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

## **S3 OLCI Cyclic Performance Report**

**S3-A** 

Cycle No. 039

Start date: 06/12/2018

End date: 02/01/2019

**S3-B** 

Cycle No. 020

Start date: 16/12/2018

End date: 12/01/2019



Mission
Performance
Centre

SENTINEL 3



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## **Changes Log**

Version	Date	Changes
1.0	18/01/2019	First Version

## **List of Changes**

Version	Section	Answers to RID	Changes



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#### **Sentinel-3 MPC**

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# 1 Processing Baseline Version

### 1.1 Sentinel3-A

IPF	IPF / Processing Baseline version	Date of deployment
OL1	06.08 / 2.42	CGS: 12/12/2018 11:38 UTC (NRT) PAC: 12/12/2018 11:38 UTC (NTC)
OL2	06.12 / 2.38	CGS: 29/08/2018 09:24 UTC PAC: 29/08/2018 09:33 UTC
SY2	06.15 / 2.40	PAC: 13/09/2018 09:00 UTC
SY2_VGS	06.06 / 2.26	PAC: 11/01/2018 10:52 UTC

## 1.2 Sentinel3-B

IPF	IPF / Processing Baseline version	Date of deployment
OL1	06.08 / 1.12	CGS: 12/12/2018 11:38 UTC (NRT) PAC: 12/12/2018 11:38 UTC (NTC)
OL2	06.12 / 1.09	CGS: 29/08/2018 09:24 UTC PAC: 29/08/2018 09:33 UTC
SY2	06.16 / 1.16	PAC: 6/01/2019 10:09 UTC
SY2_VGS	06.06 / 1.00	PAC: 11/01/2018 10:52 UTC



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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.

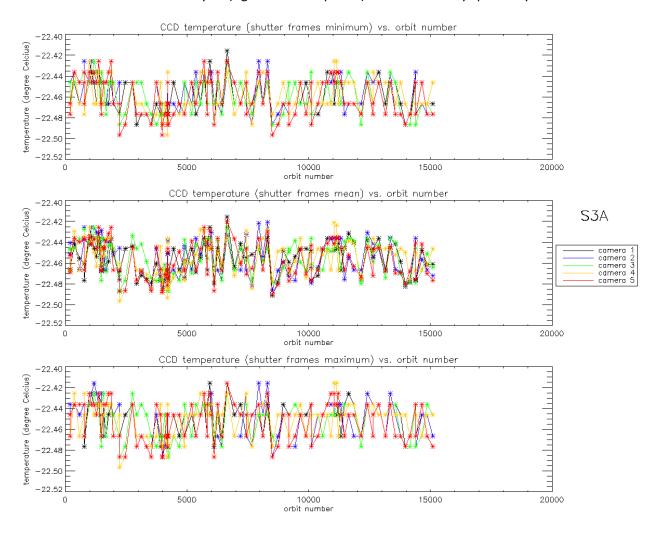


Figure 1: long term monitoring of OLCI-A CCD temperatures using minimum value (top), time averaged values (middle), and maximum value (bottom) provided in the annotations of the Radiometric Calibration Level 1 products, for the Shutter frames, all radiometric calibrations so far.

# Mission Performance Centre

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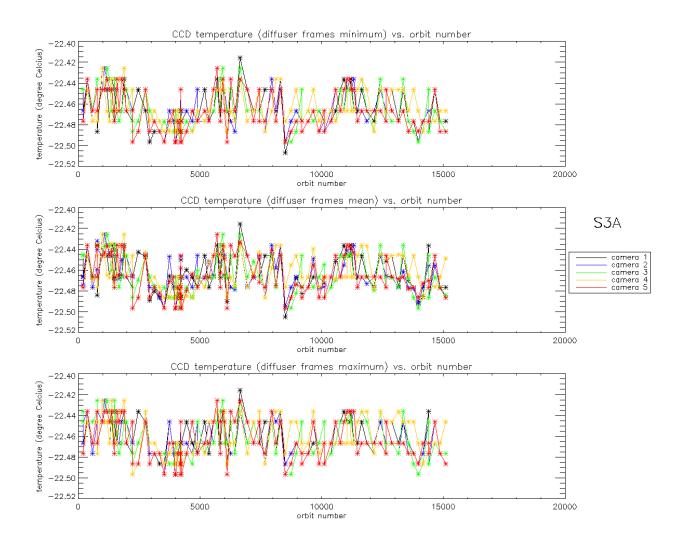


Figure 2: Same as Figure 1 for diffuser frames.

# SENTINGE, 3 Mission Performance Centre

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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.

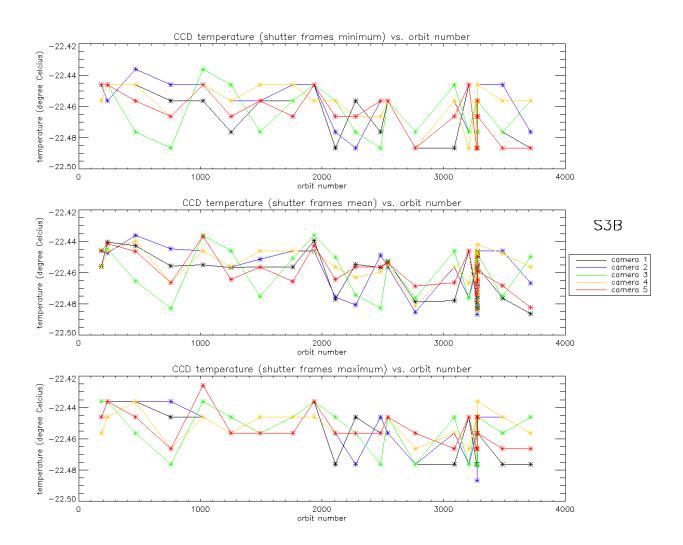


Figure 3: long term monitoring of OLCI-B CCD temperatures using minimum value (top), time averaged values (middle), and maximum value (bottom) provided in the annotations of the Radiometric Calibration Level 1 products, for the Shutter frames, all radiometric calibrations so far except the first one (absolute orbit 167).



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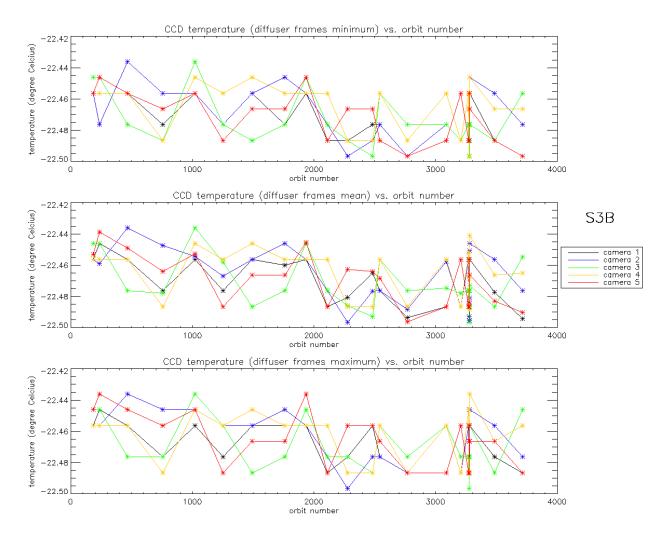


Figure 4: same as Figure 3 for diffuser frames.

#### 2.2 Radiometric Calibration

For OLCI-A, three Radiometric Calibration Sequences have been acquired during Cycle 039:

- S01 sequence (diffuser 1) on 10/12/2018 18:10 to 18:12 (absolute orbit 14658)
- S01 sequence (diffuser 1) on 25/12/2018 21:43 to 21:45 (absolute orbit 14874)
- S01 sequence (diffuser 1) on 11/01/2019 02:31 to 02:33 (absolute orbit 15105)

For OLCI-B, two Radiometric Calibration Sequences have been acquired during Cycle 020:

- S01 sequence (diffuser 1) on 26/12/2018 05:29 to 05:30 (absolute orbit 3280)
- S01 sequence (diffuser 1) on 11/01/2019 10:16 to 10:18 (absolute orbit 3485)



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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).

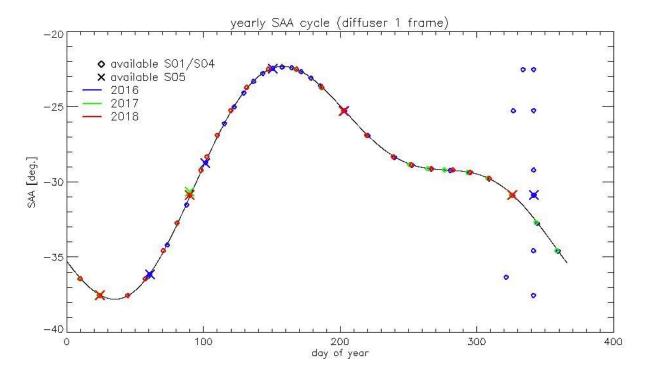


Figure 5: Sun azimuth angles during acquired OLCI-A Radiometric Calibrations (diffuser frame) on top of nominal yearly cycle (black curve). Diffuser 1 with diamonds, diffuser 2 with crosses, 2016 acquisitions in blue, 2017 in green, 2018 in yellow and 2019 in red.

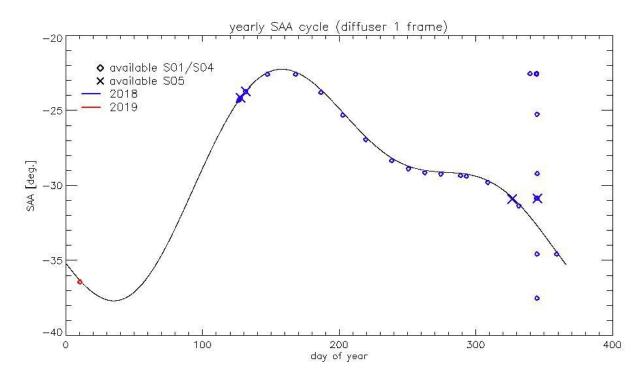


Figure 6: same as Figure 5 for OLCI-B (2018 in blue, 2019 in red).



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

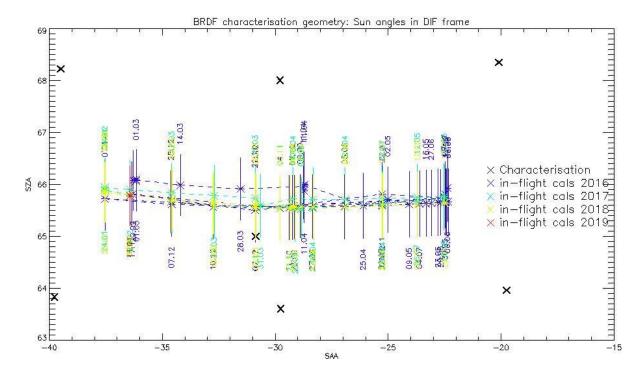


Figure 7: OLCI-A Sun geometry during radiometric Calibrations on top of characterization ones (diffuser frame)

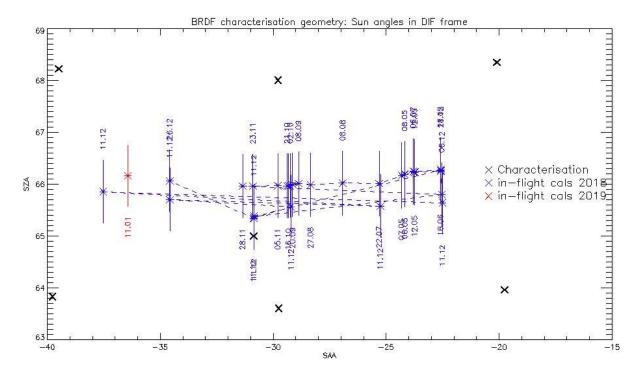


Figure 8: same as Figure 7 for OLCI-B.



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

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

#### **Note about the High Energy Particles:**

The filtering of High Energy Particle (HEP) events from radiometric calibration data has been implemented (for shutter frames only) in a post processor, allowing generating Dark Offset and Dark Current tables computed on filtered data. The post-processor starts from IPF intermediate data (corrected counts), applies the HEP detection and filtering and finally computes the Dark Offset and Dark Current tables the same way as IPF. An example of the impact of HEP filtering is given in Figure 9.

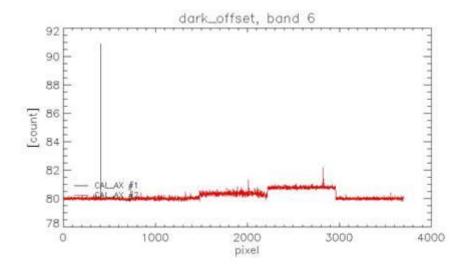


Figure 9: Dark Offset table for band Oa06 with (red) and without (black) HEP filtering (Radiometric Calibration of 22 July 2017). The strong HEP event near pixel 400 has been detected and removed by the HEP filtering.

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



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#### 2.2.1.1 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.

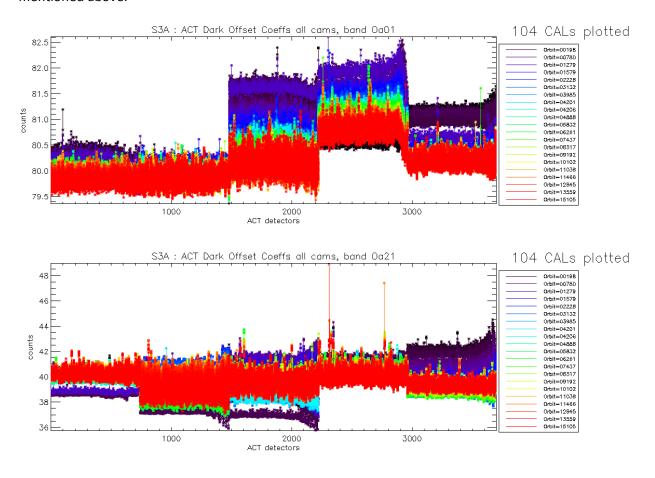


Figure 10: OLCI-A Dark Offset for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.

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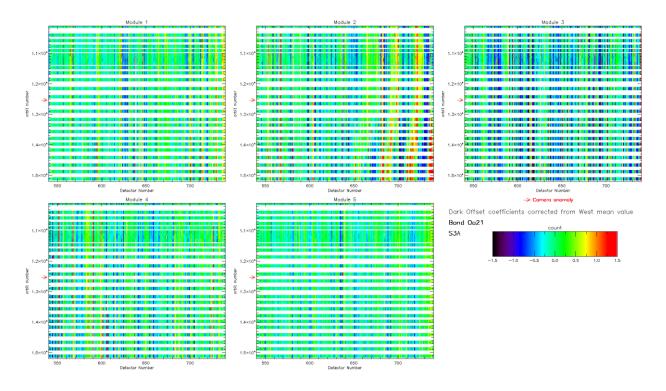


Figure 11: map of OLCI-A periodic noise for the 5 cameras, for band Oa21. X-axis is detector number (East part, from 540 to 740, where the periodic noise occurs), Y-axis is the orbit number. Y-axis range is focused on the most recent 5000 orbits. The counts have been corrected from the West detectors 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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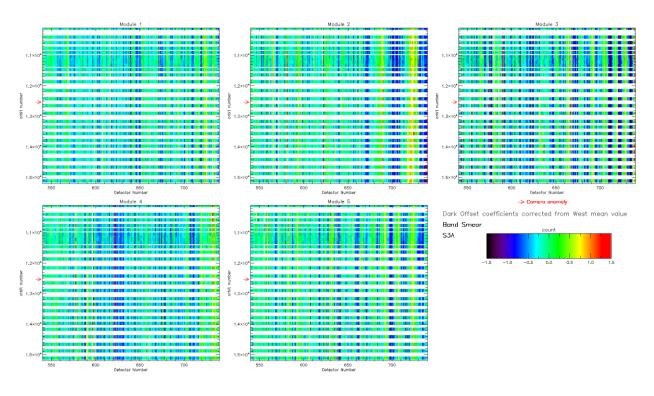


Figure 12: same as Figure 11 for smear band.

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.

As there was no camera anomaly during the current cycle, there is no sudden change of periodic noise to report during the current cycle. However we notice that for camera 2 band Oa21 the PN phase seems to be drifting again since about orbit 13500. This drift shall be monitored carefully during the following months. Other bands/camera are more stable. The hot pixel impacting one of the "East blind pixels" for camera 4 smear band, presented in cycle #26 report, is still present and stable.

A new Calibration ADF has been delivered to MPC-CC for transfer to PDGS as part of Processing Baseline 2.42 (delivered on 23 NOV 2018). It includes an update of the Dark Offset and Dark Current LUTs. The updated LUTs are the one computed from radiometric sequence S01 of 5 NOV 2018.

#### **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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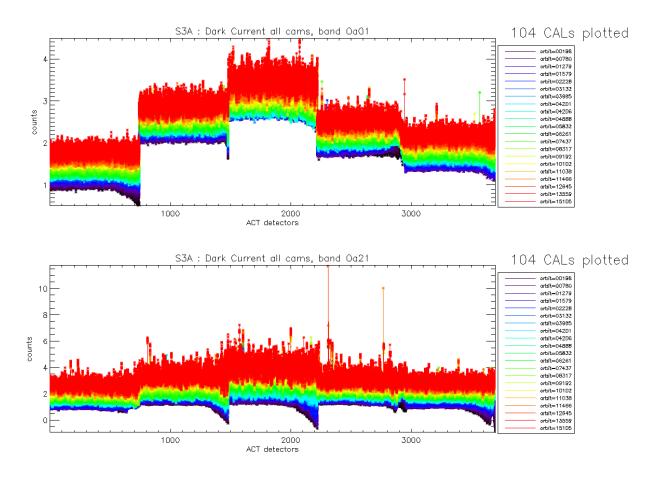


Figure 13: OLCI-A Dark Current for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.

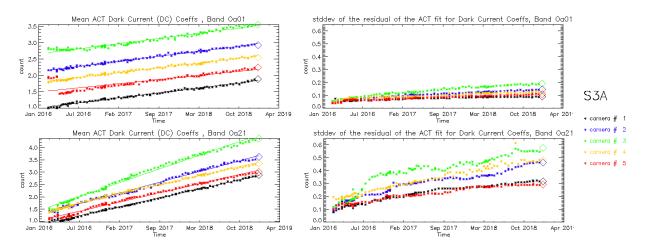


Figure 14: left column: ACT mean on 400 first detectors of OLCI-A Dark Current coefficients for spectral band Oa01 (top) and Oa21 (bottom). Right column: same as left column but for Standard deviation instead of mean.

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

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



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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).

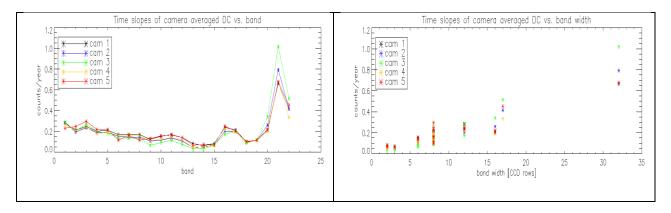


Figure 15: OLCI-A Dark current increase rates with time (in counts per year) vs. band (left) and vs. band width (right)

#### 2.2.1.2 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 for OLCI-A the strong periodic noise phase and amplitude drift, present at the very beginning of the mission, tends to stabilize.

There is no anomalous behaviour of dark offsets coefficients or periodic noise to report during the reporting period.

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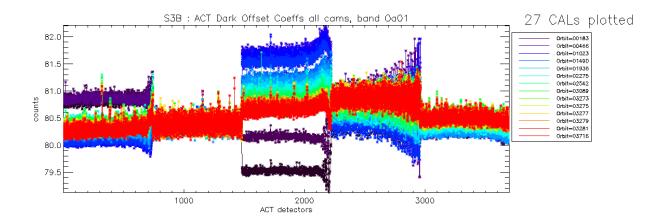
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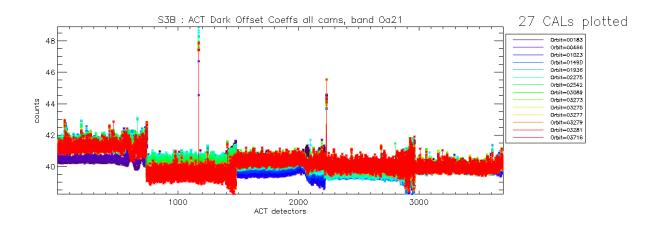


Figure 16: OLCI-B Dark Offset for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 167) for which the instrument was not thermally stable yet.



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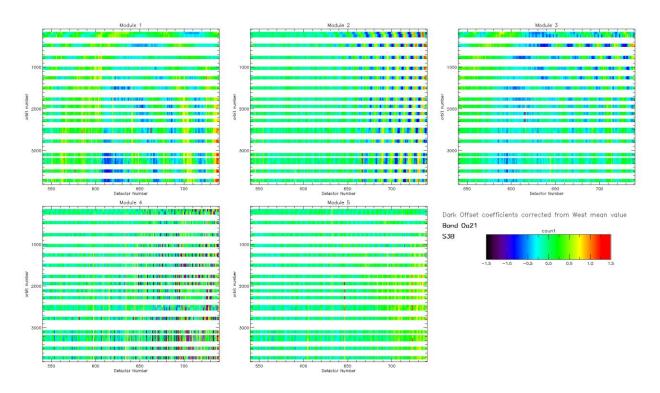


Figure 17: OLCI-B map of periodic noise for the 5 cameras, for band Oa21. X-axis is detector number (East part, from 540 to 740, where the periodic noise occurs), Y-axis is the orbit number. The counts have been corrected from the West detectors mean value (not affected by periodic noise) in order to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

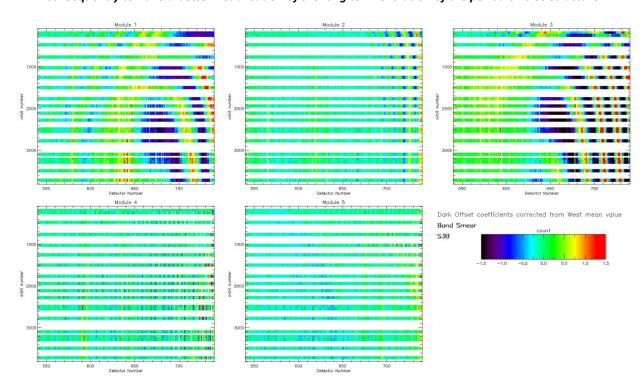


Figure 18: same as Figure 17 for smear band.

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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).

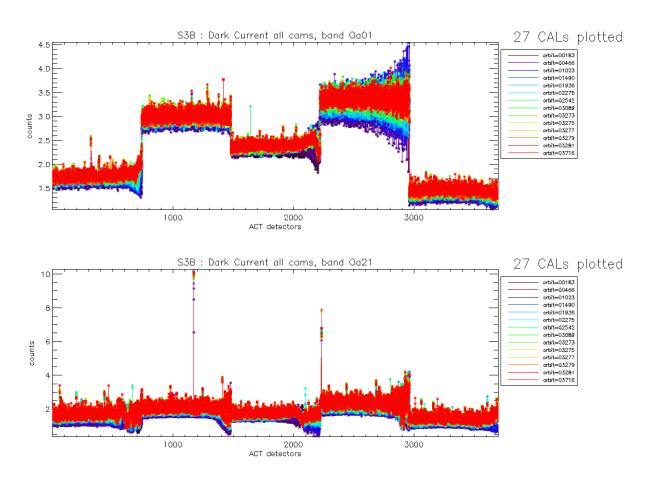


Figure 19: OLCI-B Dark Current for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 167) for which the instrument was not thermally stable yet.

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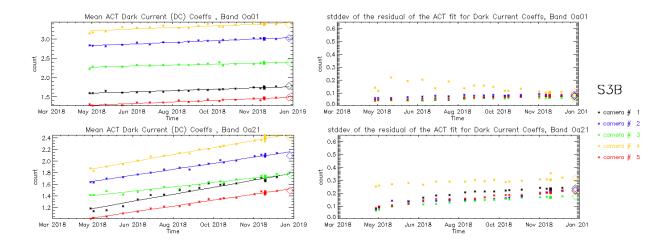


Figure 20: left column: ACT mean on 400 first detectors of OLCI-B Dark Current coefficients for spectral band Oa01 (top) and Oa21 (bottom). Right column: same as left column but for Standard deviation instead of mean.

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

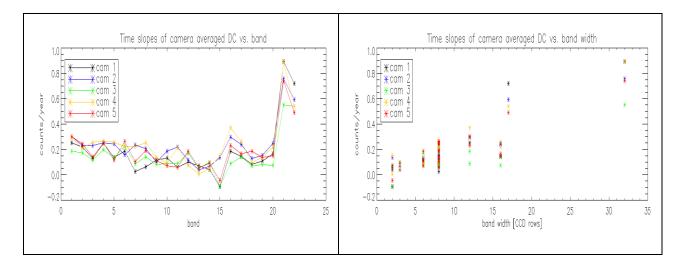


Figure 21: OLCI-B Dark Current increase rates with time (in counts per year) vs. band (left) and vs. band width (right)



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

#### 2.2.2.1 Instrument response monitoring

#### 2.2.2.1.1 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.

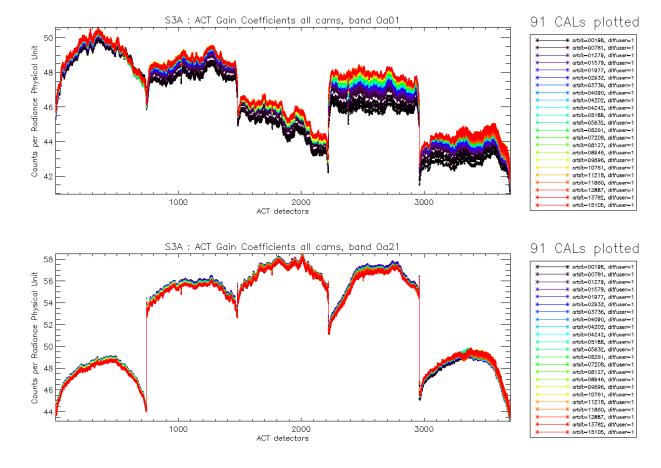


Figure 22: OLCI-A Gain Coefficients for band Oa1 (top) and Oa21 (bottom), all diffuser 1 radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.

The gains plotted in Figure 22, however are derived using the ground BRDF model – as the only one available in the operational processing software so far – which is known to suffer from illumination geometry dependent residual errors (see previous Cyclic Reports for more details). Consequently they are post-processed to replace the ground BRDF model by the in-flight version, based on Yaw Manoeuvres data, prior to determine the radiometric evolution.

Figure 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



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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.

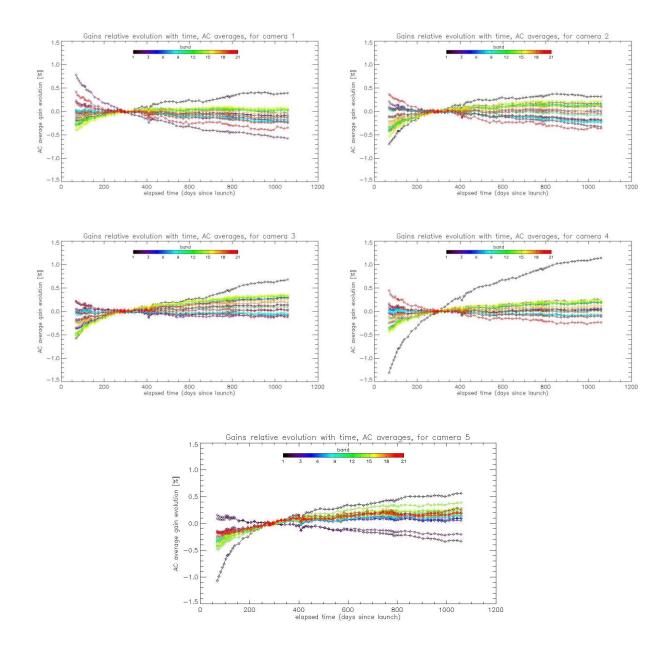


Figure 23: camera averaged gain relative evolution with respect to "best geometry" calibration (07/12/2016), as a function of elapsed time since the change in OLCI channels settings (25/04/16); one curve for each band (see colour code on plots), one plot for each module. The diffuser ageing has been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



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#### 2.2.2.1.2 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.

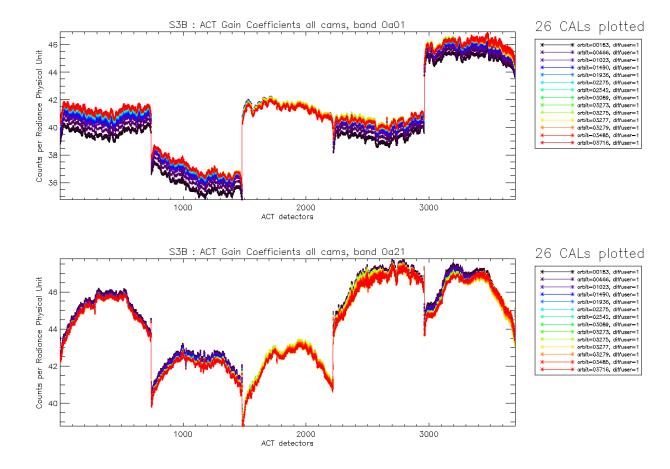


Figure 24: OLCI-B Gain Coefficients for band Oa1 (top) and Oa21 (bottom), all diffuser 1 radiometric calibrations so far except the first one (orbit 167) for which the instrument was not thermally stable yet.

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 (the last one 11/01/2019). 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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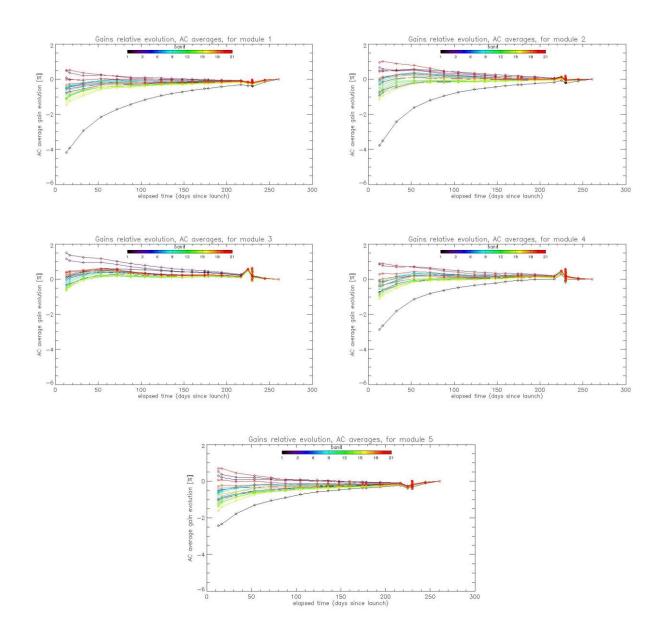


Figure 25: camera averaged gain relative evolution with respect to last calibration (11/01/2019), as a function of elapsed time since the beginning of the mission; one curve for each band (see colour code on plots), one plot for each module. The diffuser ageing is not taken into account (too early to model it yet).



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#### 2.2.2.2 Instrument evolution modelling

#### 2.2.2.2.1 OLCI-A

As mentioned in cycle #22 report, the OLCI Radiometric Model has been refreshed, and put in operations the 11/10/2017. The model has been derived on the basis of an extended Radiometric Calibration dataset (from 25/04/2016 to 27/08/2017), and includes the correction of the diffuser ageing for the five bluest bands (Oa1 to Oa5) for which it is clearly measurable. The model performance over the complete dataset (including the 35 calibrations in extrapolation over about 17 months) remains better than 0.11% – except for channels Oa1 (400 nm), Oa2 (412.5 nm) and Oa21 (1020 nm) which are respectively < 0.32%, < 0.17% and < 0.17% – when averaged over the whole field of view (Figure 26) even if a small drift of the model with respect to most recent data is now visible. The previous model, trained on a Radiometric Dataset limited to 12/03/2017, shows a stronger drift of the model with respect to most recent data (Figure 27). Comparison of the two figures shows the improvement brought by the updated Model.

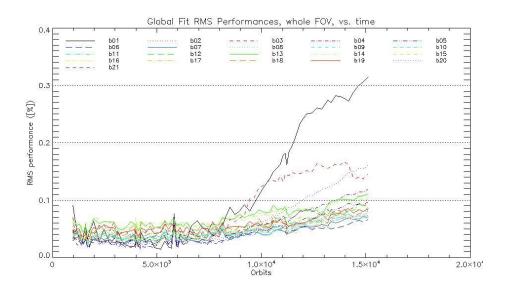


Figure 26: RMS performance of the OLCI-A Gain Model of current Processing Baseline as a function of orbit.

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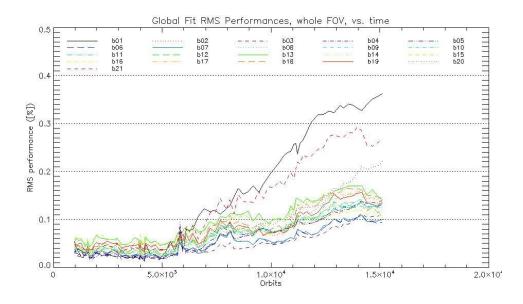


Figure 27: RMS performance of the OLCI-A Gain Model of previous Processing Baseline as a function of orbit.

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

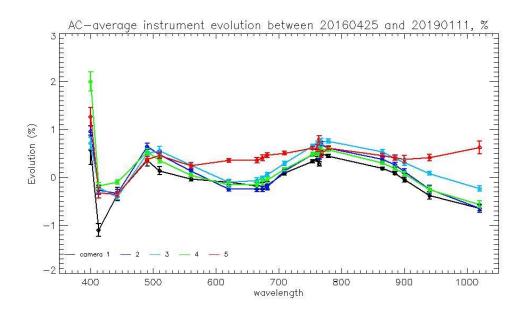


Figure 28: Camera-averaged instrument evolution since channel programming change (25/04/2016) and up to most recent calibration (11/01/2019) versus wavelength.



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#### The overall per camera performance, as a function of wavelength, and at each orbit is shown on

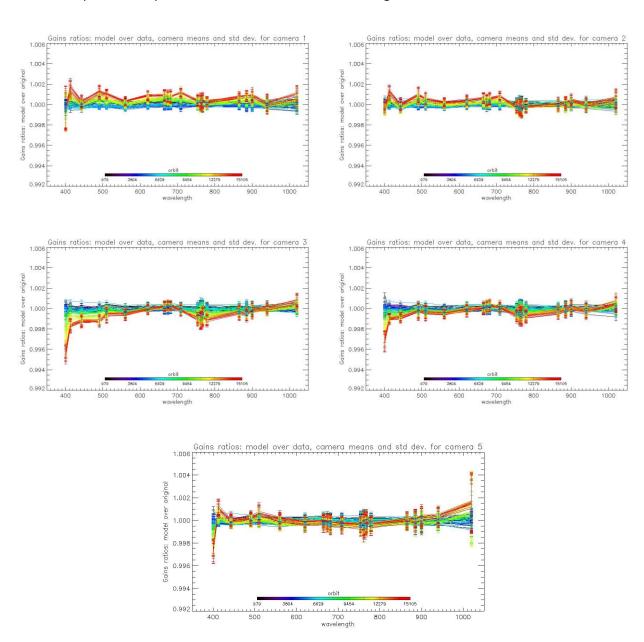


Figure 29 as the average and standard deviation of the model over data ratio.

Finally, Figure 30 to

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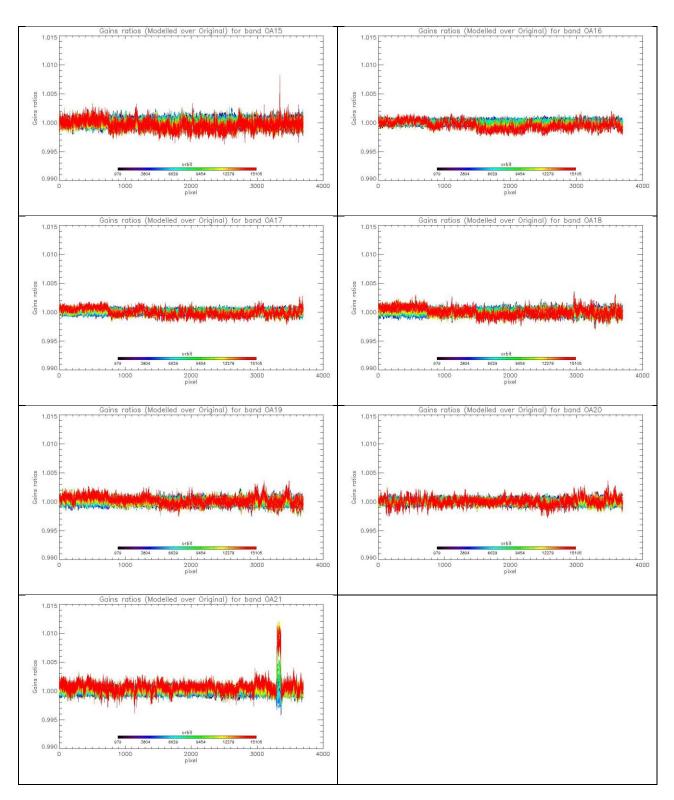


Figure 32 show the detail of the model performance, with across-track plots of the model over data ratios at each orbit, one plot for each channel.

Comparisons of Figure 30 to

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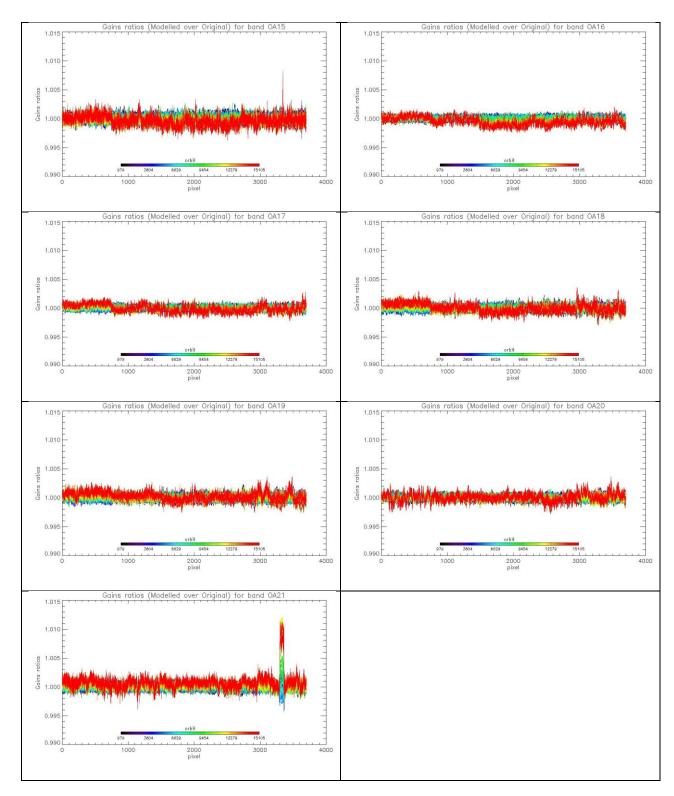


Figure 32 with their counterparts in Report of Cycle 22 clearly demonstrate the improvement brought by the new model whatever the level of detail.

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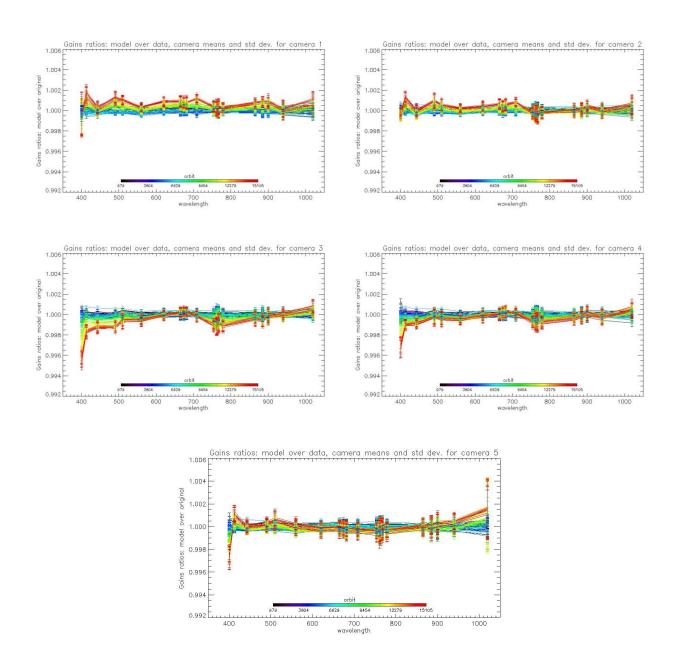


Figure 29: For the 5 cameras: Evolution model performance, as camera-average and standard deviation of ratio of Model over Data vs. wavelength, for each orbit of the test dataset, including 32 calibrations in extrapolation, with a colour code for each calibration from blue (oldest) to red (most recent).

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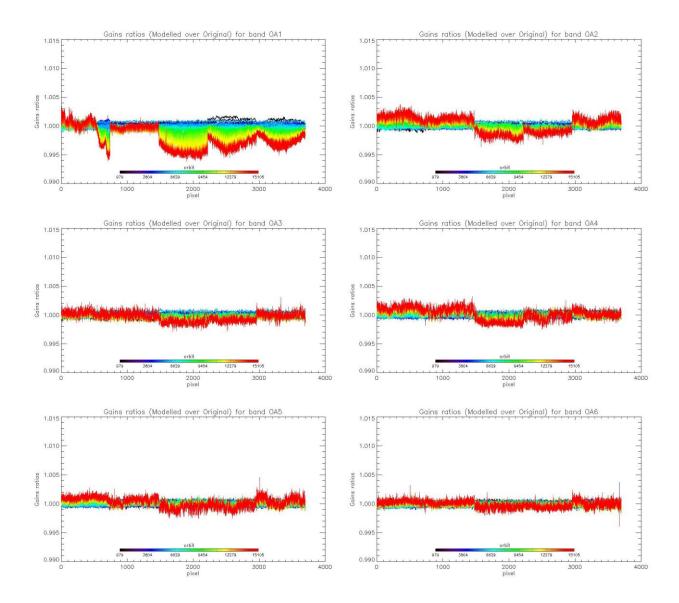


Figure 30: Evolution model performance, as ratio of Model over Data vs. pixels, all cameras side by side, over the whole current calibration dataset (since instrument programing update), including 32 calibrations in extrapolation, channels Oa1 to Oa6.

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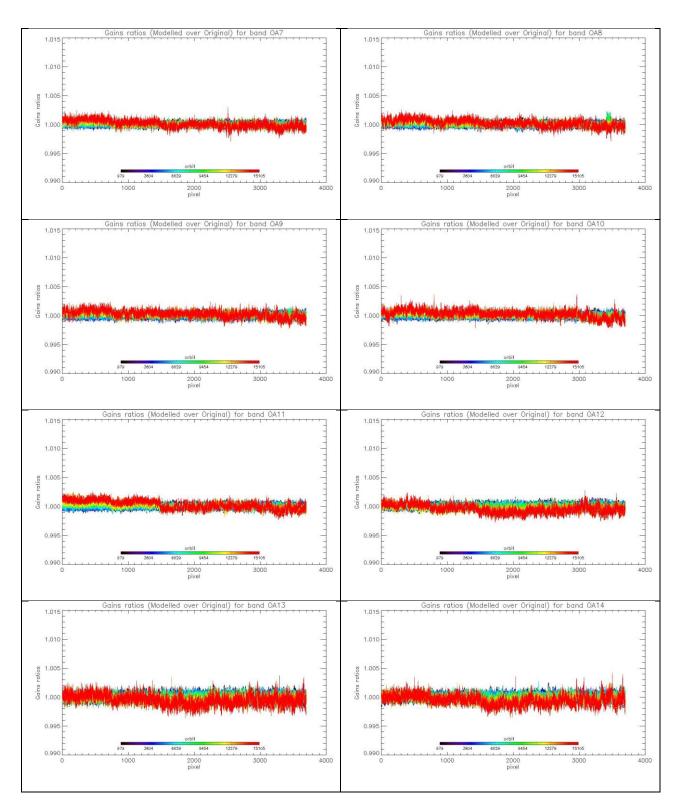


Figure 31: same as Figure 14 for channels Oa7 to Oa14.

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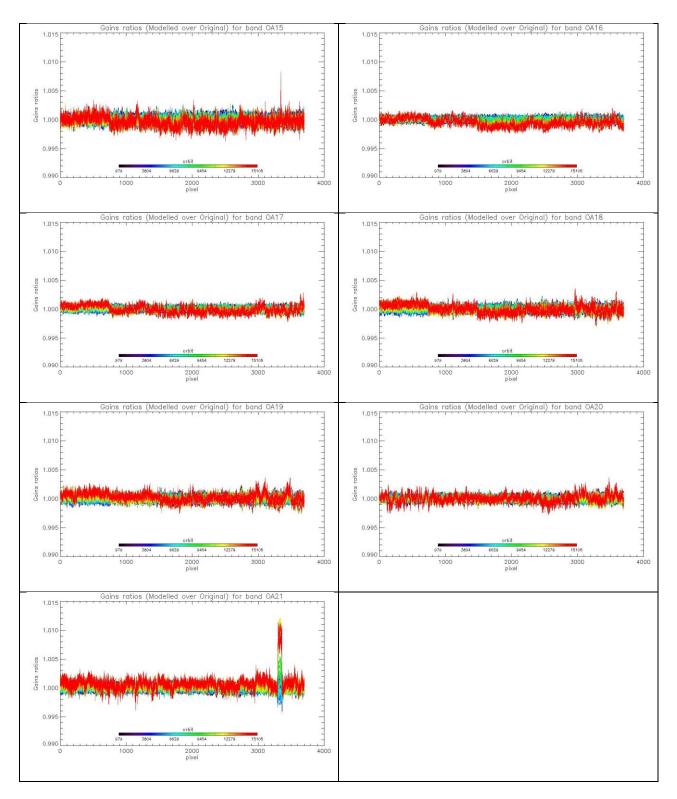


Figure 32: same as Figure 30 for channels Oa15 to Oa21.



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### 2.2.2.2.2 OLCI-B

Instrument response and degradation modelling for S3B-OLCI has been achieved in a preliminary version. Pending the in-flight BRFD model (the derivation of which, on the basis of Yaw Manoeuvres acquired on 11/12, is on-going at EUMETSAT), it is based on NIR normalised evolution. It has been deemed necessary to develop such a trending model without waiting for the in-flight BRDF model to fulfil OC SVC temporal stability requirements (see section 5.1.2). However, it has not been put in operations in the PDGS and as such is not described here. A new model, including the use of the n-flight BRDF model, is foreseen to be available around the end of March 2019.

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

## 2.2.3.1.1 OLCI-A

There has been no calibration sequence S05 (reference diffuser) for OLCI-A during acquisition during cycle **039**.

Consequently, the last ageing results, presented in CR 038 remain valid.

## 2.2.3.1.2 OLCI-B

There has been no calibration sequence S05 (reference diffuser) for OLCI-B during cycle **020**. However since the current CR is the first CR including OLCI-B results, we present the results of OLCI-B diffuser ageing obtained with the calibration sequences S05 of previous cycles.

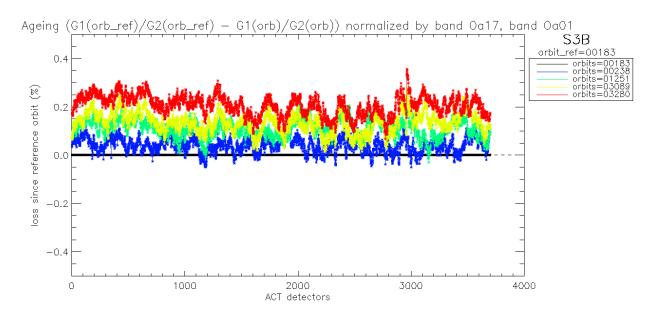


Figure 33: OLCI-B diffuser 1 ageing for spectral band Oa01 after normalisation by Oa17.

## SENTINEL 3 Mission Parformance

## **Sentinel-3 MPC**

**S3 OLCI Cyclic Performance Report** 

**S3A Cycle No. 039 – S3A Cycle No. 020** 

Ref.: S3MPC.ACR.PR.01-039-020

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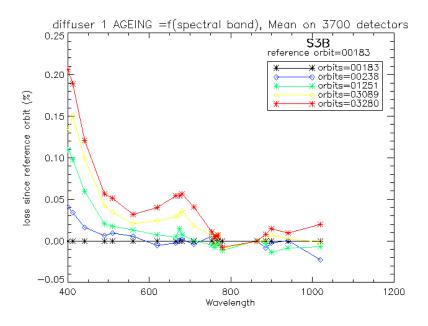


Figure 34: Diffuser 1 ageing as a function of wavelength (spectral bands).

As for OLCI-A, the ageing is clearly visible in spectral band Oa01 to Oa05. However we see also some ageing in bands Oa06 to Oa11. This ageing is more present in camera 1 than other camera as shown in **Figure 35**.

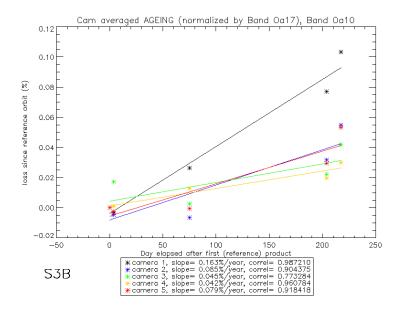


Figure 35: OLCI-B camera averaged ageing (normalized by band Oa17) as a function of elapsed time.

## Mission Performance Centre

## **Sentinel-3 MPC**

## **S3 OLCI Cyclic Performance Report**

**S3A Cycle No. 039 – S3A Cycle No. 020** 

Ref.: S3MPC.ACR.PR.01-039-020

Issue: 1.0

Date: 18/01/2019

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

## 2.2.4.1.1 OLCI-A

No CAL\_AX was delivered to PDGS during the reported period for OLCI-A.

## 2.2.4.1.2 OLCI-B

No CAL\_AX was delivered to PDGS during the reported period for OLCI-B.

However, a set of 60 OLCI-B Calibration ADF has been delivered to the CAL/VAL Reprocessing Facility in view of the OC SVC partial reprocessing: they include the Instrument Evolution Model, a reference gain from taken from the Radiometric Calibration acquired at the optimal geometry (28/11/2018), adjusted to each instrument settings configuration (per- and post-MTR) and optimal Dark Correction Tables derived from the Dark Only S04 acquired every 3 days since 18/06/2018:

S3B_OL_1_CAL_AX_20180512T115747_20180528T123040_20181220T143915   MPC_O_AL_R01.5EN3   S3B_OL_1_CAL_AX_20180618T123040_20180618T000147_20181220T143915   MPC_O_AL_R01.5EN3   S3B_OL_1_CAL_AX_20180621T171404_20180624T173631_20181220T143915   MPC_O_AL_R01.5EN3   MPC_O_	S3B OL 1 CAL AX 20180508T151050 20180512T115747 20181220T143915	MPC O AL R01.SEN3
S3B_OL_1_CAL_AX_20180528T123040_20180618T000147_20181220T143915   MPC_O_AL_R01_SEN3		
S3B_OL_1_CAL_AX_20180618T000147_20180621T171404_20181220T143915   MPC_O_AL_R01.SEN3		
S3B_OL_1_CAL_AX_20180621T171404_20180627T175858_20181220T143915   MPC_O_AL_R01.SEN3		
\$38_OL_1_CAL_AX_20180624T173631_20180627T175858_20181220T143915 \$38_OL_1_CAL_AX_20180630T164027_20180630T164027_20181220T143915 \$38_OL_1_CAL_AX_20180630T164027_20180703T170256_20181220T143915 \$38_OL_1_CAL_AX_20180709T172526_20180706T172526_20181220T143915 \$38_OL_1_CAL_AX_20180709T172526_20180709T074202_20181220T143915 \$38_OL_1_CAL_AX_20180709T074202_20180712T806344_20181220T143915 \$38_OL_1_CAL_AX_20180709T074202_20180712T806344_20181220T143915 \$38_OL_1_CAL_AX_20180709T074202_20180712T806344_20181220T143915 \$38_OL_1_CAL_AX_20180712T080434_20180715T133006_20181220T143915 \$38_OL_1_CAL_AX_20180715T133006_20180715T133006_20181220T143915 \$38_OL_1_CAL_AX_20180715T133006_20180715T133006_20181220T143915 \$38_OL_1_CAL_AX_20180715T133006_20180715T133006_20181220T143915 \$38_OL_1_CAL_AX_20180715T133006_20180721T1205914_20181220T143915 \$38_OL_1_CAL_AX_20180721T1205914_20180724T175952_20181220T143915 \$38_OL_1_CAL_AX_20180721T175952_20180731T181902_20181220T143915 \$38_OL_1_CAL_AX_20180731T181902_20180803T184142_20181220T143915 \$38_OL_1_CAL_AX_201800731T181902_20180803T184142_20181220T143915 \$38_OL_1_CAL_AX_2018003T184142_2018120803T184142_20181220T143915 \$38_OL_1_CAL_AX_20180803T184142_20180803T1943915 \$39_OL_1_CAL_AX_20180803T184142_20180803T1943915 \$39_OL_1_CAL_AX_20180803T184142_20180803T1943915 \$39_OL_1_CAL_AX_20180803T184142_20180803T1943915 \$39_OL_1_CAL_AX_20180803T184142_20180803T1943915 \$39_OL_1_CAL_AX_20180803T1943915 \$30_OL_1_CAL_AX_20180803T1943915 \$30_OL_1_CAL_AX_20180803T1943915 \$30_OL_1_CAL_AX_20180803T1943915 \$30_OL_1_CAL_AX_20180803T1943915 \$30_OL_1_CAL_AX_20180803T1943915 \$30_OL_1_CAL_AX_20180803T1943915 \$30_OL_1_CAL_AX_20180815T101232_20180818T185416_20181220T143915 \$30_OL_1_CAL_AX_20180815T101232_20180818T185416_20181220T143915 \$30_OL_1_CAL_AX_20180815T101232_20180818T185416_20181220T143915 \$30_OL_1_CAL_AX_20180815T101232_201808187185416_20181220T143915 \$30_OL_1_CAL_AX_20180815T101232_20180803T193404_20181220T143915 \$30_OL_1_CAL_AX_20180917710905_20180902T190709_20181220T143915 \$30_OL_1_CAL_AX_20180917710905_		
\$3B_OL_1_CAL_AX_20180627T175858_20180630T164027_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_20180630T164027_20180703T170256_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_20180703T170256_20180703T170256_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_20180703T170256_20180709T074202_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_20180709T074202_20180712T080434_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_20180702T080434_20180715T133006_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_20180715T133006_20180718T185539_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_20180718T185539_20180721T205914_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_20180718T185539_20180721T205914_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201807274T175952_20180721T185952_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201807274T175952_20180721T185952_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201807274T175952_20180721T181902_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_2018080371181902_201808037184142_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201808037184142_201808067190423_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201808037180422_201808097192705_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201808067190423_201808097192705_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201808067199428_201808127194948_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_20180812T194948_201808157201232_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_20180812T194948_201808157201232_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201808181185416_201808217191701_201802247143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201808217191701_201808247193947_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201808217191701_201808247193947_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201808217190709_201809057192956_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201809037192056_201809057192956_20181220T143915 MPC_O_AL_R01.5EN3 \$3B_OL_1_CAL_AX_201809017192015_201809057192956_20181220T143915 MPC_O_AL_R		
S3B_OL_1_CAL_AX_20180630T164027_20180703T170256_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180703T170256_20180709T074202_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180709T074202_20180709T074202_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180709T074202_20180712T080434_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180712T080434_20180715T133006_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180712T155539_20180721T205914_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180721T205914_20180724T175952_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180721T205914_20180724T175952_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180731T181902_2018003T1841902_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180803T184142_20180806T190423_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180806T190423_20180806T190423_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180806T190423_20180809T192705_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180815T201232_20180812T194948_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180818T194948_20180815T201232_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180821T191701_20180827T1200234_20181220T143915         MPC_O_AL_R01.SEN3           <		
S3B_OL_1_CAL_AX_20180703T170256_20180706T172526_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180706T172526_20180709T074202_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180709T074202_20180712T080434_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180712T080434_20180715T133006_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180715T133006_20180718T185539_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180718T185539_20180721T205914_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180721T205914_20180724T175952_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180724T175952_20180724T175952_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180803T184142_20180805T194023_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180803T184142_20180806T190423_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180805T190423_20180809T192705_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180812T194948_201801220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180815T201232_20180815T8201232_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180815T201232_20180815T85416_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180824T193947_20180824T193947_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_		
S3B_OL_1_CAL_AX_20180706T172526_20180709T074202_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180709T074202_20180712T080434_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180712T080434_20180715T133006_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180715T133006_20180721T305914_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180715T133006_20180721T1205914_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180715T135914_20180724T175952_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180724T175952_20180731T181902_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180734T181902_20180803T184142_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180803T184142_20180806T190423_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180803T184142_20180806T190423_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180809T192705_201808071192705_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180815T201232_20180815T201232_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180815T201232_20180815T201232_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180817194948_201808217194948_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_201808217194948_2018082717200234_20181220T143915         MPC_O_AL_R01.SEN3           <		
S3B_OL_1_CAL_AX_20180709T074202_20180712T080434_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180712T080434_20180715T133006_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180715T133006_20180718T185539_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180718T185539_20180721T205914_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180721T205914_20180724T175952_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180724T175952_20180731T181902_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180724T175952_20180803T184142_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180803T184142_20180803T184142_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180806T190423_20180809T192705_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180806T190423_20180809T192705_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180809T192705_20180812T194948_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_201808015T201232_20180812T194948_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180815T201232_20180812T1940142         20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180815T201232_20180821T191701_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180821T191701_20180824T193947_20181220T143915         MPC_O_AL_R01.SEN3		
S3B_OL_1_CAL_AX_20180712T080434_20180715T133006_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180715T133006_20180718T185539_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180718T185539_20180721T205914_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180721T205914_20180724T175952_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180724T175952_20180731T81902_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180733TT81902_20180803T184142_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180803T184142_20180806T190423_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180805T190423_20180809T192705_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180809T192705_20180812T194948_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180815T201232_20180815T201232_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180815T201232_20180815T201232_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180815T191701_20180821T191701_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180821T191701_20180824T193947_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180827T200234_20180827T200234_20181220T143915         MPC_O_AL_R01.SEN3           S3B_OL_1_CAL_AX_20180902T190709_20180902T190709_20181220T143915         MPC_O_AL_R01.SEN3 <td< td=""><td>S3B OL 1 CAL AX 20180709T074202 20180712T080434 20181220T143915</td><td>MPC O AL R01.SEN3</td></td<>	S3B OL 1 CAL AX 20180709T074202 20180712T080434 20181220T143915	MPC O AL R01.SEN3
S3B_OL_1_CAL_AX_20180715T133006_0180718T185539_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_201807218T185539_20180721T205914_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180721T205914_20180724T175952_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180724T175952_20180731T181902_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180803T184142_20180806T190423_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180808T190423_20180809T192705_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180809T192705_20180812T194948_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180809T192705_20180812T194948_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180812T194948_20180815T201232_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180815T201232_20180815T201232_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180815T301232_20180821T191701_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180815T301232_20180821T191701_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180821T191701_20180824T193947_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180827T200234_20180827T200234_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180927T2000234_20180920T190709_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180908T192956_20180905T192956_2	S3B_OL_1_CAL_AX_20180712T080434_20180715T133006_20181220T143915	
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S3B_OL_1_CAL_AX_20180803T184142_20180806T190423_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180806T190423_20180809T192705_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180809T192705_20180812T194948_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180812T194948_20180815T201232_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180815T201232_20180818T185416_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180818T185416_20180821T191701_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180821T191701_20180824T193947_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180821T191701_20180824T193947_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180824T193947_20180827T200234_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180827T200234_20180830T202521_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180830T202521_20180902T190709_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180902T190709_20180905T192956_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180905T192956_20180908T195245_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180901T1201535_2018091T1201535_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_2018091T1792015_20180920T194304_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_2018091T192055_20180920T194304_20	S3B_OL_1_CAL_AX_20180724T175952_20180731T181902_20181220T143915	MPC_O_AL_R01.SEN3
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S3B_OL_1_CAL_AX_20180905T192956_20180908T195245_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180908T195245_20180911T201535_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180911T201535_20180914T203824_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180914T203824_20180917T192015_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180917T192015_20180920T194304_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180920T194304_20180923T200554_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180923T200554_20180926T202844_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180926T202844_20180929T191034_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180929T191034_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180929T191034_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915       MPC_O_AL_R01.SEN3	S3B_OL_1_CAL_AX_20180830T202521_20180902T190709_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20180908T195245_20180911T201535_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180911T201535_20180914T203824_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180914T203824_20180917T192015_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180917T192015_20180920T194304_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180920T194304_20180923T200554_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180923T200554_20180926T202844_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180926T202844_20180929T191034_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180929T191034_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915       MPC_O_AL_R01.SEN3		MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20180911T201535_20180914T203824_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180914T203824_20180917T192015_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180917T192015_20180920T194304_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180920T194304_20180923T200554_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180923T200554_20180926T202844_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180926T202844_20180929T191034_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180929T191034_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915       MPC_O_AL_R01.SEN3		MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20180914T203824_20180917T192015_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180917T192015_20180920T194304_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180920T194304_20180923T200554_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180923T200554_20180926T202844_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180926T202844_20180929T191034_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180929T191034_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915       MPC_O_AL_R01.SEN3		MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20180917T192015_20180920T194304_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180920T194304_20180923T200554_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180923T200554_20180926T202844_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180926T202844_20180929T191034_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180929T191034_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915       MPC_O_AL_R01.SEN3		MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20180920T194304_20180923T200554_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180923T200554_20180926T202844_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180926T202844_20180929T191034_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180929T191034_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915       MPC_O_AL_R01.SEN3		
S3B_OL_1_CAL_AX_20180923T200554_20180926T202844_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180926T202844_20180929T191034_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180929T191034_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915       MPC_O_AL_R01.SEN3		
S3B_OL_1_CAL_AX_20180926T202844_20180929T191034_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20180929T191034_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915       MPC_O_AL_R01.SEN3		
S3B_OL_1_CAL_AX_20180929T191034_20181002T193324_20181220T143915       MPC_O_AL_R01.SEN3         S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915       MPC_O_AL_R01.SEN3		
S3B_OL_1_CAL_AX_20181002T193324_20181005T195613_20181220T143915MPC_O_AL_R01.SEN3		
S3B_OL_1_CAL_AX_20181005T195613_20181008T201902_20181220T143915MPC_O_AL_R01.SEN3		
	S3B_OL_1_CAL_AX_20181005T195613_20181008T201902_20181220T143915	MPC_O_AL_R01.SEN3

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S3B_OL_1_CAL_AX_20181008T201902_20181011T204151_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181011T204151_20181014T192340_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181014T192340_20181017T194600_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181017T194600_20181020T200748_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181020T200748_20181023T202936_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181023T202936_20181026T190802_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181026T190802_20181029T192648_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181029T192648_20181101T194533_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181101T194533_20181104T200418_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181104T200418_20181107T202301_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181107T202301_20181110T190050_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181110T190050_20181113T191931_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181113T191931_20181116T193812_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181116T193812_20181119T195652_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181119T195652_20181122T183712_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181122T183712_20181125T185947_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181125T185947_20181129T203718_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181129T203718_20181202T191854_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181202T191854_20181205T194128_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181205T194128_20181208T200401_20181220T143915	MPC_O_AL_R01.SEN3
S3B_OL_1_CAL_AX_20181208T200401_20181231T235959_20181220T143915	MPC_O_AL_R01.SEN3

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

## 2.2.5.1.1 OLCI-A

This activity has not evolved during cycle 039 and results presented in Cycle 15 report are still valid.

## 2.2.5.1.2 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. It is however too early to provide consolidated results.

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

## 2.3.1.1.1 OLCI-A

There has been no Spectral Calibration (S02/S03, S09) acquisition during the reporting period.

Consequently, last results, presented in cycle 036 report are still valid.

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## 2.3.1.1.2 OLCI-B

There has been no Spectral Calibration (S02/S03, S09) acquisition for OLCI-B during the reporting period. However, since this CR is the first one containing OLCI-B results we show below the results of the spectral calibration obtained with S02/S03 of previous cycles.

The S02/S03 data have been processed and analysed to assess OLCI spectral long-term evolution. The absolute results are presented in Figure 36 while its long term evolution is presented in Figure 37.

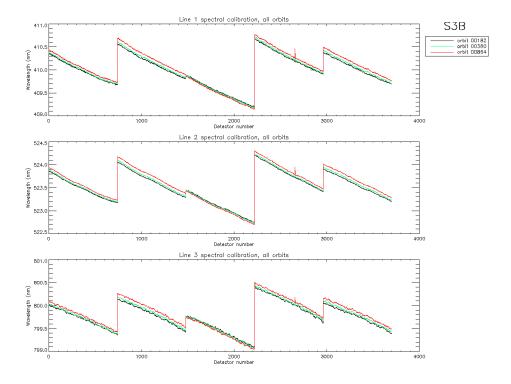


Figure 36: OLCI-B across track spectral calibration from all S02/S03 sequences since the beginning of the mission.

Top plot is spectral line 1, middle plot is spectral line 2 and bottom plot spectral line 3.

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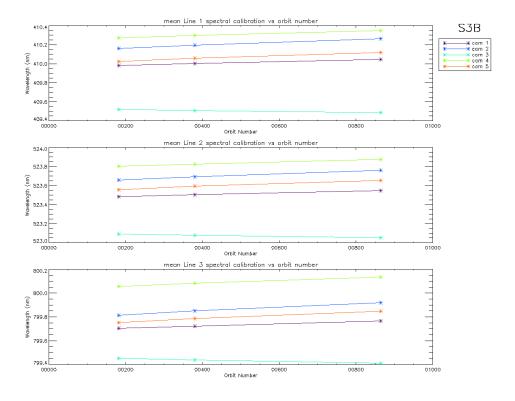


Figure 37: OLCI-B camera averaged spectral calibration evolution as a function of time since launch (all spectral S02/S03 calibrations since the beginning of the mission are included).

## 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 38.

SNR computed for all calibration data as a function of orbit number for band Oa01 (the less stable band) is presented in Figure 39.

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

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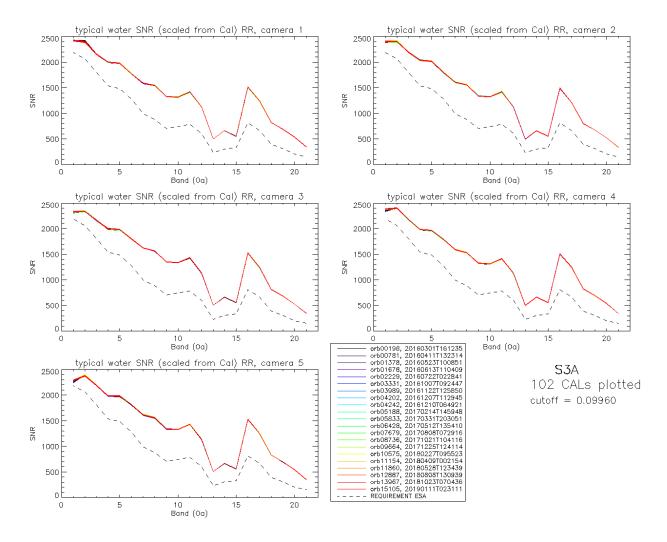


Figure 38: OLCI-A Signal to Noise ratio as a function of the spectral band for the 5 cameras. These results have been computed from radiometric calibration data. All calibrations except first one (orbit 183) are presents with the colours corresponding to the orbit number (see legend). The SNR is very stable with time: the curves for all orbits are almost superimposed. The dashed curve is the ESA requirement.

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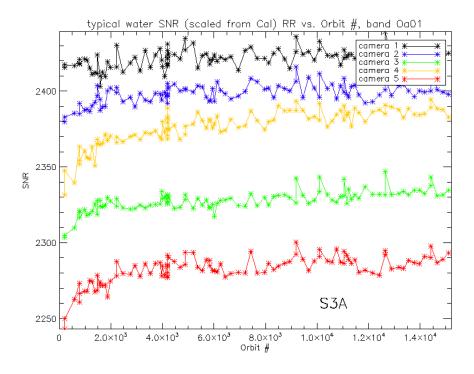


Figure 39: long-term stability of the SNR estimates from Calibration data, example of channel Oa1.

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<sup>-1</sup>.m<sup>-2</sup>.nm<sup>-1</sup>).

	$L_{ref}$	SNR	<b>C</b> 1	L	CZ	2	C3	3	C4	1	C!	5	Α	II
nm	LU	RQT	avg	std	avg	std	avg	std	avg	std	avg	std	avg	std
400	63.0	2188	2421	6.1	2398	6.5	2327	6.8	2376	11.6	2282	9.4	2361	6.9
412	74.1	2061	2393	8.2	2407	5.4	2340	4.6	2401	4.7	2384	7.4	2385	4.3
442	65.6	1811	2160	5.1	2198	5.6	2165	4.7	2185	4.0	2196	5.1	2181	3.4
490	51.2	1541	2001	4.7	2036	5.2	1996	3.9	1982	4.2	1988	4.8	2001	3.4
510	44.4	1488	1979	5.1	2014	4.9	1984	4.8	1966	4.6	1985	4.5	1986	3.8
560	31.5	1280	1776	4.4	1802	4.3	1802	5.0	1794	3.8	1818	3.5	1798	3.1
620	21.1	997	1591	4.2	1610	4.1	1624	3.2	1593	3.3	1615	3.6	1607	2.6
665	16.4	883	1547	4.3	1558	4.4	1567	3.8	1533	3.8	1560	3.9	1553	3.2
674	15.7	707	1329	3.4	1338	3.5	1350	2.7	1323	3.2	1342	3.8	1336	2.5
681	15.1	745	1319	3.7	1327	3.1	1337	2.8	1314	2.5	1333	3.6	1326	2.2
709	12.7	785	1420	4.5	1421	4.3	1435	3.5	1414	3.6	1430	3.2	1424	3.0
754	10.3	605	1127	3.3	1120	3.0	1135	3.6	1124	2.6	1139	3.1	1129	2.5
761	6.1	232	502	1.2	498	1.2	505	1.3	500	1.1	507	1.4	502	1.0
764	7.1	305	663	1.6	658	1.6	667	2.1	661	1.6	669	2.1	664	1.4
768	7.6	330	558	1.6	554	1.3	562	1.3	556	1.6	564	1.4	559	1.2
779	9.2	812	1515	5.0	1497	5.0	1524	5.4	1510	5.2	1525	5.1	1515	4.5
865	6.2	666	1244	3.6	1213	3.9	1238	4.1	1246	3.8	1250	2.9	1238	3.1
885	6.0	395	823	1.7	801	1.7	814	2.1	824	1.5	831	1.9	819	1.3
900	4.7	308	691	1.6	673	1.3	683	1.7	693	1.5	698	1.4	687	1.0
940	2.4	203	534	1.1	522	1.1	525	1.0	539	1.1	542	1.4	532	0.8
1020	3.9	152	345	0.8	337	0.9	348	0.7	345	0.8	351	0.7	345	0.5

## 2.4.1.2 OLCI-B

SNR computed for all OLCI-B calibration data (S01, S04 and S05 sequences) as a function of band number is presented in Figure 40.

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 41.

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.

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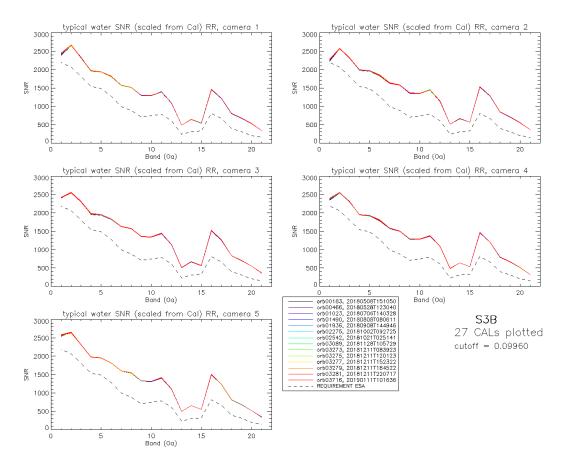


Figure 40: OLCI-B Signal to Noise ratio as a function of the spectral band for the 5 cameras. These results have been computed from radiometric calibration data. All calibrations except first one (orbit 167) are presents with the colours corresponding to the orbit number (see legend). The SNR is very stable with time: the curves for all orbits are almost superimposed. The dashed curve is the ESA requirement.

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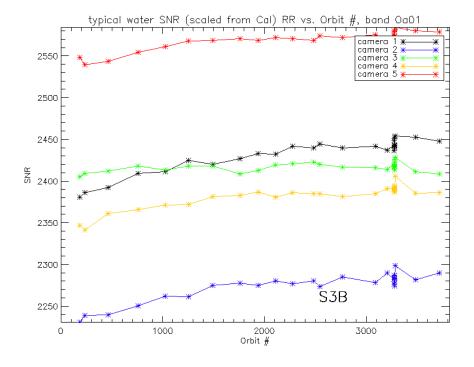


Figure 41: long-term stability of the OLCI-B SNR estimates from Calibration data, example of channel Oa1.



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Table 2: 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<sup>-1</sup>.m<sup>-2</sup>.nm<sup>-1</sup>).

	$L_{ref}$	SNR	C1	L	C	2	C3	3	C4	1	C	5	А	II
nm	LU	RQT	avg	std	avg	std	avg	std	avg	std	avg	std	avg	std
400	63.0	2188	2431	20	2273	16.6	2416	5.4	2381	14.1	2568	10.9	2414	12.6
412	74.1	2061	2654	6.4	2569	4.9	2550	5.5	2548	5.1	2641	6.2	2592	3.1
442	65.6	1811	2326	4.6	2317	4.9	2304	5	2307	5.3	2312	3.7	2314	3.7
490	51.2	1541	1964	4.8	1984	5.8	1970	6	1949	4.1	1976	4.4	1969	3.9
510	44.4	1488	1934	5.4	1963	5.2	1940	5	1920	4.4	1950	4.1	1941	3.7
560	31.5	1280	1811	5.4	1844	6.3	1827	5	1801	5	1815	5	1820	4.5
620	21.1	997	1571	4.3	1626	4.5	1624	3.9	1575	4.5	1600	2.9	1599	2.9
665	16.4	883	1512	4.3	1578	4.2	1573	4.6	1501	3.3	1546	4.1	1542	3.2
674	15.7	707	1300	3.7	1357	3.9	1352	4.1	1292	3.3	1328	3.1	1326	2.8
681	15.1	745	1292	3.7	1346	2.9	1342	3.3	1285	2.7	1316	3.1	1316	2.3
709	12.7	785	1388	4.6	1446	4.6	1442	5.4	1372	3.6	1411	4.4	1412	3.9
754	10.3	605	1093	4.4	1140	3.9	1140	4.1	1087	3.1	1113	4.1	1114	3.6
761	6.1	232	486	1.4	508	1.3	508	1.4	485	1.3	496	1.5	497	1.2
764	7.1	305	642	1.8	671	2.2	671	2.2	639	1.9	656	2.2	656	1.8
768	7.6	330	540	1.3	566	1.3	563	1.4	540	1.4	553	1.7	552	1
779	9.2	812	1463	5.1	1531	5.7	1522	6.6	1463	3.9	1502	5.4	1497	4.8
865	6.2	666	1218	3.9	1284	4.6	1256	4.5	1202	3.7	1236	3.7	1239	3.5
885	6.0	395	806	2.6	846	1.7	833	2	798	1.6	813	2.3	819	1.7
900	4.7	308	679	1.5	713	1.5	703	1.6	669	1.4	682	1.5	689	1.1
940	2.4	203	527	1.1	549	1.1	550	1.5	509	1	522	1	531	0.7
1020	3.9	152	336	0.7	359	1	358	0.7	318	0.6	339	0.8	342	0.5

## 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.



## **S3 OLCI Cyclic Performance Report**

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Ref.: S3MPC.ACR.PR.01-039-020

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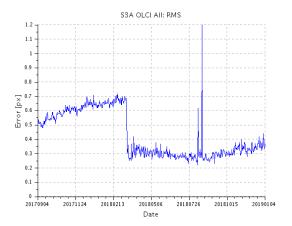
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## 2.5 Geometric Calibration/Validation

## 2.5.1 OLCI-A

The good performance of OLCI-A georeferencing since the introduction of the upgraded Geometric Calibration on 14/03/2018 is confirmed. The following figures show time series of the overall RMS performance (requirement criterion) and of the across-track and along-track biases for each camera. The performance improvement on the 14/03/2018 is obvious on each figure, the most dramatic improvements affecting along-track bias of Camera 3 (Figure 46) and across-track biases of Cameras 4 and 5 (Figure 47 & Figure 48, respectively). Compliance is comfortably met since then (Figure 42): RMS values remain around 0.3 pixel and all biases below 0.2 pixel from 14/03 on, except for the along-track bias of camera 3 for which a small drift can be noticed, implying a performance slightly below -0.2 pixel since a few weeks (Figure 46, right).

It can be seen that the peak RMS value on 14/08/2018 is associated to a very low number of GCPs: only 345 (out of scale on Figure 43) and can be considered as an outlier. The same remark applies to the AC and AL biases displayed in Figure 44 to Figure 48.



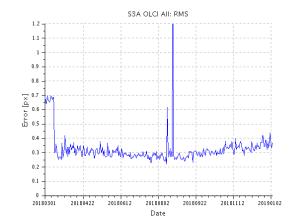


Figure 42: overall OLCI-A georeferencing RMS performance time series over the whole monitoring period (left) and restricted to March 2018 on (right)



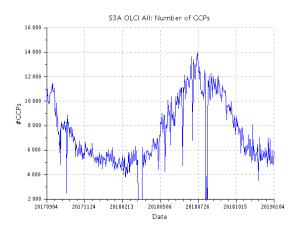
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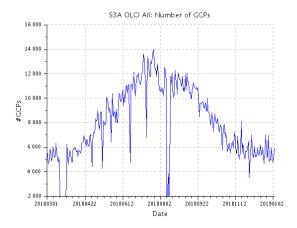
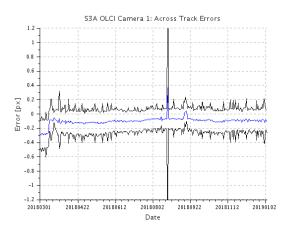


Figure 43: number of validated control points corresponding to the performance time series of Figure 42 for the same periods (complete, left, and restricted to March 2018, right).



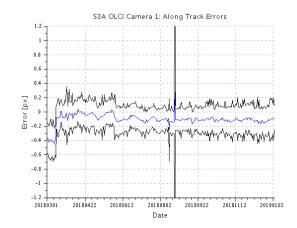
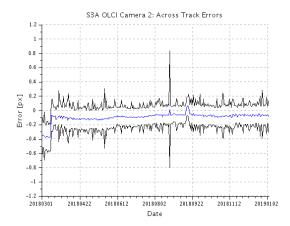


Figure 44: across-track (left) and along-track (right) georeferencing biases time series for Camera 1 (starting 01/03/2018).



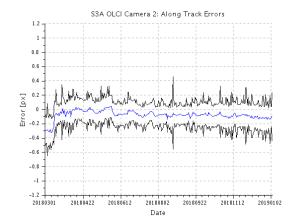


Figure 45: same as Figure 44 for Camera 2.

## SENTINEL 3 Mission Performance

## **Sentinel-3 MPC**

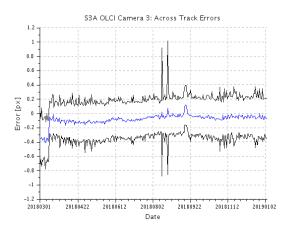
**S3 OLCI Cyclic Performance Report** 

**S3A Cycle No. 039 – S3A Cycle No. 020** 

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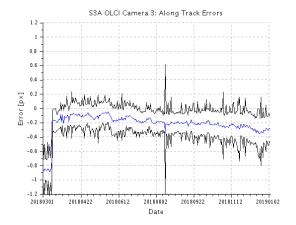
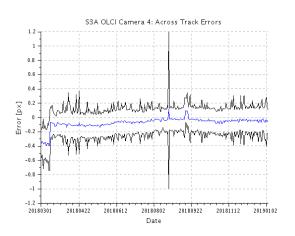


Figure 46: same as Figure 44 for Camera 3.



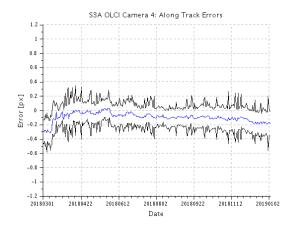
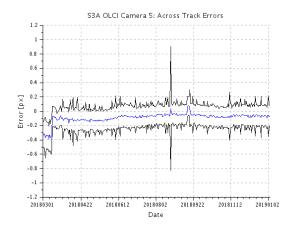


Figure 47: same as Figure 44 for Camera 4.



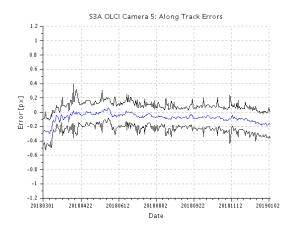


Figure 48: same as Figure 44 for Camera 5.



## **S3 OLCI Cyclic Performance Report**

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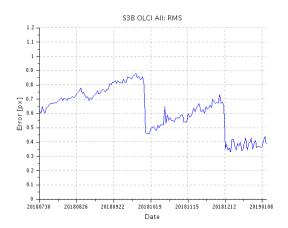
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## 2.5.2 OLCI-B

The performance of OLCI-B georeferencing is within requirements since the introduction of the 3<sup>rd</sup> Geometric Calibration on 12/12/2018. The following figures show time series of the overall RMS performance (requirement criterion) and of the across-track and along-track biases for each camera. The performance of across-track pointing is excellent over the whole mission. The along-track performance, showing significant drifts for all cameras is well corrected with the latest Calibration. It seems fairly stable for cameras 1, 3 and 4, but a small drift still seems present for cameras 2 & 5 without challenging the compliance in the short term.



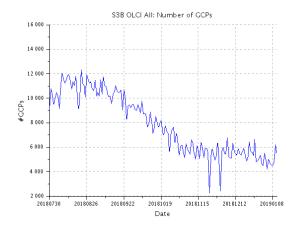
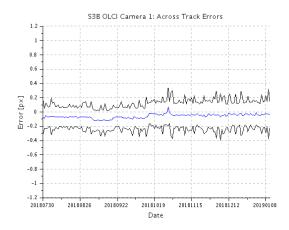


Figure 49: overall OLCI-B georeferencing RMS performance time series (left) and number of validated control points corresponding to the performance time series (right) over the whole monitoring period



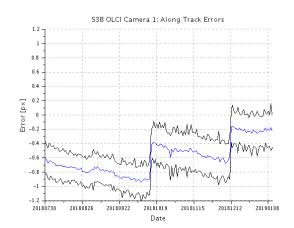


Figure 50: across-track (left) and along-track (right) georeferencing biases time series for Camera 1.

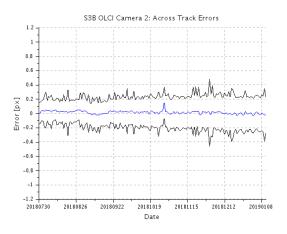
## **S3 OLCI Cyclic Performance Report**

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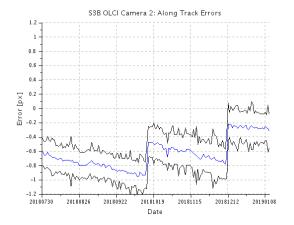
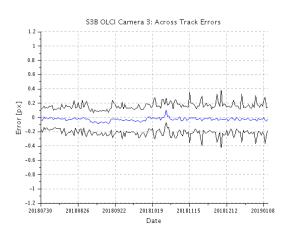


Figure 51: same as Figure 50 for Camera 2.



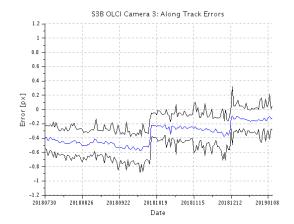
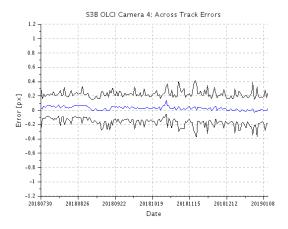


Figure 52: same as Figure 50 for Camera 3.



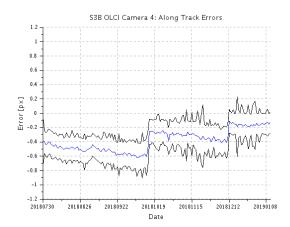


Figure 53: same as Figure 50 for Camera 4.

## SENTINEL 3 Mission Performance Centre

## **Sentinel-3 MPC**

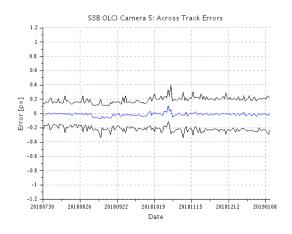
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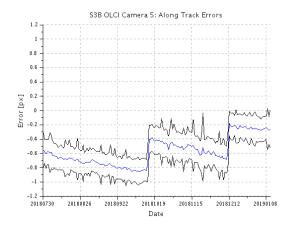


Figure 54: same as Figure 50 for Camera 5.



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## 3 OLCI Level 1 Product validation

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

## 3.1.1 S3ETRAC Service

### **Activities done**

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

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

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

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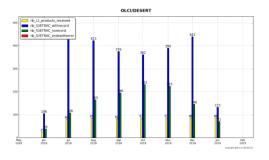
Ref.: S3MPC.ACR.PR.01-039-020

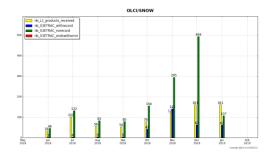
Issue: 1.0

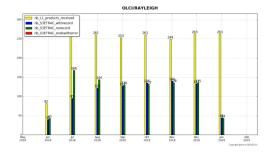
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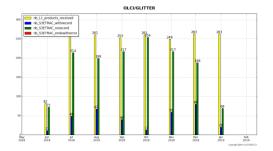
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For illustration, we provide below statistics on the number of S3ETRAC/OLCI records generated per type of targets (DESERT, SNOW, RAYLEIGH, SUNGLINT and DCC) for both OLCI-A (Figure 55) and OLCI-B (









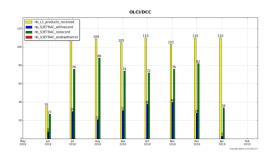


Figure 56).

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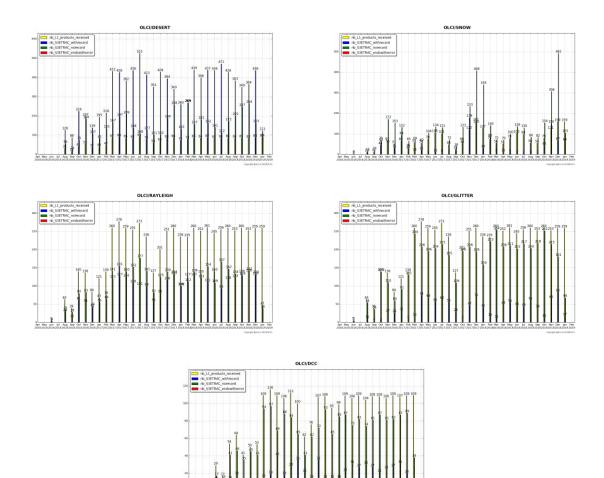


Figure 55: summary of S3ETRAC products generation for OLCI-A

(number of OLCI-A 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).

## Sentinel, 3 Mission Performance Centre

## **Sentinel-3 MPC**

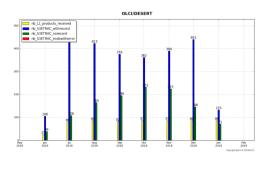
**S3 OLCI Cyclic Performance Report** 

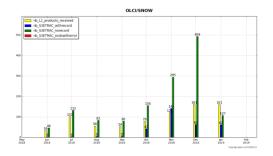
**S3A Cycle No. 039 – S3A Cycle No. 020** 

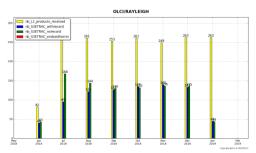
Ref.: S3MPC.ACR.PR.01-039-020

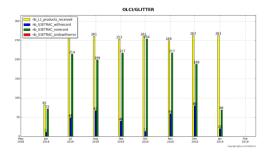
Issue: 1.0

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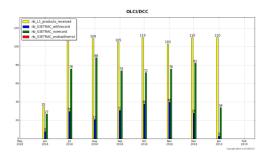


Figure 56: summary of S3ETRAC products generation for OLCI-B

(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 14<sup>th</sup> January 2019.
- All results over Rayleigh, Glint and PICS are consistent with the previous cycle over the used CalVal sites (OLCI-A).
- Good stability of both sensors could be observed, nevertheless the time-series average shows slightly higher reflectance over the VNIR spectral range with bias of 2%-4% except bands Oa06-Oa09 and Oa16-Oa17.
- 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 calval-sites (Algeria3 & 5, Libya 1 & 4 and Mauritania 1 & 2) has been performed until 14<sup>th</sup> January 2019.
- 2. The results are consistent overall the six used PICS sites (Figure 58). OLCI-A reflectance shows a good stability over the analysed period.
- 3. The temporal average over the period January 2018 January 2019 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 59). Unlikely, the temporal average over the period November 2018-January 2019 of the elementary ratios (observed reflectance to the simulated one) for OLCI-B shows values around 2% (mission requirement) over the whole spectral range, except bands Oa6, which displays biases within 2-3% (Figure 59). Please note that OLCI-B results are very preliminary due to the limited time period (one can see a slight seasonal pattern in Figure 57, with a minimum in summer and maximum in winter, than clearly affects averages over short periods, in this case resulting in an overestimation of the ratios i.e. a pessimistic assessment).
- 4. The spectral bands with significant absorption from water vapour and O<sub>2</sub> (Oa11, Oa13, Oa14 and Oa15) are excluded.

## Mission Performance Centre

## **Sentinel-3 MPC**

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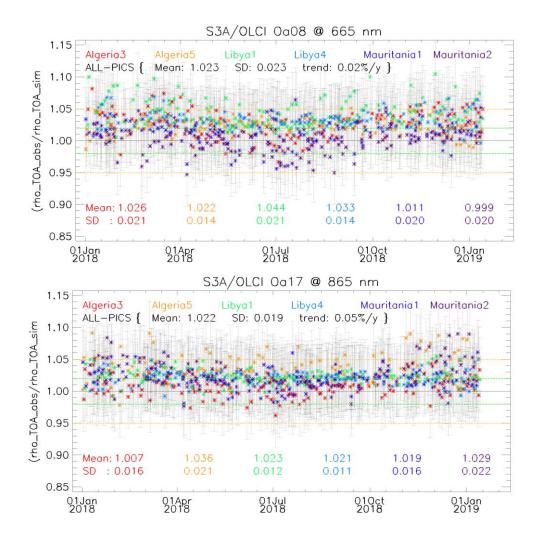


Figure 57: Time-series of the elementary ratios (observed/simulated) signal from S3A/OLCI for (top to bottom) bands Oa08 and Oa17 respectively over January 2018 to January 2019 from the six PICS Cal/Val sites. Dashed-green and orange lines indicate the 2% and 5% respectively. Error bars indicate the desert methodology uncertainty.

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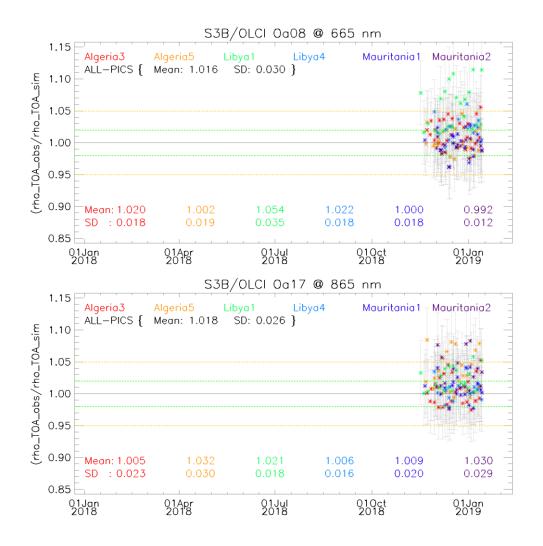


Figure 58: Same as Figure 57 for OLCI-B.



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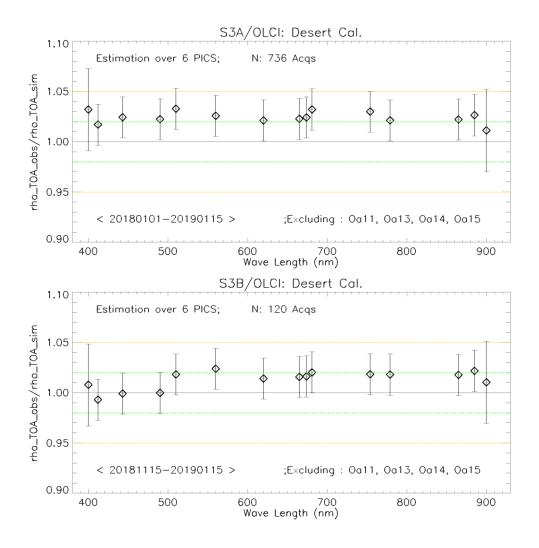


Figure 59: The estimated gain values for OLCI-A (top) and OLCI-B (bottom) from the 6 PICS sites identified by CEOS over the period January 2018 – January 2019 and November 2018 – January 2019 respectively, as a function of wavelength. Dashed-green and orange lines indicate the 2% and 5% respectively. 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 November 2018 and January 2019 respectively. Figure 60 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 January 2019.

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

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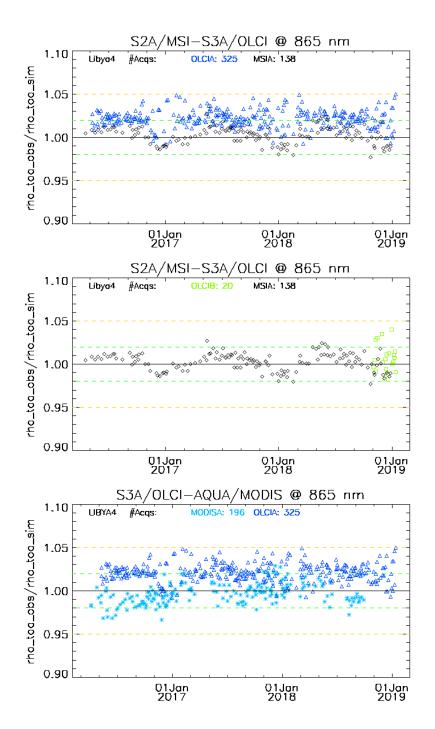


Figure 60: Time-series of the elementary ratios (observed/simulated) signal from (black) S2A/MSI, (blue) S3A/OLCI, (green) S3B/OLCI and (Cyan) Aqua/MODIS for band Oa17 (865nm) over the LIBYA4 site. Dashed-green and orange lines indicate the 2% and 5% respectively. The systematic and total uncertainties of the desert methodology are 1% and 5% respectively.



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## **III-Validation over Rayleigh**

Rayleigh method has been performed over the available mini-files on the Opt-server from January 2018 to present for OLCI-A and from November 2018 to present for OLCI-B. The results are produced with the configuration (ROI-AVERAGE). The gain coefficients of OLCI-A are consistent with the previous results (Cycle-37). Bands Oa01-Oa05 display biases values between 4%-5% while bands Oa6-Oa9 exhibit biases between 3%-4%, higher than the 2% mission requirements (Figure 61 and Figure 62). 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 3% mission requirements (Figure 61 and Figure 62). Again, **OLCI-B results are very preliminary** due to the limited time period and need to be consolidated with more acquisitions over both Northern and Southern hemispheres.

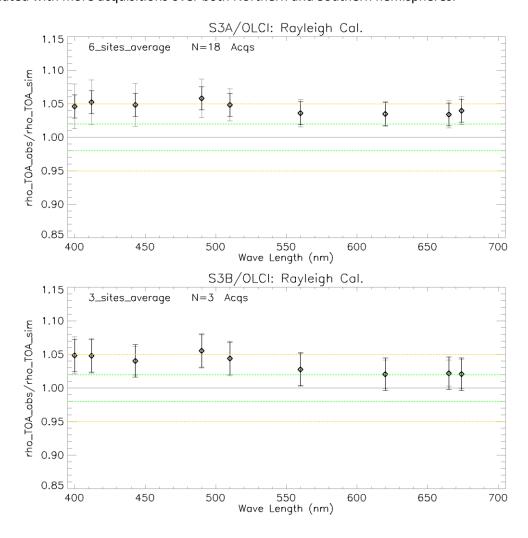


Figure 61: The estimated gain values for OLCI-A and OLCI-B over the 6 Ocean CalVal sites (Atl-NW\_Optimum, Atl-SW\_Optimum, Pac-NE\_Optimum, Pac-NW\_Optimum, SPG\_Optimum and SIO\_Optimum) over the period January 2018-Present and November 2018-Present respectively, as a function of wavelength. Dashed-green, and orange lines indicate the 2%, 5% respectively. Error bars indicate (black) the methodology uncertainty and (grey) the standard deviation over the 6 CalVal sites.



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## **IV-Validation over Glint and synthesis**

Glint calibration method with the configuration (ROI-PIXEL) has been performed over the period January 2018-present for OLCI-A and November 2018-present for OLCI-B. The outcome of this analysis shows a good consistency with the desert outputs over the NIR spectral range Oa06-Oa09. Glint results show that the VNIR bands are within 2% (mission requirement), except Oa21 which show biases of ~6% and ~5% respectively (see Figure 62). We remind that **OLCI-B results are very preliminary** due to the limited time period.

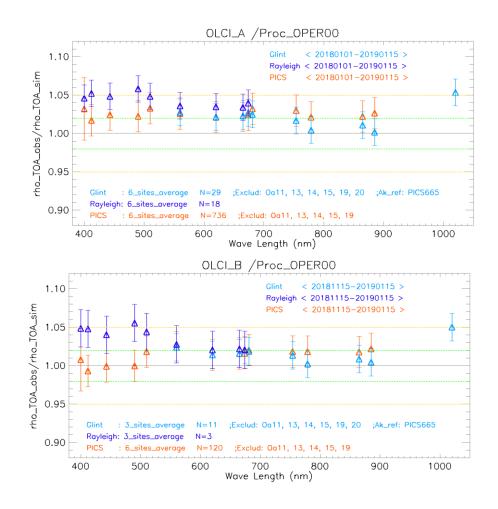


Figure 62: The estimated gain values for OLCI-A and OLCI-B from Glint, Rayleigh and PICS methods over the period January 2018-Present and November 2018-Present respectively as a function of wavelength. We use the gain value of Oa8 from PICS-Desert method as reference gain for Glint method. Dashed-green and orange lines indicate the 2% and 5% respectively. Error bars indicate the method uncertainties.

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## **Sentinel-3 MPC**

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## 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 for December 2018. Please note that the S3A scenes are only partly processed.

The average OSCAR Rayleigh results and the standard deviation calibration are shown below (Figure 63). Results are in line with previously reported results.

The weighted average OSCAR S3A and S3B Rayleigh results for December 2018 and the standard deviation calibration are shown below (Figure 63 and Table 3). A better performance of OLCI S3B compared to S3A is observed where S3A seems to be 1 to 2% brighter than S3B.

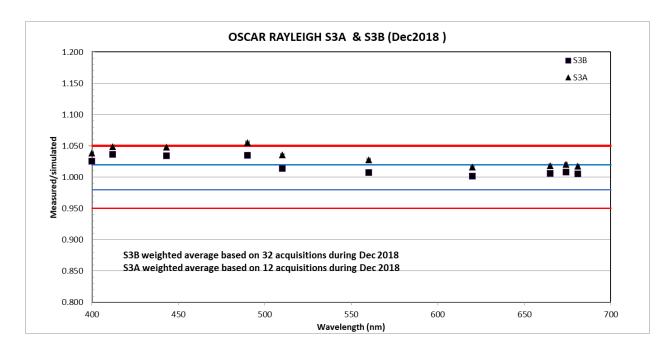


Figure 63. OSCAR Rayleigh S3A Calibration results: weighted average over all sites and standard deviation for December 2018.

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## Table 3: OSCAR Rayleigh S3A and S3B results for the period Dec 2018

OLCI	Wavelength	Oscar Rayleigh Dec 2018	S3A	Oscar Rayleigh S3B Dec 2018			
band	(nm)	Weight. average	stdev	Weight. average	stdev		
Oa01	400	1.039*	0.028	1.026*	0.026		
Oa02	412	1.049	0.028	1.036	0.025		
Oa03	443	1.048	0.024	1.034	0.022		
Oa04	490	1.055	0.019	1.035	0.015		
Oa05	510	1.035	0.016	1.014	0.011		
Oa06	560	1.028	0.013	1.007	0.010		
Oa07	620	1.016	0.008	1.002	0.009		
Oa08	665	1.019	0.006	1.006	0.009		
Oa09	674	1.020	0.007	1.008	0.009		
Oa10	681	1.018	0.006	1.005	0.009		
Oa11	709	0.998	0.006	0.991	0.011		
Oa12	754	1.010	0.002	1.007	0.007		
Oa13	761.25	NA	NA	NA	NA		
Oa14	764.375	NA	NA	NA	NA		
Oa15	767.5	NA	NA	NA	NA		
Oa16	778.75	NA	NA	NA	NA		
Oa17	865	NA	NA	NA	NA		
Oa18	885	NA	NA	NA	NA		
Oa19	900	NA	NA	NA	NA		
Oa20	940	NA	NA	NA	NA		
Oa21 1020		NA	NA	NA	NA		

## 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 9<sup>th</sup> November 2018. 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 2018. The time series therefore represent spring, summer and fall season.

Figure 64 to Figure 73below present the CoreLand Sites OLCI time series over the current OLCI-A mission.

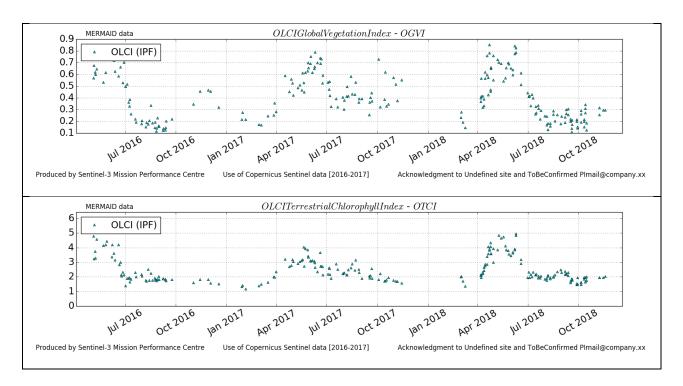


Figure 64: DeGeb time series over current report period



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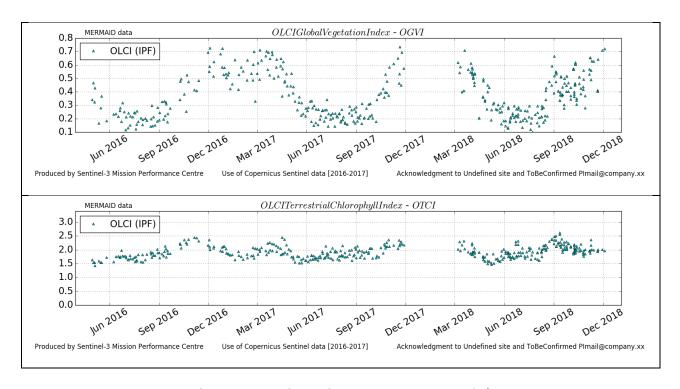


Figure 65: ITCat time series over current report period

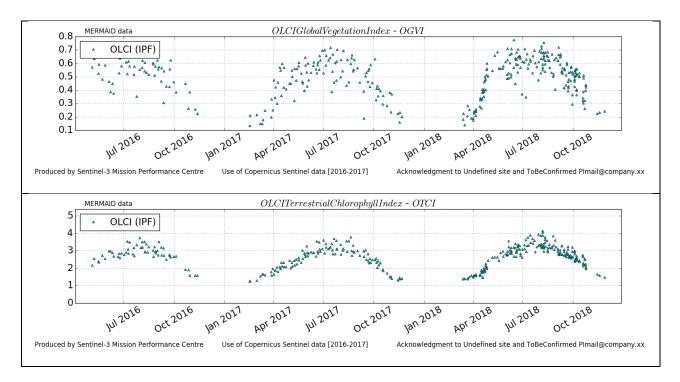


Figure 66: ITsp time series over current report period

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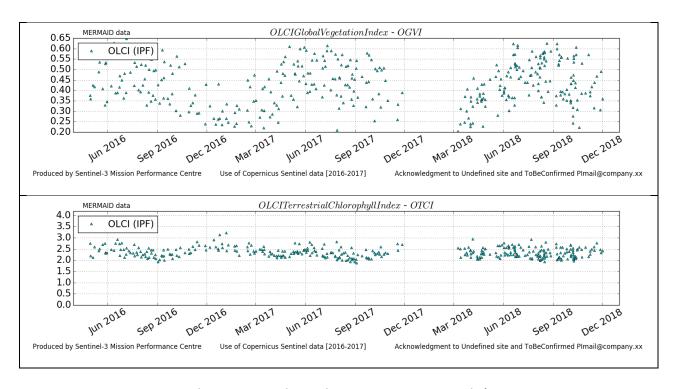


Figure 67: ITSro time series over current report period

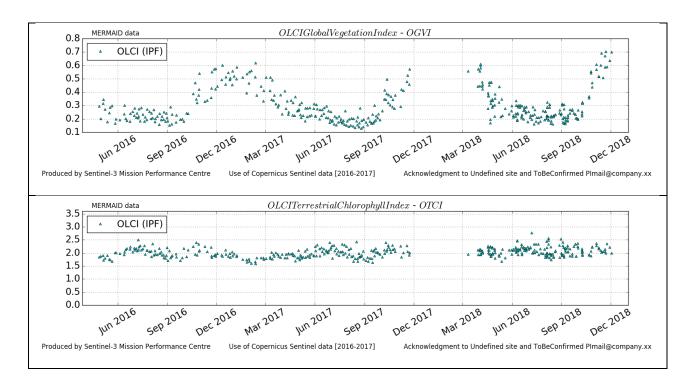


Figure 68: ITTra time series over current report period

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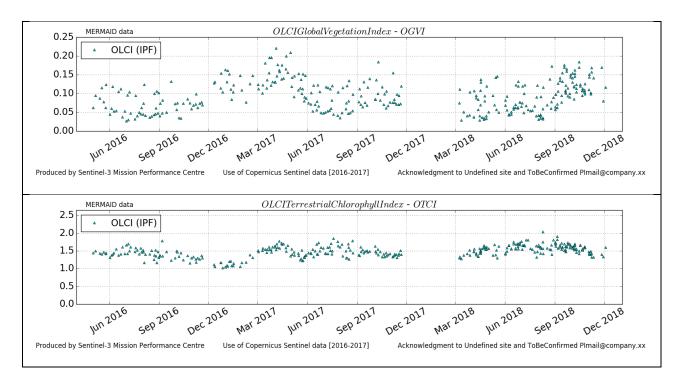


Figure 69: SPAli time series over current report period

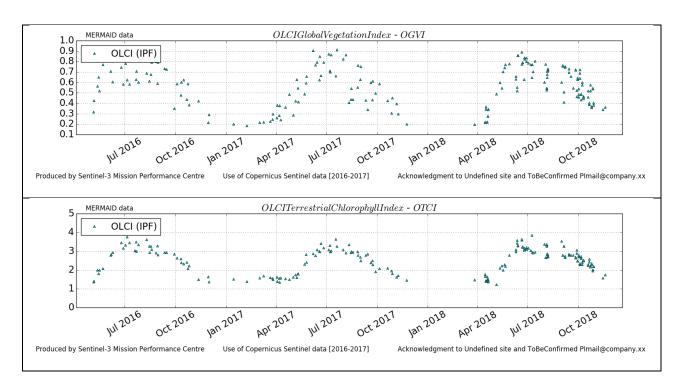


Figure 70: UKNFo time series over current report period



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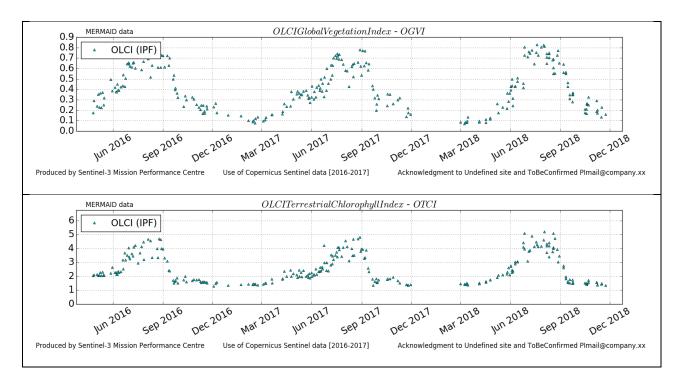


Figure 71: USNe1 time series over current report period

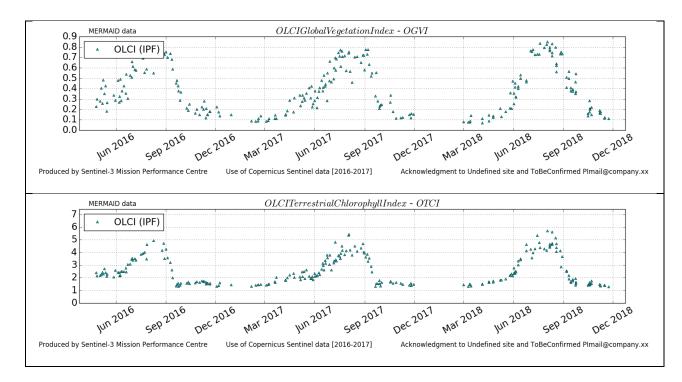


Figure 72: USNe2 time series over current report period



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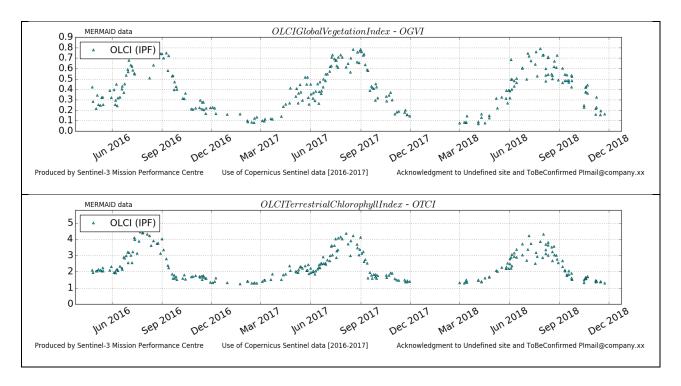


Figure 73: USNe3 time series over current report period

#### 4.1.1.2 OLCI-B

Routine extractions have started for OLCI-B, but there are too few results so far to generate sound time series.

#### 4.1.2 Comparisons with MERIS MGVI and MTCI climatology

This report presents results of the performance of OTCI and OGVI as compared to MERIS climatology. Unlike previous reports, the current one presents results of both, Sentinel-3A (S3A) and Sentinel 3B (S3B). This report includes nine validation sites located in Europe, United States and Australia (see Table 1). A variety of land covers are shown including cropland (Figure 74), cultivated and managed area (Figure 75), broadleaved deciduous closed (Figure 76, Figure 79 and Figure 80), mixed forest (Figure 77), shrub cover (Figure 78), broadleaved evergreen (Figure 81) and needle-leaved evergreen (Figure 82). In general, the land products from both platforms seem to follow the climatology and temporal local trend. Systematic over estimation in MGVI at mixed forest site IT-Isp (Figure 77) is noticeable for both, S3A and S3B. Regarding data availability, some sites are missing the most recent cycle for S3B (e.g. Figures Figure 74, Figure 76, Figure 77, Figure 79 and Figure 82). The reasons for the deviations from the trends and for missing data require further inspection. The results of S3B scatterplots must be taken with caution as only a few months (3-4) of data are available. Scatterplots will be updated as more data becomes available.

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WARNING: OLCI-B L2 products are still in phase of adjustment and are not yet delivered to the users, so corresponding validation results shall be considered as preliminary and unofficial.

Table 4: Satellite land products validation sites presented in current report.

Acronym	Country	Network	Lat	Lon	Land cover	
AU-Calperum	Australia	TERN-SuperSites, AusCover/OzFlux	-34.003	140.588	Shrub Cover, closed-open, deciduous	
AU-Litchfield	Australia	TERN-SuperSites, AusCover/OzFlux	ux -13.18 130.79 Tree Cover, broadleaved, evergree		Tree Cover, broadleaved, evergreen	
BE-Brasschaat	Belgium	ıcos	51.308	4.52	Tree Cover, needle-leaved, evergreen	
DE-Hones-Holz	Deutschland	ICOS 52.085 11.222 Tree Cover, broadles		Tree Cover, broadleaved, deciduous, closed		
FR-Estrees-Mons	France	ICOS Associated	49.872	3.021	Cultivated and managed areas	
IT-Isp	Italy	CORE	45.813	8.635	Mixed forest	
IT-Lison	Italy	ıcos	45.74	12.75	Cropland	
UK-Wytham-Woods	United Kingdom	ForestGeo - NPL	51.774	-1.338	Broadleaved, deciduous, closed	
US-Harvard	United States	NEON, AERONET	42.537	-72.173	Tree Cover, broadleaved, deciduous, closed	

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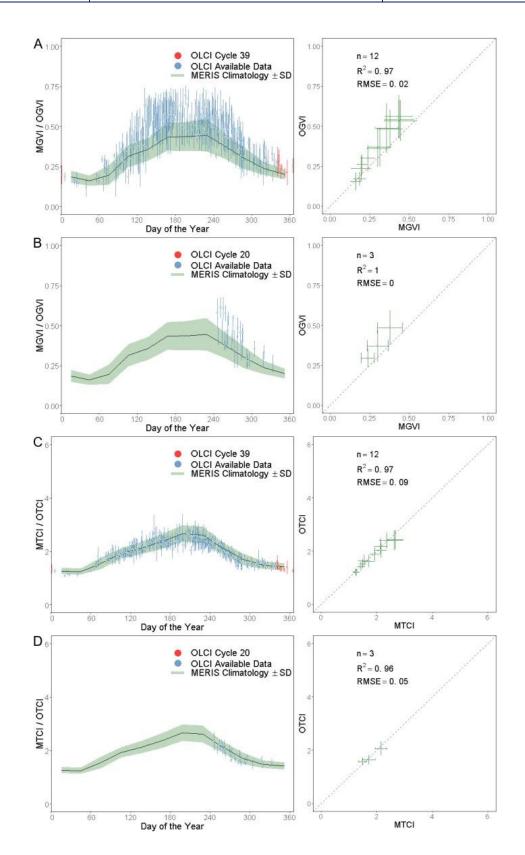


Figure 74: Time-series OGVI vs OTCI and corresponding scatterplot of monthly time-step for site IT-Lison, Italy, land cover Cropland. A and C represent S3A; B and C represent S3B.

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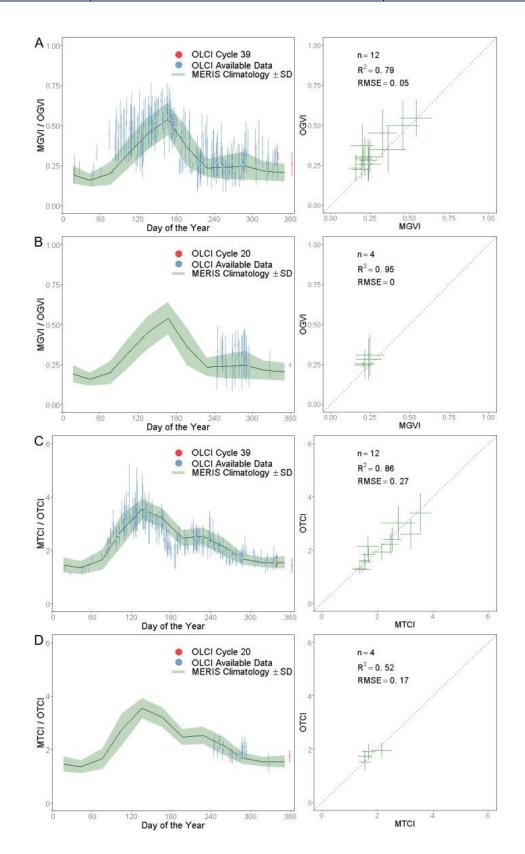


Figure 75: Time-series OGVI vs OTCI and corresponding scatterplot of monthly time-step for site FREstrees-Mons, France, land cover Cultivated and managed areas. A and C represent S3A; B and C represent S3B.

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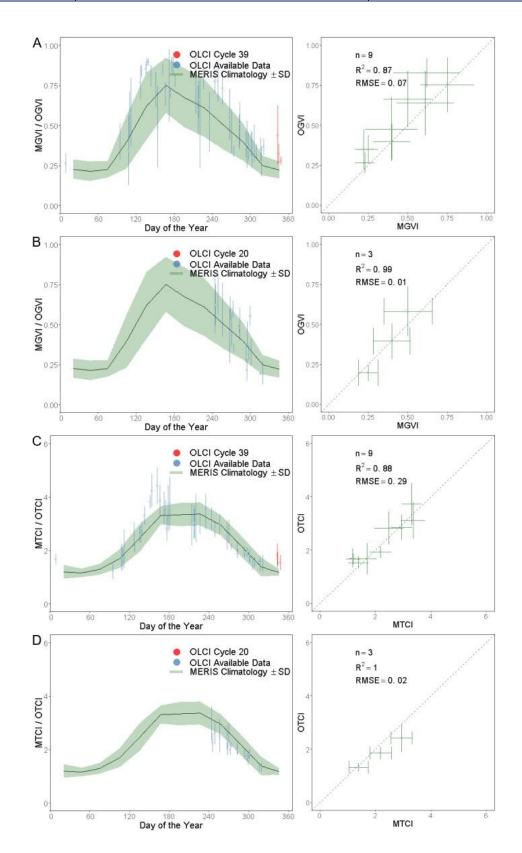


Figure 76: Time-series OGVI vs OTCI and corresponding scatterplot of monthly time-step for site UK-Wytham-Woods, United Kingdom, land cover Tree Cover, broadleaved, deciduous, closed . A and C represent S3A; B and C represent S3B.

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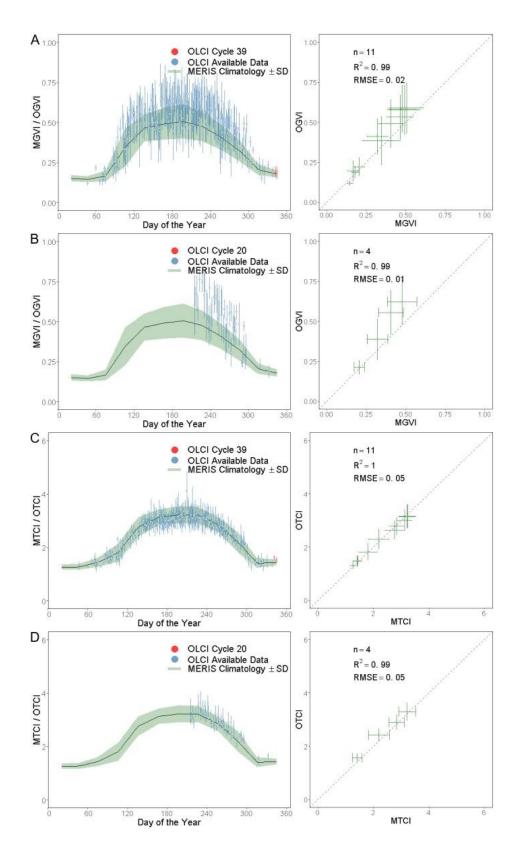


Figure 77: Time-series OGVI vs OTCI and corresponding scatterplot of monthly time-step for site IT-Isp, Italy, land cover Mixed Forest. A and C represent S3A; B and C represent S3B.

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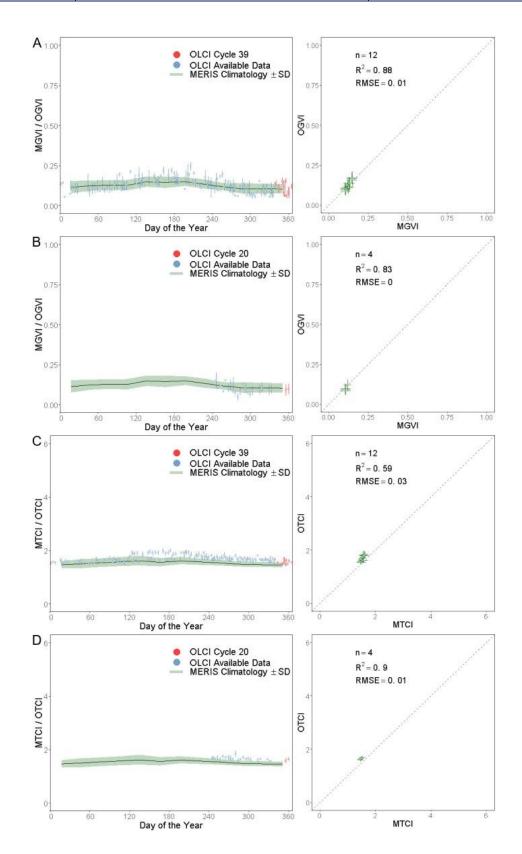


Figure 78: Time-series OGVI vs OTCI and corresponding scatterplot of monthly time-step for site AU-Calperum, Australia, land cover Shrub Cover, closed-open, deciduous . A and C represent S3A; B and C represent S3B.



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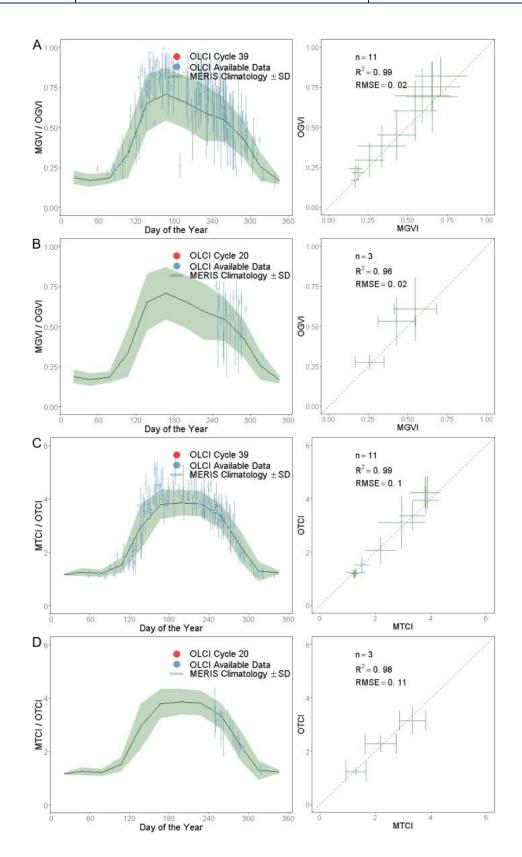


Figure 79: Time-series OGVI vs OTCI and corresponding scatterplot of monthly time-step for site DE-Hones-Holz, Deutschland, land cover Tree Cover, broadleaved, deciduous, closed . A and C represent S3A; B and C represent S3B.

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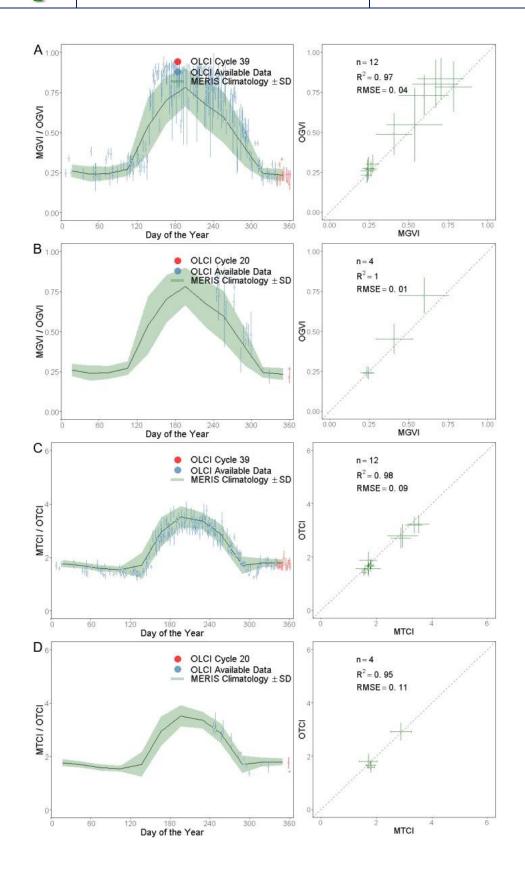
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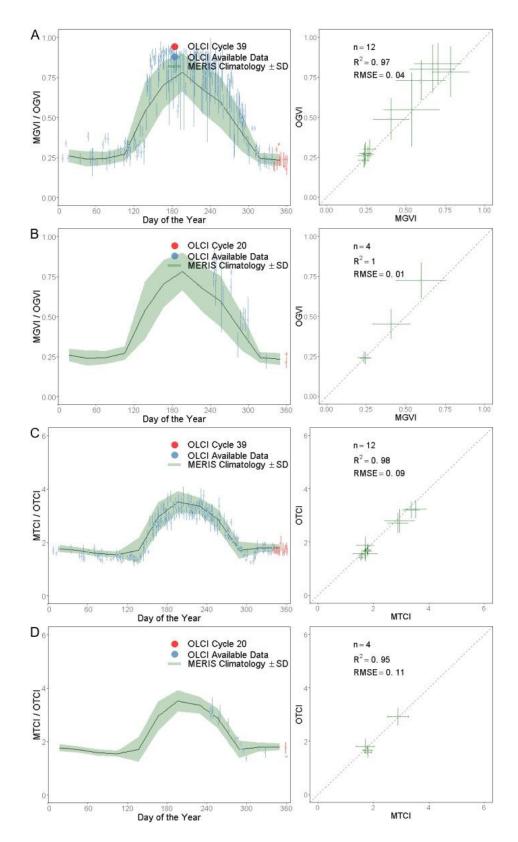


Figure 80: Time-series OGVI vs OTCI and corresponding scatterplot of monthly time-step for site US-Harvard, United States, land cover Tree Cover, broadleaved, deciduous, closed . A and C represent S3A; B and C represent

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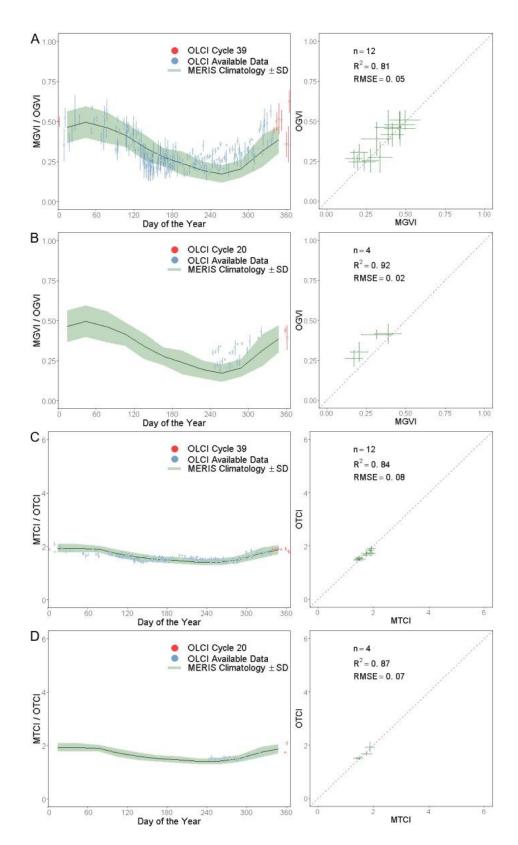


Figure 81: Time-series OGVI vs OTCI and corresponding scatterplot of monthly time-step for site AU-Litchfield, Australia, land cover Tree Cover, broadleaved, evergreen. A and C represent S3A; B and C represent S3B.

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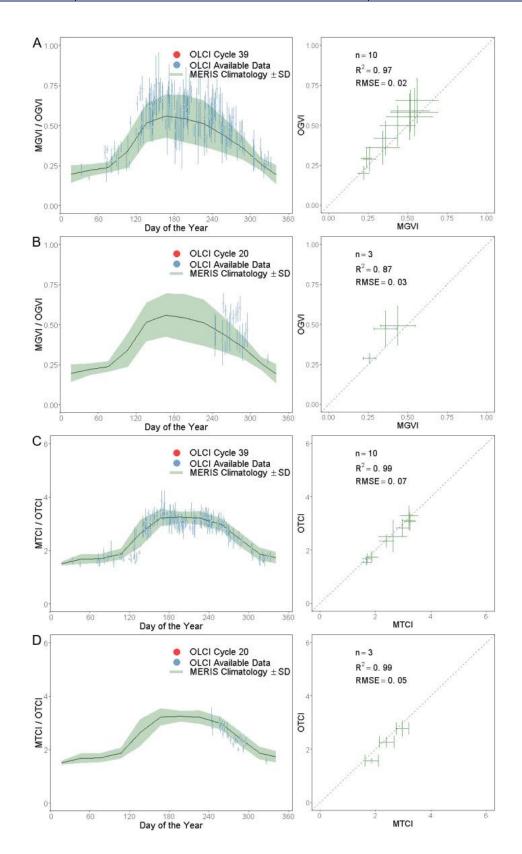


Figure 82: Time-series OGVI vs OTCI and corresponding scatterplot of monthly time-step for site BE-Brasschaat, Belgium, land cover Tree Cover, needle-leaved, evergreen. A and C represent S3A; B and C represent S3B.

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### 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 039. Last figures (cycle 17) are considered valid.

#### 5.1.2 OLCI-B

Ocean Colour System Vicarious Calibration for OLCI-B has started. Current period activities consist in identifying the OLCI-B Level 0 data covering the CV sites for both NIR and VIS SVC, they have been completed in due time for the partial RP which took place end of December. Extractions from L1 reprocessed products were done early January and SVC calibration has started. Results are under analysis and refinement and will be presented in next Cyclic Performance Report.

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 OLCI-A

#### **Activities done**

The Marine Products Validation infrastructure being currently focused on the OLCI-B System Vicarious Calibration, there are no new validation results for OLCI-A. Results including up to cycle 38 have been left included for reference.

#### **Overall Water-leaving Reflectance performance**

Figure 83 and Figure 84 below presents the scatterplots and statistics of OLCI FR versus in situ reflectance. Two time periods are considered:

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The reprocessed archive covering the April 2016 to November 2017 time period

The current reporting period computed on the NT dataset (July 2017 to December 2018).

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

Table 5 and Table 6 below summarise the statistics over reprocessed time period and the current reporting period, respectively. Some statistical variables can differ very much as a consequence of the little number of points (ex: slope and intercept). Nonetheless RMSE are in the same order of magnitude for both dataset.



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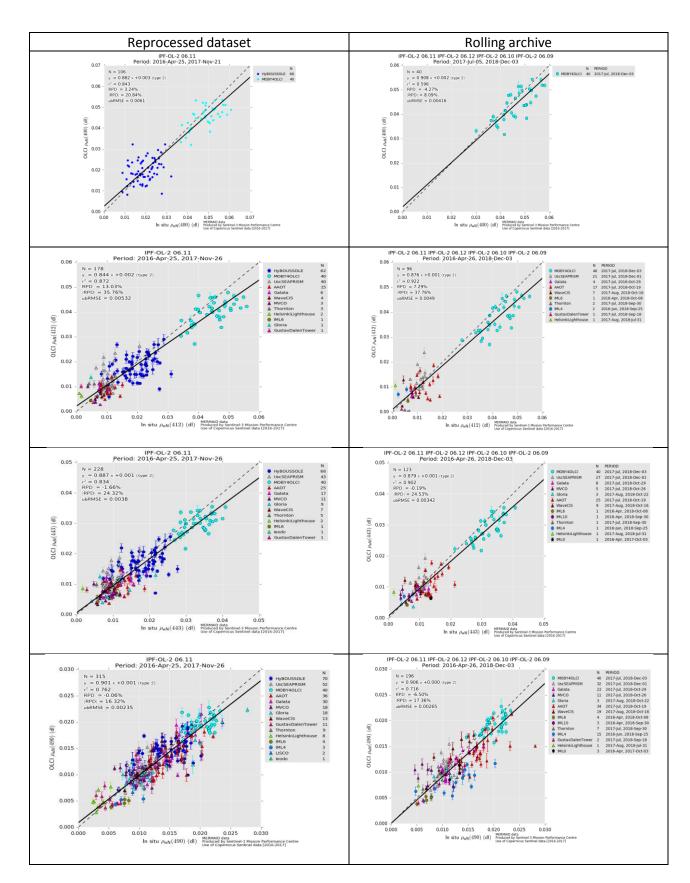


Figure 83: Scatter plots of OLCI versus in situ radiometry (FR data). Reprocessed dataset (left), all available data for the current time period (right), channels Oa1 to Oa4.

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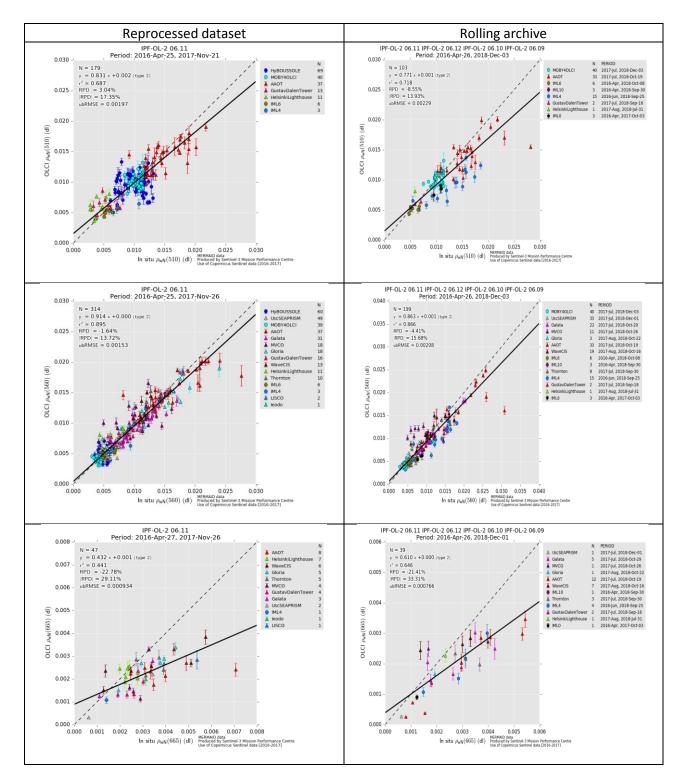


Figure 84: Scatter plots of OLCI versus in situ radiometry (FR data). Reprocessed dataset (left), all available data for the current time period (right), channels Oa5, Oa6 and Oa8

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Table 5: 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 6: FR statistics over July 2017 to December 2018, cycles 20 to 38; FR data.

lambda	N	RPD	RPD	MAD	RMSE	slope	intercept	r2
400	40	-4.27%	8.09%	-0.0022	0.0047	0.9083	0.0020	0.5957
412	96	7.29%	37.76%	-0.0019	0.0052	0.8760	0.0010	0.9223
443	123	-0.19%	24.53%	-0.0014	0.0037	0.8785	0.0007	0.9024
490	196	-6.50%	17.36%	-0.0012	0.0029	0.9064	0.0001	0.7156
510	103	-8.55%	13.93%	-0.0013	0.0026	0.7714	0.0015	0.7177
560	199	-4.41%	15.68%	-0.0007	0.0022	0.8628	0.0006	0.8660
665	39	-21.41%	33.31%	-0.0007	0.0010	0.6098	0.0004	0.6456

#### Time series

Figure 85 and Figure 86 below present AAOT and MOBY in situ and OLCI time series over the current reporting period.

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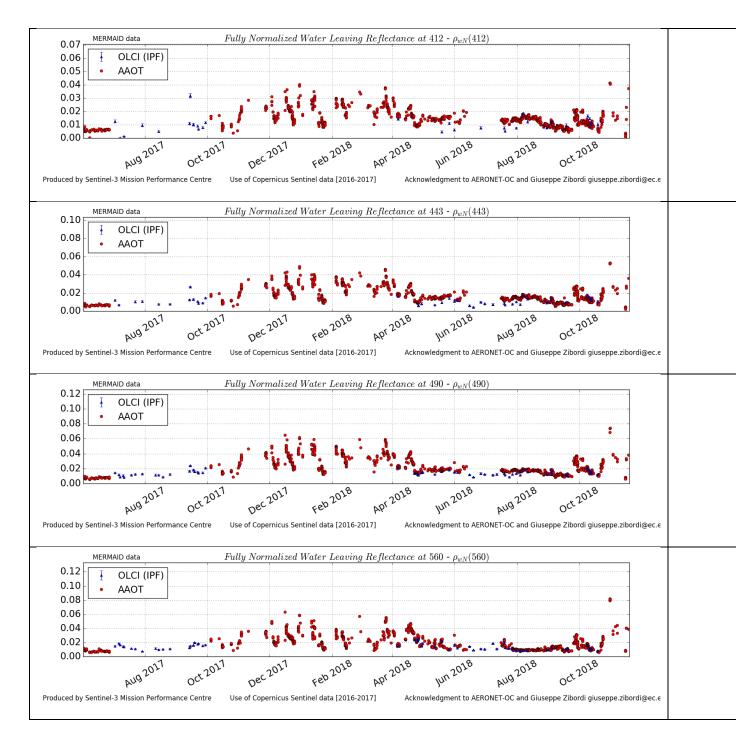


Figure 85: AAOT time series over current reporting period

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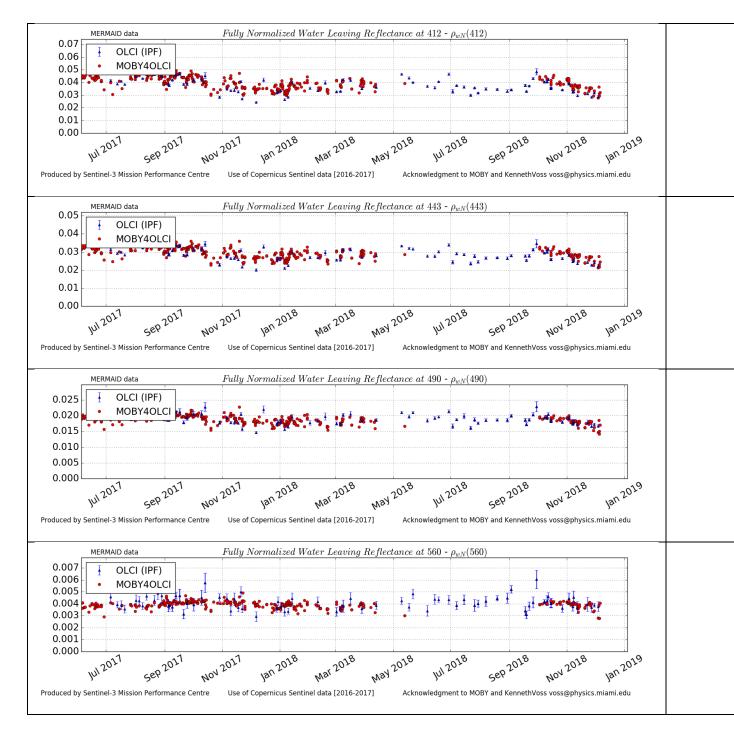


Figure 86: MOBY time series over current reporting period



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#### 5.2.2 OLCI-B

The System Vicarious Calibration process being on-going for OLCI-B, no validation results are available yet.

### 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 OLCI-A result during the cycle. Last figures (cycle 38) are considered valid.

There has been no result for OLCI-B yet.

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

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



**S3 OLCI Cyclic Performance Report** 

**S3A Cycle No. 039 – S3A Cycle No. 020** 

Ref.: S3MPC.ACR.PR.01-039-020

Issue: 1.0

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### 6 Validation of Integrated Water Vapour over Land & Water

There has been no new OLCI-A result during the cycle. Last figures (cycle 38) are considered valid.

There has been no result for OLCI-B yet.



**S3 OLCI Cyclic Performance Report** 

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### 7 Level 2 SYN products validation

There has been no new OLCI-A result during the cycle. Last figures (cycle 38) are considered valid.

There has been no result for OLCI-B yet.

#### **Sentinel-3 MPC**

#### **S3 OLCI Cyclic Performance Report**

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#### **8** Events

For OLCI-A, three Radiometric Calibration Sequences have been acquired during Cycle 039:

- S01 sequence (diffuser 1) on 10/12/2018 18:10 to 18:12 (absolute orbit 14658)
- S01 sequence (diffuser 1) on 25/12/2018 21:43 to 21:45 (absolute orbit 14874)
- S01 sequence (diffuser 1) on 11/01/2019 02:31 to 02:33 (absolute orbit 15105)

For OLCI-B, two Radiometric Calibration Sequences have been acquired during Cycle 020:

- S01 sequence (diffuser 1) on 26/12/2018 05:29 to 05:30 (absolute orbit 3280)
- S01 sequence (diffuser 1) on 11/01/2019 10:16 to 10:18 (absolute orbit 3485)

#### **Sentinel-3 MPC**

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### 9 Appendix A

Other reports related to the Optical mission are:

S3 SLSTR Cyclic Performance Report, S3A Cycle No. 039, S3B Cycle No. 020 (ref. S3MPC.RAL.PR.02-039-020)

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

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