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

S3 OLCI Cyclic Performance Report

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Cycle No. 052

Start date: 22/11/2019

End date: 19/12/2019

S3-B

Cycle No. 033

Start date: 02/12/2019

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SENTINEL 3



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Changes Log

Version	Date	Changes
1.0	10/01/2020	First Version

List of Changes

Version	Section	Answers to RID	Changes



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1 Processing Baseline Version

1.1 Sentinel3-A

IPF	IPF / Processing Baseline version	Date of deployment
OL1	06.08 / 2.58	NRT: 29/10/2019 08:26UTC NTC 29/10/2019 08:26UTC
OL2 LAND	06.13 / 2.60	NRT: 27/11/2019 09:38 UTC NTC: 27/11/2019 09:38 UTC
OL2 MAR	06.12 / 2.38	NRT: 29/08/2018 09:24 UTC NTC: 29/08/2018 09:33 UTC
SY2	06.17 / 2.51	NTC: 30/05/2019 11:00 UTC
SY2_VGS	06.07 / 2.44	NTC: 21/01/2019 10:06 UTC

1.2 Sentinel3-B

IPF	IPF / Processing Baseline version	Date of deployment
OL1	06.08 / 1.30	NRT: 29/10/2019 08:26 UTC NTC: 29/10/2019 08:26 UTC
OL2 LAND	06.13 / 1.32	NRT: 27/11/2019 09:38 UTC NTC: 27/11/2019 09:38 UTC
OL2 MAR	06.12 / 1.09	NRT: 29/08/2018 09:24 UTC NTC: 29/08/2018 09:33 UTC
SY2	06.17 / 1.23	NTC: 30/05/2019 11:00 UTC
SY2_VGS	06.07 / 1.16	NTC: 21/01/2019 10:06 UTC

SENTINEL 3 Mission Performance

Sentinel-3 MPC

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2 Instrument monitoring

2.1 CCD temperatures

2.1.1 OLCI-A

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.

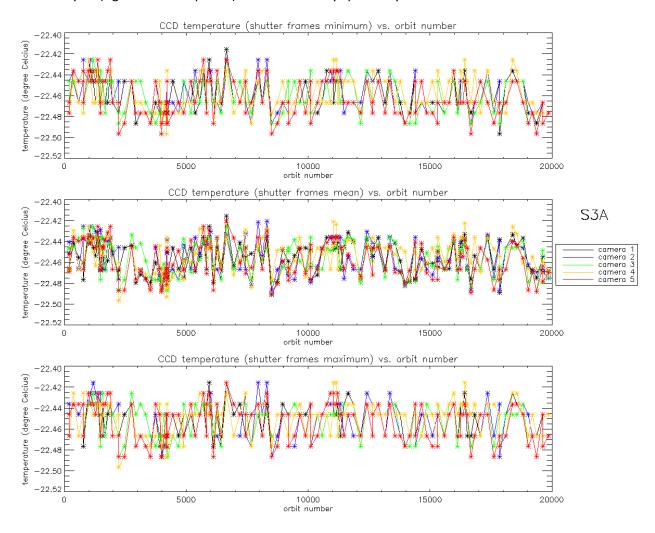


Figure 1: long term monitoring of OLCI-A CCD temperatures using minimum value (top), time averaged values (middle), and maximum value (bottom) provided in the annotations of the Radiometric Calibration Level 1 products, for the Shutter frames, all radiometric calibrations so far except the first one (absolute orbit 183) for which the instrument was not yet thermally stable.

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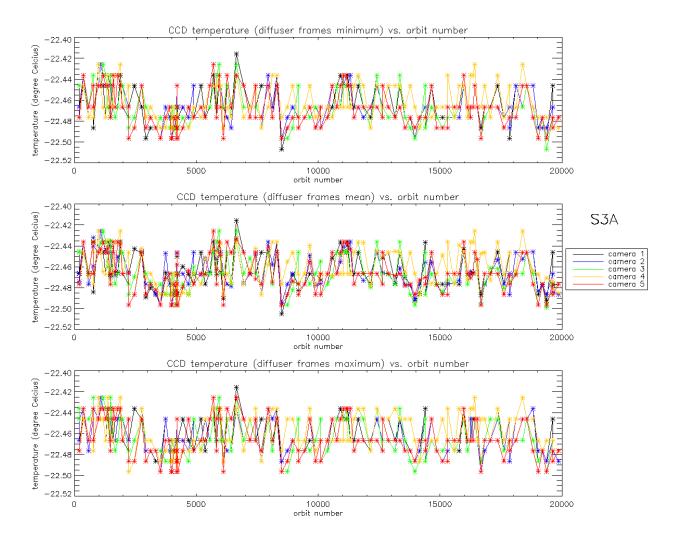


Figure 2: Same as Figure 1 for diffuser frames.

SENTINEL 3 Mission Performance Centre

Sentinel-3 MPC

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2.1.2 OLCI-B

As for OLCI-A, the variations of CCD temperature are very small (0.08 C peak-to-peak) and no trend can be identified. Data from current cycle (rightmost data points) do not show any specificity.

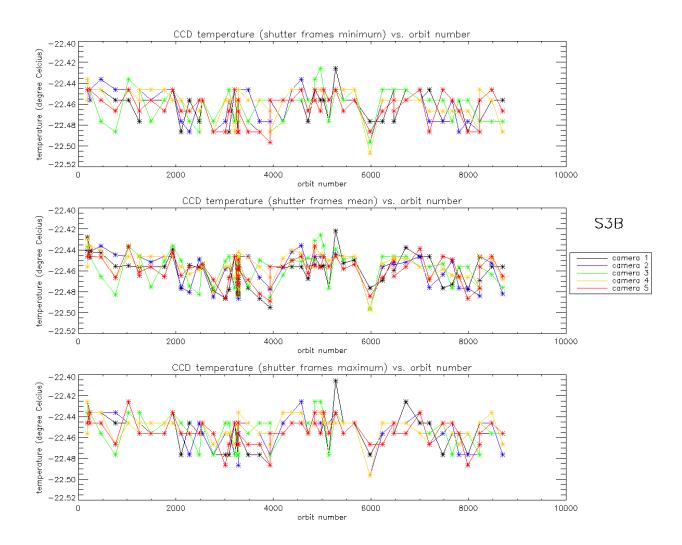


Figure 3: long term monitoring of OLCI-B CCD temperatures using minimum value (top), time averaged values (middle), and maximum value (bottom) provided in the annotations of the Radiometric Calibration Level 1 products, for the Shutter frames, all radiometric calibrations so far except the first one (absolute orbit 167) for which the instrument was not yet thermally stable.

Sentinel-3 MPC

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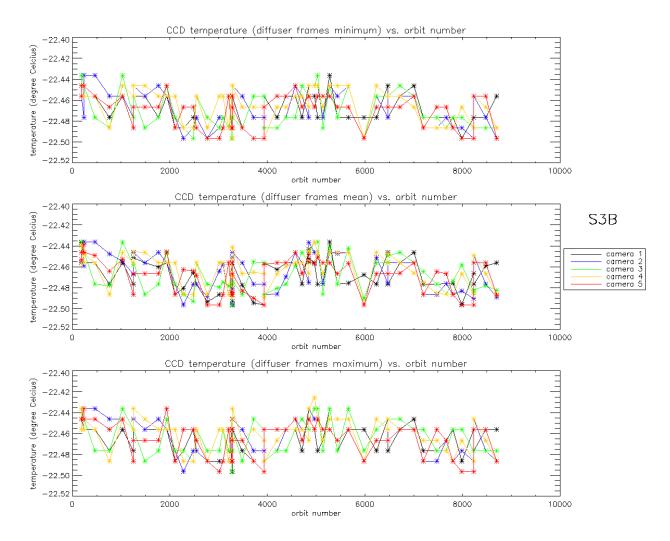


Figure 4: same as Figure 3 for diffuser frames.



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2.2 Radiometric Calibration

For OLCI-A, three Radiometric Calibration Sequences have been acquired during Cycle 052:

- S01 sequence (diffuser 1) on 23/11/2019 07:41 to 07:42 (absolute orbit 19614)
- S05 sequence (diffuser 2) on 23/11/2019 09:22 to 09:23 (absolute orbit 19615)
- S01 sequence (diffuser 1) on 11/12/2019 03:12 to 03:14 (absolute orbit 19868)

For OLCI-B, two Radiometric Calibration Sequences have been acquired during Cycle 033:

- S01 sequence (diffuser 1) on 11/12/2019 17:41 to 17:43 (absolute orbit 8483)
- So1 sequence (diffuser 1) on 26/12/2019 17:53 to 17:55 (absolute orbit 8697)

The acquired Sun azimuth angles are presented on Figure 5 for OLCI-A and Figure 6 for OLCI-B, on top of the nominal values without Yaw Manoeuvre (i.e. with nominal Yaw Steering control of the satellite).

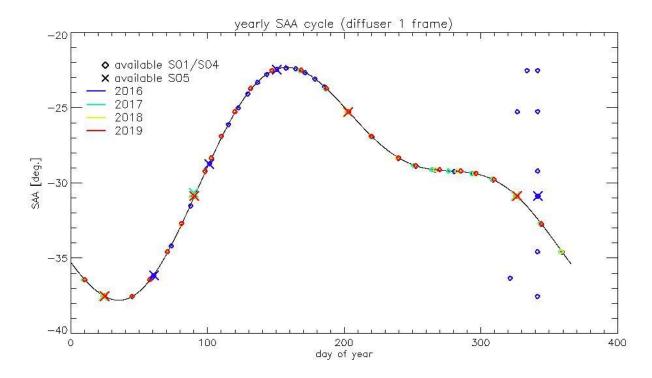


Figure 5: Sun azimuth angles during acquired OLCI-A Radiometric Calibrations (diffuser frame) on top of nominal yearly cycle (black curve). Diffuser 1 with diamonds, diffuser 2 with crosses, 2016 acquisitions in blue, 2017 in green, 2018 in yellow and 2019 in red.



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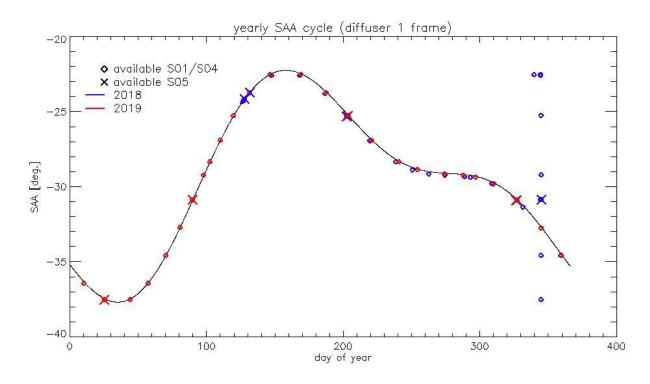


Figure 6: same as Figure 5 for OLCI-B (2018 in blue, 2019 in red).

Sun Azimuth Angles as a function of solar zenith Angles are presented in Figure 7 for OLCI-A and Figure 8 for OLCI-B.

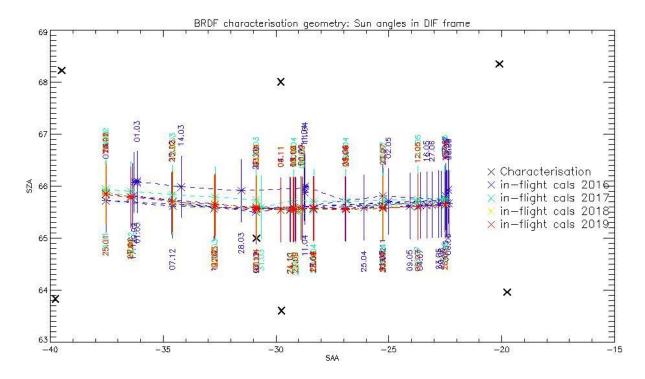


Figure 7: OLCI-A Sun geometry during radiometric Calibrations on top of characterization ones (diffuser frame)

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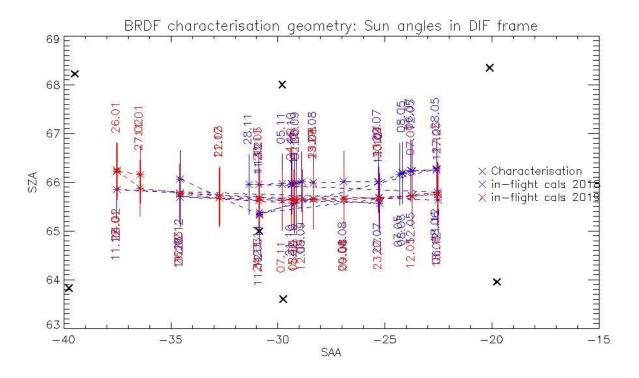


Figure 8: same as Figure 7 for OLCI-B

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2.2.2 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 9.

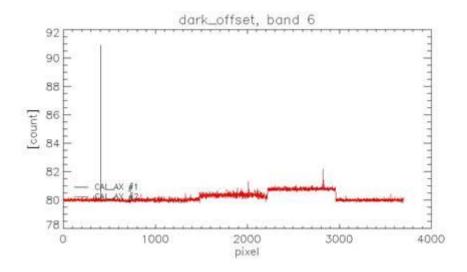


Figure 9: Dark Offset table for band Oa06 with (red) and without (black) HEP filtering (Radiometric Calibration of 22 July 2017). The strong HEP event near pixel 400 has been detected and removed by the HEP filtering.

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

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2.2.2.2 OLCI-A

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.

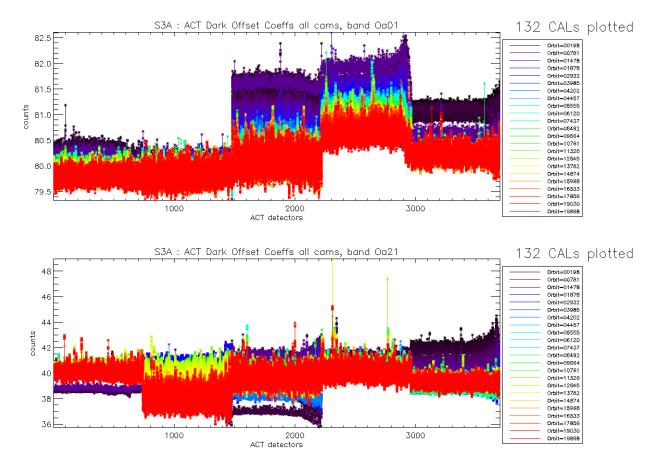


Figure 10: OLCI-A Dark Offset for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.

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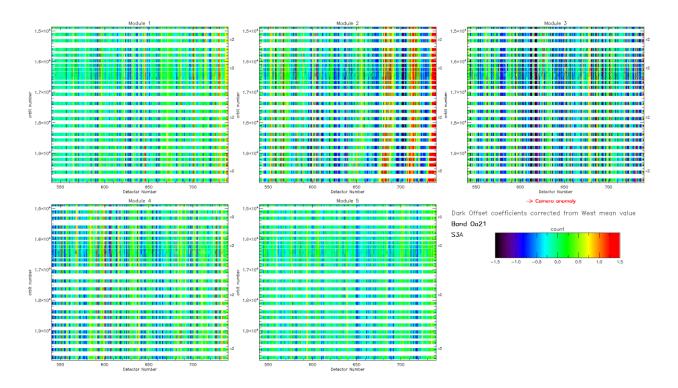


Figure 11: map of OLCI-A periodic noise for the 5 cameras, for band Oa21. X-axis is detector number (East part, from 540 to 740, where the periodic noise occurs), Y-axis is the orbit number. Y-axis range is focused on the most recent 5000 orbits. The counts have been corrected from the West detectors 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. At the beginning of the mission the periodic noise for band Oa21 had strong amplitude in camera 2, 3 and 5 compared to camera 1 and 4. However PN evolved through the mission and these discrepancies between cameras have been reduced. At the time of this Cyclic Report Camera 2 still shows a slightly higher PN than other cameras.



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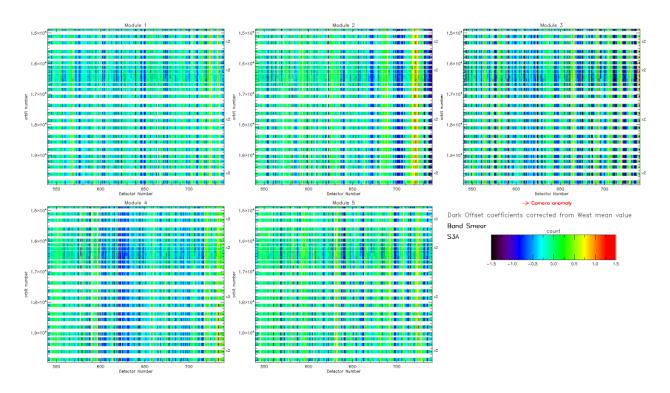


Figure 12: same as Figure 11 for smear band.

Figure 11 and Figure 12 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 from one CAL to the other and consequently to highlight the shape of the PN. Maps are focused on the last 200 EAST detectors where PN occurs and on a time range covering only the last 5000 orbits in order to better visualize the CALs of the current cycle.

As there was no camera anomaly during the current cycle, there is no sudden change of periodic noise to report during the current cycle. We can notice however that a small drift of the PN phase is present since about orbit 18000 in camera 2 Oa21 for the 100 eastern pixels (see Figure 11). This kind of behaviour was already encountered for the same camera/band between orbit 13500 and 14500.

Dark Currents

Dark Currents (Figure 13) 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 14).

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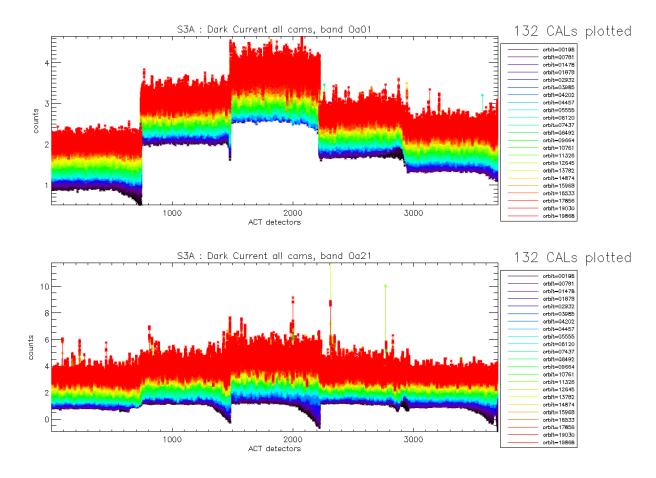


Figure 13: OLCI-A Dark Current for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.

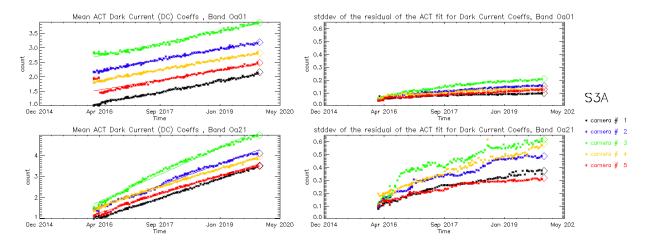


Figure 14: left column: ACT mean on 400 first detectors of OLCI-A Dark Current coefficients for spectral band Oa01 (top) and Oa21 (bottom). Right column: same as left column but for Standard deviation instead of mean.

We see an increase of the DC level as a function of time especially for band Oa21.



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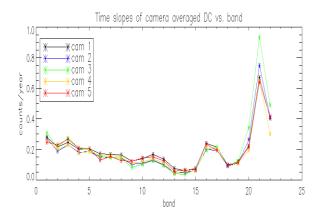
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A possible explanation of the regular increase of DC could be the increase of the number of hot pixels which is more important in Oa21 because this band is made of more CCD lines than band Oa01 and thus receives more cosmic rays impacts. It is known that cosmic rays degrade the structure of the CCD, generating more and more hot pixels at long term scales. Indeed, when computing the time slopes of the spatially averaged Dark Current as a function of band, i.e. the slopes of curves in left plots of Figure 14, one can see that Oa21 is by far the most affected, followed by the smear band (Figure 15, left); when plotting these slopes against total band width (in CCD rows, regardless of the number of micro-bands), the correlation between the slope values and the width becomes clear (Figure 15, right).



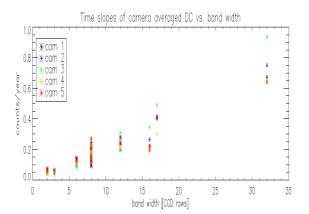


Figure 15: OLCI-A Dark current increase rates with time (in counts per year) vs. band (left) and vs. band width (right)

2.2.2.3 OLCI-B

Dark Offsets

Dark offsets for OLCI-B show a similar behaviour than for OLCI-A: mean level gaps between different orbits, induced by the presence of a pseudo periodic noise on the east edge of the cameras with a drifting phase.

Evolution of OLCI-B Dark Offset coefficients for band Oa01 and Oa21 are represented in Figure 16.

The periodic noise maps are shown for band Oa21 and smear band respectively in Figure 17 and Figure 18. As it happened for OLCI-A after a few thousands of orbits, the strong periodic noise phase and amplitude drift, present at the very beginning of the mission is now showing a clear stabilization.

There is no specific behaviour of the PN to report in the current cycle.

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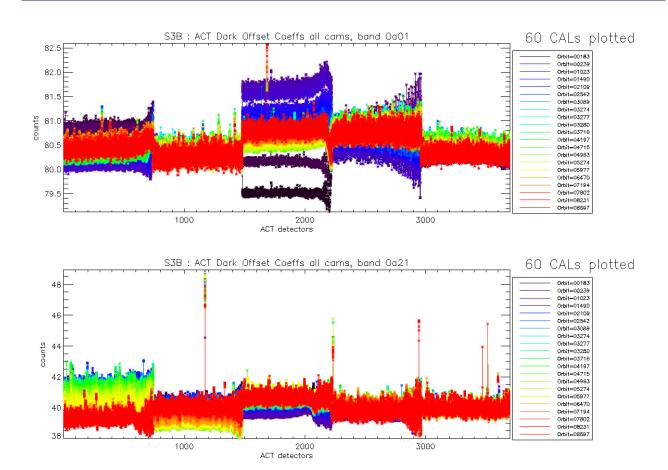


Figure 16: OLCI-B Dark Offset for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 167) for which the instrument was not thermally stable yet.



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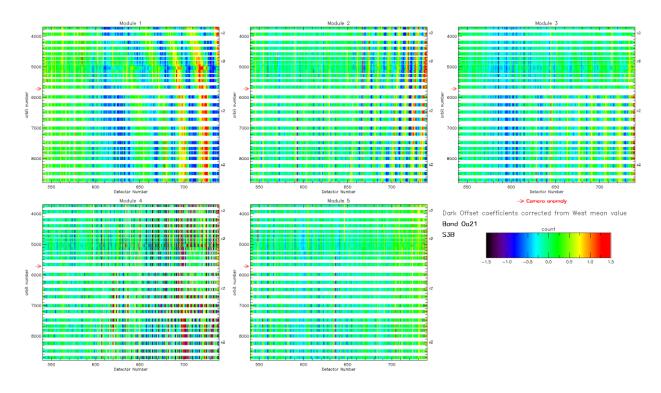


Figure 17: OLCI-B map of periodic noise for the 5 cameras, for band Oa21. X-axis is detector number (East part, from 540 to 740, where the periodic noise occurs), Y-axis is the orbit number. The counts have been corrected from the West detectors mean value (not affected by periodic noise) in order to remove mean level gaps and consequently to have a better visualisation of the long term evolution of the periodic noise structure.

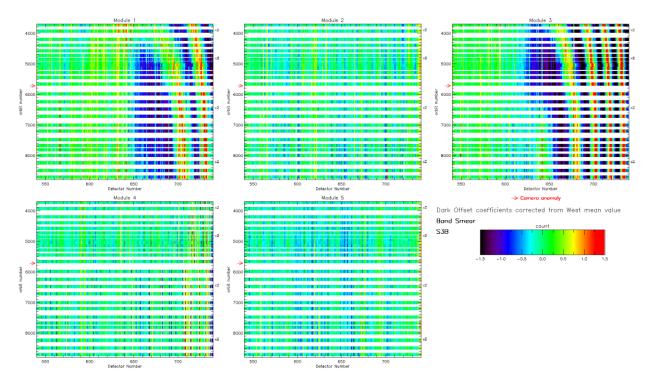


Figure 18: same as Figure 17 for smear band.

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Dark Currents

As for OLCI-A there is no significant evolution of the Dark Current coefficients (Figure 19) during the current cycle except the small regular increase (almost linear), for all detectors, since the beginning of the mission (see Figure 20) probably due to an increase of hot pixels (see Figure 21).

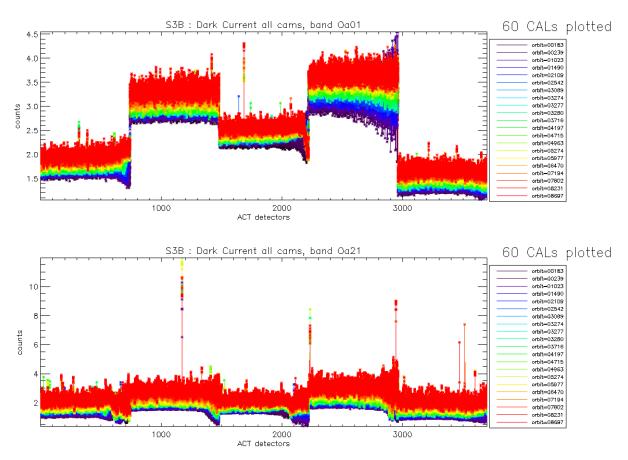


Figure 19: OLCI-B Dark Current for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 167) for which the instrument was not thermally stable yet.

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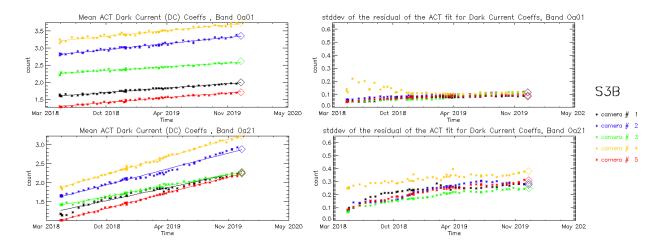


Figure 20: left column: ACT mean on 400 first detectors of OLCI-B Dark Current coefficients for spectral band Oa01 (top) and Oa21 (bottom). Right column: same as left column but for Standard deviation instead of mean.

We see an increase of the DC level as a function of time especially for band Oa21.

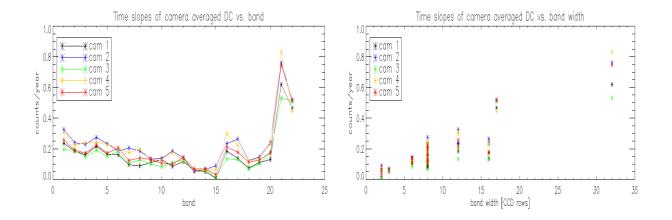


Figure 21: OLCI-B Dark Current increase rates with time (in counts per year) vs. band (left) and vs. band width (right)

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

2.2.3.1 Instrument response monitoring

2.2.3.1.1 OLCI-A

Figure 22 shows the gain coefficients of every pixel for two OLCI-A channels, Oa1 (400 nm) and Oa21 (1020 nm), highlighting the significant evolution of the instrument response since early mission.



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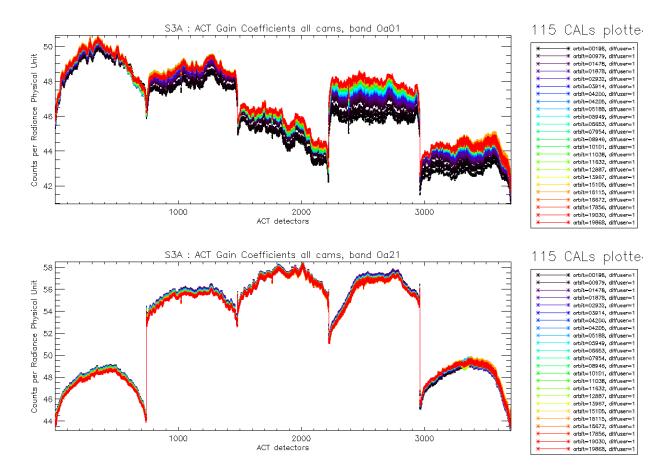


Figure 22: OLCI-A Gain Coefficients for band Oa1 (top) and Oa21 (bottom), all diffuser 1 radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.

The gains plotted in Figure 22, however are derived using the ground BRDF model 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 23 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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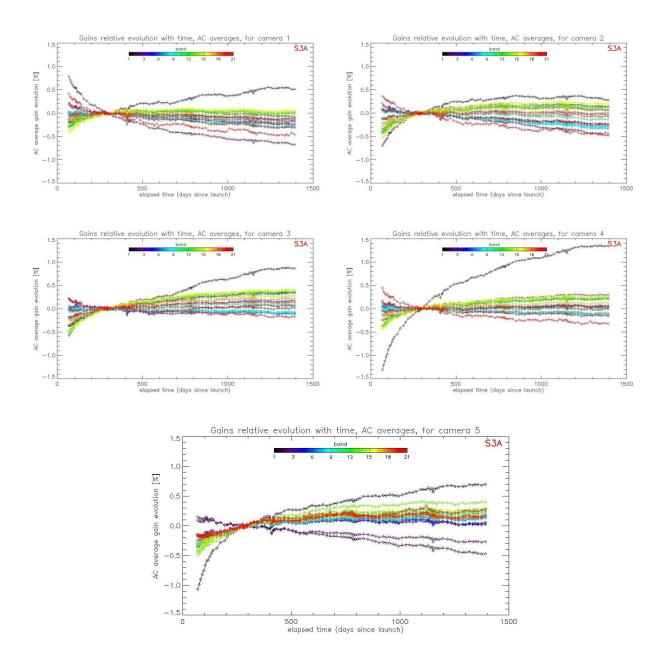


Figure 23: camera averaged gain relative evolution with respect to "best geometry" calibration (07/12/2016), as a function of elapsed time since the change in OLCI channels settings (25/04/16); one curve for each band (see colour code on plots), one plot for each module. The diffuser ageing has been taken into account.

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2.2.3.1.2 OLCI-B

Figure 24 shows the gain coefficients of every pixel for two OLCI-B channels, Oa1 (400 nm) and Oa21 (1020 nm), highlighting the significant evolution of the instrument response since early mission.

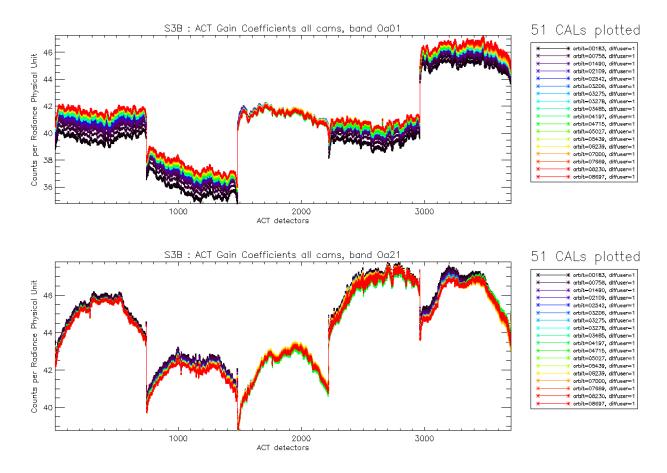


Figure 24: OLCI-B Gain Coefficients for band Oa1 (top) and Oa21 (bottom), all diffuser 1 radiometric calibrations so far except the first one (orbit 167) for which the instrument was not thermally stable yet.

Figure 25 displays a summary of the time evolution derived from post-processed gains: the cross-track average of the BRDF corrected gains is plotted as a function of time, for each module, relative to a given reference calibration (first calibration after channel programming change: 18/06/2018). It shows that, if a significant evolution occurred during the early mission, the trends tend to stabilize. The large amount of points near elapsed time = 220 days is due to the yaw manoeuvre campaign.

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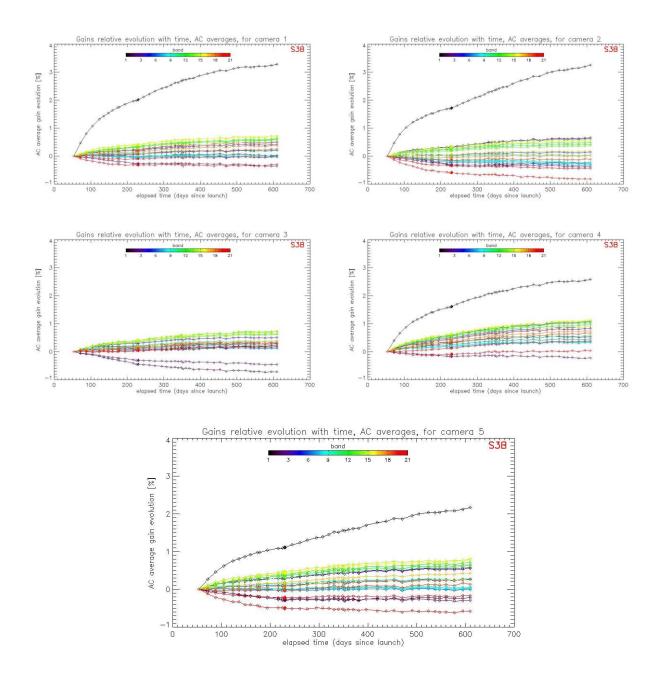


Figure 25: OLCI-B camera averaged gain relative evolution with respect to first calibration after channel programming change (18/06/2018), as a function of elapsed time since the beginning of the mission; one curve for each band (see colour code on plots), one plot for each module. The diffuser ageing has been taken into account.



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2.2.3.2 Instrument evolution modelling

2.2.3.2.1 OLCI-A

The OLCI-A Radiometric Model has been refreshed and put in operations the 29/10/2019 (Processing Baseline 2.58). The model has been derived on the basis of an extended Radiometric Calibration dataset (from 25/04/2016 to 28/08/2019). It 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 7 calibrations in extrapolation over about 4 months) remains better than 0.1% (at the exception of band Oa01 for the very first CAL) when averaged over the whole field of view (Figure 26) while the previous model, trained on a Radiometric Dataset limited to 11/04/2019, shows a small drift of the model with respect to most recent data, especially for band Oa01 (Figure 27). Comparison of the two figures shows the improvement brought by the updated Model over almost all the mission: only Oa01 show a lower performance for the very first calibration with the new model.

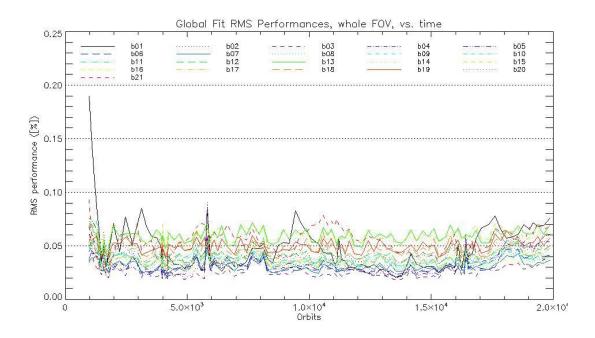


Figure 26: RMS performance of the OLCI-A Gain Model of the current processing baseline as a function of orbit.

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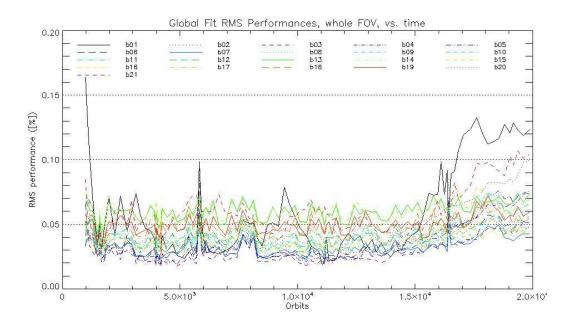


Figure 27: RMS performance of the OLCI-A Gain Model of the previous Processing Baseline as a function of orbit.

The overall instrument evolution since channel programming change (25/04/2016) is shown on Figure 28.

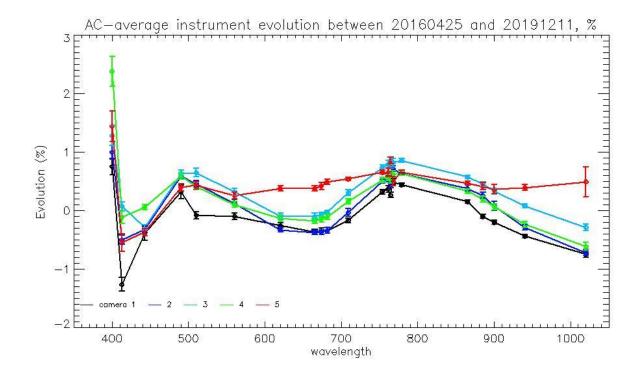


Figure 28: OLCI-A Camera-averaged instrument evolution since channel programming change (25/04/2016) and up to most recent calibration (11/12/2019) versus wavelength.



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The overall per camera performance, as a function of wavelength, and at each orbit is shown on Figure 29 as the average and standard deviation of the model over data ratio.

Finally, Figure 30 to Figure 32 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 30 to Figure 32 with their counterparts in Report of Cycle 49 clearly demonstrate the improvement brought by the new model whatever the level of detail.

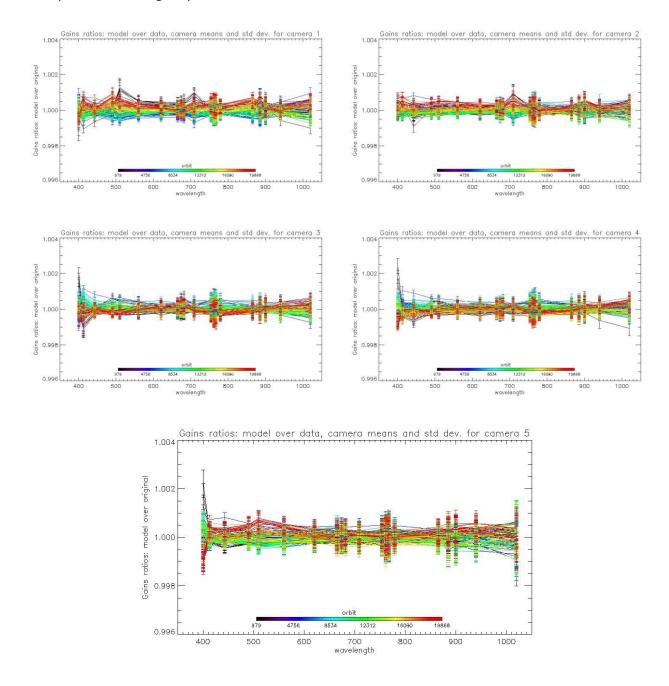


Figure 29: For the 5 cameras: OLCI-A Evolution model performance, as camera-average and standard deviation of ratio of Model over Data vs. wavelength, for each orbit of the test dataset, including 7 calibrations in extrapolation, with a colour code for each calibration from blue (oldest) to red (most recent).

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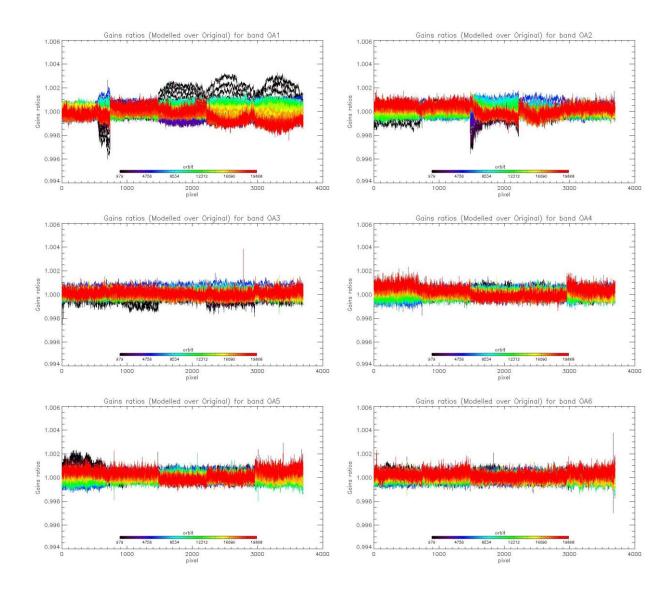


Figure 30: Evolution model performance, as ratio of Model over Data vs. pixels, all cameras side by side, over the whole current calibration dataset (since instrument programing update), including 7 calibrations in extrapolation, channels Oa1 to Oa6.

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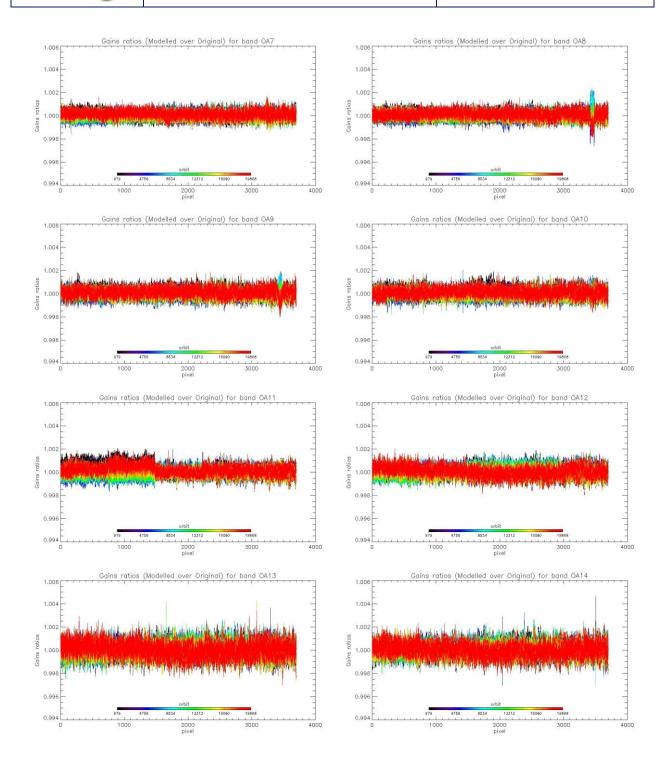


Figure 31: same as Figure 30 for channels Oa7 to Oa14.

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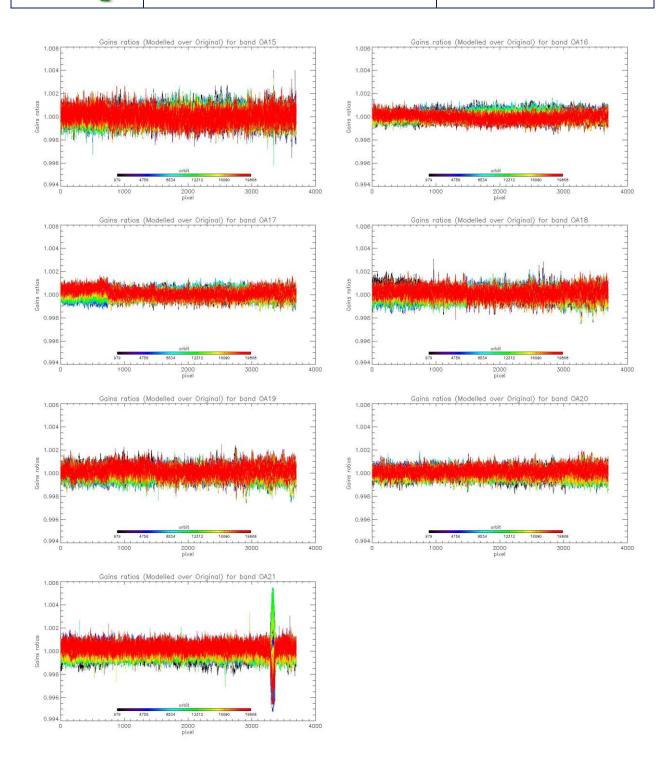


Figure 32: same as Figure 30 for channels Oa15 to Oa21.

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2.2.3.2.2 OLCI-B

Instrument response and degradation modelling for OLCI-B, including the use of the in-flight BRDF model (based on 11th December 2018 Yaw Manoeuvres), has been refreshed and deployed at PDGS on 29th October 2019 (Processing Baseline 1.30). The model has been derived on the basis of an extended Radiometric Calibration dataset (from 11/05/2018 to 02/10/2019). It 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 6 calibrations in extrapolation over about 3 month) is illustrated in Figure 33. It remains better than 0.09% when averaged over the whole field of view while the previous model, trained on a Radiometric Dataset limited to 27/02/2019, shows a drift of the model with respect to most recent data, especially for band Oa01 (Figure 34). Comparison of the two figures shows the improvement brought by the updated Model over all the mission.

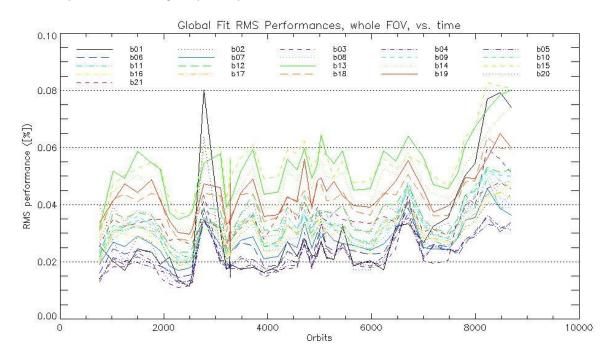


Figure 33: RMS performance of the OLCI-B Gain Model of the current processing baseline as a function of orbit

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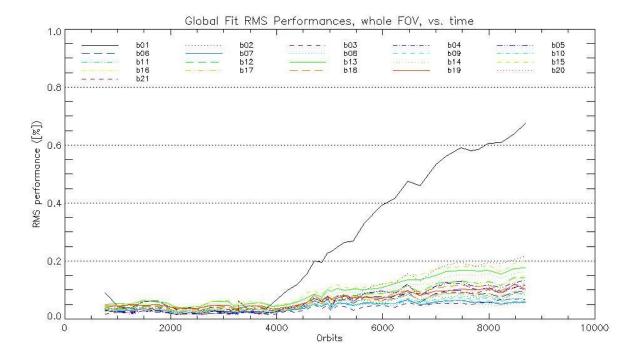


Figure 34: RMS performance of the OLCI-B Gain Model of the previous processing baseline as a function of orbit (please note the different vertical scale with respect to Figure 33)



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The overall instrument evolution since channel programming change (18/06/2018) is shown on Figure 35.

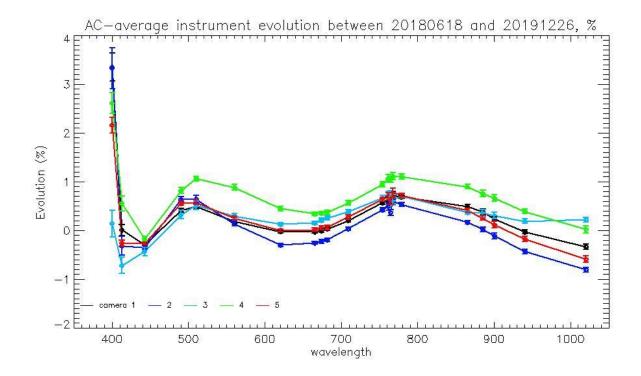


Figure 35: OLCI-B Camera-averaged instrument evolution since channel programming change (18/06/2018) and up to most recent calibration (26/12/2019) versus wavelength.

The overall per camera performance, as a function of wavelength, and at each orbit is shown on Figure 36 as the average and standard deviation of the model over data ratio.

Finally, Figure 37 to Figure 39 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.

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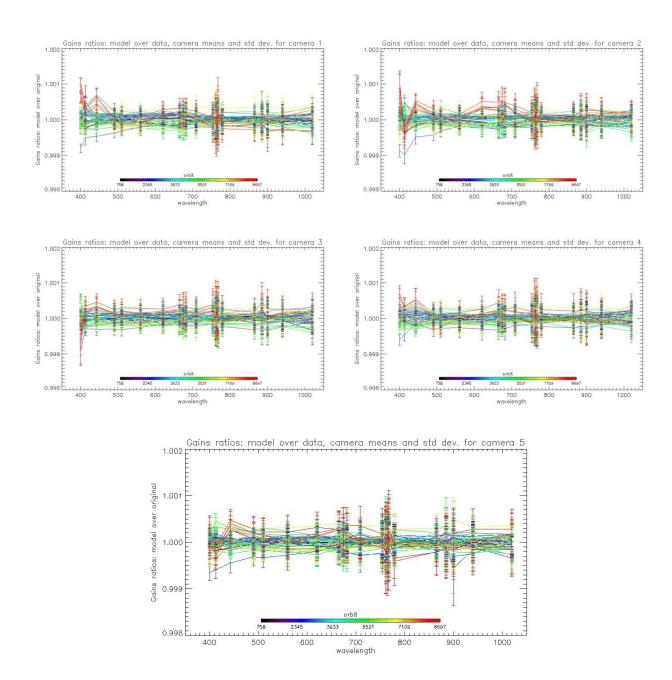


Figure 36: For the 5 cameras: OLCI-B Evolution model performance, as camera-average and standard deviation of ratio of Model over Data vs. wavelength, for each orbit of the test dataset, including 6 calibrations in extrapolation, with a colour code for each calibration from blue (oldest) to red (most recent).

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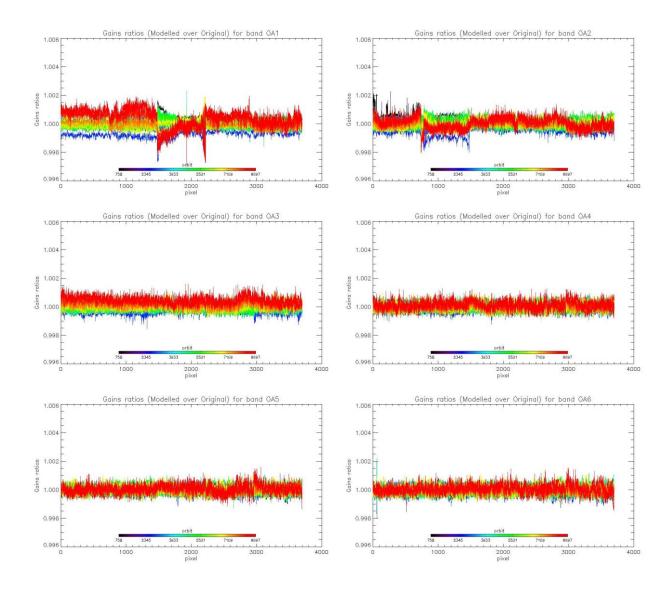


Figure 37: Evolution model performance, as ratio of Model over Data vs. pixels, all cameras side by side, over the whole current calibration dataset (since instrument programming update), including 6 calibrations in extrapolation, channels Oa1 to Oa6.

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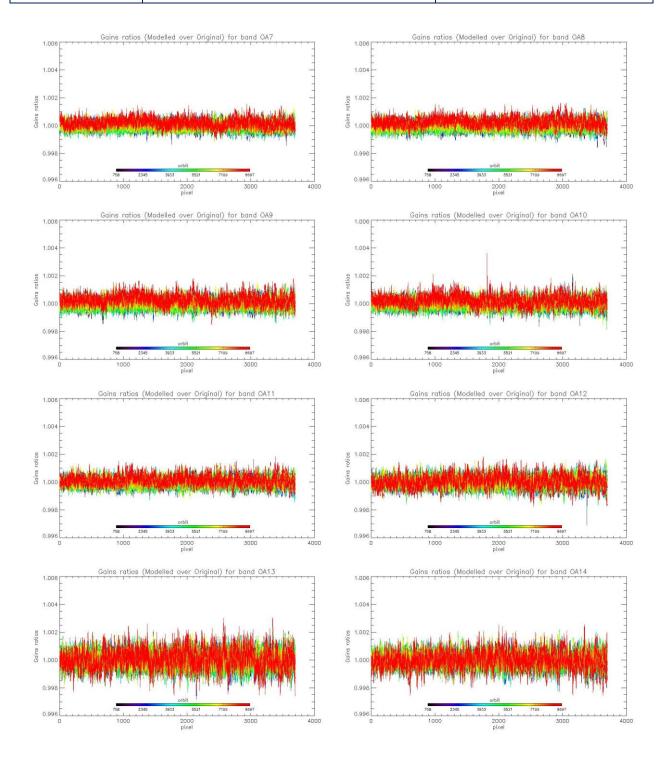


Figure 38: same as Figure 37 for channels Oa7 to Oa14.

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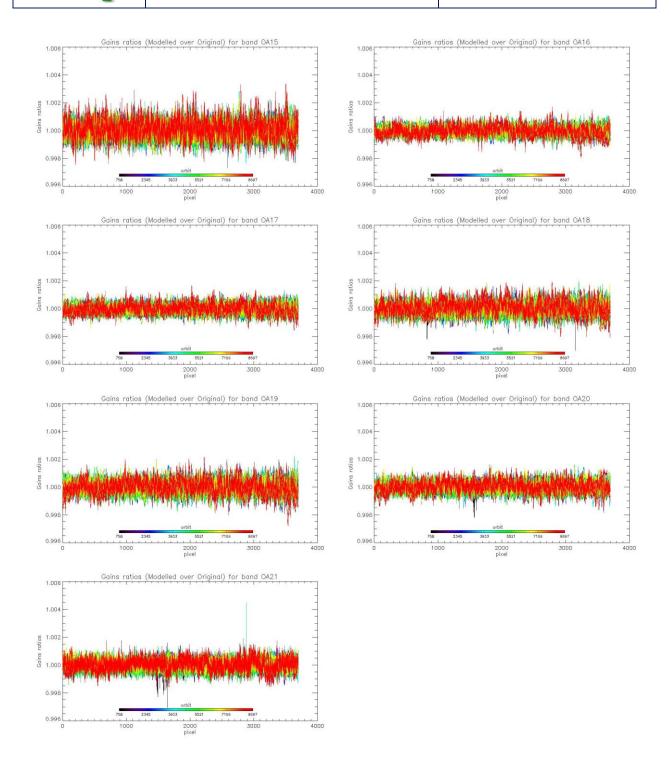


Figure 39: same as Figure 37 for channels Oa15 to Oa21.

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

2.2.4.1 OLCI-A

There has been one calibration sequence S05 (reference diffuser) for OLCI-A during acquisition cycle 052:

S05 sequence (diffuser 2) on 23/11/2019 09:22 to 09:23 (absolute orbit 19615)

With the associated S01 sequence in order to compute ageing:

S01 sequence (diffuser 1) on 23/11/2019 07:41 to 07:42 (absolute orbit 19614)

The diffuser 1 Ageing is computed for each 3700 detector and each spectral band by formula:

Ageing(orb)=G1(orb)/G2(orb)-G1(orb_ref)/G2(orb_ref)

Where:

- G1 is the diffuser 1 (= nominal diffuser) Gain coefficients
- G2 is the diffuser 2 (= reference diffuser) Gain coefficients
- orb_ref is a reference orbit chosen at the beginning of the mission

Ageing is represented in Figure 40 for band Oa01 and in Figure 41 for band Oa17. The negative shift of the sequence at orbit 5832 (for which a slight increase would be expected instead) is not explained so far and still under investigation. It should be noted that the corresponding orbit of diffuser 1 (nominal) has also been detected as an outlier in the modelling of the radiometric long-term trend with an unexpected excess of brightness.

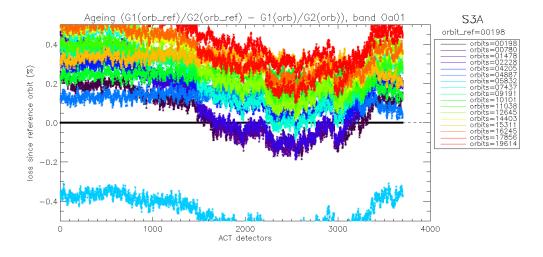


Figure 40: diffuser 1 ageing for spectral band Oa01. We see strong ACT low frequency structures that are due to residual of BRDF modelling.



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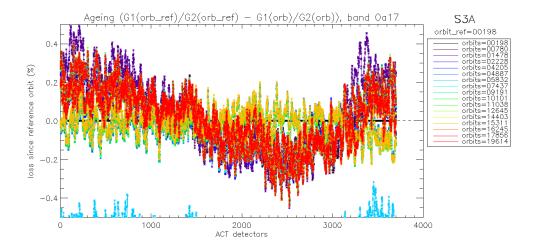


Figure 41: same as Figure 40 for spectral band Oa17. We use this band in order to normalize other bands and remove the ACT structures due to residual of BRDF modelling. Normalized curve for spectral band Oa01 is presented in Figure 42.

Figure 40 and Figure 41 show that the Ageing curves are impacted by a strong ACT pattern which is due to residuals of the bad modelling (on-ground) of the diffuser BRDF. This pattern is dependant of the azimuth angle. It is a 'white' pattern which means it is the same for all spectral bands. As such, we can remove this pattern by normalizing the ageing of all bands by the curve of band Oa17 which is expected not to be impacted by ageing because in the red part of the spectrum. We use an ACT smoothed version (window of 100 detectors) of band Oa17 in order to reduce the high frequency noise. Normalized ageing for spectral band Oa01 is represented in Figure 42 where we can see that this band is impacted by ageing of the diffuser.

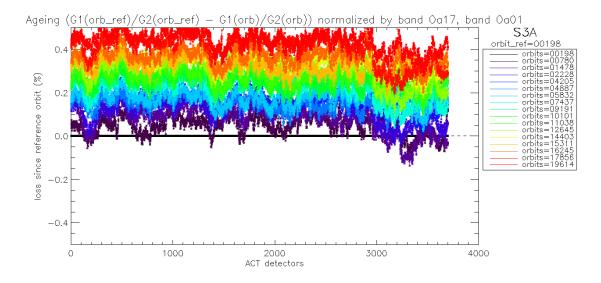


Figure 42: same as Figure 40 after normalization by band Oa17. Ageing of the diffuser 1 is now visible in the 5 cameras.



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Camera averaged ageing (normalized by band Oa17) as a function of wavelength is represented in Figure 43 where we can see that ageing is stronger in the 'bluest' spectral bands (short wavelengths). Ageing is clearly visible only for the 5 first spectral bands so far in the OLCI mission life.

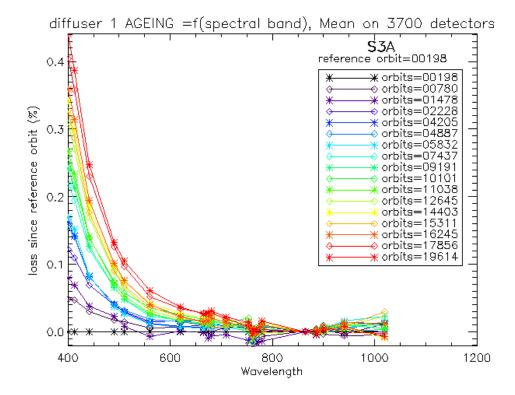


Figure 43: Diffuser 1 ageing as a function of wavelength (or spectral band). Ageing is clearly visible in spectral band #1 to #5.

Figure 44 shows the evolution, for spectral band Oa01, of the 5 cameras averaged ageing as a function of time.

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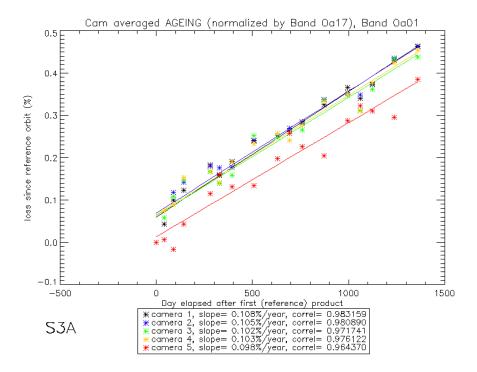


Figure 44: Camera averaged ageing for band Oa01 (normalized by band Oa17) as a function of elapsed time.

Linear fit for each camera is plotted. The slope (% loss per year) and the correlation coefficient.

A model of diffuser ageing as a function of cumulated exposure time (i.e. number of acquisition sequence on nominal diffuser, regardless of the band setting) has been built and is described in Cyclic #23 Report. The results of this model confirm the need to model ageing against cumulated exposure rather than elapsed time, as it provides a more linear trend, even if not perfect (see Figure 21 of Cyclic #23 Report).

The slope of this ageing model (% of loss per exposure) as a function of wavelength is presented in Figure 45).



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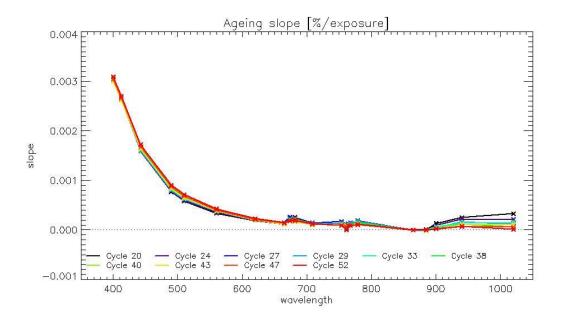


Figure 45: Slope of ageing fit (% of loss per exposure) vs wavelengths, using all the available ageing sequence at the time of the current cycle (red curve) and at the time of previous cycle for which an ageing sequence was measured (see legend within the figure).

In Figure 45, we see that the Ageing slopes have not significantly changed between the current Cycle and the last eight cycles with a S05 sequence (cycles #47, #43, #40, #38, #33, #29, #27, #24 and #20). Cycle #47 has been used to derive the Ageing Correction model used for the currently operational Gain Model. The exposure time dependent ageing model is used to derive the Gain Model, the most recent version of which has been put in operations in PDGS on 29th October 2019.

2.2.4.2 OLCI-B

There has been no calibration sequence S05 (reference diffuser) for OLCI-B during acquisition Cycle 033.

Consequently, the last results presented in Cycle Report #51/#32 (S3A/S3B) remain valid.

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

2.2.5.1.1 OLCI-A

No CAL_AX ADF has been delivered to PDGS during the reported period.

2.2.5.1.2 OLCI-B

The following CAL_AX ADF was delivered to PDGS during the reported period for OLCI-B:

S3B_OL_1_CAL_AX_20191030T000000_20991231T235959_20191129T120000______M
PC_O_AL_009.SEN3



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It contains an update of the geometric calibration necessary for the transition to the new Year (caused by the drift of the instrument) and of the Dark Correction LUTs.

It was put in operation the 17-Dec-2019 (within the processing baseline 1.34).

2.2.6 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]

2.2.6.1.1 OLCI-A

This activity has not evolved during cycle 052 and results presented in Cycle 15 report are still valid.

2.2.6.1.2 OLCI-B

Activity has started for S3B-OLCI. The SAA domain explored is now increased by the acquisitions from the Yaw Manoeuvres and analysis becomes meaningful. Analysis is on-going.

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

2.3.1 OLCI-A

There has been no Spectral Calibration (S02 + S03, S09) acquisition for OLCI-A during the reporting period.

The last results presented in Cyclic Report 51/32 (S3A/S3B) stay valid.

2.3.2 OLCI-B

There has been no Spectral Calibration (S02 + S03, S09) acquisition for OLCI-B during the reporting period.

The last results presented in Cyclic Report 51/32 (S3A/S3B) stay valid.

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

2.4.1 SNR from Radiometric calibration data

2.4.1.1 OLCI-A

SNR computed for all calibration data (S01, S04 and S05 sequences) as a function of band number is presented in Figure 46.

SNR computed for all calibration data as a function of orbit number for band Oa01 (the less stable band) is presented in Figure 47.



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

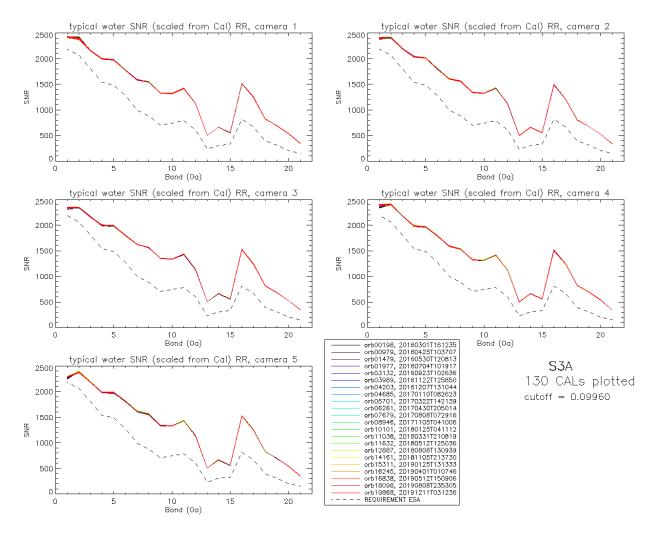


Figure 46: OLCI-A Signal to Noise ratio as a function of the spectral band for the 5 cameras. These results have been computed from radiometric calibration data. All calibrations except first one (orbit 183) are presents with the colours corresponding to the orbit number (see legend). The SNR is very stable with time: the curves for all orbits are almost superimposed. The dashed curve is the ESA requirement.

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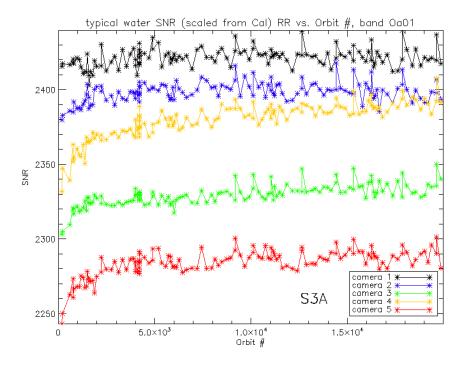


Figure 47: long-term stability of the SNR estimates from Calibration data, example of channel Oa1.

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: OLCI-A 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).

	radiance level are recalled (in mov.sr .iii .iiii).													
	L _{ref}	SNR	C1		C2		C3		C4		C5		All	
nm	LU	RQT	avg	std	avg	std	avg	std	avg	std	avg	std	avg	std
400.000	63.0	2188	2421	6.2	2398	6.6	2329	7.3	2379	12.1	2283	9.1	2362	7.0
412.000	74.1	2061	2391	8.7	2406	5.9	2339	4.8	2401	5.0	2383	8.1	2384	4.9
442.000	65.6	1811	2160	5.2	2198	5.8	2164	4.9	2185	4.1	2195	5.2	2180	3.6
490.000	51.2	1541	2000	4.7	2036	5.1	1997	4.2	1983	4.4	1988	4.7	2001	3.4
510.000	44.4	1488	1979	5.3	2014	4.7	1985	4.6	1967	4.6	1985	4.6	1986	3.7
560.000	31.5	1280	1776	4.5	1802	4.2	1803	4.9	1794	3.9	1818	3.4	1798	3.1
620.000	21.1	997	1591	4.0	1609	4.1	1624	3.2	1593	3.3	1615	3.5	1607	2.6
665.000	16.4	883	1546	4.1	1558	4.4	1567	3.8	1533	3.6	1561	3.9	1553	3.1
674.000	15.7	707	1329	3.5	1337	3.7	1350	2.8	1323	3.2	1342	3.6	1336	2.5
681.000	15.1	745	1319	3.7	1326	3.2	1338	2.7	1314	2.4	1333	3.5	1326	2.2
709.000	12.7	785	1421	4.4	1420	4.2	1435	3.4	1414	3.5	1430	3.1	1424	2.9
754.000	10.3	605	1127	3.2	1120	3.0	1135	3.5	1124	2.5	1139	2.9	1129	2.4
761.000	6.1	232	502	1.1	498	1.2	505	1.2	500	1.1	508	1.4	503	0.9
764.000	7.1	305	663	1.6	658	1.5	668	2.1	661	1.6	670	2.1	664	1.4
768.000	7.6	330	558	1.5	554	1.3	562	1.3	556	1.5	564	1.4	559	1.1
779.000	9.2	812	1516	4.9	1498	4.9	1525	5.3	1511	5.1	1526	5.0	1515	4.3
865.000	6.2	666	1244	3.6	1213	3.6	1238	4.0	1246	3.7	1250	2.8	1238	3.0
885.000	6.0	395	823	1.7	801	1.7	814	2.0	824	1.5	831	1.8	819	1.2
900.000	4.7	308	691	1.6	673	1.3	683	1.7	693	1.4	698	1.5	688	1.0
940.000	2.4	203	534	1.1	522	1.1	525	1.0	539	1.1	542	1.4	532	0.7
1020.000	3.9	152	345	0.9	337	0.9	348	0.7	345	0.8	351	0.8	345	0.5



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2.4.1.2 OLCI-B

SNR computed for all OLCI-B calibration data (S01, S04 (but not the dark-only S04) and S05 sequences) as a function of band number is presented in Figure 48.

SNR computed for all OLCI-B calibration data as a function of orbit number for band Oa01 (the less stable band) is presented in Figure 49.

As for OLCI-A the SNR is very stable in time. There is no significant evolution of this parameter during the current cycle and the ESA requirement is fulfilled for all bands.

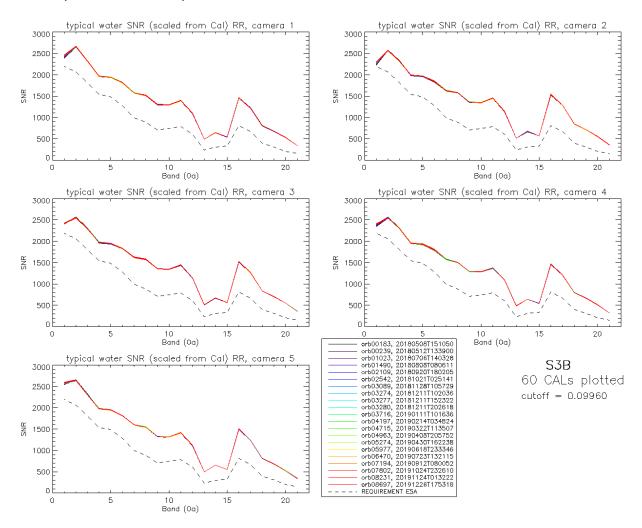


Figure 48: OLCI-B Signal to Noise ratio as a function of the spectral band for the 5 cameras. These results have been computed from radiometric calibration data. All calibrations except first one (orbit 167) are presents with the colours corresponding to the orbit number (see legend). The SNR is very stable with time: the curves for all orbits are almost superimposed. The dashed curve is the ESA requirement.

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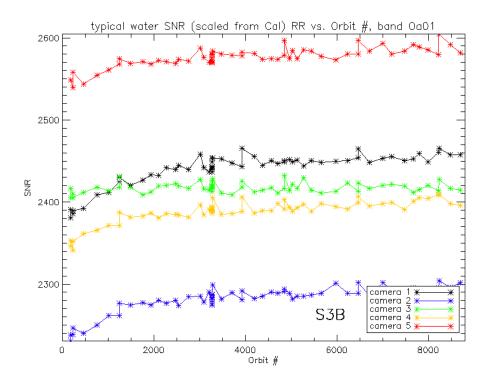


Figure 49: long-term stability of the OLCI-B SNR estimates from Calibration data, example of channel Oa1.



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Table 2: OLCI-B 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).

		CNID				e recuiieu (iii iiivv.si					0.5		A II	
	L _{ref}	SNR	C1		C2		C3		C4		C5		All	
nm	LU	RQT	avg	std	avg	std	avg	std	avg	std	avg	std	avg	std
400.000	63.0	2188	2440	19.8	2281	16.4	2417	6.0	2388	14.5	2575	12.3	2420	12.8
412.000	74.1	2061	2655	6.8	2570	6.0	2549	8.3	2549	6.0	2640	6.9	2593	5.0
442.000	65.6	1811	2326	6.2	2318	6.1	2303	6.2	2306	6.2	2311	6.2	2313	5.1
490.000	51.2	1541	1965	4.8	1987	5.9	1971	5.1	1951	4.9	1978	4.9	1971	4.0
510.000	44.4	1488	1937	5.3	1965	5.5	1942	5.1	1922	5.1	1951	4.6	1943	4.1
560.000	31.5	1280	1813	5.0	1846	5.7	1829	4.7	1803	5.4	1816	4.7	1821	4.1
620.000	21.1	997	1573	4.4	1626	4.9	1625	3.8	1576	4.1	1602	3.3	1600	3.1
665.000	16.4	883	1513	4.3	1579	4.0	1574	4.2	1501	3.1	1546	3.9	1543	3.0
674.000	15.7	707	1301	3.8	1358	4.0	1353	3.5	1292	2.9	1329	3.2	1327	2.7
681.000	15.1	745	1293	3.4	1347	3.3	1343	3.1	1285	2.8	1316	2.9	1317	2.1
709.000	12.7	785	1389	4.4	1447	4.3	1443	4.6	1373	3.3	1412	4.1	1413	3.4
754.000	10.3	605	1095	4.2	1141	3.8	1141	3.9	1088	3.0	1115	3.8	1116	3.4
761.000	6.1	232	487	1.3	509	1.2	508	1.4	485	1.2	497	1.5	497	1.1
764.000	7.1	305	643	1.7	672	2.1	672	2.1	640	1.7	657	2.0	657	1.6
768.000	7.6	330	541	1.5	567	1.4	564	1.4	540	1.4	554	1.7	553	1.2
779.000	9.2	812	1465	4.7	1533	5.0	1525	6.2	1465	4.0	1504	4.9	1499	4.3
865.000	6.2	666	1220	4.0	1286	4.0	1258	4.1	1203	3.6	1237	3.2	1241	3.1
885.000	6.0	395	807	2.6	847	1.9	834	2.1	798	1.9	814	2.0	820	1.7
900.000	4.7	308	679	1.4	714	2.0	704	1.6	669	1.5	682	1.5	690	1.2
940.000	2.4	203	527	1.3	550	1.7	550	1.4	509	1.2	522	1.4	532	1.0
1020.000	3.9	152	336	0.8	359	1.2	358	0.9	318	0.8	339	1.2	342	0.7



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2.4.2 SNR from EO data

2.4.2.1 OLCI-A

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

2.4.2.2 OLCI-B

The SNR assessment from EO data has not been applied to OLCI-B considering a) that SNR estimates from RC data have been proved more reliable for OLCI-A and b) that it requires a significant amount of human and machine resources that can be more efficiently used for other tasks.

2.5 Geometric Calibration/Validation

2.5.1 OLCI-A

OLCI georeferencing performance was compliant since the introduction of MPC Geometric Calibration, put in production on the 14th of March 2018. It has however significantly improved after its last full revision of GCMs (Geometric Calibration Models, or platform to instrument alignment quaternions) and IPPVMs (Instrument Pixels Pointing Vectors) both derived using the GeoCal Tool.

The following figures (Figure 50 to Figure 55) show time series of the overall RMS performance (requirement criterion) and of the across-track and along-track biases for each camera. New plots (Figure 56 and Figure 57) introduce monitoring of the performance homogeneity within the field of view: georeferencing errors in each direction at camera transitions (difference between last pixel of camera N and first pixel of camera N+1) and within a given camera (maximum bias minus minimum inside each camera). The performance improvement since the 30/07/2019 is significant on most figures: the global RMS value decreases form around 0.35 to about 0.2 (Figure 50), the across-track biases decrease significantly for all cameras (Figure 51 to Figure 55), the along-track bias reduces for at least camera 3 (Figure 53) and the field of view homogeneity improves drastically (Figure 56 and Figure 57, but also reduction of the dispersion – distance between the ± 1 sigma lines – in Figure 51 to Figure 55).



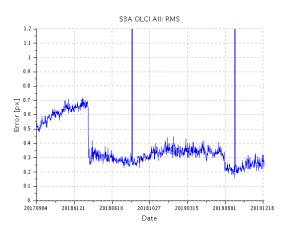
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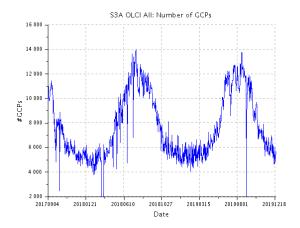
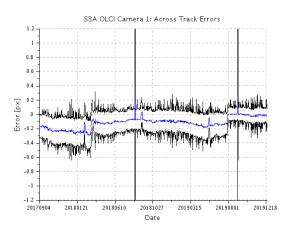


Figure 50: overall OLCI-A georeferencing RMS performance time series (left) and number of validated control points corresponding to the performance time series (right) over the whole monitoring period



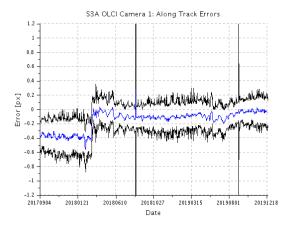
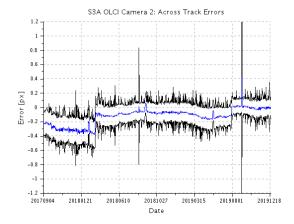


Figure 51: across-track (left) and along-track (right) OLCI-A georeferencing biases time series for Camera 1. Blue line is the average, black lines are average plus and minus 1 sigma.



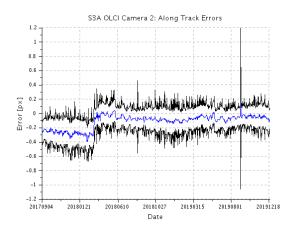


Figure 52: same as Figure 51 for Camera 2.

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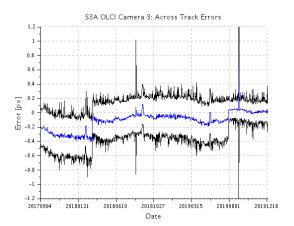
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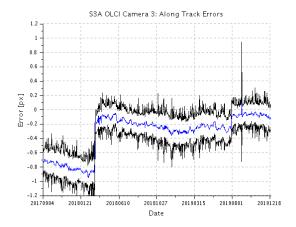
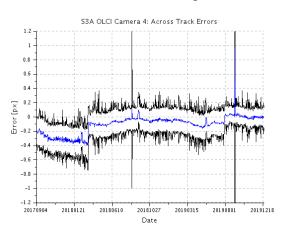


Figure 53: same as Figure 51 for Camera 3.



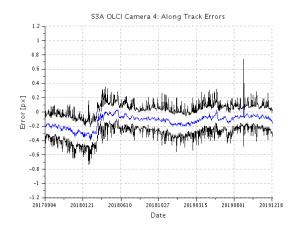
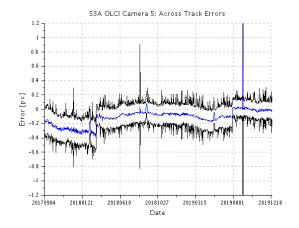


Figure 54: same as Figure 51 for Camera 4.



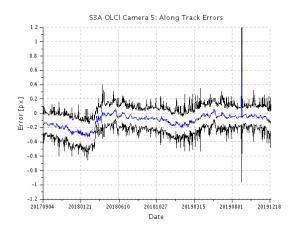


Figure 55: same as Figure 51 for Camera 5.



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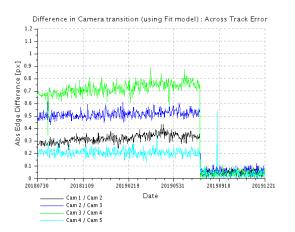
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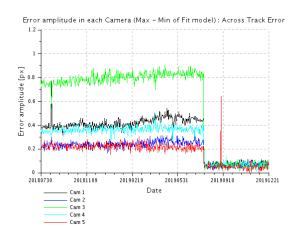
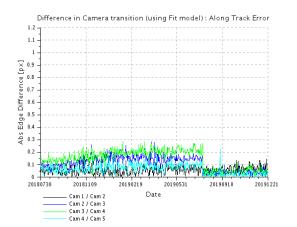


Figure 56: OLCI-A spatial across-track misregistration at each camera transition (left) and maximum amplitude of the across-track error within each camera (left).



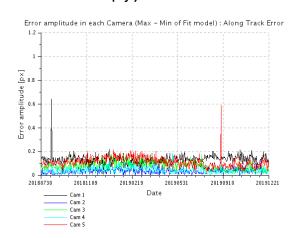


Figure 57: OLCI-A spatial along-track misregistration at each camera transition (left) and maximum amplitude of the along-track error within each camera (left).

2.5.2 OLCI-B

The current Geometric Calibration currently in production is the fourth one, introduced the 30/07/2019. As for OLCI-A, despite compliance to the RMS requirement of 0.5 pixel, OLCI-B showed significant heterogeneity of the performance within the field of view, with discrepancies at camera transitions of up to 1 pixel. Introduction of upgraded IPPVMs greatly improves many performance indicators: the global RMS value decreases form around 0.4 to about 0.3 (Figure 58), the across-track biases decrease significantly for all cameras (Figure 59 to Figure 63) and the field of view homogeneity improves drastically (Figure 64 and Figure 65, but also reduction of the dispersion – distance between the \pm 1 sigma lines – in Figure 59 to Figure 63).



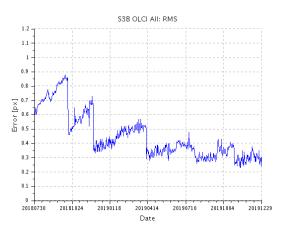
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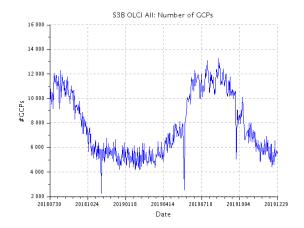
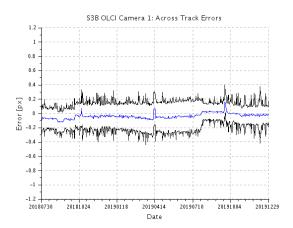


Figure 58: overall OLCI-B georeferencing RMS performance time series over the whole monitoring period (left) and corresponding number of validated control points (right)



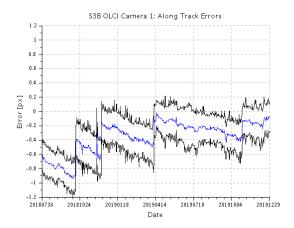
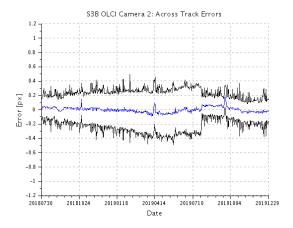


Figure 59: across-track (left) and along-track (right) OLCI-B georeferencing biases time series for Camera 1.



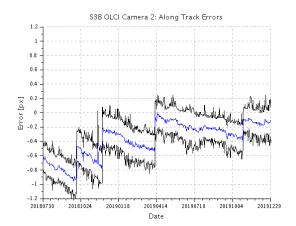


Figure 60: same as Figure 51 for Camera 2.



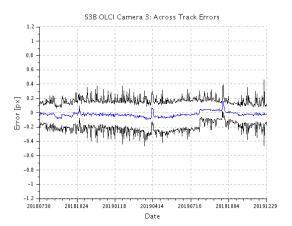
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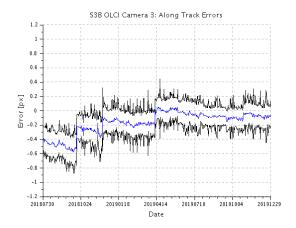
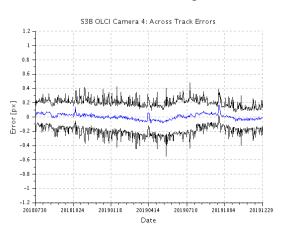


Figure 61: same as Figure 51 for Camera 3.



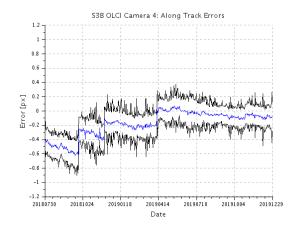
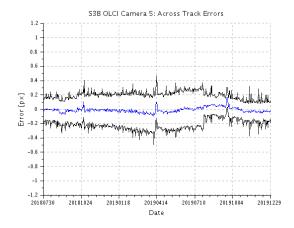


Figure 62: same as Figure 51 for Camera 4.



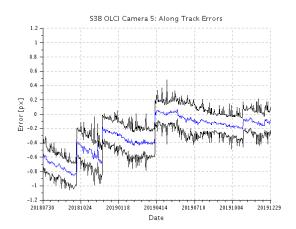


Figure 63: same as Figure 51 for Camera 5.

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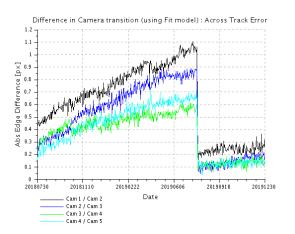
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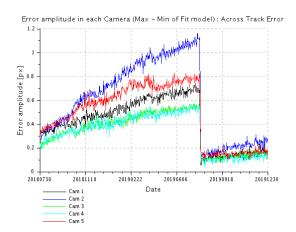
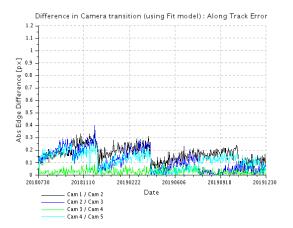


Figure 64: OLCI-B spatial across-track misregistration at each camera transition (left) and maximum amplitude of the across-track error within each camera (left).



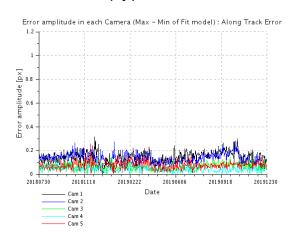


Figure 65: OLCI-B spatial along-track misregistration at each camera transition (left) and maximum amplitude of the along-track error within each camera (left).



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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) for both OLCI-A (Figure 66) and OLCI-B (Figure 67).

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Figure 66: summary of S3ETRAC products generation for OLCI-A (number of OLCI-A L1 products Ingested, blue – number of S3ETRAC extracted products generated, green – number of S3ETRAC runs without generation of output product (data not meeting selection requirements), yellow – number of runs ending in error, red, one plot per site type).

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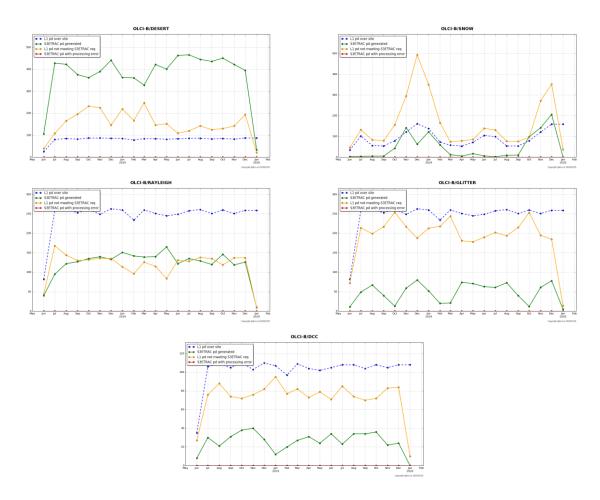


Figure 67: summary of S3ETRAC products generation for OLCI-B

(number of OLCI-B 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).

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3.1.2 Radiometric validation with DIMITRI

Highlights

S3A/OLCI and S3B/OLCI L1B radiometry verification as follow:

- The verification is performed until the 31st of December 2019.
- All OLCI-A and OLCI-B results over Rayleigh, Glint and PICS are consistent with the previous cycle over the used CalVal sites.
- Good stability of both sensors could be observed; the time-series averages show slightly higher reflectance for OLCI-A.
- 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 (Algeria3 & 5, Libya 1 & 4 and Mauritania 1 & 2) has been performed until the 31st of December 2019.
- 2. The results are consistent over all the six used PICS sites (Figure 68 & Figure 69). Both sensors show a good stability over the analysed period.
- 3. The temporal average over the period January 2019 present of the elementary ratios (observed reflectance to the simulated one) for OLCI-A shows gain values within 2-4% over all the VNIR bands (Figure 70). Unlikely, the temporal average over the same period of the elementary ratios (observed reflectance to the simulated one) for OLCI-B shows values within 2% (mission requirement) over the whole spectral range (Figure 70).
- 4. The spectral bands with significant absorption from water vapour and O₂ (Oa11, Oa13, Oa14 and Oa15) are excluded.

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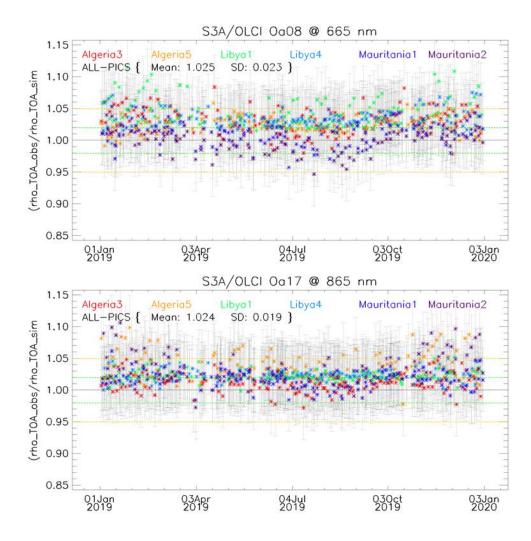


Figure 68: Time-series of the elementary ratios (observed/simulated) signal from S3A/OLCI for (top to bottom) bands Oa08 and Oa17 respectively over January 2019 - Present from the six PICS Cal/Val sites. Dashed-green and orange lines indicate the 2% and 5% respectively. Error bars indicate the desert methodology uncertainty.

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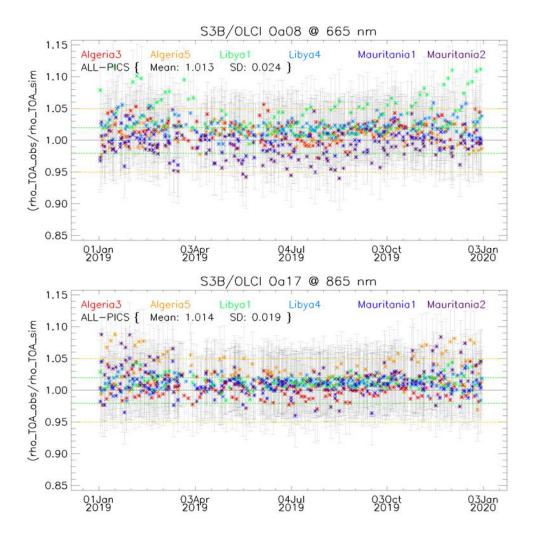


Figure 69: Same as Figure 68 for OLCI-B.



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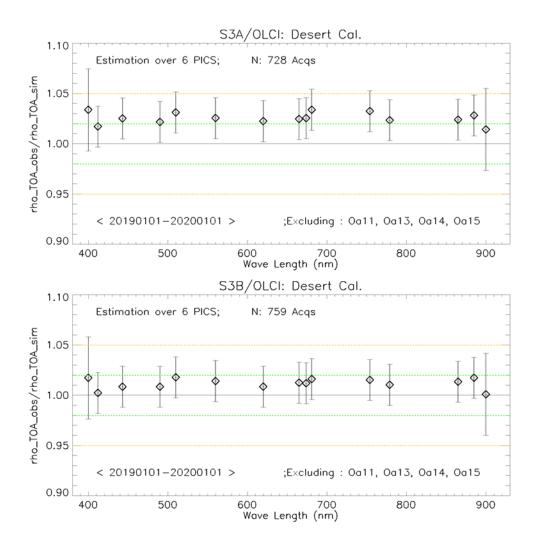


Figure 70: The estimated gain values for OLCI-A (top) and OLCI-B (bottom) from the 6 PICS sites identified by CEOS over the period January 2019 – present as a function of wavelength. Dashed-green and orange lines indicate the 2% and 5% respectively. Error bars indicate the desert methodology uncertainty.

II- Cross-mission Intercomparison over PICS

X-mission Intercomparison with MODIS-A and MSI-A has been performed until February and August 2019 respectively.

Figure 71 shows time-series of the elementary ratios from S2A/MSI, Aqua/MODIS and S3A/OLCI and S3B/OLCI over the LYBIA4 site over the period April-2016 until February and August 2019 respectively. We observe a clear stability over the three sensors, associated with higher reflectance from OLCI-A wrt to MSI-A and MODISA. MODISA shows higher fluctuation wrt to MSI-A and OLCI-A/B ones.

Figure 72 shows the estimated gain over different time-series for different sensors MSI-A, MSI-B, OLCI-A, OLCI-B and MODIS-A) over PICS. The spectral bands with significant absorption from water vapour and O2 are excluded. OLCI-A seems to have higher gain wrt the other sensors, which means that OLCI-A has brighter reflectance than its simulated one by PICS method.

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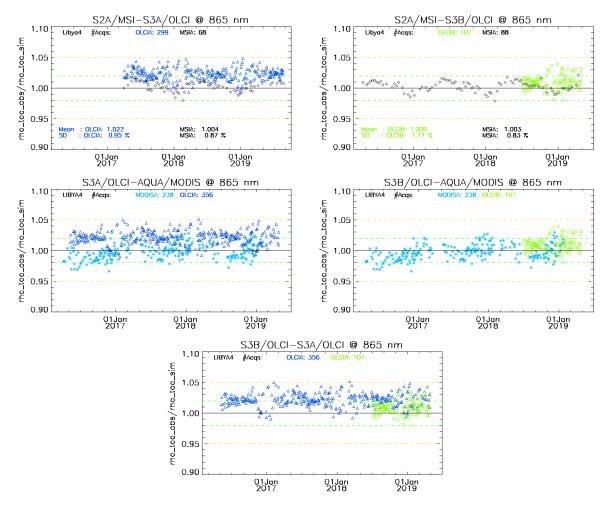


Figure 71: Time- series of the elementary ratios (observed/simulated) signal from (black) S2A/MSI, (blue) S3A/OLCI, (green) S3B/OLCI and (Cyan) Aqua/MODIS for NIR band 865nm over LIBYA4 site. Dashed-green and orange lines indicate the 2% and 5% respectively. The systematic and total uncertainties of the desert methodology are 1% and 5% respectively.

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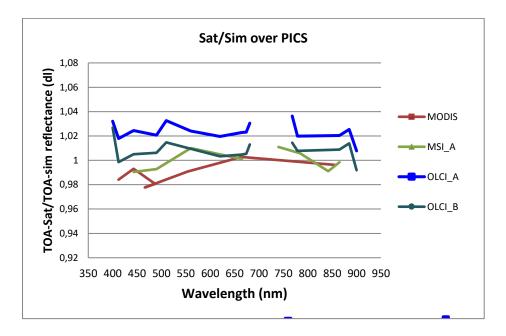


Figure 72: Ratio of observed TOA reflectance to simulated one for (green) S2A/MSI, (purple) S2B/MSI, (red)
Aqua/MODIS, (blue) S3A/OLCI and (dark-green) S3B/OLCI averaged over the six PICS test sites as a function of wavelength.

III-Validation over Rayleigh

Rayleigh method has been performed over the available mini-files on the Opt-server from January 2019 to present for OLCI-A and OLCI-B. The results are produced with the configuration (ROI-AVERAGE). The gain coefficients of OLCI-A are consistent with the previous results. Bands Oa01-Oa05 display biases values between 5%-7% while bands Oa6-Oa9 exhibit biases between 2%-3%, higher than the 2% mission requirements (Figure 73). The gain coefficients of OLCI-B are lower than OLCI-A ones, where bands Oa01-Oa05 display biases values about 3-5%, when bands Oa6-Oa9 exhibit biases better than 2%, the mission requirement (Figure 73).

IV-Validation over Glint and synthesis

Glint calibration method with the configuration (ROI-PIXEL) has been performed over the period January 2019 - present for OLCI-A and OLCI-B. The outcome of this analysis shows a good consistency with the desert outputs over the NIR spectral range Oa06-Oa09 for both sensors. Glint results show that the VNIR bands are within 2% (mission requirement), except Oa21 which show biases of ~6% (see Figure 73). Again, the glint gains from OLCI-B look slightly lower than OLCI-A one.



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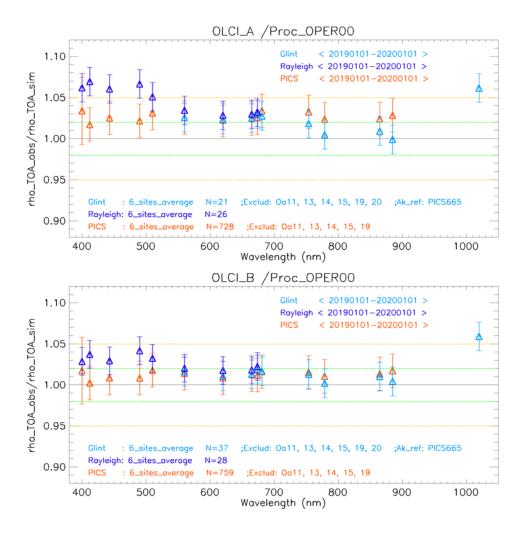


Figure 73: The estimated gain values for OLCI-A and OLCI-B from Glint, Rayleigh and PICS methods over the period November 2018-Present as a function of wavelength. We use the gain value of Oa8 from PICS-Desert method as reference gain for Glint method. Dashed-green and orange lines indicate the 2% and 5% respectively.

Error bars indicate the method uncertainties.

3.1.3 Radiometric validation with OSCAR

The OSCAR Rayleigh method has been applied to the S3A and S3B S3ETRAC data from the 6 oceanic calibration sites listed in Table 3, for November 2019.

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Table 3. S3ETRAC Ocean Calibration sites

Site Name	Ocean	North Latitude	South Latitude	East Longitude	West Longitude
PacSE	South-East of Pacific	-20.7	-44.9	-89	-130.2
PacNW	North-West of Pacific	22.7	10	165.6	139.5
PacN	North of Pacific	23.5	15	200.6	179.4
AtlN	North of Atlantic	27	17	-44.2	-62.5
AtIS	South of Atlantic	-9.9	-19.9	-11	-32.3
IndS	South of Indian	-21.2	-29.9	100.1	89.5

The weighted average OSCAR S3A and S3B Rayleigh results for November 2019 and the whole mission periods are shown below (Table 4, Figure 74 and Figure 75). Similarly to previous reporting periods, S3A is brighter than S3B.

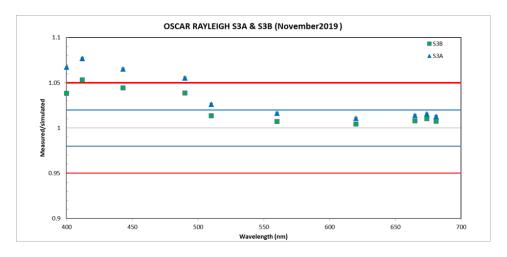


Figure 74. OSCAR Rayleigh S3A and S3B Calibration results: weighted average from November 2019.

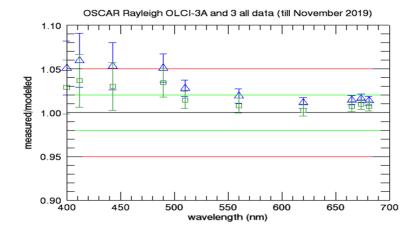


Figure 75. OSCAR Rayleigh S3A and S3B Calibration results: average over all months (till November 2019).

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Table 4: OSCAR Rayleigh S3A and S3B results for the period May till July 2019.

ubie 4.	Sentinel-3A Sentinel-3B									
	wvl	Novemb	per 2019	Whole	Mission	November 2019 Whole Mission				
OLCI band	(nm)	w_avg	stdev	w_avg	stdev	w_avg	stdev	w_avg	stdev	
Oa01*	400	1.067	0.024	1.051	0.031	1.038	0.023	1.029	0.031	
Oa02	412	1.077	0.024	1.060	0.031	1.053	0.023	1.037	0.030	
Oa03	443	1.065	0.019	1.053	0.027	1.044	0.020	1.030	0.027	
Oa04	490	1.055	0.011	1.051	0.016	1.039	0.013	1.034	0.016	
Oa05	510	1.026	0.008	1.028	0.010	1.014	0.009	1.015	0.010	
Oa06	560	1.016	0.007	1.019	0.008	1.007	0.008	1.008	0.009	
Oa07	620	1.011	0.005	1.011	0.006	1.004	0.005	1.003	0.007	
Oa08	665	1.014	0.004	1.014	0.005	1.008	0.004	1.007	0.006	
Oa09	674	1.015	0.004	1.016	0.005	1.010	0.004	1.009	0.006	
Oa10	681	1.013	0.004	1.014	0.005	1.007	0.004	1.007	0.005	
Oa11	709	0.995	0.007	0.996	0.008	0.992	0.005	0.993	0.008	
Oa12	754	1.010	0.001	1.010	0.002	1.009	0.001	1.009	0.002	
Oa13	761.25	NA	NA	NA	NA	NA	NA	NA	NA	
Oa14	764.375	NA	NA	NA	NA	NA	NA	NA	NA	
Oa15	767.5	NA	NA	NA	NA	NA	NA	NA	NA	
Oa16	778.75	NA	NA	NA	NA	NA	NA	NA	NA	
Oa17	865	NA	NA	NA	NA	NA	NA	NA	NA	
Oa18	885	NA	NA	NA	NA	NA	NA	NA	NA	
Oa19	900	NA	NA	NA	NA	NA	NA	NA	NA	
Oa20	940	NA	NA	NA	NA	NA	NA	NA	NA	
Oa21	1020	NA	NA	NA	NA	NA	NA	NA	NA	

^{*}OSCAR Rayleigh results for band Oa01 have to be considered with care due to larger uncertainty in the radiative transfer calculation

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

3.2.1 OLCI-A

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

3.2.2 OLCI-B

This activity has not started for OLCI-B.

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4 Level 2 Land products validation

4.1 [OLCI-L2LRF-CV-300]

4.1.1 Routine extractions

4.1.1.1 OLCI-A

- The focus for this time period has been on the rolling archive Non Time Critical (NT) data until the 27th of December 2019. More data available for statistical analysis as a concatenation procedure for all available data in the MERMAID processing has been implemented.
- Concatenated time series of OLCI Global Vegetation Index and OLCI Terrestrial Chlorophyll Index have been regenerated on the current rolling archive availability including previous extractions since April 2016. The time series therefore represent spring, summer and fall season.

Figure 76 to Figure 85 below present the Core Land Sites OLCI-A time series over the current period.

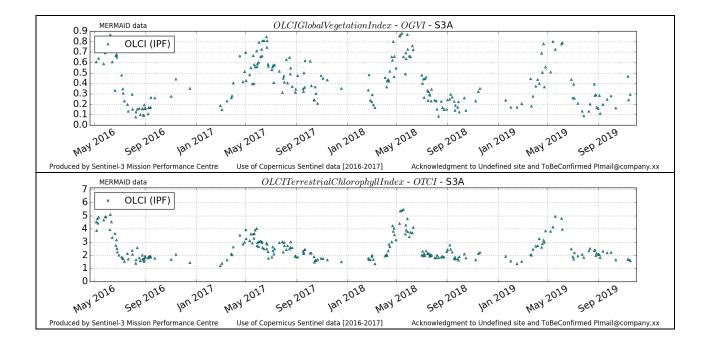


Figure 76: DeGeb time series over current report period

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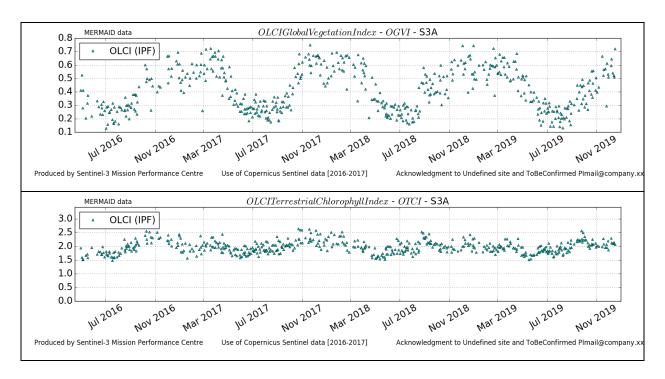


Figure 77: ITCat time series over current report period

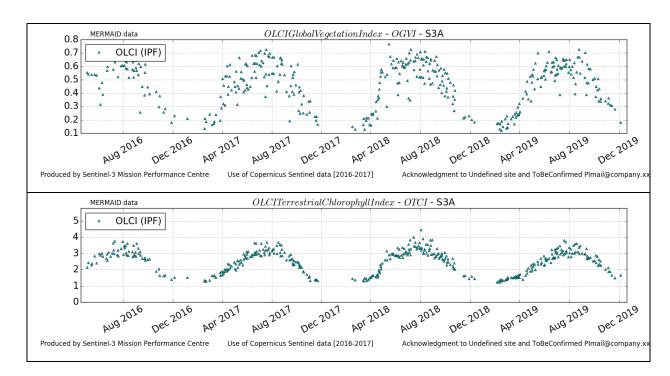


Figure 78: ITsp time series over current report period

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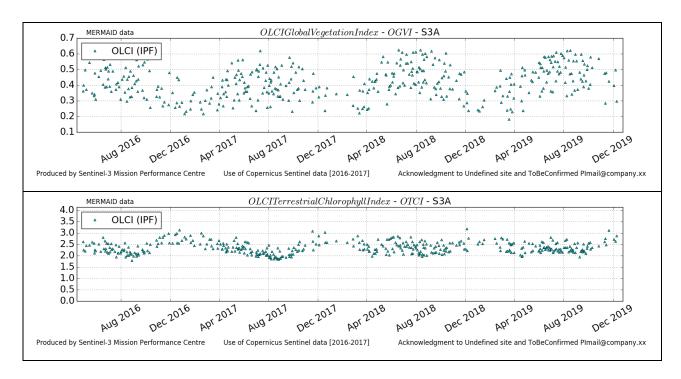


Figure 79: ITSro time series over current report period

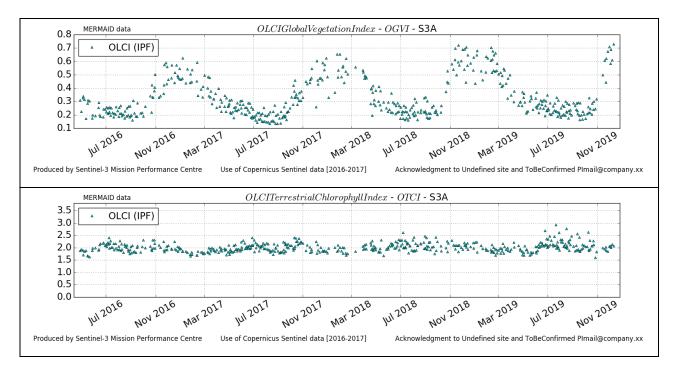


Figure 80: ITTra time series over current report period

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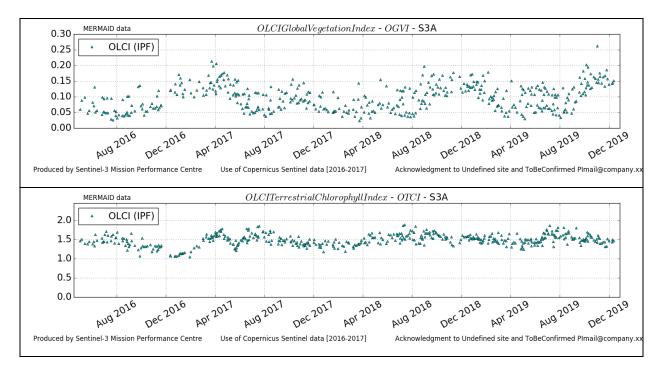


Figure 81: SPAli time series over current report period

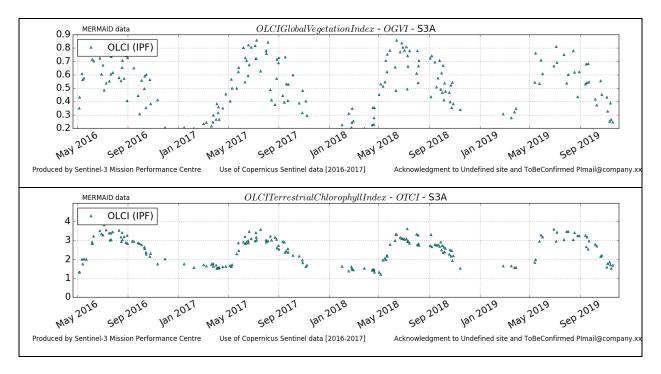


Figure 82: UKNFo time series over current report period

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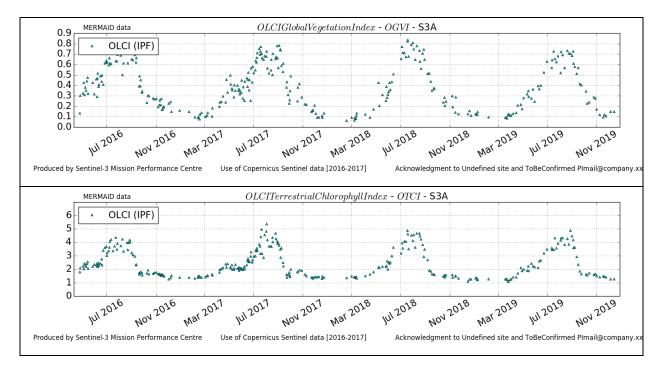


Figure 83: USNe1 time series over current report period

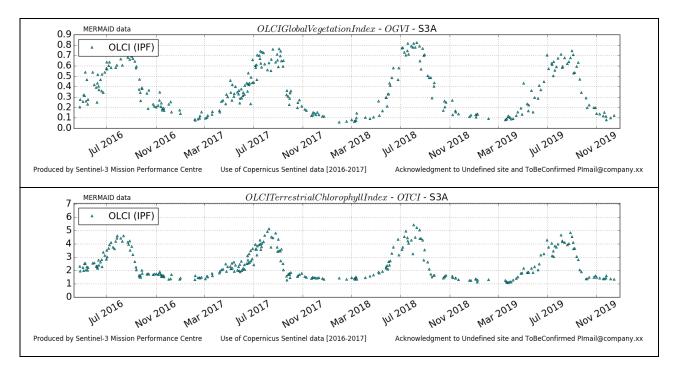


Figure 84: USNe2 time series over current report period



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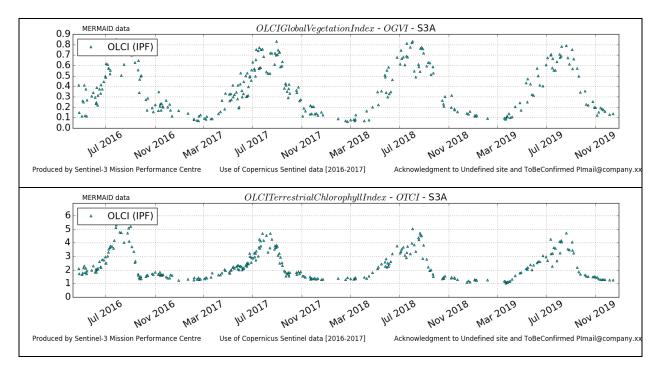


Figure 85: USNe3 time series over current report period

4.1.1.2 OLCI-B

Figure 86 to Figure 95 below present the Core Land Sites OLCI-B time series over the current period.

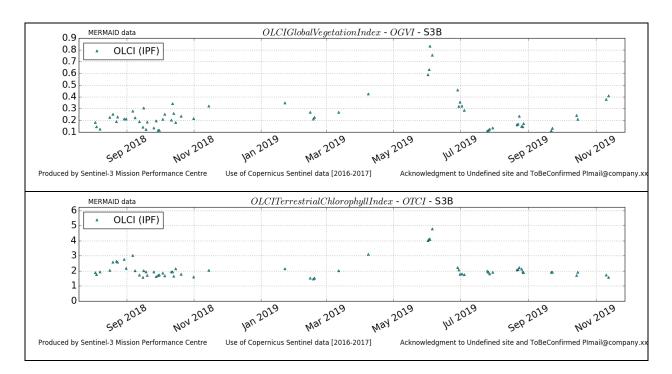


Figure 86: DeGeb time series over current report period

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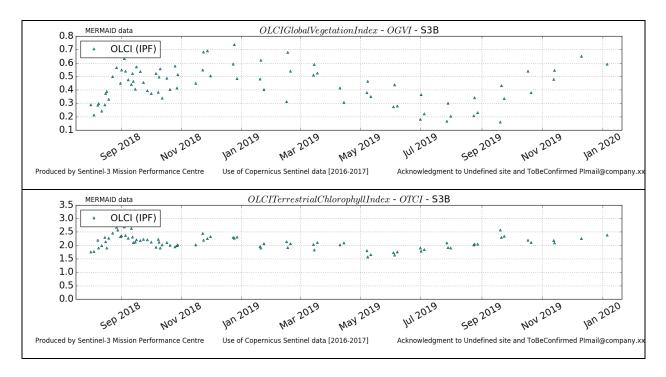


Figure 87: ITCat time series over current report period

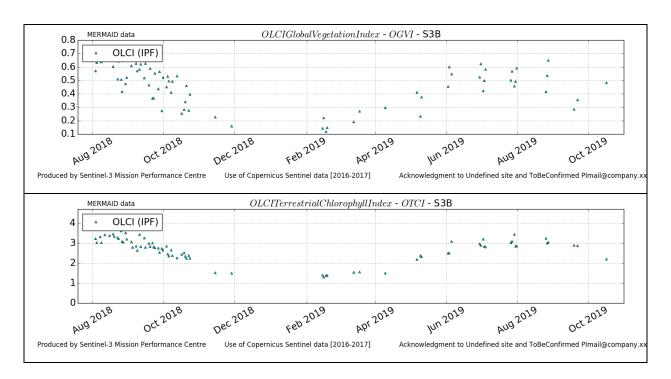


Figure 88: ITsp time series over current report period

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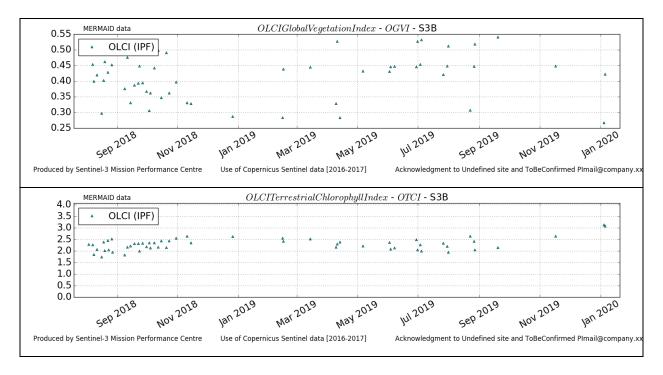


Figure 89: ITSro time series over current report period

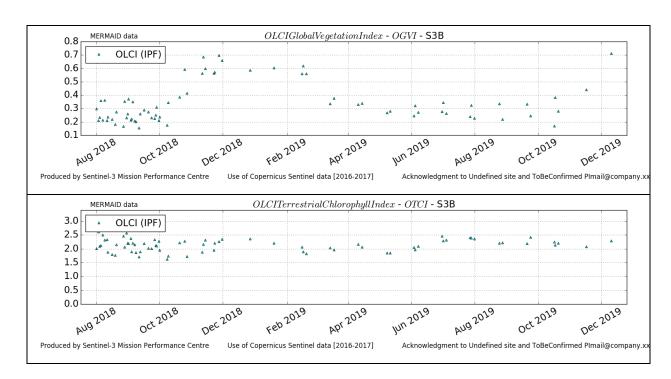


Figure 90: ITTra time series over current report period

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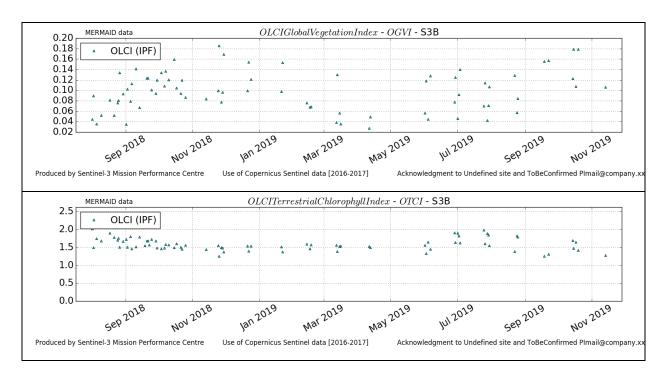


Figure 91: SPAli time series over current report period

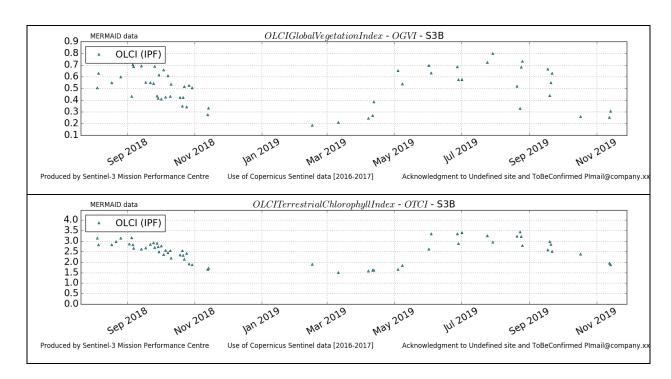


Figure 92: UKNFo time series over current report period

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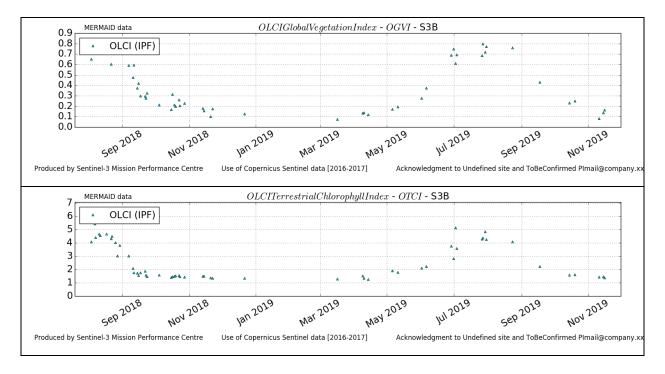


Figure 93: USNe1 time series over current report period

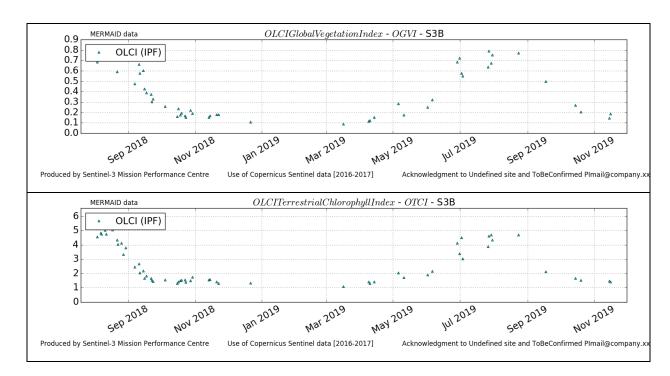


Figure 94: USNe2 time series over current report period



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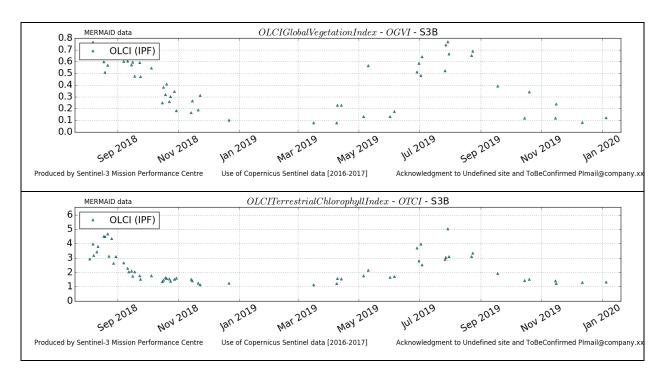


Figure 95: USNe3 time series over current report period

4.1.2 Comparisons with MERIS MGVI and MTCI climatology

Assessment

This section shows the performance of the OLCI Level-2 land products OTCI and OGVI as compared to their MERIS counterpart the MGVI and MTCI climatology. This report covers the period 22 November 2019 to 19 December 2019. Pixel extractions were obtained over 53 CEOS and ESA Core sites from both, OLCI and MERIS (sites 1 to 35 shown in Table 5). Comparison statistics are computed and summarised in Table 6. Time-series of OLCI acquisitions overlaid on long-term monthly mean of MERIS, and monthly mean between MERIS and OLCI scatterplots are presented in Figure 96 to Figure 98. Three illustrative land cover types were selected for these figures: broadleaved deciduous, forest, cropland and evergreen forest. Figure 99 shows the agreement between monthly mean of MERIS and OLCI including all 53 validation sites. In general, OLCI land products follow the trend of the climatology and the seasonal pattern. Sites located in the Northern hemisphere has reached its lowest values due to winter vegetation senescence. Systematic under and overestimations are consistent with previous cycles.

When all sites are pooled together coloured by vegetation type, the slight underestimation of OTCI and slight overestimation of OGVI is evident, mainly for broadleaved deciduous and evergreen sites (Figure 99). Notice overall S3B shows greater disagreement with MERIS climatology. This is due to the lower number of acquisitions, which makes it more sensitive to outliers.

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Table 5: Validation sites included in report S3A 51/S3B 32. Land cover data from GLC2000.

Acronym	Contry	Network	Lat	Lon	Land cover
US-Smithsonian	United States	NEON, AERONET	38.89	-78.14	Broadleaved, deciduous, closed
BE-Brasschaat	Belgium	ICOS	51.31	4.52	Needle-leaved, evergreen
DE-Hones-Holz	Deutschland	ICOS	52.09	11.22	Broadleaved, deciduous, closed
FR-Montiers	France	ICOS	48.54	5.31	Broadleaved, deciduous, closed
US-Harvard	United States	NEON, AERONET	42.54	-72.17	Broadleaved, deciduous, closed
DE-Haininch	Deutschland	ICOS Associated	51.08	10.45	Broadleaved, deciduous, closed
IT-Collelongo	Italy	EFDC	41.85	13.59	Broadleaved, deciduous, closed
IT-Isp	Italy	CORE	45.81	8.64	Mixed forest
UK-NFo	United Kingdom	CORE	50.85	-1.54	Deciduous forest
US-Mountain-Lake	United States	NEON, AERONET	37.38	-80.53	Broadleaved, deciduous, closed
US-Oak-Rige	United States	NEON, AERONET	35.96	-84.28	Broadleaved, deciduous, closed
BR-Mata-Seca	Brazil	ENVIRONET	-14.88	-43.97	Herbaceous, closed-open
CR-Santa-Rosa	Costa Rica	ENVIRONET	10.84	-85.62	Broadleaved, evergreen
IT-Lison	Italy	ICOS	45.74	12.75	Cropland
US-Talladega	United States	NEON, AERONET	32.95	-87.39	Needle-leaved, evergreen
US-Steigerwarldt	United States	NEON	45.51	-89.59	Broadleaved, deciduous, closed
AU-Great-Western	Australia	TERN-SuperSites, AusCover/OzFlux	-30.19	120.65	Broadleaved, deciduous, open
AU-Robson-Creek	Australia	TERN-SuperSites, AusCover/OzFlux	-17.12	145.63	Broadleaved, evergreen
IT-Casterporziano2	Italy	ICOS	41.70	12.36	Tree Cover, mixed leaf type
US-Bartlett	United States	NEON, AERONET	44.06	-71.29	Broadleaved, deciduous, closed
FR-Estrees-Mons	France	ICOS Associated	49.87	3.02	Cultivated and managed areas
AU-Tumbarumba	Australia	TERN-SuperSites, AusCover/OzFlux	-35.66	148.15	Broadleaved, evergreen
AU-Litchfield	Australia	TERN-SuperSites, AusCover/OzFlux	-13.18	130.79	Broadleaved, evergreen
CA-Mer-Bleue	Canada	National Capitol Comission	45.40	-75.49	Peatland
UK-Wytham-Woods	United Kingdom	ForestGeo - NPL	51.77	-1.34	Broadleaved, deciduous, closed
AU-Cape-Tribulation	Australia	TERN-SuperSites, OzFlux	-16.11	145.38	Broadleaved, evergreen
DE-Tharandt	Deutschland	ICOS	50.96	13.57	Needle-leaved, evergreen
IT-Sro	Italy	CORE	43.73	10.28	Mixed forest
DE-Geb	Deutschland	CORE	51.10	10.91	Cropland
US-Jornada	United States	LTER	32.59	-106.84	Shrub, closed-open, deciduous
AU-Cumberland	Australia	TERN-SuperSites, AusCover/OzFlux	-33.62	150.72	Broadleaved, evergreen
BE-Vielsalm	Belgium	ICOS	50.31	6.00	Needle-leaved, evergreen
DE-Selhausen	Deutschland	ICOS	50.87	6.45	Cropland
FR-Puechabon	France	ICOS	43.74	3.60	Needle-leaved, evergreen
NE-Loobos	Netherlands	ICOS Associated	52.17	5.74	Needle-leaved, evergreen

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Table 6: Comparison statistics between monthly S3A/B OLCI land products and MERIS archive data.

0	S3A						S3B									
Site Acronym		ОТ	CI vs MTCI			OG\	/I vs MGVI			OTO	CI vs MTCI			OG'	√I vs MGVI	ĺ.
	n	R2	NRMSD	Bias	n	R2	NRMSD	Bias	n	R2	NRMSD	Bias	n	R2	NRMSD	Bias
US-Smithsonian	10	1	0.03	-0.21	10	0.98	0.07	0.02	10	0.98	0.07	-0.18	10	0.99	0.07	0
BE-Brasschaat	10	0.99	0.03	-0.1	10	0.98	0.05	0.04	9	0.9	0.08	-0.18	9	0.88	0.11	0.01
DE-Hones-Holz	11	0.99	0.04	0.05	11	1	0.02	0.04	9	0.89	0.15	-0.22	9	0.9	0.15	-0.01
FR-Montiers	12	0.99	0.04	-0.06	12	0.97	0.08	0.06	9	0.97	0.07	-0.1	9	0.93	0.15	0.06
US-Harvard	12	0.99	0.03	-0.13	12	0.97	0.09	0.05	10	0.97	0.05	-0.2	10	0.9	0.18	0.01
DE-Haininch	10	0.98	0.08	-0.08	10	0.99	0.08	0.07	10	0.92	0.16	-0.12	10	0.96	0.13	0.06
IT-Collelongo	12	0.98	0.06	-0.02	12	0.98	0.08	0.01	11	0.81	0.24	0.03	11	0.86	0.22	0.01
IT-Isp	12	0.98	0.04	0.04	12	0.99	0.06	0.07	10	0.91	0.09	-0.07	10	0.78	0.22	0.03
UK-NFo	11	0.98	0.04	-0.23	11	0.96	0.08	0.07	10	0.97	0.05	-0.24	10	0.96	0.11	0.05
US-Mountain-Lake	12	0.98	0.05	-0.35	12	0.98	0.08	0.01	11	0.96	0.06	-0.52	11	0.97	0.08	
US-Oak-Rige	12	0.98	0.05	-0.05	12	0.99	0.05	0.04	11	0.99	0.05	-0.12	11	0.94	0.12	0.03
BR-Mata-Seca	12	0.97	0.06	-0.02	12	0.99	0.07	0.01	12	0.95	0.06	-0.12	12	0.98	0.07	0.01
CR-Santa-Rosa	12	0.97	0.05	0.08	12	0.65	0.2	0.12	12	0.84	0.12	-0.04	12	0.38	0.29	0.07
IT-Lison	12	0.97	0.04	-0.05	12	0.97	0.07	0.07	11	0.88	0.07	-0.07	11	0.92	0.13	0.08
US-Talladega	12	0.97	0.02	-0.12	12	0.97	0.05	0.07	10	0.91	0.05	-0.2	10	0.93	0.1	0.09
US-Steigerwarldt	11	0.96	0.06	0.09	11	0.97	0.1	0	7	0.81	0.11	-0.1	7	0.94	0.13	0.02
AU-Great-Western	12	0.95	0.02	0.12	12	0.92	0.1	0.04	12	0.89	0.03	0.13	12	0.75	0.1	0.03
AU-Robson-Creek	12	0.95	0.02	-0.08	12	0.69	0.09	0.1	12	0.81	0.05	-0.17	12	0.68	0.13	0.1
IT-Casterporziano2	12	0.95	0.03	-0.06	12	0.76	0.05	0.08	12	0.75	0.08	0.02	12	0.38	0.1	0.08
US-Bartlett	12	0.95	0.05	-0.04	12	0.97	0.1	0.06	11	0.81	0.1	0.02	11	0.87	0.22	0.02
FR-Estrees-Mons	12	0.93	0.08	0.07	12	0.86	0.14	0.06	10	0.89	0.11	0.11	10	0.91	0.11	0.05
AU-Tumbarumba	12	0.92	0.03	0.33	12	0.79	0.06	0.12	12	0.91	0.03	0.26	12	0.06	0.16	0.07
AU-Litchfield	12	0.91	0.03	-0.03	12	0.92	0.09	0.03	12	0.61	0.07	0	12	0.76	0.09	
CA-Mer-Bleue	9	0.91	0.07	0.01	9	0.99	0.03	0.05	7	0.91	0.06	-0.06	7	0.96	0.08	0.02
UK-Wytham-Woods	12	0.89	0.09	0.05	12	0.87	0.12	0.08	10	0.89	0.08	-0.15	10	0.82	0.21	0.05
AU-Cape-Tribulation	12	0.87	0.04	-0.08	12	0.24	0.08	0.15	10	0.89	0.02	-0.21	10	0.53	0.12	0.14
DE-Tharandt	10	0.87	0.09	0	10	0.91	0.16	0.12	10	0.94	0.07	-0.24	10	0.98	0.09	0.09
IT-Sro	12	0.87	0.02	-0.24	12	0.92	0.06	0.08	12	0.68	0.05	-0.26	12	0.55	0.13	0.08
DE-Geb	12	0.86	0.12	-0.12	12	0.87	0.18	0.03	10	0.81	0.1	-0.07	10	0.61	0.23	-0.02
US-Jornada	9	0.83	0.04	0.03	9	0.81	0.2	0.01	8	0.69	0.04	0.11	8	0.28	0.2	-0.01
AU-Cumberland	12	0.8	0.03	0.01	12	0.55	0.07	0.08	12	0.5	0.06	0.02	12	0.33	0.17	0.06
BE-Vielsalm	11	0.8	0.07	0.06	11	0.94	0.08	0.11	7	0.72	0.08	-0.01	7	0.83	0.2	0.1
DE-Selhausen	12	0.8	0.12	-0.04	12	0.26	0.27	0.05	10	0.74	0.09	-0.2	10	0.17	0.27	-0.01
FR-Puechabon	12	0.8	0.04	-0.06	12	0.82	0.06	0.09	12	0.82	0.05	0.04	12	0.87	0.09	0.04
NE-Loobos	12	0.8	0.06	-0.01	12	0.91	0.1	0.04	10	0.54	0.07	0.07	10	0.88	0.1	0.04

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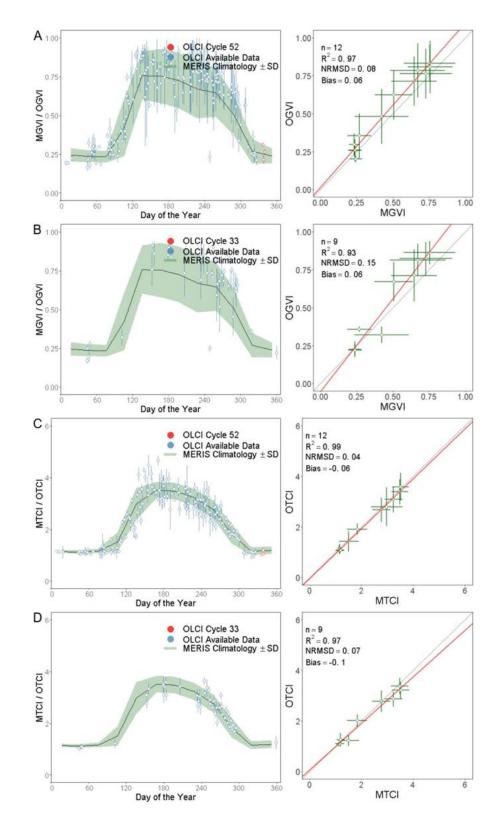


Figure 96: Time-series OGVI and OTCI and corresponding scatterplot of monthly mean for site FR-Montiers, France, land cover Broadleaved, deciduous, closed. A and C represent S3A; B and D represent S3B.

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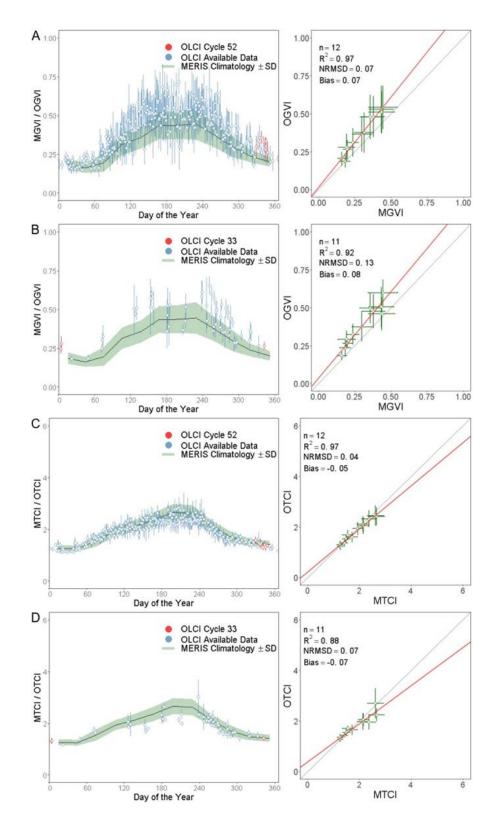


Figure 97: Time-series OGVI and OTCI and corresponding scatterplot of monthly mean for site IT-Lison, Italy, land cover Cropland. A and C represent S3A; B and D represent S3B.

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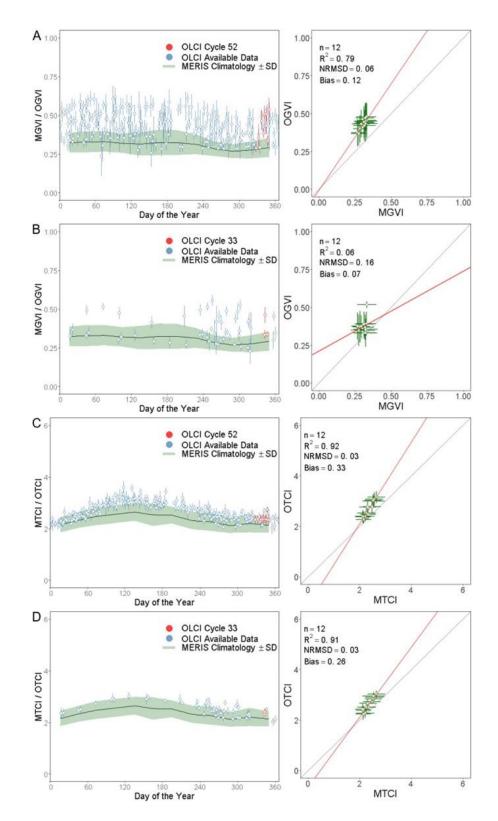


Figure 98: Time-series OGVI and OTCI and corresponding scatterplot of monthly mean for site AU-Tumbarumba, Australia, land cover Broadleaved, evergreen. A and C represent S3A; B and D represent S3B.

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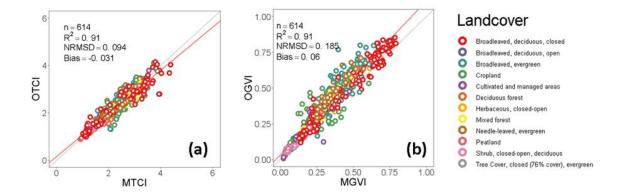


Figure 99: Comparison of OTCI-MTCI (a) and OGVI-MGVI (b). Points in the scatterplot represent the monthly mean of all available S3A and MERIS archive over 53 validation sites. Red and grey lines represent the modelled and 1:1 lines respectively. The scatterplots are updated to include extractions from cycles S3A 51.

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

5.1.1 OLCI-A

There has been no update of the SVC (System Vicarious Calibration) during Cycle 052. Last figures (cycle 17) are considered valid.

5.1.2 OLCI-B

OLCI-B SVC has been reattempted using (a) current OL_2 Marine PB and (b) latest delivered one (PB 1.32-B), including BPC upgrade, as no decision has been taken yet regarding the use of PB 1.32 in operations. Corresponding results are presented below for the two cases. It clearly demonstrates two points:

- 1. SVC is now feasible for OLCI-B and yields good performance on validation
- 2. The BPC upgrade of PB 1.32 is beneficial for the SVC match-up selection (increase of the number of selected calibration match-ups by about 25%) as well as for the validation performance with independent in-situ data.

Results are not further discussed here since there is no decision yet regarding implementation in the Ground Segment.

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.

5.2.1 Acknowledgements

S3-MPC acknowledges all PIs mentioned below and their respective institutions for their valuable contribution to the validation of OLCI L2 water products with a special emphasis on AERONET-OC PIs for their unique contribution to NRT data validation and a special mention to Giuseppe Zibordi maintaining and providing data over 5 ground stations. AERONET-OC is indeed from far the largest contributor of Fiducial Reference Measurements for routine quantitative data validation.

AERONET-OC

- AAOT, Galata, Gloria, GDT, HLH, Irbe Lighthouse: Giuseppe Zibordi, Joint Research Centre of the European Commission
- leodo, Socheongcho: Young-Je Park & Hak-Yeol You, Korean Institute of Ocean Science and Technology & Korea Hydrographic and Oceanographic Administration



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• LISCO: Sam Ahmed, Alex Gilerson, City College of New York

- MVCO: Hui Feng and Heidi Sosik, Ocean Process Analysis Laboratory (OPAL), Woods Hole Oceanographic Institution
- Thornton: Dimitry Van der Zande, RBINS/OD Nature
- Lucinda: Thomas Schroeder, Integrated Marine Observing System, IMOS
- USC_SEAPRISM: Burton Jones and Curtiss Davis, University Southern California | USC, Oregon State University
- WaveCIS: Alan Weidemann, Bill Gibson, Robert Arnone, University of Southern MS, Coastal Studies Inst – LSU, Naval Research Laboratory
- Ariake tower: Joji Ishizaka, Kohei Arai, Nagoya University & Saga University
- Blyth NOAH: Rodney Forster, University of Hull, UK
- Casablanca platform: Giuseppe Zibordi, Marco Talone, Joint Research Centre of the European Commission
- Grizzly bay, Lake Okeechobee, South Greenbay: NimaPahlevan, NASA
- Lake Erie: Tim Moore, Steve Ruberg, Menghua Wang, University of New Hampshire & NOAA

BOUSSOLE

- David Antoine, Enzo Vellucci (Curtin University, Perth & Laboratoire d'Oceanographie de Villefranche, CNRS)
- MOBY
 - Kenneth Voss & Carol Johnson (University of Miami & NIST)
- SLGO
 - Simon Belanger, Thomas Jaegler & Peter Galbraith (Arctus, Inc & Department of fisheries and Ocean Canada)
- AWI
 - Astrid Bracher (Alfred-Wegener-Institut)
- IMOS
 - Thomas Schroeder (Integrated Marine Observing System, IMOS)
- BSH
 - Holger Klein (Bundesamt für Seeschifffahrt und Hydrographie, BSH)
- Proval
 - Edouard Leymarie (Laboratoire d'Oceanographie de Villefranche, CNRS)

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5.2.2 OLCI-A

Activities done

- The focus for this time period has been on the rolling archive Non Time Critical (NT) data until the 7th of January 2020.
- Current reporting period is hereafter compared to the reprocessed archive covering the April 2016 to November 2017 period. No issues are reported neither in the extraction process nor in OLCI data.
- All extractions and statistics have been regenerated on the current rolling archive availability including all the extraction since July 2017. The available matchups therefore represent over almost three years of operation.
- At best 375 and 383 matchups at 490 and 560nm respectively are useful for this time period. OLCI's performances remain nominal.

Overall Water-leaving Reflectance performance

Scatter plots and Performance Statistics

Figure 100 and Figure 101 below present 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 7 below summarises the statistics over the reprocessing period while Table 8 provides the same figures for the NT rolling Archive over July 2017 – present. The latter statistics are almost within the requirements (5% accuracy in the blue/green bands) – as demonstrated by the RPD values between 2 and 7.5% – performances over the current period appear a bit lower than for the calibration period (except at 412 nm), but of the same order of magnitude.

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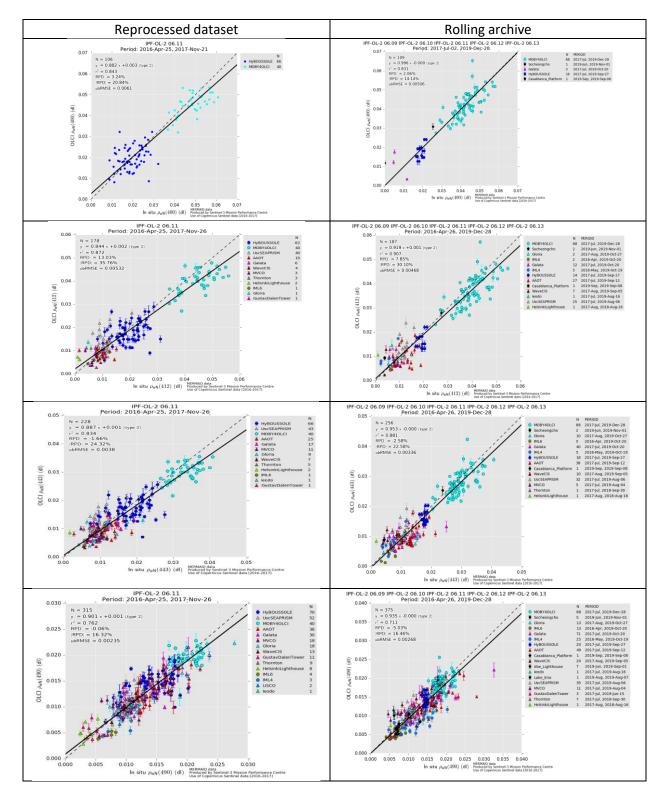


Figure 100: Scatter plots of OLCI-A versus in situ radiometry (FR data). Reprocessed dataset (left), all available data for the current time period (right), Oa1 to Oa4 (400 to 490 nm)

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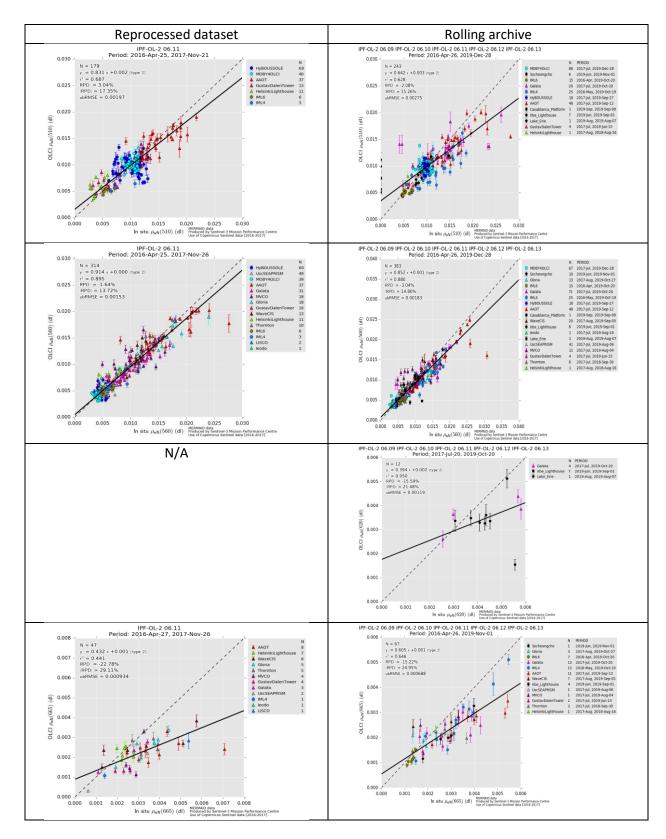


Figure 101: Scatter plots of OLCI-A versus in situ radiometry (FR data). Reprocessed dataset (left), all available data for the current time period (right), Oa5 Oa6 and Oa8 (510, 560 and 665 nm).

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Table 7: OLCI-A 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 8: OLCI-A FR statistics over July 2017-September 2019 reporting period.

lambda	N	RPD	RPD	MAD	RMSE	slope	intercept	r2
400	109	2.06%	14.14%	-0.0002	0.0051	0.9965	-0.0001	0.8312
412	187	7.85%	30.10%	-0.0013	0.0048	0.9187	0.0007	0.9073
443	256	-2.58%	22.58%	-0.0013	0.0036	0.9533	-0.0004	0.8806
490	375	-5.03%	16.46%	-0.0010	0.0029	0.9348	0.0000	0.7109
510	243	-2.08%	15.26%	-0.0005	0.0028	0.6421	0.0035	0.6277
560	383	-3.04%	14.80%	-0.0006	0.0019	0.8525	0.0007	0.8796
620	12	-15.59%	21.48%	-0.0009	0.0015	0.3942	0.0018	0.0503
665	67	-15.22%	24.95%	-0.0006	0.0009	0.6047	0.0005	0.6460

Time series

Figure 102 and Figure 103 below present Galata and AAOT in situ and OLCI time series over the June 2017-September 2019 period, for the same IPF configuration (from a scientific point of view).

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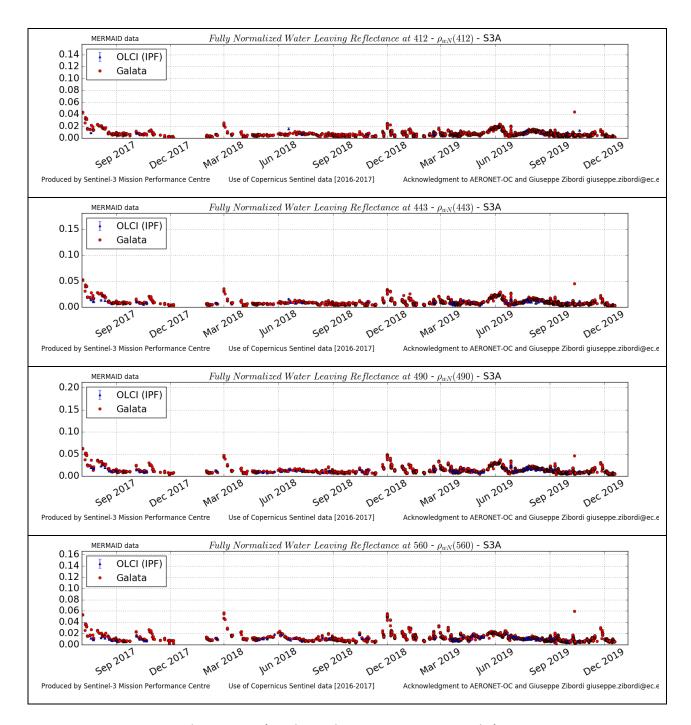


Figure 102: Galata time series over current report period

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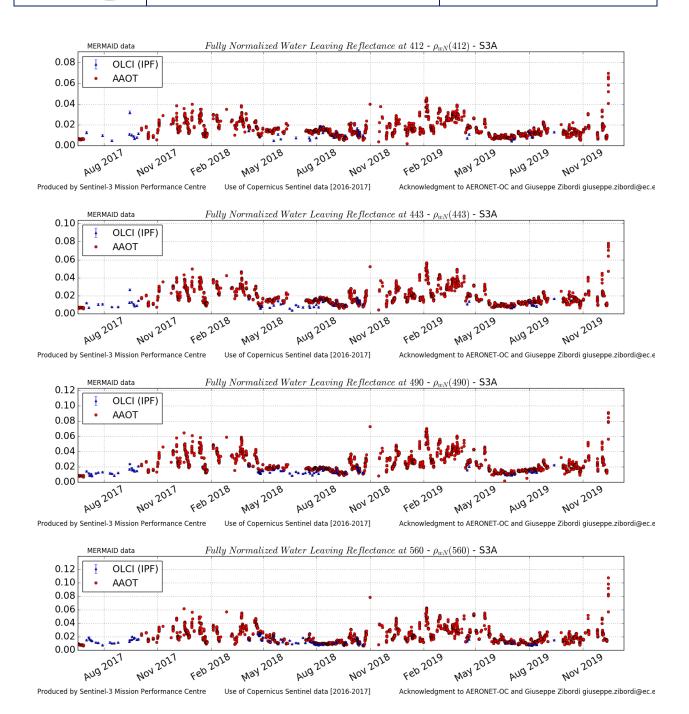


Figure 103: AAOT time series over current report period

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5.2.3 OLCI-B

Activities done

- The focus for this time period has been on the rolling archive Non Time Critical (NT) data until the 7th of January 2020.
- All extractions and statistics have been regenerated on the current rolling archive availability including all the extraction since February 2019.
- At best 178 and 186 matchups at 490 and 560nm respectively are useful for this time period.

It must be noted that OLCI-B has no SVC adjustment and as such cannot be expected to provide performances of the same level of quality than OLCI-A.

Overall Water-leaving Reflectance performance

Scatter plots and Performance Statistics

- Figure 104 below presents the scatterplots and statistics of OLCI-B FR versus in situ reflectance.
- ❖ Table 9 below summarises the statistics over the current reporting period.

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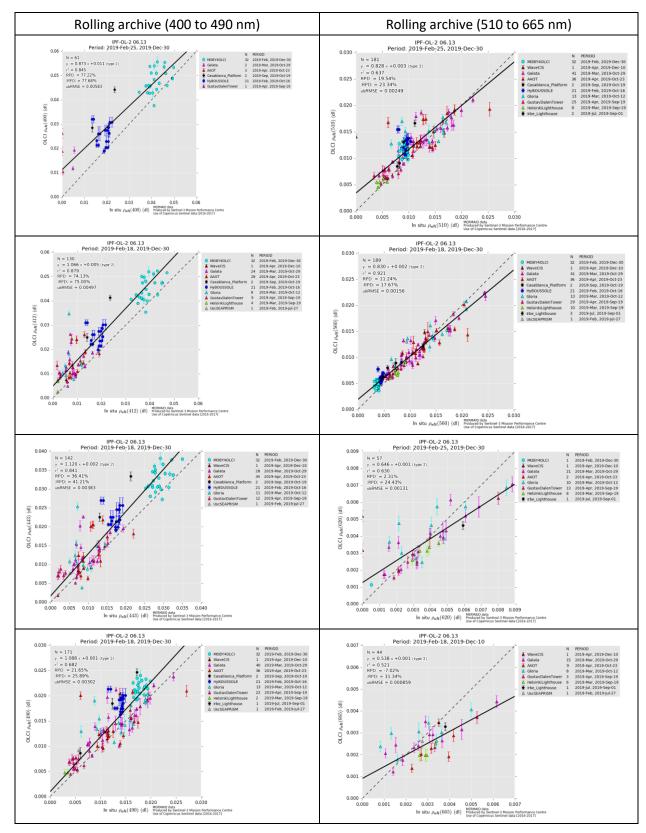


Figure 104: Scatter plots of OLCI-B versus in situ radiometry (FR data). All available data for the current time period.

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Table 9: OLCI-B FR statistics over February to Decemver 2019 reporting period.

lambda	N	RPD	RPD	MAD	MAD RMSE slope		intercept	r2
400	60	33.10%	33.56%	0.0075	0.0095	0.8700	0.0114	0.8348
412	130	74.13%	75.00%	0.0060	0.0078	1.0662	0.0049	0.8786
443	139	31.70%	36.60%	0.0034	0.0051	1.1329	0.0014	0.8379
490	168	20.69%	25.00%	0.0021	0.0037	1.1024	0.0007	0.6670
510	178	18.82%	22.68%	0.0016	0.0030	0.8281	0.0034	0.6240
560	186	11.09%	17.63%	0.0003	0.0016	0.8300	0.0019	0.9199
620	56	2.49%	24.76%	-0.0001	0.0013	0.6430	0.0013	0.6291
665	44	-7.02%	31.34%	-0.0005	0.0010	0.5379	0.0009	0.5208

Time series

Figure 105 and Figure 106 below present AAOT and GALATA in situ and OLCI-B time series over the current period.

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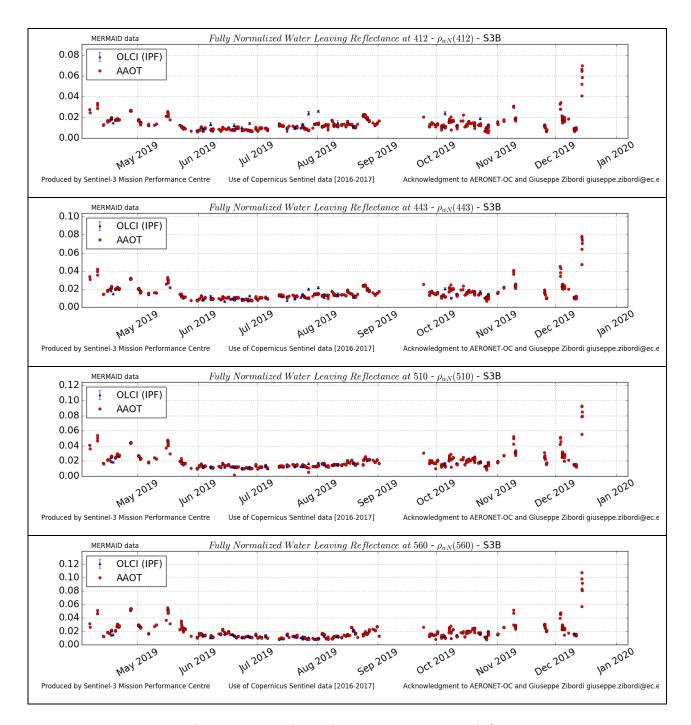


Figure 105: AAOT time series over current report period

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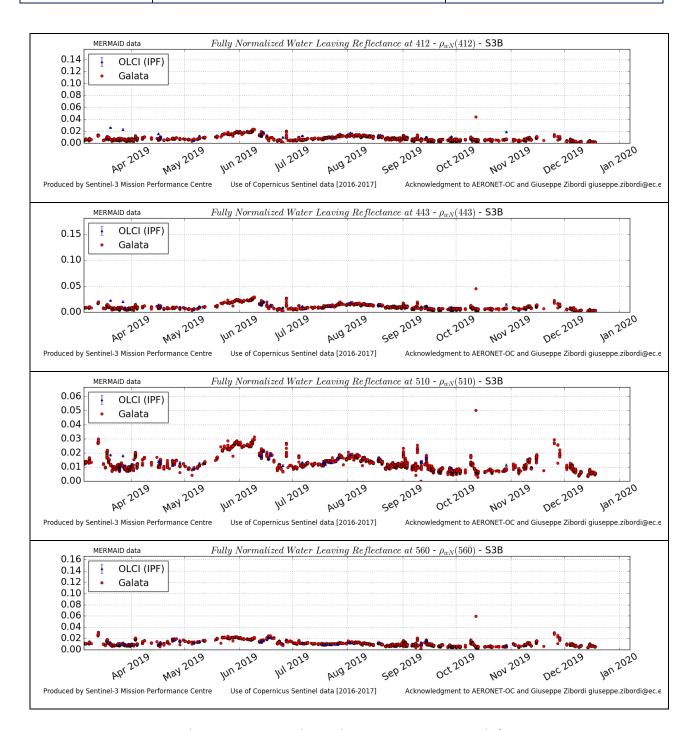


Figure 106: GALATA time series over current report period



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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.

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 047/028) are considered valid.

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

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



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6 Validation of Integrated Water Vapour over Land & Water

There has been no new result during the cycle. Last figures (cycle 047/028) are considered valid.



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7 Level 2 SYN products validation

There has been no new result during the cycle. Last figures (cycle 43/24) are considered valid.

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8 Events

For OLCI-A, three Radiometric Calibration Sequences have been acquired during Cycle 052:

- S01 sequence (diffuser 1) on 23/11/2019 07:41 to 07:42 (absolute orbit 19614)
- S05 sequence (diffuser 2) on 23/11/2019 09:22 to 09:23 (absolute orbit 19615)
- S01 sequence (diffuser 1) on 11/12/2019 03:12 to 03:14 (absolute orbit 19868)

For OLCI-B, two Radiometric Calibration Sequences have been acquired during Cycle 033:

- S01 sequence (diffuser 1) on 11/12/2019 17:41 to 17:43 (absolute orbit 8483)
- So1 sequence (diffuser 1) on 26/12/2019 17:53 to 17:55 (absolute orbit 8697)



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9 Appendix A

Other reports related to the Optical mission are:

S3 SLSTR Cyclic Performance Report, S3A Cycle No. 052, S3B Cycle No. 033 (ref. S3MPC.RAL.PR.02-052-033)

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

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