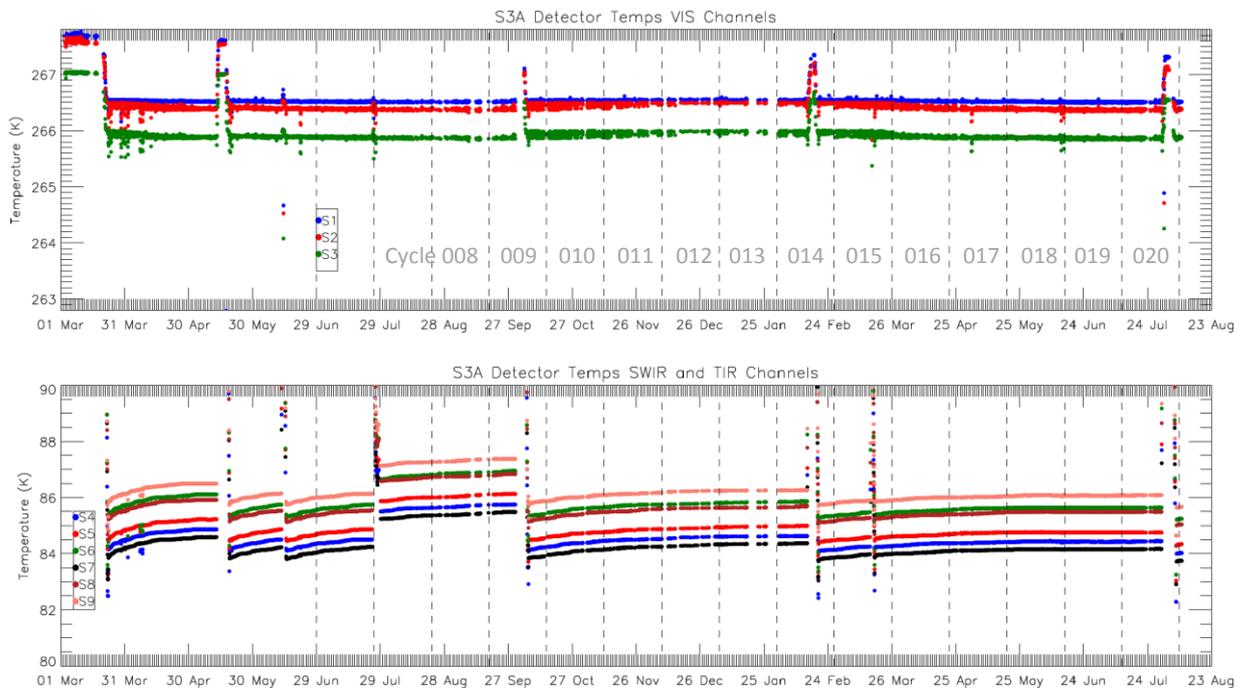
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# 1 Instrument monitoring

## 1.1 Instrument temperatures

- ❖ Instrument temperatures were stable and consistent with previous operations until an anomaly occurred on 30<sup>th</sup> July at 14:33. This was recovered by running a decontamination cycle (see Section 2). The detectors warmed up following the anomaly and during the decontamination. They were then cooled down again and the temperatures returned to their expected values towards the end of the cycle.
- ❖ Blackbody, baffle and OME temperatures peaked around 3<sup>rd</sup> January when the Earth was at perihelion. In cycle 20, the blackbody temperatures fell during the decontamination that followed the anomaly on 30<sup>th</sup> July but have returned to their expected values afterwards.



**Figure 1: Detector temperatures for each channel from 1st March 2016. Discontinuities occur for the infrared channels where the FPA was heated for decontamination or following an anomaly. The vertical dashed lines indicate the start and end of each cycle.**



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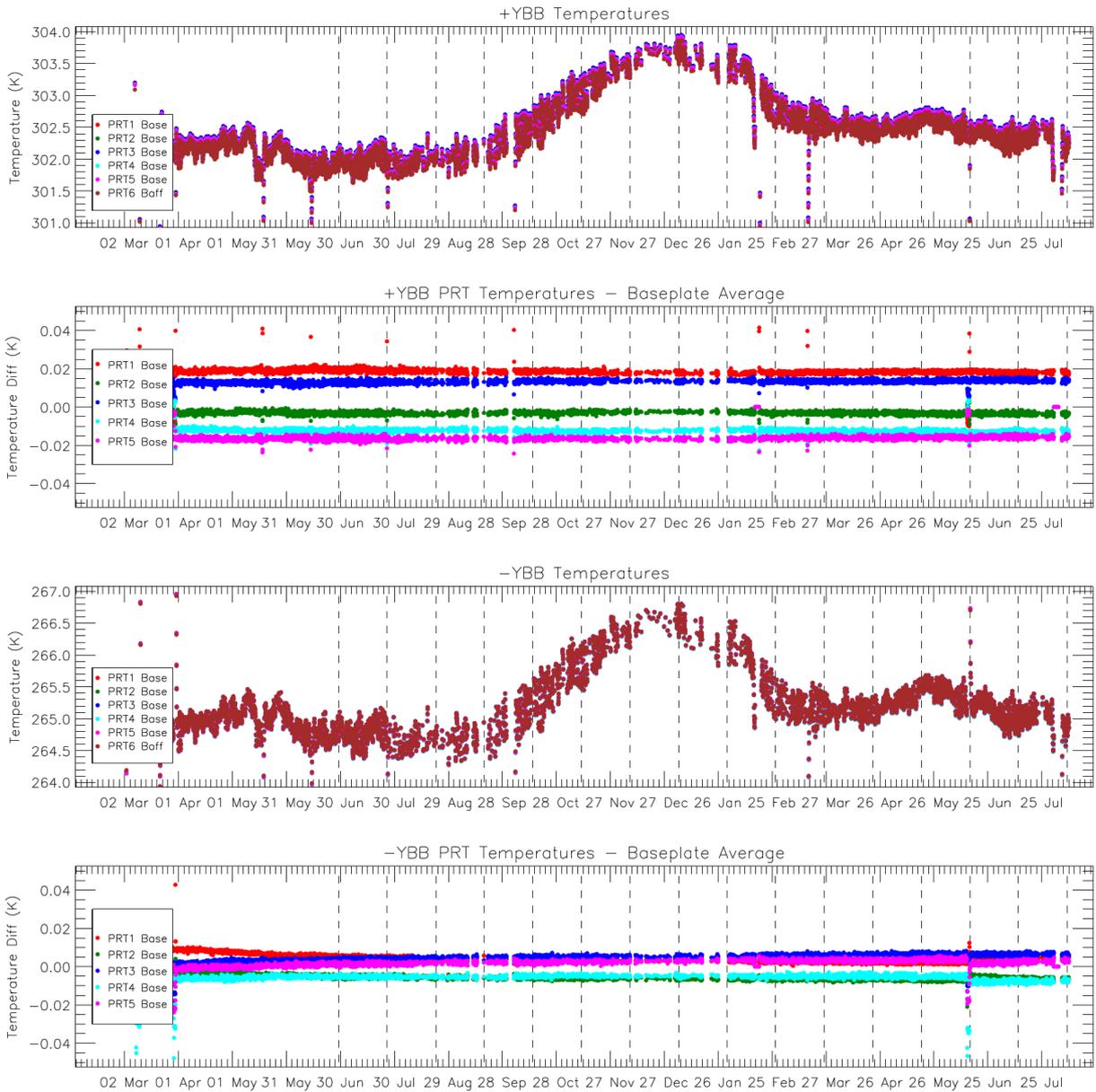


Figure 2: Blackbody temperature and baseplate gradient trends. The vertical dashed lines indicate the start and end of each cycle.

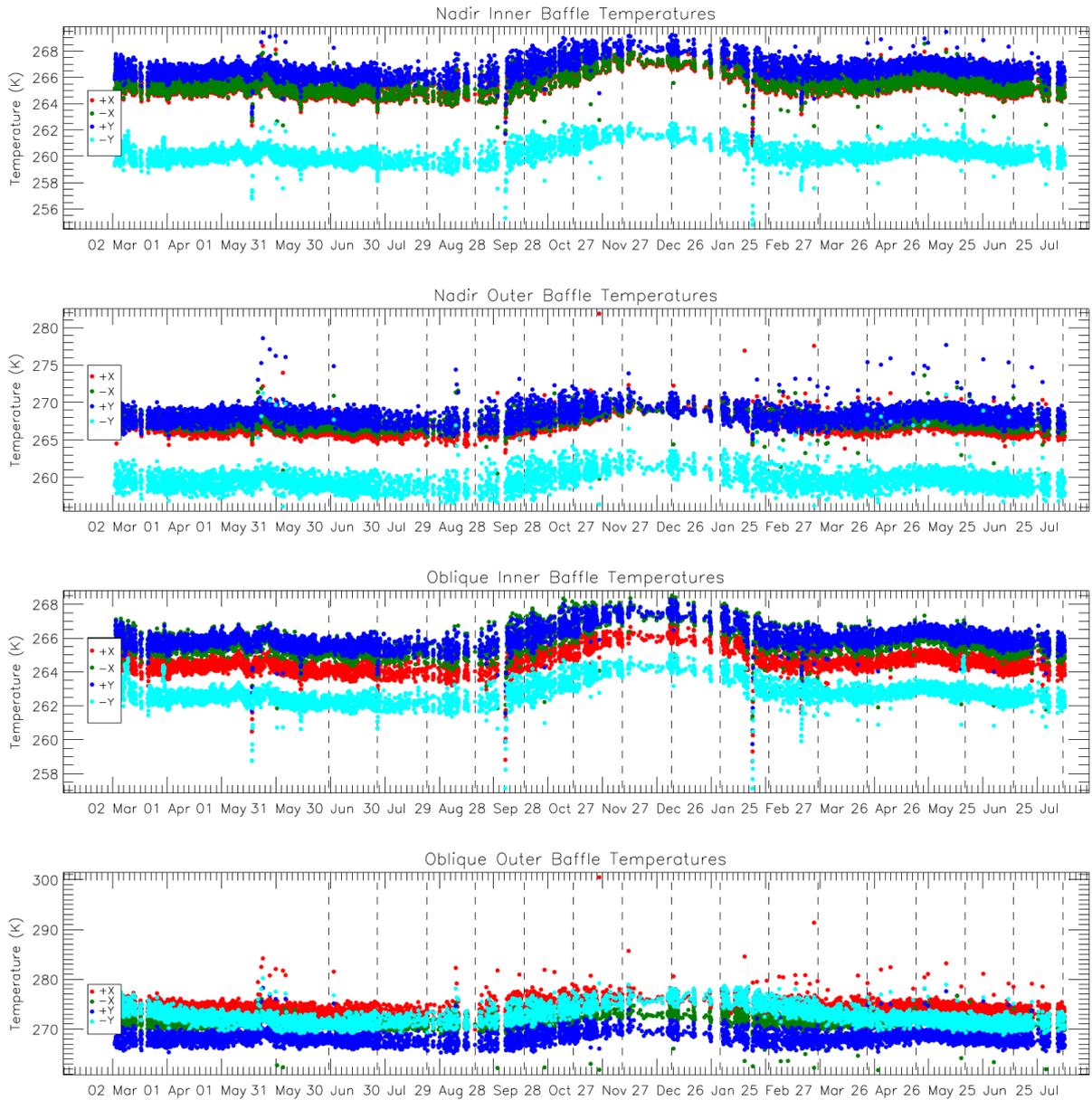
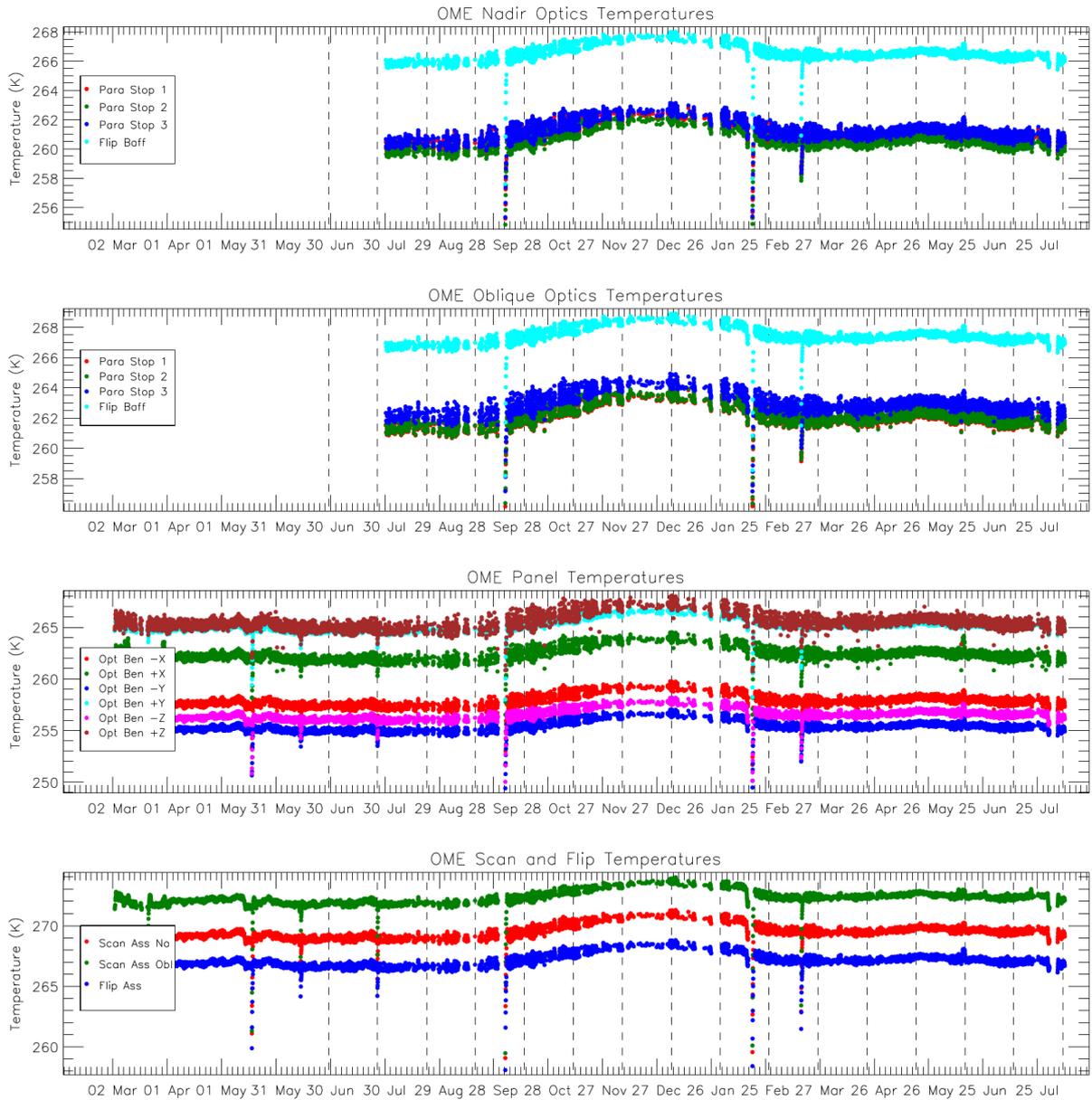


Figure 3: Baffle temperature trends. The vertical dashed lines indicate the start and end of each cycle.

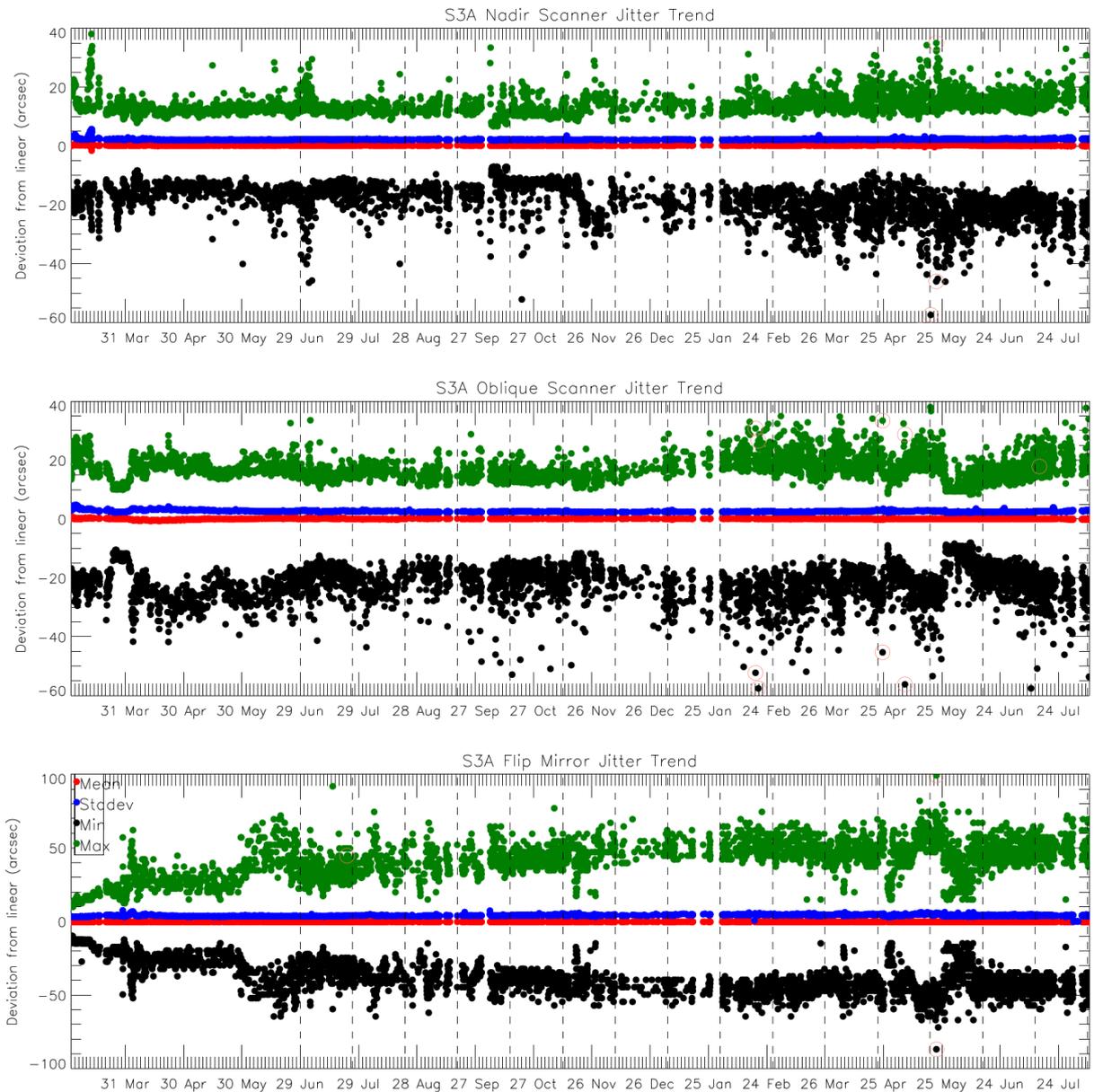


**Figure 4: OME temperature trends showing the paraboloid stops and flip baffle (top two plots) and optical bench and scanner and flip assembly (lower two plots). The top two plots only show data starting from 30th July 2016. The vertical dashed lines indicate the start and end of each cycle.**

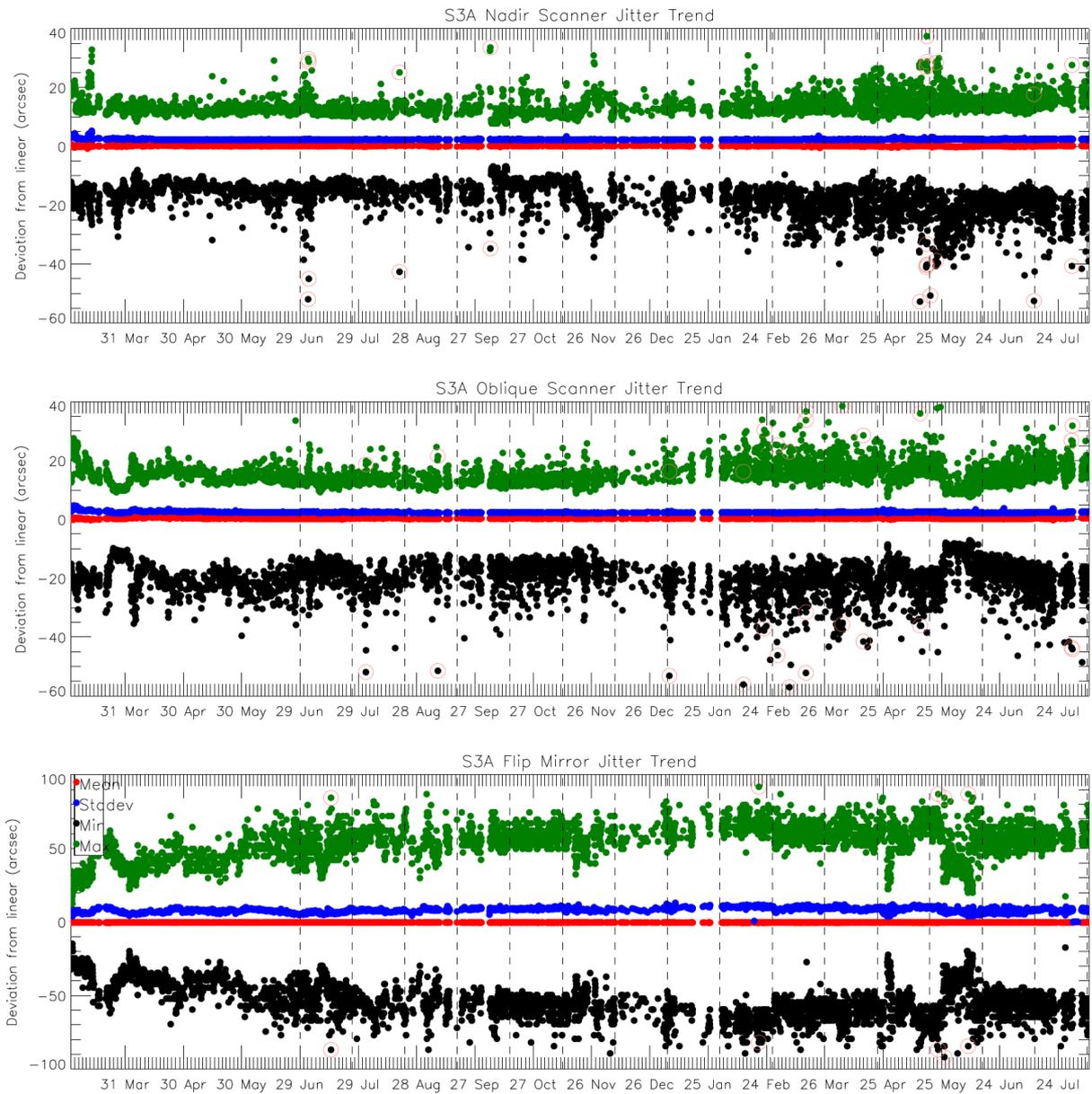


## 1.2 Scanner performance

Scanner performance has been consistent with previous operations and within required limits.



**Figure 5: Scanner and flip jitter, showing mean, stddev and max/min position compared to the expected one for the nadir view. The vertical dashed lines indicate the start and end of each cycle.**



**Figure 6: Scanner and flip jitter, showing mean, stddev and max/min position compared to the expected one for the oblique view. The vertical dashed lines indicate the start and end of each cycle.**

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## 1.3 Detector noise levels

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### 1.3.1 VIS and SWIR channel signal-to-noise

The VIS and SWIR channel noise is stable and consistent with previous operations, except for a period around the anomaly and decontamination, as shown by the signal-to-noise ratio of the measured VISCAL signal in Figure 7. The VIS channel signal-to-noise ratio drops gradually on the 31<sup>st</sup> July because the visible detectors started warming up before they were switched off for the decontamination phase. After the decontamination was over, the signal-to-noise recovered to the previous levels. Table 1 and Table 2 give the average signal-to-noise in each cycle excluding the anomaly/decontamination period. Note that this averages over the significant detector-detector dispersion for the SWIR channels that is shown in Figure 7.

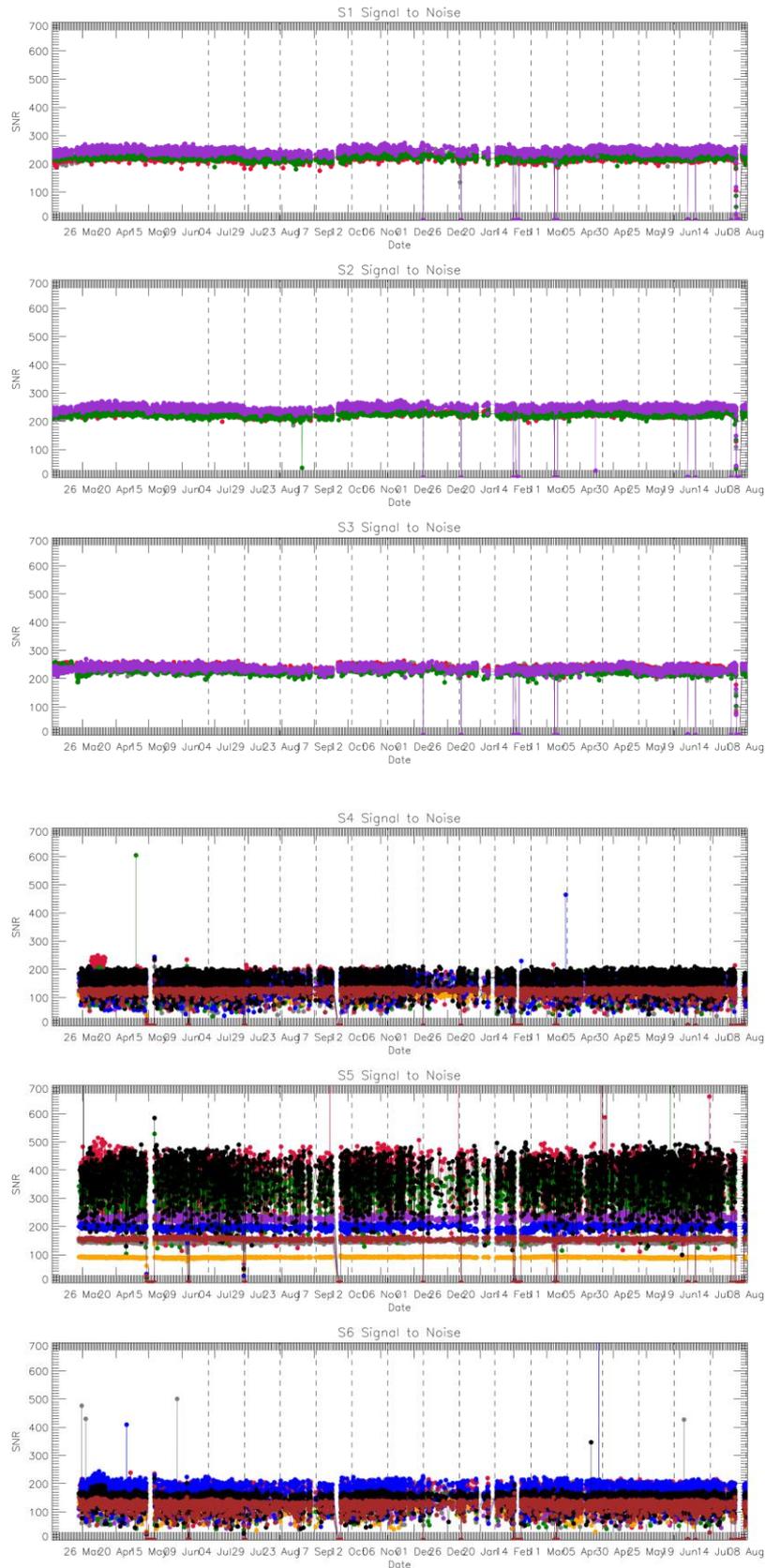


Figure 7: VIS and SWIR channel signal-to-noise of the measured VISCAL signal in each orbit. Different colours indicate different detectors.



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**Table 1: Average reflectance factor, and signal-to-noise ratio of the measured VISCAL signal for cycles 009-020, averaged over all detectors for the nadir view.**

	Average Reflectance Factor	Nadir Signal-to-noise ratio											
		Cycle 009	Cycle 010	Cycle 011	Cycle 012	Cycle 013	Cycle 014	Cycle 015	Cycle 016	Cycle 017	Cycle 018	Cycle 019	Cycle 020
<b>S1</b>	0.187	229	236	235	233	226	217	224	233	234	231	229	233
<b>S2</b>	0.194	233	238	238	236	234	227	230	236	236	232	231	235
<b>S3</b>	0.190	235	238	239	235	230	221	230	236	238	228	231	230
<b>S4</b>	0.191	141	141	145	141	139	137	139	142	140	140	139	137
<b>S5</b>	0.193	235	236	235	238	234	234	233	233	235	236	233	232
<b>S6</b>	0.175	140	143	147	145	143	141	144	142	143	143	142	140

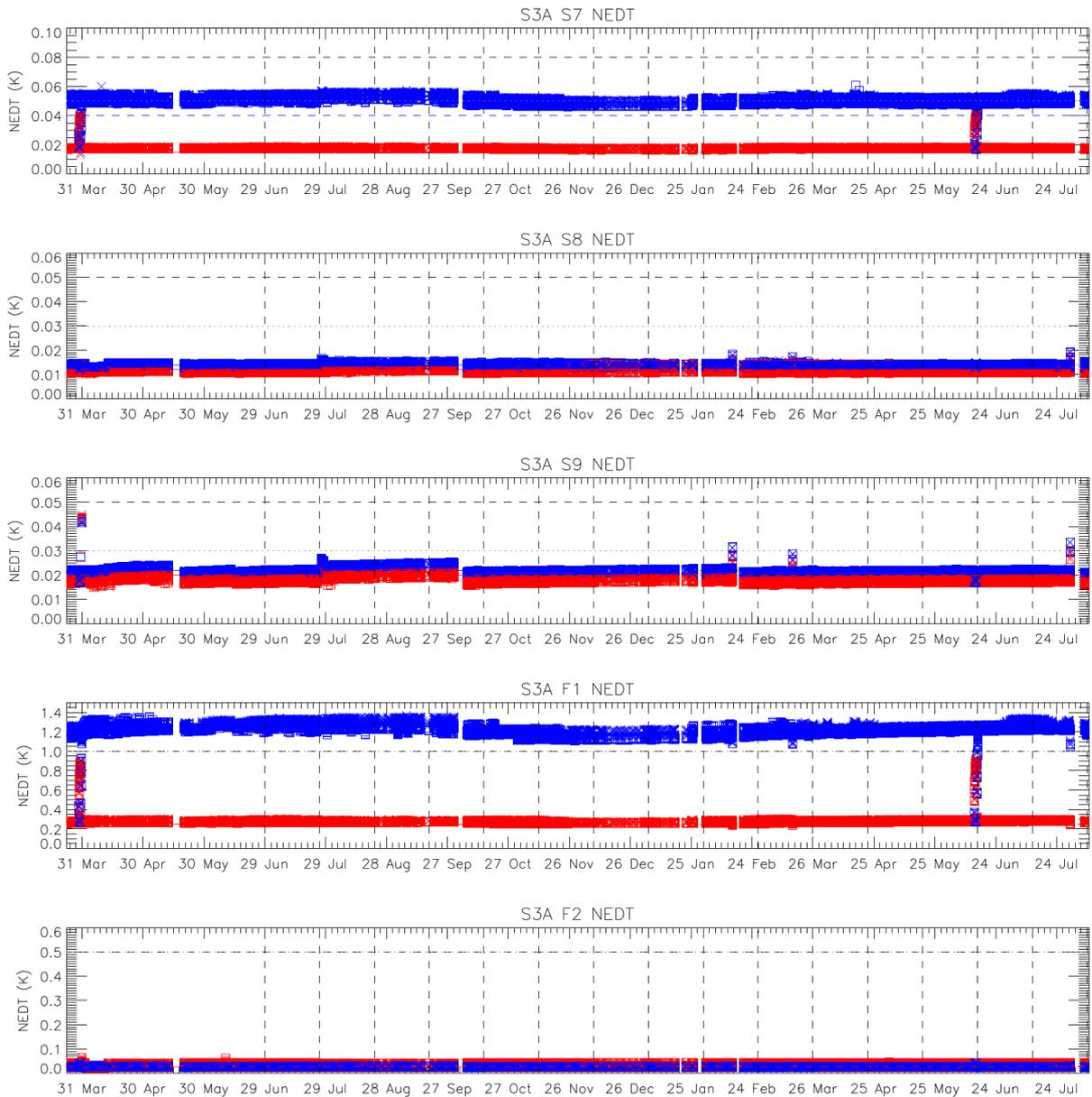
**Table 2: Average reflectance factor, and signal-to-noise ratio of the measured VISCAL signal for cycles 009-020, averaged over all detectors for the oblique view.**

	Average Reflectance Factor	Oblique Signal-to-noise ratio											
		Cycle 009	Cycle 010	Cycle 011	Cycle 012	Cycle 013	Cycle 014	Cycle 015	Cycle 016	Cycle 017	Cycle 018	Cycle 019	Cycle 020
<b>S1</b>	0.166	242	249	249	247	238	229	236	243	247	246	242	241
<b>S2</b>	0.170	247	254	253	250	241	232	241	248	251	249	247	247
<b>S3</b>	0.168	249	251	251	244	237	227	236	245	249	244	242	239
<b>S4</b>	0.166	107	109	112	112	108	107	108	108	111	110	109	108
<b>S5</b>	0.166	168	173	173	173	169	169	172	169	169	171	168	168
<b>S6</b>	0.155	111	110	114	113	105	106	107	109	109	110	108	106



### 1.3.2 TIR channel NEDT

The thermal channel NEDT values are consistent with previous operations and within the requirements, except for a period around the anomaly and decontamination. NEDT values for each cycle, averaged over all detectors and both Earth views, are shown in Table 3 and Table 4.



**Figure 8: NEDT trend for the thermal channels. Blue points were calculated from the cold blackbody signal and red points from the hot blackbody. Horizontal lines indicate the requirement (dashed) and goal (dotted) as well as the measured values on ground (red and blue dashed).**



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**Table 3: NEDT for cycles 009-020 averaged over all detectors for both Earth views towards the +YBB (hot).**

	Cycle 009	Cycle 010	Cycle 011	Cycle 012	Cycle 013	Cycle 014	Cycle 015	Cycle 016	Cycle 017	Cycle 018	Cycle 019	Cycle 020
<b>+YBB temp (K)</b>	302.381	302.822	303.289	303.680	303.621	303.206	302.674	302.544	302.541	302.593	302.386	302.348
<b>NEDT (mK)</b>												
<b>S7</b>	17.3	17.2	16.9	16.9	16.8	16.9	17.2	17.2	17.2	18.1	17.2	17.2
<b>S8</b>	11.3	10.9	11.0	11.0	11.1	11.0	10.9	10.9	11.0	11.1	11.0	11.1
<b>S9</b>	18.1	17.1	17.4	17.7	17.9	17.6	17.0	17.0	17.2	17.5	17.4	17.5
<b>F1</b>	269	265	260	260	260	260	268	268	271	297	276	276
<b>F2</b>	27.7	27.5	27.7	28.0	28.0	27.9	27.6	27.6	27.8	27.8	27.8	27.8

**Table 4: NEDT for cycles 009-020 averaged over all detectors for both Earth views towards the -YBB (cold).**

	Cycle 009	Cycle 010	Cycle 011	Cycle 012	Cycle 013	Cycle 014	Cycle 015	Cycle 016	Cycle 017	Cycle 018	Cycle 019	Cycle 020
<b>-YBB temp (K)</b>	265.020	265.575	266.112	266.512	266.353	265.807	265.183	265.136	265.260	265.412	265.125	265.000
<b>NEDT (mK)</b>												
<b>S7</b>	49.3	48.1	47.2	46.6	46.8	47.9	48.7	49.0	48.8	46.9	49.1	49.5
<b>S8</b>	14.7	14.4	14.4	14.5	14.4	14.4	14.2	14.2	14.3	14.2	14.3	14.4
<b>S9</b>	22.7	21.5	21.8	22.2	22.4	22.1	21.3	21.4	21.6	21.6	21.9	22.0
<b>F1</b>	1220	1209	1162	1123	1130	1178	1222	1191	1199	1163	1229	1235
<b>F2</b>	30.2	29.3	29.5	29.6	29.6	29.6	29.2	29.3	29.3	29.4	29.6	29.7



## 1.4 Calibration factors

### 1.4.1 VIS and SWIR VISCAL signal response

Signals from the VISCAL source for the VIS channels show oscillations due to the build up of ice on the optical path within the FPA. Decontamination must be carried out periodically in order to warm up the FPA and remove the ice. The latest decontamination cycle was successfully performed following the anomaly on 30<sup>th</sup> July – see Section 2. The VISCAL signal has returned to its expected value following the decontamination.

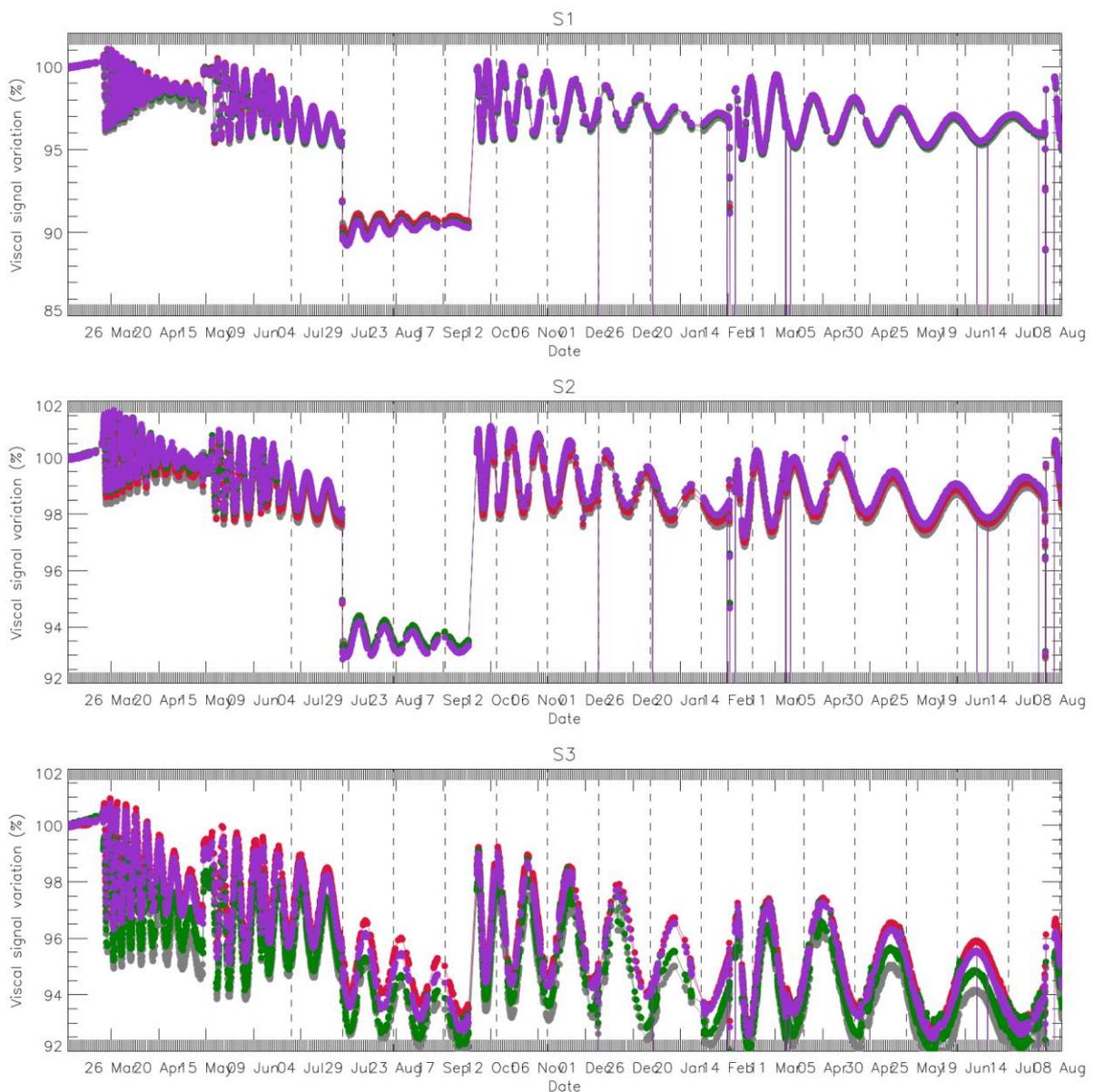


Figure 9: VISCAL signal trend for VIS channels (nadir view).



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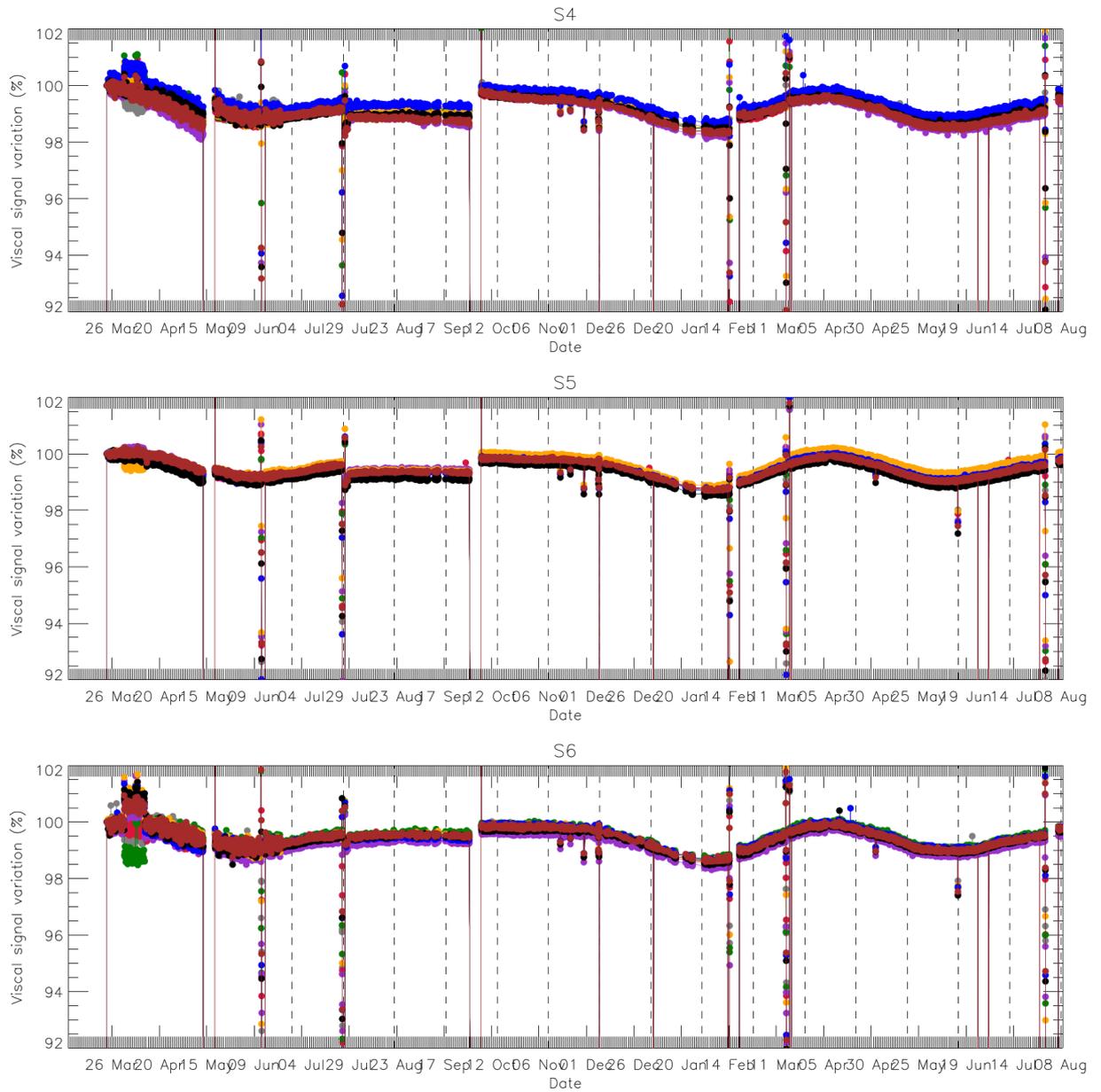


Figure 10: VISCAL signal trend for SWIR channels (nadir view).

## 2 Events

SLSTR was switched on and operating nominally during the cycle, with SUE scanning and autonomous switching between day and night modes until an anomaly occurred on 30<sup>th</sup> July 2017.

The anomaly is suspected to be due to a double bit flip error and caused the instrument to transition to Standby-Refuse mode. It occurred at 14:33 on 30<sup>th</sup> July 2017. Recovery was carried out by running a full decontamination cycle. The decontamination cycle, which involves warming the instrument to evaporate any residual water ice from the focal plane unit, would otherwise have been due at the end of September.

The instrument was switched off at 15:15 on 31<sup>st</sup> July and the decontamination started at 16:56. Cooling of the infrared detectors following the warm-up was started at approximately 08:55 on 5<sup>th</sup> August. The infrared detectors were switched on again when the instrument was transitioned to ON\_DUTY mode at 11:04 on 6<sup>th</sup> August.

**Table 5: Timeline of anomaly/decontamination/cooldown**

14:33, 30 July 2017	Anomaly - IR detectors start to warm up
15:15, 31 July 2017	Instrument switched off
16:56, 31 July 2017	Decontamination started
08:38, 4 <sup>th</sup> Aug 2017	Scanning re-started
08:55, 5 <sup>th</sup> Aug 2017	Cooling of IR channels started
11:04, 6 <sup>th</sup> Aug 2017	Instrument switched to ON_DUTY mode (IR channels switched on) IR detector temperatures stable

Due to the degradation in calibration and signal-to-noise, data obtained between 14:33 on 30<sup>th</sup> July and 11.04 on 6<sup>th</sup> August should not be used.

 The logo for the Sentinel-3 Mission Performance Centre. It features a blue satellite icon at the top, the text 'SENTINEL 3' in blue, and 'Mission Performance Centre' in blue. Below the text are four small square images: a sunset, a satellite, a landscape, and a person. A green checkmark icon is at the bottom right.	<p style="text-align: center;"><b>Sentinel-3 MPC</b></p> <p style="text-align: center;"><b>S3-A SLSTR Cyclic Performance Report</b></p> <p style="text-align: center;"><b>Cycle No. 020</b></p>	<p>Ref.: S3MPC.RAL.PR.02-020</p> <p>Issue: 1.0</p> <p>Date: 14/08/2017</p> <p>Page: 18</p>
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### 3 Appendix A

Other reports related to the Optical mission are:

- ❖ S3-A OLCI Cyclic Performance Report, Cycle No. 020 (ref. S3MPC.ACR.PR.01-020)

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

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