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

S3-A OLCI Cyclic Performance Report

Cycle No. 031

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SENTINEL 3



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Changes Log

Version	Date	Changes
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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
OL1	06.07 / 2.29	CGS: 05/07/2017 13:00 UTC PAC: 05/07/2017 12:50 UTC
OL2	06.11 / 2.23	CGS: 11/10/2017 08:53 UTC (NRT)
		PAC: 11/10/2017 08:15 UTC (NTC)
SY2	06.12 / 2.26	PAC: 11/01/2018 10:52 UTC
SY2_VGS	06.12 / 2.26	PAC: 11/01/2018 10:52 UTC

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2 Instrument monitoring

2.1 CCD temperatures

The monitoring of the CCD temperatures is based on MPMF data extractions not yet operational. In the meantime, we monitor the CCD temperatures on the long-term using Radiometric Calibration Annotations (see Figure 1). Variations are very small (0.09 C peak-to-peak) and no trend can be identified. Data from current cycle (rightmost data points) do not show any specificity.

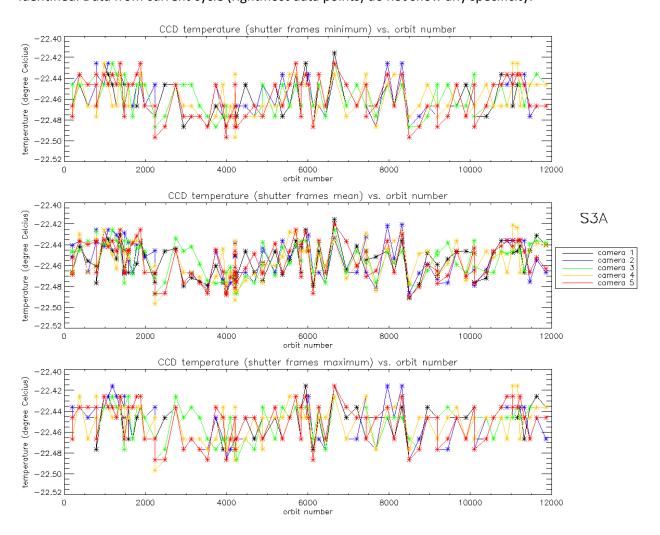


Figure 1: long term monitoring of CCD temperatures using minimum value (top), time averaged values (middle), and maximum value (bottom) provided in the annotations of the Radiometric Calibration Level 1 products, for the Shutter frames, all radiometric calibrations so far.

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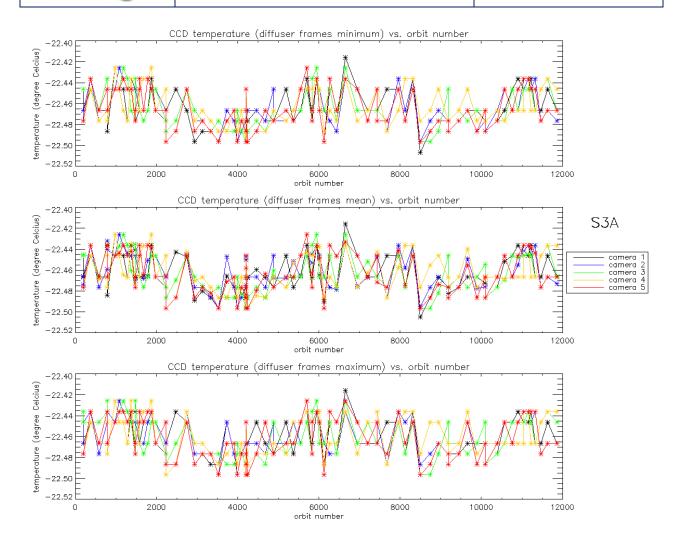


Figure 2: Same as Figure 1 for diffuser frames.

2.2 Radiometric Calibration

Two OLCI Radiometric Calibration Sequences have been acquired during Cycle 031:

- S01 sequence (diffuser 1) on 12/05/2018 12:50 to 12:52 (absolute orbit 11632)
- \$ S01 sequence (diffuser 1) on 28/05/2018 12:34 to 12:36 (absolute orbit 11860)

The acquired Sun azimuth angles are presented on Figure 3, on top of the nominal values without Yaw Manoeuvre (i.e. with nominal Yaw Steering control of the satellite).



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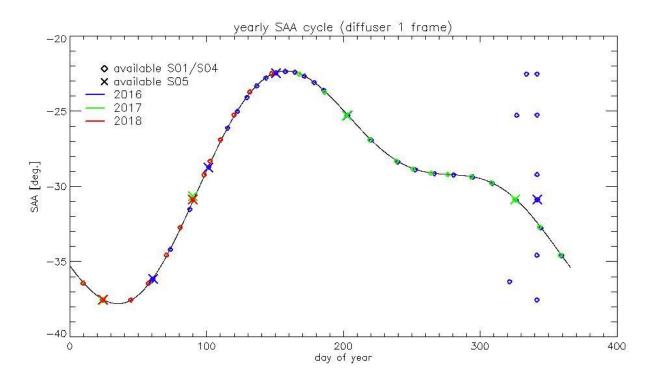


Figure 3: Sun azimuth angles during acquired Radiometric Calibrations (diffuser frame) on top of nominal yearly cycle (black curve). Diffuser 1 with diamonds, diffuser 2 with crosses, 2016 acquisitions in blue, 2017 in green, 2018 in red.

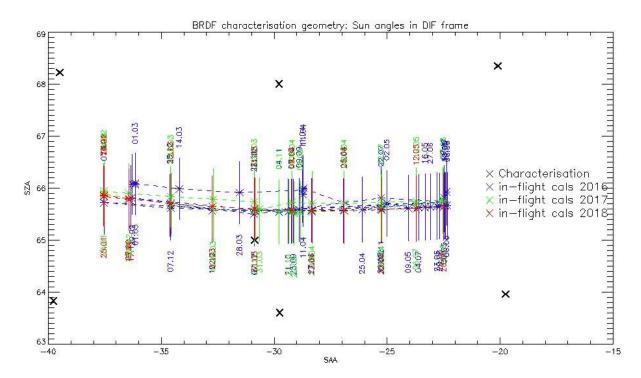


Figure 4: Sun geometry during radiometric Calibrations on top of characterization ones (diffuser frame)

This section presents the overall monitoring of the parameters derived from radiometric calibration data and highlights, if present, specificity of current cycle data.



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2.2.1 Dark Offsets [OLCI-L1B-CV-230]

Note about the High Energy Particles:

The filtering of High Energy Particle (HEP) events from radiometric calibration data has been implemented (for shutter frames only) in a post processor, allowing generating Dark Offset and Dark Current tables computed on filtered data. The post-processor starts from IPF intermediate data (corrected counts), applies the HEP detection and filtering and finally computes the Dark Offset and Dark Current tables the same way as IPF. An example of the impact of HEP filtering is given in Figure 5.

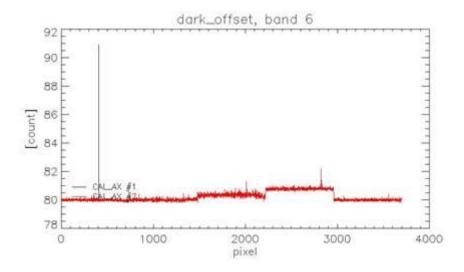


Figure 5: Dark Offset table for band Oa06 with (red) and without (black) HEP filtering (Radiometric Calibration of 22 July 2017). The strong HEP event near pixel 400 has been detected and removed by the HEP filtering.

All results presented below in this section have been obtained using the HEP filtered Dark Offset and Dark Current tables.

Dark offsets

Dark offsets are continuously affected by the global offset induced by the Periodic Noise on the OCL convergence. Current Cycle calibrations are affected the same way as others. The amplitude of the shift varies with band and camera from virtually nothing (e.g. camera 2, band 0a1) to up to 5 counts (Oa21, camera 3). The Periodic Noise itself comes on top of the global shift with its known signature: high frequency oscillations with a rapid damp. This effect remains more or less stable with time in terms of amplitude, frequency and decay length, but its phase varies with time, introducing the global offset mentioned above.

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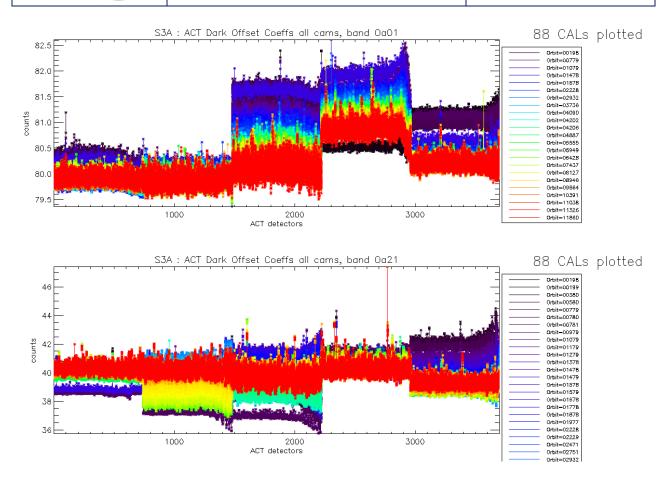


Figure 6: Dark Offset for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.



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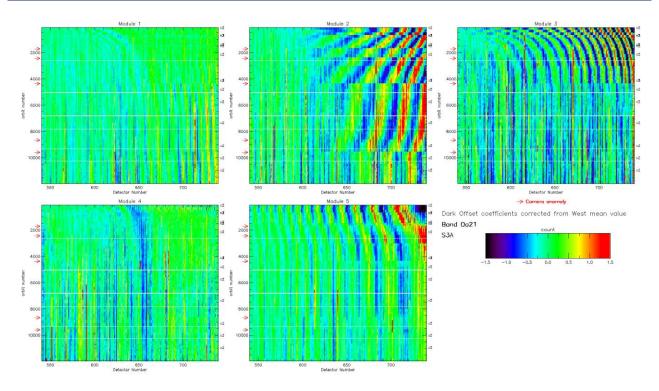


Figure 7: map of periodic noise for the 5 cameras, for band Oa21. X-axis is detector number (East part, from 540 to 740, where the periodic noise occurs), Y-axis is the orbit number. The counts have been corrected from the West detectors mean value (not affected by periodic noise) in order to remove mean level gaps and consequently to have a better visualisation of the long term evolution of the periodic noise structure. Periodic noise amplitude is high in camera 2, 3 and 4. It is lower in camera 4 and small in camera 1.

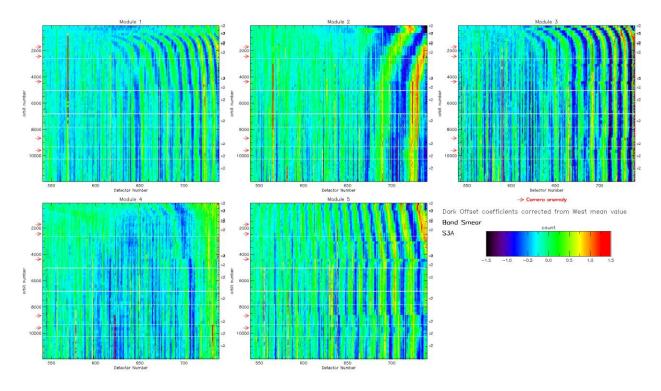


Figure 8: same as Figure 7 for smear band.



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Figure 7 and Figure 8 show the so-called 'map of periodic noise' in the 5 cameras, for respectively band 21 and smear band. These maps have been computed from the dark offsets after removal of the mean level of the WEST detectors (not impacted by PN) in order to remove mean level gaps and consequently to highlight the shape of the PN. Maps are focused on the last 200 EAST detectors where PN occurs.

As there was no camera anomaly during the current cycle, there is no sudden change of periodic noise to report during the current cycle. The hot pixel impacting one of the "East blind pixels" for camera 4 smear band, presented in cycle #26 report, is still present.

In PDGS, the dark levels are corrected using a CAL_AX containing reference Dark LUTs derived from the 25/01/2017 calibration. This CAL_AX was delivered to MPC-CC on 08/02/2018 and deployed in PDGS on 16/03/2018.

Dark Currents

Dark Currents (Figure 9) are not affected by the global offset of the Dark Offsets, thanks to the clamping to the average blind pixels value. However, the oscillations of Periodic Noise remain visible. There is no significant evolution of this parameter during the current cycle except the small regular increase (almost linear), for all detectors, since the beginning of the mission (see Figure 10).

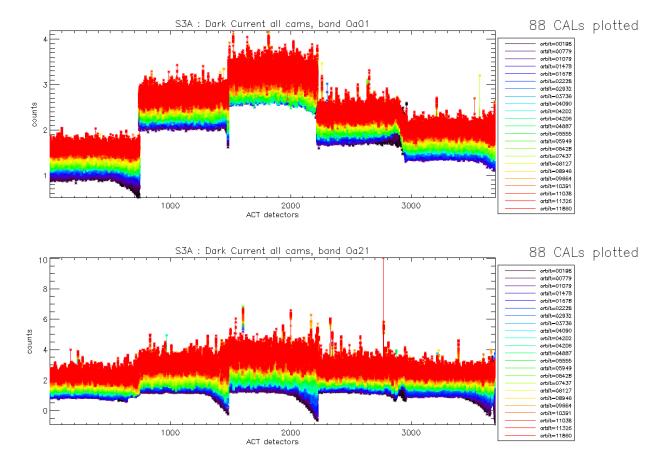


Figure 9: Dark Current for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.

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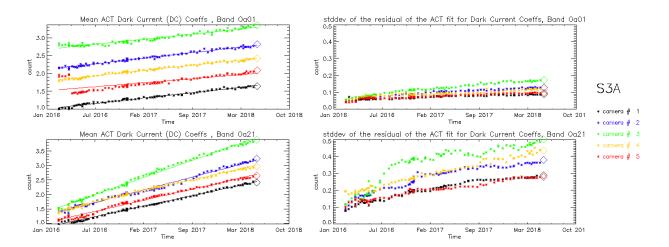


Figure 10: left column: ACT mean on 400 first detectors of Dark Current coefficients for spectral band Oa01 (top) and Oa21 (bottom). Right column: same as left column but for Standard deviation instead of mean. We see an increase of the DC level as a function of time especially for band Oa21. A possible explanation could be the increase of the number of hot pixels which is more important in Oa21 because this band is made of more CCD lines than band Oa01 and thus receives more cosmic rays impacts. It is known that cosmic rays degrade the structure of the CCD, generating more and more hot pixels at long term scales.

2.2.2 Instrument response and degradation modelling [OLCI-L1B-CV-250]

2.2.2.1 Instrument response monitoring

Figure 11 shows the gain coefficients of every pixel for two OLCI channels, Oa1 (400 nm) and Oa21 (1020 nm), highlighting the significant evolution of the instrument response since early mission.



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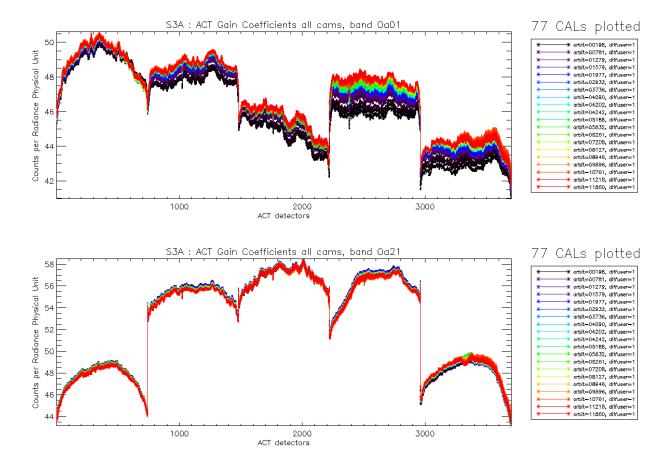


Figure 11: Gain Coefficients for band Oa1 (top) and Oa21 (bottom), all diffuser 1 radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.

The gains plotted in Figure 11, however are derived using the ground BRDF model — as the only one available in the operational processing software so far — which is known to suffer from illumination geometry dependent residual errors (see previous Cyclic Reports for more details). Consequently they are post-processed to replace the ground BRDF model by the in-flight version, based on Yaw Manoeuvres data, prior to determine the radiometric evolution.

Figure 12 displays a summary of the time evolution derived from post-processed gains: the cross-track average of the BRDF corrected gains (taking into account the diffuser ageing) is plotted as a function of time, for each module, relative to a given reference calibration (the 07/12/2016). It shows that, if a significant evolution occurred during the early mission, the trends tend to stabilize, with the exception of band 1 of camera 1 and 4.



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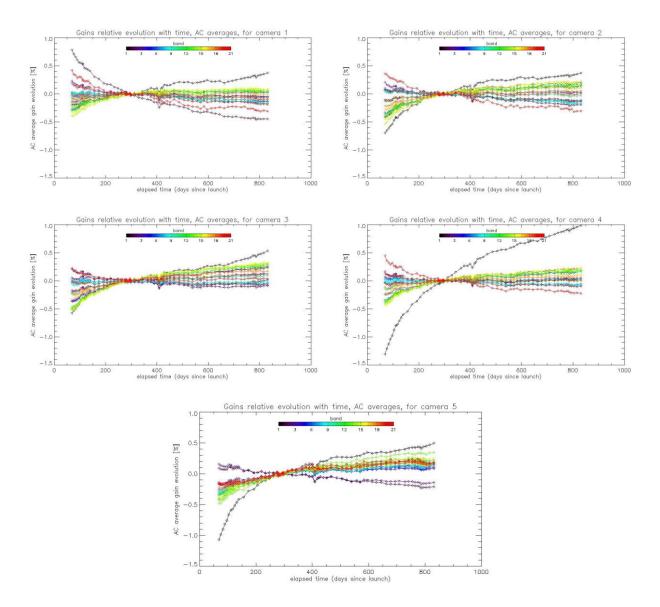


Figure 12: camera averaged gain relative evolution with respect to "best geometry" calibration (07/12/2016), as a function of elapsed time since the change in OLCI channels settings (25/04/16); one curve for each band (see colour code on plots), one plot for each module. The diffuser ageing has been taken into account.

2.2.2.2 Instrument evolution modelling

As mentioned in cycle #22 report, the OLCI Radiometric Model has been refreshed, and put in operations the 11/10/2017. The model has been derived on the basis of an extended Radiometric Calibration dataset (from 25/04/2016 to 27/08/2017), and includes the correction of the diffuser ageing for the five bluest bands (Oa1 to Oa5) for which it is clearly measurable. The model performance over the complete dataset (including the 21 calibrations in extrapolation over about nine months) remains better than 0.1% – except for channels Oa1 (400nm) and Oa21 (1020 nm) which are respectively < 0.25% and < 0.15% – when averaged over the whole field of view (Figure 13) even if a small drift of the model with respect to most recent data is now visible. The previous model, trained on a Radiometric



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Dataset limited to 12/03/2017, shows a stronger drift of the model with respect to most recent data (Figure 14). Comparison of the two figures shows the improvement brought by the updated Model.

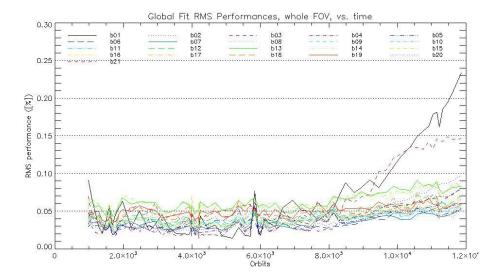


Figure 13: RMS performance of the Gain Model of current Processing Baseline as a function of orbit.

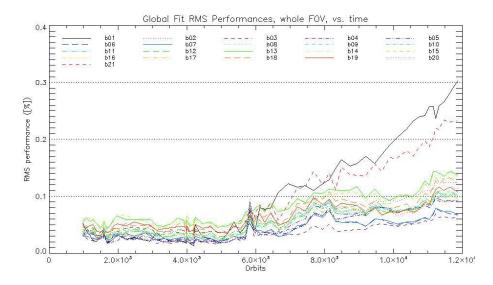


Figure 14: RMS performance of the Gain Model of previous Processing Baseline as a function of orbit.

The overall instrument evolution since channel programming change (25/04/2016) is shown on Figure 15.

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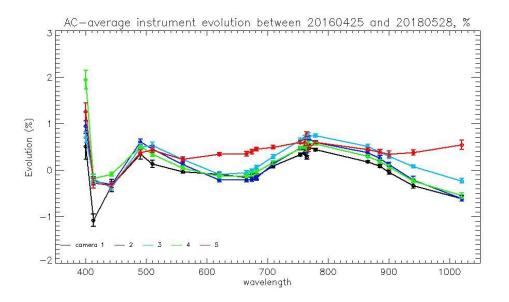


Figure 15: Camera-averaged instrument evolution since channel programming change (25/04/2016) and up to most recent calibration (28/05/2018) versus wavelength.

The overall per camera performance, as a function of wavelength, and at each orbit is shown on Figure 16 as the average and standard deviation of the model over data ratio.

Finally, Figure 17 to Figure 19 show the detail of the model performance, with across-track plots of the model over data ratios at each orbit, one plot for each channel.

Comparisons of Figure 17 to Figure 19 with their counterparts in Report of Cycle 22 clearly demonstrate the improvement brought by the new model whatever the level of detail.

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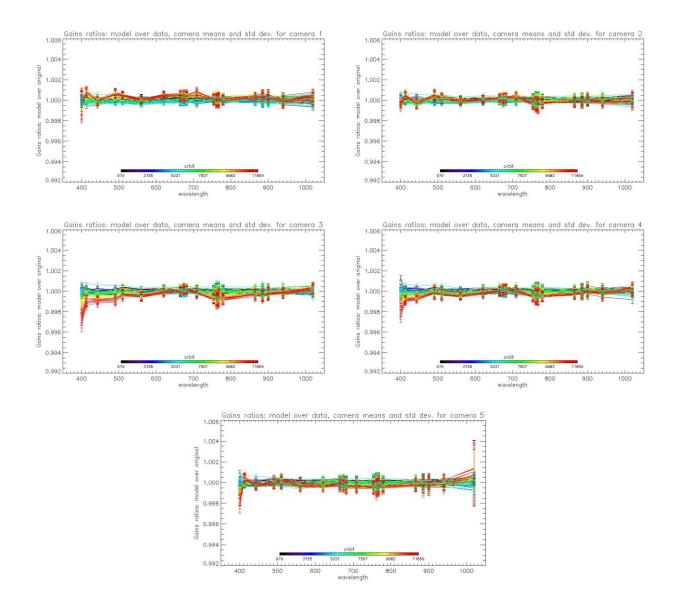


Figure 16: For the 5 cameras: Evolution model performance, as camera-average and standard deviation of ratio of Model over Data vs. wavelength, for each orbit of the test dataset, including 21 calibrations in extrapolation, with a colour code for each calibration from blue (oldest) to red (most recent).

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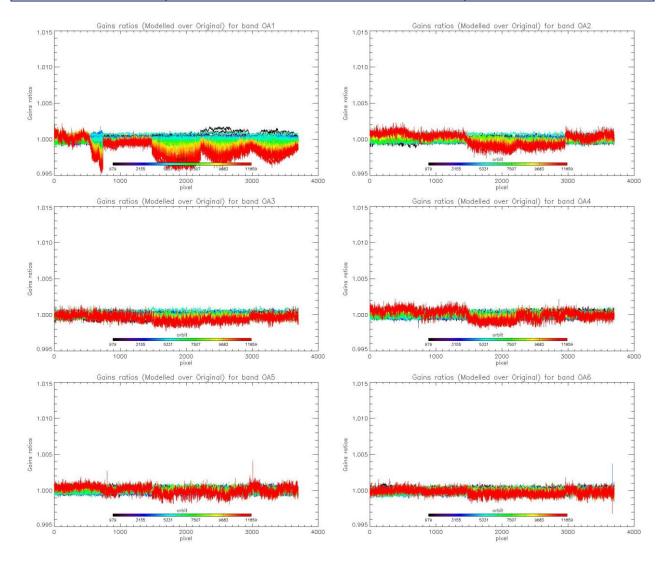


Figure 17: Evolution model performance, as ratio of Model over Data vs. pixels, all cameras side by side, over the whole current calibration dataset (since instrument programing update), including 21 calibrations in extrapolation, channels Oa1 to Oa6.

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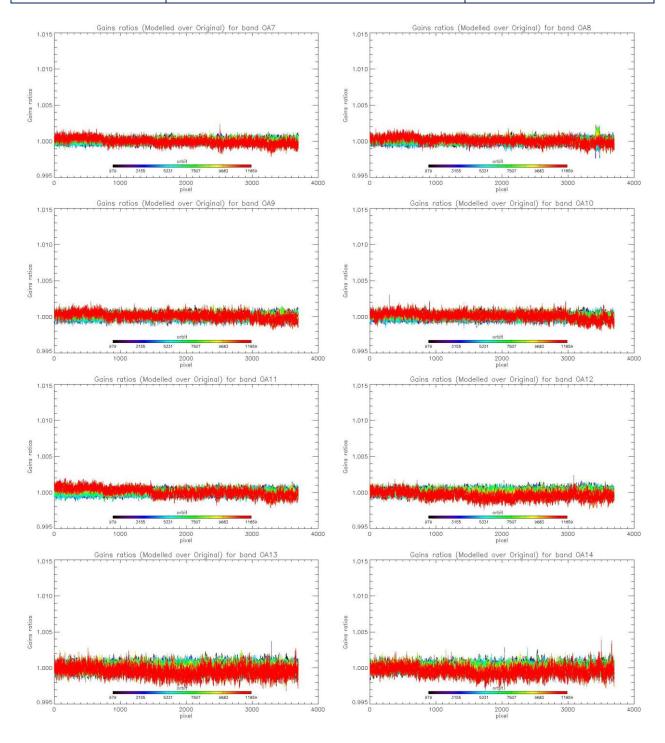


Figure 18: same as Figure 14 for channels Oa7 to Oa14.

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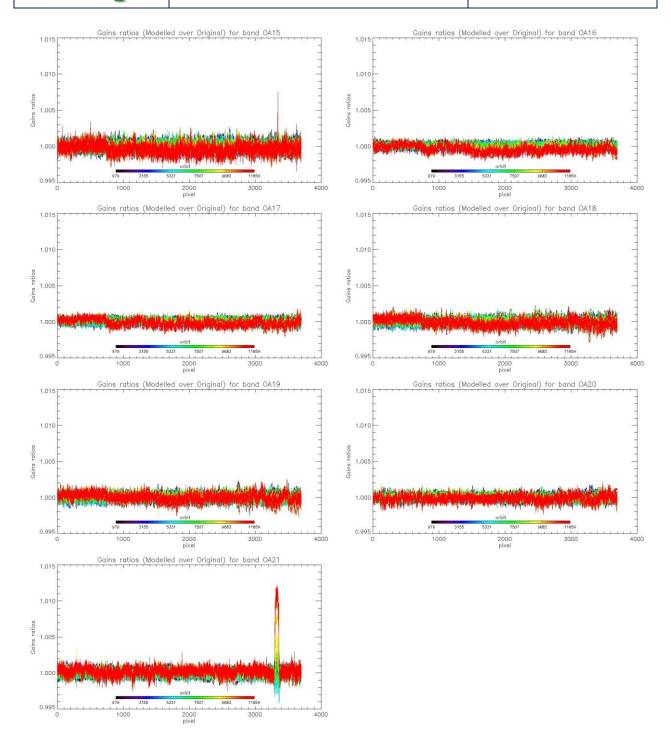


Figure 19: same as Figure 17 for channels Oa15 to Oa21.



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2.2.3 Ageing of nominal diffuser [OLCI-L1B-CV-240]

There has been no calibration sequence S05 (reference diffuser) acquisition during cycle 031.

Consequently, the last updated results (cycle 029) are still valid.

2.2.4 Updating of calibration ADF [OLCI-L1B-CV-260]

There has been no Calibration ADF generation during the current cycle.

2.2.5 Radiometric Calibrations for sun azimuth angle dependency and Yaw Manoeuvres for Solar Diffuser on-orbit re-characterization [OLCI-L1B-CV-270 and OLCI-L1B-CV-280]

This activity has not evolved during cycle 031 and results presented in Cycle 15 report are still valid.

2.3 Spectral Calibration [OLCI-L1B-CV-400]

There has been no Spectral Calibration (S02 + S03) acquisition during the reporting period.

Consequently, last results, presented in cycle 029 report are still valid.

2.4 Signal to Noise assessment [OLCI-L1B-CV-620]

2.4.1 SNR from Radiometric calibration data

SNR computed for all calibration data (S01, S04 and S05 sequences) as a function of band number is presented in Figure 20.

SNR computed for all calibration data as a function of orbit number for band Oa01 (the less stable band) is presented in Figure 21.

There is no significant evolution of this parameter during the current cycle and the ESA requirement is fulfilled for all bands.

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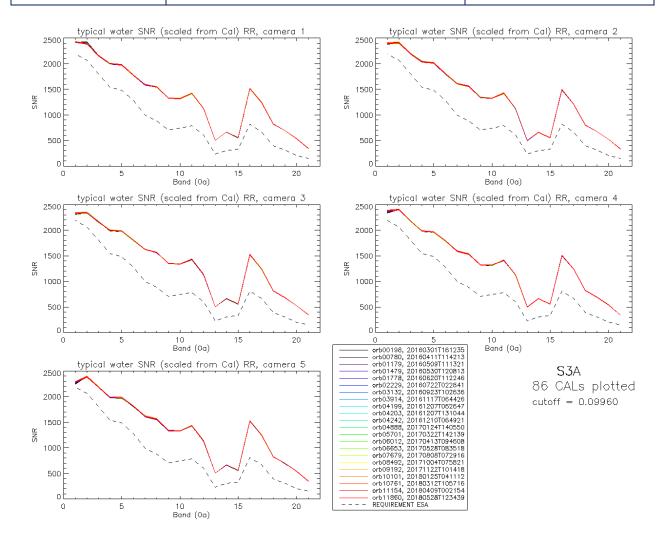


Figure 20: Signal to Noise ratio as a function of the spectral band for the 5 cameras. These results have been computed from radiometric calibration data. All calibrations except first one (orbit 183) are presents with the colours corresponding to the orbit number (see legend). The SNR is very stable with time: the curves for all orbits are almost superimposed. The dashed curve is the ESA requirement.

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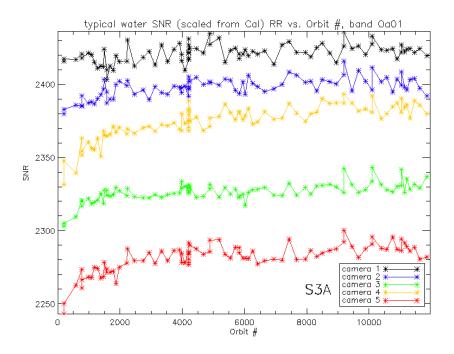


Figure 21: long-term stability of the SNR estimates from Calibration data, example of channel Oa1.

The mission averaged SNR figures are provided in Table 1 below, together with their radiance reference level. According to the OLCI SNR requirements, these figures are valid at these radiance levels and at Reduced Resolution (RR, 1.2 km). They can be scaled to other radiance levels assuming shot noise (CCD sensor noise) is the dominating term, i.e. radiometric noise can be considered Gaussian with its standard deviation varying as the square root of the signal; in other words: $SNR(L) = SNR(L_{ref}) \cdot \sqrt{\frac{L}{L_{ref}}}$. Following the same assumption, values at Full Resolution (300m) can be derived from RR ones as 4 times smaller.



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Table 1: SNR figures as derived from Radiometric Calibration data. Figures are given for each camera (time average and standard deviation), and for the whole instrument. The requirement and its reference radiance level are recalled (in mW.sr⁻¹.m⁻².nm⁻¹).

	L_{ref}	SNR	C	1	C2		C3		C4		C5		All	
nm	LU	RQT	avg	std	avg	std	avg	std	avg	std	avg	std	avg	std
400	63	2188	2420	6.1	2397	6.7	2326	6.3	2374	11.6	2281	9.7	2360	7
412	74.1	2061	2394	7.7	2408	5.5	2340	4.8	2402	4.5	2386	7	2386	4
442	65.6	1811	2161	5.1	2199	5.6	2166	4.8	2185	4.1	2197	4.6	2182	3.3
490	51.2	1541	2000	5	2036	5.3	1996	3.9	1982	3.9	1988	5	2000	3.5
510	44.4	1488	1979	5.4	2014	5	1984	4.9	1966	4.7	1985	4.7	1985	4
560	31.5	1280	1776	4.4	1802	4.3	1802	4.8	1794	4	1818	3.7	1798	3.2
620	21.1	997	1591	4.2	1610	4.1	1625	3.1	1593	3.3	1615	3.7	1607	2.7
665	16.4	883	1547	4.5	1559	4.1	1567	3.8	1533	4	1560	3.9	1553	3.2
674	15.7	707	1329	3.3	1338	3.7	1350	2.9	1324	2.9	1342	4	1336	2.5
681	15.1	745	1320	3.7	1327	3	1337	2.8	1314	2.6	1333	3.8	1326	2.3
709	12.7	785	1421	4.5	1421	4.3	1435	3.5	1414	3.6	1430	3.2	1424	3.1
754	10.3	605	1127	3.3	1120	3	1134	3.7	1124	2.6	1138	3.1	1129	2.6
761	6.1	232	502	1.3	498	1.2	505	1.3	500	1.1	507	1.5	502	1
764	7.1	305	663	1.7	657	1.5	667	2.2	661	1.7	669	2.2	663	1.5
768	7.6	330	558	1.7	554	1.3	562	1.3	556	1.6	564	1.4	559	1.2
779	9.2	812	1515	5.1	1497	5.1	1524	5.4	1510	5.4	1525	5	1514	4.6
865	6.2	666	1244	3.7	1213	4.1	1238	4.2	1246	3.8	1250	3	1238	3.2
885	6	395	823	1.8	801	1.7	814	2	824	1.5	831	1.9	819	1.3
900	4.7	308	691	1.6	673	1.3	683	1.7	693	1.5	698	1.5	687	1.1
940	2.4	203	534	1.1	522	1	525	1	539	1.1	542	1.3	532	0.7
1020	3.9	152	345	0.8	337	0.8	348	0.7	345	8.0	351	0.7	345	0.5

2.4.2 SNR from EO data

There has been no update on SNR assessment from EO data during the cycle. Last figures (cycle 9) are considered valid.



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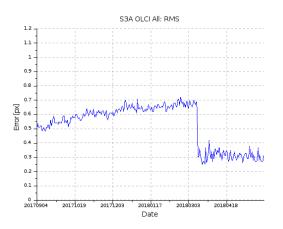
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2.5 Geometric Calibration/Validation

OLCI georeferencing performance was slowly degrading among the last months, down to the point at which compliance to the requirement (0.5 pixel RMS) was not met anymore. A new geometric calibration has been done by ESTEC, provided to S3-MPC for formatting into the appropriate ADF and validation (successful and reported in S3MPC.ACR.VR.030); it was put in production on the 14th of March 2018.

The following figures show time series of the overall RMS performance (requirement criterion) and of the across-track and along-track biases for each camera. The performance improvement on the 14/03/2018 is obvious on each figure and compliance is comfortably met again (Figure 22): RMS values remain around 0.3 pixel from 14/03 on. The most dramatic improvements affect along-track bias of Camera 3 (Figure 26) and across-track biases of Cameras 4 and 5 (Figure 27 & Figure 28, respectively).



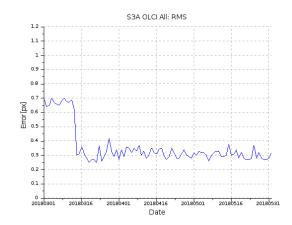
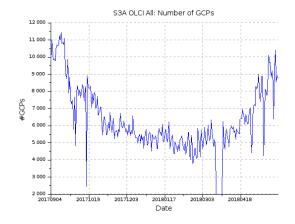


Figure 22: overall OLCI georeferencing RMS performance time series over the whole monitoring period (left) and restricted to March 2018 (right)



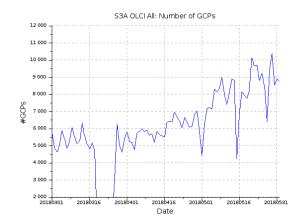


Figure 23: number of validated control points corresponding to the performance time series of Figure 22 for the same periods (complete, left, and restricted to March 2018, right).



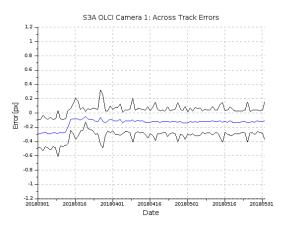
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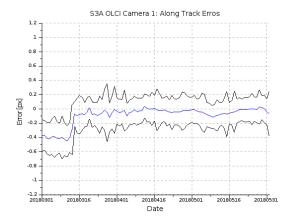
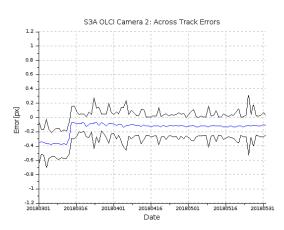


Figure 24: across-track (left) and along-track (right) georeferencing biases time series for Camera 1 (starting 01/03/2018).



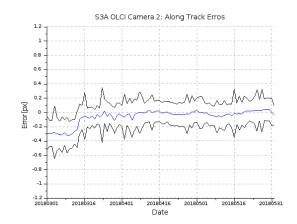
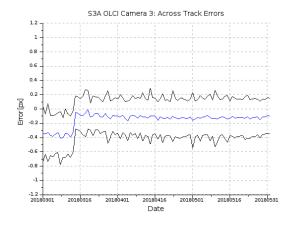


Figure 25: same as Figure 24 for Camera 2.



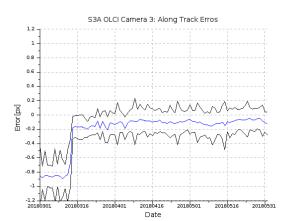


Figure 26: same as Figure 24 for Camera 3.

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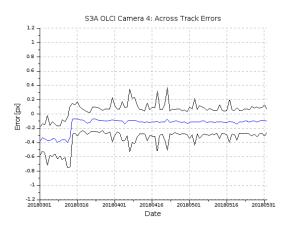
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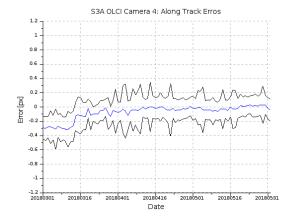
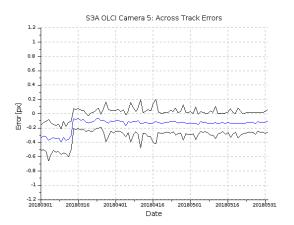


Figure 27: same as Figure 24 for Camera 4.



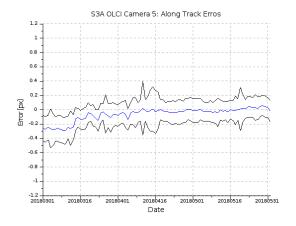


Figure 28: same as Figure 24 for Camera 5.



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3 OLCI Level 1 Product validation

3.1 [OLCI-L1B-CV-300], [OLCI-L1B-CV-310] - Radiometric Validation

3.1.1 S3ETRAC Service

Activities done

The S3ETRAC service extracts OLCI L1 RR and SLSTR L1 RBT data and computes associated statistics over 49 sites corresponding to different surface types (desert, snow, ocean maximizing Rayleigh signal, ocean maximizing sunglint scattering and deep convective clouds). The S3ETRAC products are used for the assessment and monitoring of the L1 radiometry (optical channels) by the ESLs.

All details about the S3ETRAC/OLCI and S3ETRAC/SLSTR statistics are provided on the S3ETRAC website http://s3etrac.acri.fr/index.php?action=generalstatistics

- Number of OLCI products processed by the S3ETRAC service
- Statistics per type of target (DESERT, SNOW, RAYLEIGH, SUNGLINT and DCC)
- Statistics per sites
- Statistics on the number of records

For illustration, we provide below statistics on the number of S3ETRAC/OLCI records generated per type of targets (DESERT, SNOW, RAYLEIGH, SUNGLINT and DCC). Note that due to a technical issue, S3ETRAC production rate has been reduced in December and came back to nominal only recently. As a consequence, figures below do not represent the full production of December 2017.



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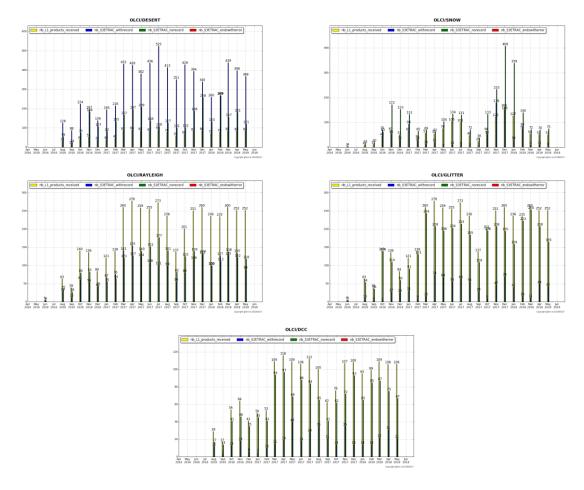


Figure 29: summary of S3ETRAC products generation for OLCI
(number of OLCI L1 products Ingested, yellow – number of S3ETRAC extracted products generated, blue –
number of S3ETRAC runs without generation of output product (data not meeting selection requirements), green
– number of runs ending in error, red, one plot per site type).

3.1.2 Radiometric validation with DIMITRI

Highlights

- Run Rayleigh, Glint and Desert methods over the available products until 31st of May 2018.
- The results (Glint and PICS) are consistent with the previous cycle over the used CalVal sites, while no new products have passed Rayleigh criteria.
- Good stability of the sensor could be observed, nevertheless, the time-series average shows higher reflectance over the VNIR spectral range with biases of 2%-4% except bands Oa06-Oa09
- Bands with high gaseous absorption are excluded.

I-Validation over PICS

1. Ingestion of all the available L1B-LN1-NT products in the S3A-Opt database over the 6 desert CalValsites (Algeria 3 & 5, Libya 1 & 4 and Mauritania 1 & 2) has been performed until 31st of May 2018.



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2. The results are consistent overall the six used PICS sites (Figure 30). OLCI reflectance shows a good stability over the analysed period.

3. The temporal average over the period **January 2018 – May 2018** of the elementary ratios (observed reflectance to the simulated one) shows values higher than/around 2-3% (above the 2% mission requirements) over all the VNIR bands (Figure 31). The spectral bands with significant absorption from water vapour and O_2 (Oa11, Oa13 Oa14 and Oa15) are excluded.

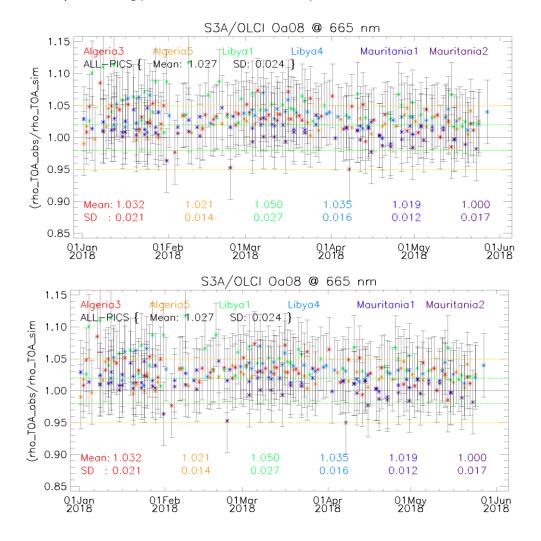


Figure 30: 2018 Time-series of the elementary ratios (observed/simulated) signal from S3A/OLCI for (top to bottom) bands Oa03, Oa8 and Oa17 respectively over Six PICS Cal/Val sites. Dashed-green and orange lines indicate the 2% and 5% respectively. Error bars indicate the desert methodology uncertainty.



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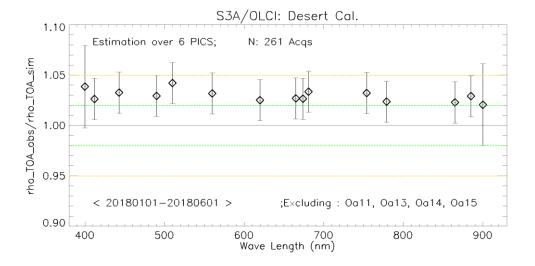


Figure 31: The estimated gain values for S3A/OLCI over the 6 PICS sites identified by CEOS over the period January 2018 – May 2018 as a function of wavelength. Dashed-green and orange lines indicate the 2% and 5% respectively. Error bars indicate the desert methodology uncertainty.

II- Cross-mission Intercomparison over PICS

X-mission Intercomparison with MODIS-A and MSI-A has been performed until January and May 2018 respectively. Figure 32 shows time-series of the elementary ratios from S2A/MSI, Aqua/MODIS and S3A/OLCI over the LYBIA4 site over the period April-2016 until May 2018 (for OLCI).

We observe a clear stability over the three sensors, associated with higher reflectance from OLCI wrt to MSI and MODISA. MODISA shows higher fluctuation with respect to MSI and OLCI ones.

Figure 33 shows the estimated gain over the different time-series from different sensors (MERIS (3REP archive), MSI-A, MODIS-A and OLCI) over PICS for the common bands. The spectral bands with significant absorption from water vapour and O_2 are excluded. OLCI-A seems to have higher gain (Figure 33) than the other sensors, which means that OLCI-A has higher reflectance that the ones simulated by the PICS method.

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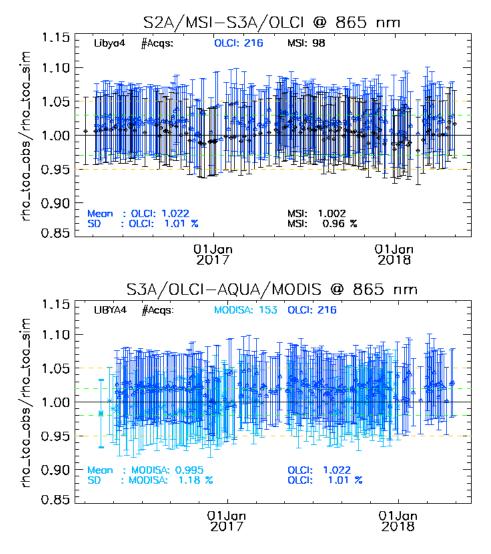


Figure 32: Time-series of the elementary ratios (observed/simulated) signal from (black) S2A/MSI, (blue) S3A/OLCI, and (Cyan) MODIS-A for band Oa17 (865nm) over the LIBYA4 site. Dashed-green and orange lines indicate the 2% and 5% respectively. Error bars indicate the desert methodology uncertainty.

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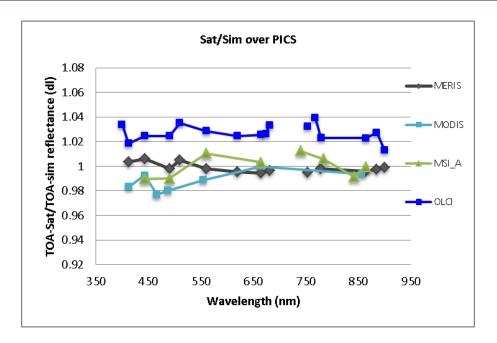


Figure 33: Ratio of observed TOA reflectance to simulated one for (black) MERIS/3REP, (green) S2A/MSI, (cyan) Aqua/MODIS and (blue) S3A/OLCI averaged over the six PICS test sites as a function of wavelength.

III-Validation over Rayleigh

Rayleigh method has been performed over the available mini-files on the Opt-server until May 2018. The results produced with the configuration (ROI-AVERAGE) are consistent with the results of PICS method but slightly higher than the Cycles 29 ones in the blue part of the spectrum. While bands Oa01-Oa05 display a bias values between 2%-5%, bands Oa6-Oa9 exhibit biases at the edge of the 2% mission requirement (Figure 34 and Figure 35).



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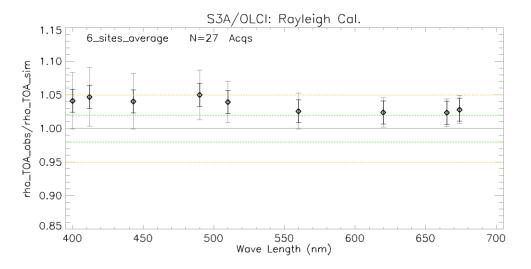


Figure 34: The estimated gain values for S3A/OLCI over the 6 Ocean CalVal sites (Atl-NW_Optimum, Atl-SW_Optimum, Pac-NE_Optimum, Pac-NW_Optimum, SPG_Optimum and SIO_Optimum) over the period November 2016 – May 2018 as a function of wavelength. Dashed-green, and orange lines indicate the 2%, 5% respectively. Error bars indicate (black) the methodology uncertainty and (grey) the standard deviation over the 6 CalVal sites.

IV-Validation over Glint

Glint calibration method with the configuration (ROI-PIXEL) has been extended over the period December 2016 – May 2018 from the available mini-files. The outcome of this analysis shows a good consistency with Rayleigh and the desert outputs over the NIR spectral range Oa06-Oa09, while bands Oa12, Oa16, Oa17 and Oa18 are within the 2% mission requirements (see Figure 35).

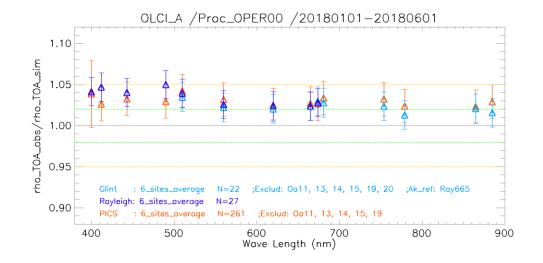


Figure 35: The estimated gain values for S3A/OLCI from Glint, Rayleigh and PICS over the period January 2018 – May 2018 for PICS and December 2016- May 2018 for Glint and Rayleigh methods as a function of wavelength. We use the gain value of Oa8 from Rayleigh method as reference gain for Glint. Dashed-green and orange lines indicate the 2% and 5% respectively. Error bars indicate the methods uncertainties.

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3.1.3 Radiometric validation with OSCAR

There has been no new result during the cycle. Last figures (cycle 29) are considered valid.

3.2 [OLCI-L1B-CV-320] – Radiometric Validation with Level 3 products

There has been no new result during the cycle. Last figures (cycle 20) are considered valid.



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4 Level 2 Land products validation

4.1 [OLCI-L2LRF-CV-300]

There has been no new result during the cycle. Last figures (cycle 30) are considered valid.

4.2 [OLCI-L2LRF-CV-410 & OLCI-L2LRF-CV-420] — Cloud Masking & Surface Classification for Land Products

There has been no new result during the cycle. Last figures (cycle 27) are considered valid.



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5 Level 2 Water products validation

5.1 [OLCI-L2-CV-210, OLCI-L2-CV-220] – Vicarious calibration of the NIR and VIS bands

There has been no update of the SVC (System Vicarious Calibration) during Cycle 031. Last figures (cycle 17) are considered valid.

5.2 [OLCI-L2WLR-CV-300, OLCI-L2WLR-CV-310, OLCI-L2WLR-CV-32, OLCI-L2WLR-CV-330, OLCI-L2WLR-CV-340, OLCI-L2WLR-CV-350, OLCI-L2WLR-CV-360 and OLCI-L2WLR-CV-370] — Level 2 Water-leaving Reflectance product validation.

Activities done

- The focus for this time period has been on the rolling archive None Time Critical (NT) data from March 1st to June 3rd. There are very few data available for statistical analysis. Current reporting period is her after compared to the reprocessed archive covering the April 2016 to November 2017 period. None issues are reported neither in the extraction process nor in OLCI data.
- All extractions and statistics have been regenerated from March 1st onward (rolling archive availability) for WFR data. The available matchups therefore cover the spring situation.
- At best 26 matchups at 490 and 560nm are useful for this time period. OLCI's performances remain nominal.

Overall Water-leaving Reflectance performance

Figure 36 and Figure 37 below presents the scatterplots and statistics of OLCI FR versus in situ reflectance. Two time periods are considered:

- The reprocessed archive covering the April 2016 to November 2017 time period
- The current reporting period computed on the NT dataset.

The current reporting period statistics are in line with the reprocessed dataset.

Table 2 to Table 3 below summarise the statistics over reprocessed time period and the current reporting period. Some statistical variables can differ very much as a consequence of the little number of points (ex: slope and intercept). None the less RPQ and RMSE are in the same order of magnitude for both dataset.

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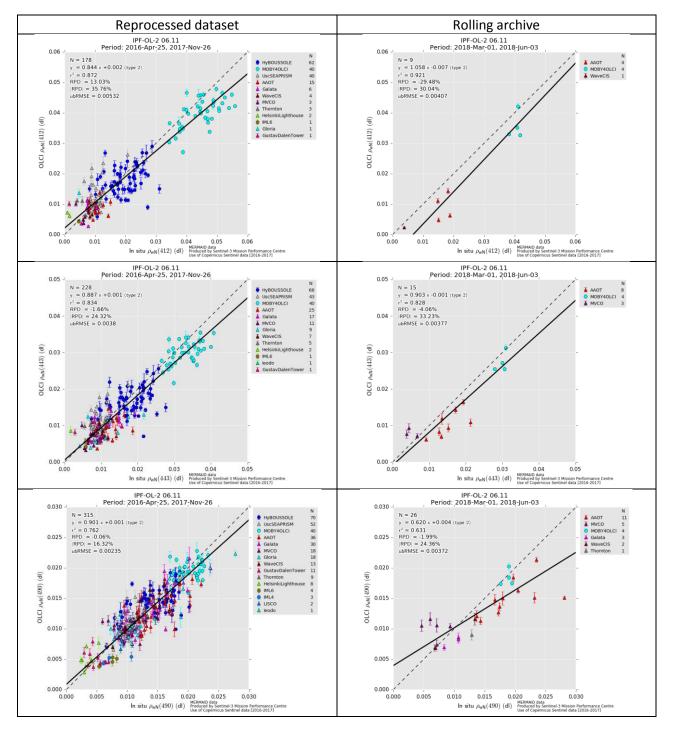


Figure 36: Scatter plots of OLCI versus in situ radiometry (FR data). Reprocessed dataset (left), current time period (right)

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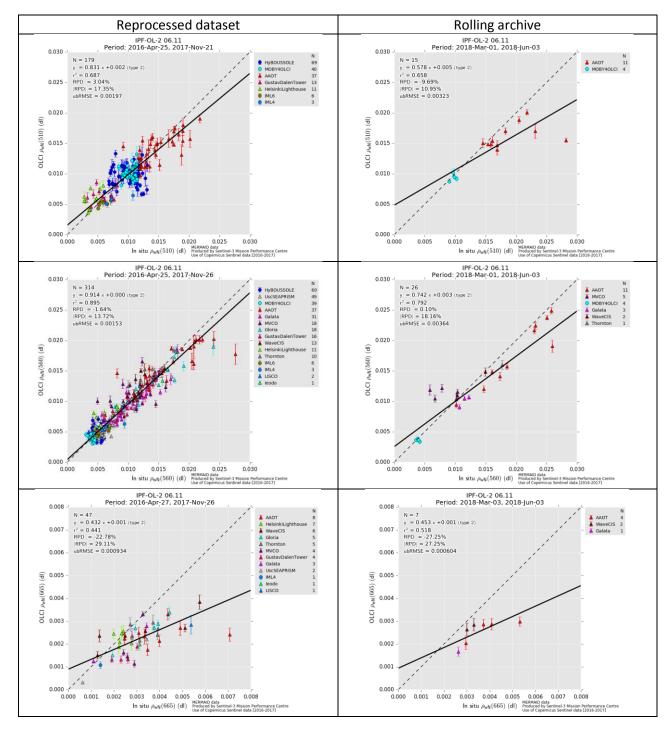


Figure 37: Scatter plots of OLCI versus in situ radiometry (FR data). Reprocessed dataset (left), current time period (right)



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Table 2: FR statistics over REP_006 period; FR data.

lambda	N	RPD	RPD	MAD	RMSE	slope	intercept	r2
400	105	3.52%	20.74%	-0.0009	0.0062	0.8774	0.0029	0.8435
412	178	13.03%	35.76%	-0.0011	0.0054	0.8444	0.0021	0.8721
443	228	-1.66%	24.32%	-0.0013	0.0040	0.8874	0.0006	0.8336
490	315	-0.06%	16.32%	-0.0004	0.0024	0.9009	0.0009	0.7618
510	179	3.04%	17.35%	-0.0002	0.0020	0.8314	0.0015	0.6869
560	314	-1.64%	13.72%	-0.0003	0.0016	0.9139	0.0004	0.8946
665	47	-22.78%	29.11%	-0.0009	0.0013	0.4325	0.0009	0.4406

Table 3: FR statistics over March 2018-June 2018 reporting period, cyclic report#31; FR data.

lambda	N	RPD	RPD	MAD	RMSE	slope	intercept	r2
400	14	-9.9%	11.7%	-0.0049	0.0065	0.9241	-0.0012	0.5049
412	18	-14.1%	16.1%	-0.0057	0.0072	0.8357	0.0005	0.9427
443	24	-12.4%	16.2%	-0.0033	0.0046	0.8364	0.0005	0.9605
490	31	-5.5%	10.3%	-0.0011	0.0021	0.8081	0.0021	0.8710
510	14	-8.1%	10.8%	-0.0009	0.0015	2.5638	-0.0183	0.2207
560	30	-5.1%	12.1%	-0.0003	0.0011	1.0427	-0.0006	0.9236

Figure 38 and Figure 39 below present AAOT and MOBY in situ and OLCI time series over the current reprocessing period.

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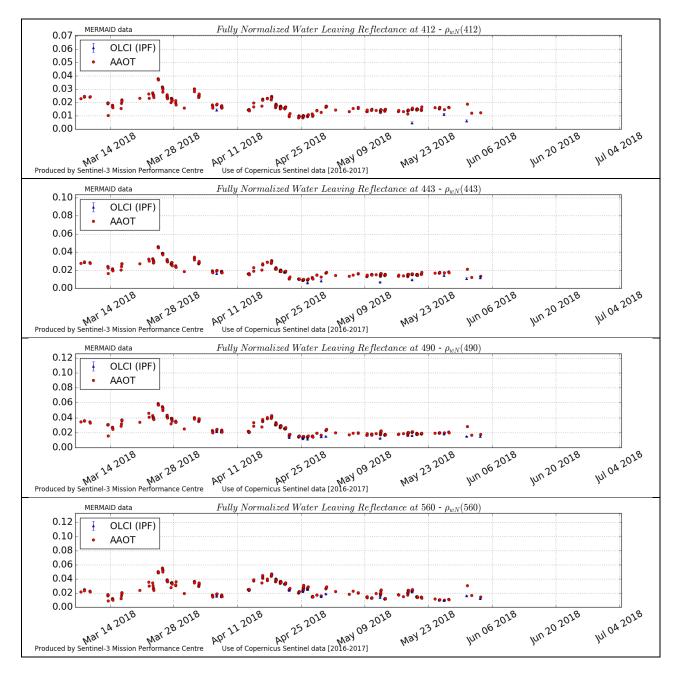


Figure 38: AAOT time series over current report period



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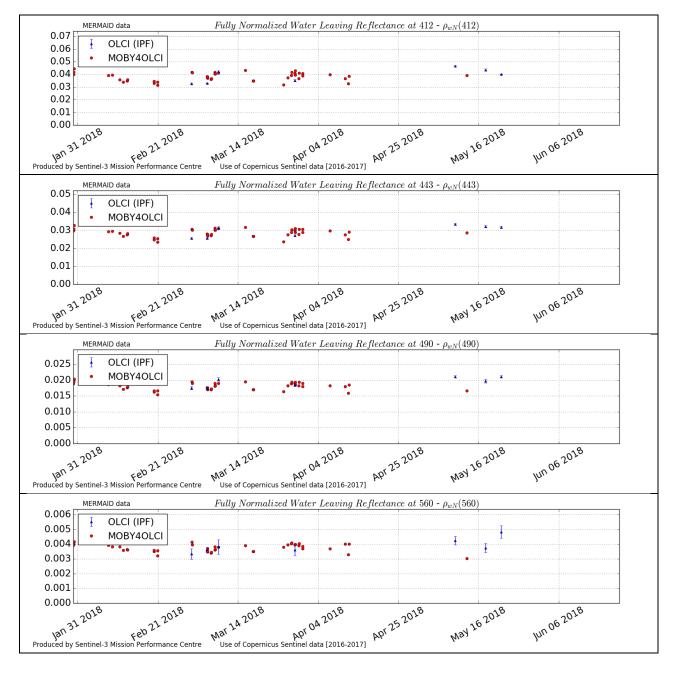


Figure 39: MOBY time series over current report period

5.3 [OLCI-L2WLR-CV-430] – Algorithm performance over spatial and temporal domains

There has been no new result during the cycle. Last figures (cycle 27) are considered valid.



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5.4 [OLCI-L2WLR-CV-510 & 520] — Cloud Masking & Surface Classification for Water Products

There has been no new result during the cycle. Last figures (cycle 27) are considered valid.

5.5 [OLCI-L2WLR-CV530] Validation of Aerosol Product

There has been no new result during the cycle. Last figures (cycle 30) are considered valid.

5.6 [OLCI-L2WLR-CV-380] Development of calibration, product and science algorithms

There has been no new developments on calibration, product and science algorithms during the cycle.



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6 Validation of Integrated Water Vapour over Land & Water

The OLCI IWV above land surface product is continuously validated via global GNSS (Ware et al. 2000) measurements. 12500 matchups within the period of June 2017 to May 2018 have been analysed yet. The scenes cover high and low elevations; however, the majority of the used SUOMI-NET ground stations are in North and Central America. Only OLCI measurements are taken for the validation which are above land and are cloud-free in an area of about 30 km around the GNSS stations. For the cloud detection, the standard L2 cloud-mask has been applied (including the cloud ambiguous and cloud margin flags).

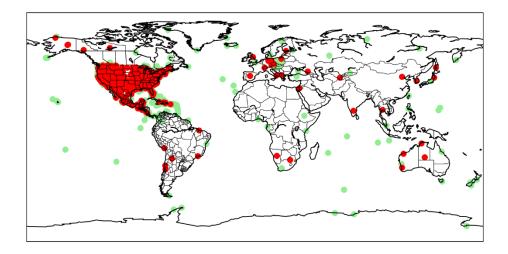


Figure 40: Position of the GNSS stations used for the IWV validation. Light green dots indicate positions which haven't been used, because of cloud contaminations.

The validation of the TCWC product shows a high agreement between the OLCI and the GNSS derived IWV (Figure 41). However, surprisingly the quality decrease compared to last report (March 2018). The correlation between both quantities is 0.85 (was 0.95). The root-mean-squared-difference (rmsd) is 4.5 kg/m² (was 3.3 kg/m²), the bias corrected rmsd is 4.3 kg/m² (was 2.6 kg/m²). The systematic overestimation of 10% reduces to 5%, but this is obviously a compensating effect. Apparently, the amount of too dry OLCI retrievals has increased drastically. This is usually a result of a non-perfect cloud detection. As a first test we added a filter to the investigated scenes: only cases were considered, where the standard deviation within the scene was smaller than 5%. The excluded mountainous scenes but also undetected clouds. The results are shown in Figure 42. The consequences are as expected, all quality measures improved, the systematic wet bias moved back to the 'normal' 10%. The next step is to visually inspect selected scenes (with dry biases), in order to investigate if the hypothesis is true.

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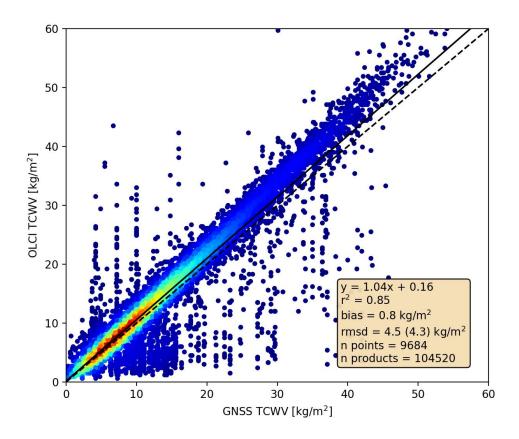


Figure 41: Scatter plot of the IWV products, derived from OLCI above land and from GNSS measurements.

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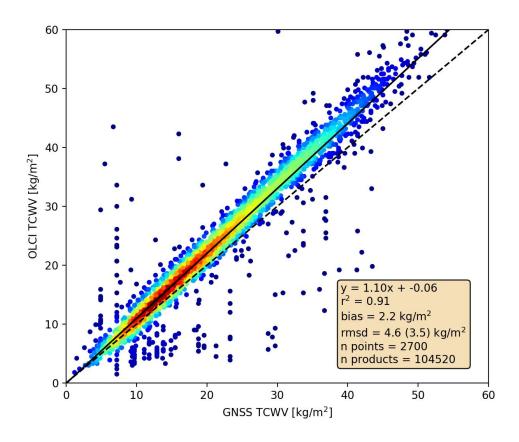


Figure 42: Scatter plot of the IWV products, derived from OLCI above land and from GNSS measurements.



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7 Level 2 SYN products validation

7.1 [SYN-L2-CV-100]

There has been no new result during the cycle. Last figures (cycle 27) are considered valid.

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8 Events

Two OLCI Radiometric Calibration Sequences have been acquired during Cycle 031:

- S01 sequence (diffuser 1) on 12/05/2018 12:50 to 12:52 (absolute orbit 11632)
- S01 sequence (diffuser 1) on 28/05/2018 12:34 to 12:36 (absolute orbit 11860)



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9 Appendix A

Other reports related to the Optical mission are:

S3-A SLSTR Cyclic Performance Report, Cycle No. 031 (ref. S3MPC.RAL.PR.02-031)

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

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