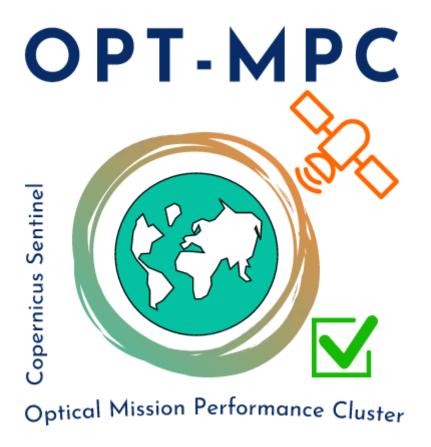
COPERNICUS SPACE COMPONENT SENTINEL OPTICAL IMAGING MISSION PERFORMANCE CLUSTER SERVICE

Data Quality Report

Sentinel-3 OLCI

October 2022



Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Contract: 4000136252/21/I-BG

Customer:	ESA	Document Ref.:	OMPC.ACR.DQR.03.10-2022
Contract No.:	4000136252/21/I-BG	Date:	10/11/2022
		Issue:	1.0

Project:	COPERNICUS SPACE COMPONE PERFORMANCE CLUSTER SERVI		L IMAGING MISSION
Title:	Data Quality Report - OLCI		
Author(s):	OLCI ESL team		
Approved by:	L. Bourg, OPT-MPC OLCI ESL Coordinator S. Clerc, OPT-MPC Optical ESL Coordinator	Authorized by	C. Hénocq, OPT-MPC S3 Technical Manager
Distribution:	ESA, EUMETSAT, published in S	entinel Online	
Accepted by ESA	S. Dransfeld, ESA TO		
Filename	OMPC.ACR.DQR.03.10-2022 - i:	1r0 - OLCI DQR Octob	er 2022.docx

Disclaimer

The views expressed herein can in no way be taken to reflect the official opinion of the European Space Agency or the European Union.









Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: iii

Changes Log

Version	Date	Changes
1.0	10/11/2022	First version

List of Changes

Version	Section	Answers to RID	Changes



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: iv

Table of content

1	PRO	CESSING BASELINE VERSION	
	1.1	Sentinel3-A	1
	1.2	Sentinel3-B	1
2	INST	RUMENT MONITORING	2
	2.1	CCD temperatures	2
	2.1.	1 OLCI-A	2
	2.1.2	2 OLCI-B	4
	2.2	Radiometric Calibration	5
	2.2.	1 Dark Offsets [OLCI-L1B-CV-230]	8
	2.2.2		
	2.2.3	9. 8	
	2.2.4	,	
	2.3	Spectral Calibration [OLCI-L1B-CV-400]	
		1 OLCI-A	
		2 OLCI-B	
	2.4	Signal to Noise assessment [OLCI-L1B-CV-620]	
	2.4	1 SNR from Radiometric calibration data	
		1 OLCI-A	
		2 OLCI-B	
3		I LEVEL 1 PRODUCT VALIDATION	
3			
	3.1	[OLCI-L1B-CV-300], [OLCI-L1B-CV-310] – Radiometric Validation	
	3.1.		
	3.1.2		
	3.1.3 3.1.4		
	_		
4	LEVE	EL 2 LAND PRODUCTS VALIDATION	
	4.1	[OLCI-L2LRF-CV-300]	68
	4.1.		
		2 Comparisons with MERIS MGVI and MTCI climatology	
	4.2	[OLCI-L2LRF-CV-410 & OLCI-L2LRF-CV-420] — Cloud Masking & Surface Classification for	
		tts	
		1 Sky Camera based validation – prototype results for October 2022	
5		IDATION OF INTEGRATED WATER VAPOUR OVER LAND & WATER	
6	LEVE	EL 2 SYN PRODUCTS VALIDATION	87
	6.1	SYN L2 SDR products	87
	6.2	SY_2_VGP, SY_2_VG1 and SY_2_V10 products	87



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: v

8	ΔPPFN	DIX A	96
7	EVENT	S	95
	6.3.3	Analysis of the outliers	92
		Testing validation results for "elevated" matchups	
		Testing sun zenith angle (SZA) applicable limit	
		YN L2 AOD NTC products	

Optical MPC

Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: vi

List of Figures

Figure 1: long term monitoring of OLCI-A CCD temperatures using minimum value (top), time averaged values (middle), and maximum value (bottom) provided in the annotations of the Radiometric Calibration Level 1 products, for the shutter frames, all radiometric calibrations so far except the first one (absolute orbit 183) for which the instrument was not yet thermally stable
Figure 2: Same as Figure 1 for diffuser frames 3
Figure 3: long term monitoring of OLCI-B CCD temperatures using minimum value (top), time averaged values (middle), and maximum value (bottom) provided in the annotations of the Radiometric Calibration Level 1 products, for the Shutter frames, all radiometric calibrations so far except the first one (absolute orbit 167) for which the instrument was not yet thermally stable
Figure 4: same as Figure 3 for diffuser frames5
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. Different colours correspond to different years of acquisition (see the legend inside the figure)
Figure 6: same as Figure 5 for OLCI-B 6
Figure 7: OLCI-A Sun geometry during radiometric Calibrations on top of characterization ones (diffuser frame)7
Figure 8: same as Figure 7 for OLCI-B7
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
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 yet9
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.
Figure 12: same as Figure 11 for smear band 11
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
Figure 15: OLCI-A Dark current increase rates with time (in counts per year) vs. band (left) and vs. band width (right)
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



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: vii

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 15
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 16
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)
Figure 22: OLCI-A Gain Coefficients for band Oa1 (top) and Oa21 (bottom), derived using the in-flight BRDF model. The dataset is made of all diffuser 1 radiometric calibrations since orbit 979 19
Figure 23: camera averaged gain relative evolution with respect to calibration of 25/04/2016 (change of OLCI channel settings), 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 taken into account.
Figure 24: OLCI-B Gain Coefficients for band Oa1 (top) and Oa21 (bottom), derived using the in-flight BRDF model. The dataset is made of all diffuser 1 radiometric calibrations since orbit 758 21
Figure 25: OLCI-B camera averaged gain relative evolution with respect to first calibration after channel programming change (18/06/2018), as a function of elapsed time since the beginning of the mission; one curve for each band (see colour code on plots), one plot for each module. The diffuser ageing is taken into account
Figure 26: RMS performance of the OLCI-A Gain Model of the current processing baseline as a function of orbit 23
Figure 27: RMS performance of the OLCI-A Gain Model of the previous Processing Baseline as a function of orbit24
Figure 28: OLCI-A Camera-averaged instrument evolution since channel programming change (25/04/2016) and up to the most recent calibration (24/10/2022) versus wavelength 24
Figure 29: For the 5 cameras: OLCI-A Evolution model performance, as camera-average and standard deviation of ratio of Model over Data vs. wavelength, for each orbit of the test dataset, including 11 calibrations in extrapolation, with a colour code for each calibration from blue (oldest) to red (most recent)
Figure 30: OLCI-A evolution model performance, as ratio of Model over Data vs. pixels, all cameras side by side, over the whole current calibration dataset (since instrument programming update), including 11 calibrations in extrapolation, channels Oa1 to Oa6
Figure 31: same as Figure 30 for channels Oa7 to Oa14 28
Figure 32: same as Figure 30 for channels Oa15 to Oa21 29
Figure 33: RMS performance of the OLCI-B Gain Model of the current processing baseline as a function of orbit 30



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: viii

of orbit (please note the different vertical scale with respect to Figure 33)
Figure 35: OLCI-B Camera-averaged instrument evolution since channel programming change (18/06/2018) and up to most recent calibration (30/10/2022) versus wavelength 32
Figure 36: For the 5 cameras: OLCI-B Evolution model performance, as camera-average and standard deviation of ratio of Model over Data vs. wavelength, for each orbit of the test dataset, including 11 calibrations in extrapolation, with a colour code for each calibration from blue (oldest) to red (most recent).
Figure 37: OLCI-B evolution model performance, as ratio of Model over Data vs. pixels, all cameras side by side, over the whole current calibration dataset (since instrument programming update), including 11 calibrations in extrapolation, channels Oa1 to Oa6.
Figure 38: same as Figure 37 for channels Oa7 to Oa14 35
Figure 39: same as for channels Oa15 to Oa21 36
Figure 40: OLCI-A 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. The nominal spectral calibration is plotted as a red horizontal dotted line and the on-ground spectra calibration as a red thick line
Figure 41: OLCI-A 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). The data are normalized with the first Spectral Calibration of the plot
Figure 42: OLCI-A across track spectral calibration from all S09 sequences since the beginning of the mission. The used features are the atmospheric oxygen at 759nm and the Fraunhofer lines at 485nm, 656nm and 854nm. The nominal spectral calibration is plotted as a red dotted line
Figure 43: OLCI-A camera averaged spectral calibration evolution as a function of orbit number from SOS calibrations since the 4th May 2016. The last calibration for SOS is from 05 June 2022. For each camera, the spectral evolution corresponding derived from spectral lines at 485 nm, 656 nm, 770 nm and 854 nm have been averaged. The data are normalized with the first Spectral Calibration of the plot
Figure 44: 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. The nominal spectral calibration is plotted as a red dotted line and the on-ground spectral calibration as a red thick line
Figure 45: 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). The data are normalized with the first Spectral Calibration
Figure 46: OLCI-B across track spectral calibration from all (few during commissioning have been left out for the sake of clearness) S09 sequences since the beginning of the mission. The used features are the atmospheric oxygen at 759nm and the Fraunhofer lines at 485nm, 656nm and 854nm. The nominal spectral calibration is plotted as a red dotted line
Figure 47: OLCI-B camera averaged spectral calibration evolution as a function of orbit number since launch from S09 calibrations since the beginning of the mission. The last calibration for S09 is from 15 June 2022. For each camera, the spectral evolution corresponding derived from spectral lines at 485 nm, 656 nm, 770 nm and 854 nm have been averaged. The data are normalized with the first Spectral Calibration.
Laiini aliuli



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: ix

Figure 48: OLCI-A Signal to Noise ratio as a function of the spectral band for the 5 cameras. These result nave 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 wit time: the curves for all orbits are almost superimposed. The dashed curve is the ESA requirement.				
Figure 49: long-term stability of the SNR estimates from Calibration data, example of channel Oa1				
Figure 50: OLCI-B Signal to Noise ratio as a function of the spectral band for the 5 cameras. These result 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 wit time: the curves for all orbits are almost superimposed. The dashed curve is the ESA requirement 5 Figure 51: long-term stability of the OLCI-B SNR estimates from Calibration data, example of channel Oac				
Figure 52: overall OLCI-A georeferencing RMS performance time series (left) and number of validate control points corresponding to the performance time series (right) over the whole monitoring period 5				
Figure 53: across-track (left) and along-track (right) OLCI-A georeferencing biases time series for Camer 1. Blue line is the average, black lines are average plus and minus 1 sigma				
Figure 54: same as Figure 53 for Camera 2 5				
Figure 55: same as Figure 53 for Camera 3 5				
gure 56: same as Figure 53 for Camera 4 5				
igure 57: same as Figure 53 for Camera 5 5				
Figure 58: OLCI-A spatial across-track misregistration at each camera transition (left) and maximur amplitude of the across-track error within each camera (left).				
Figure 59: OLCI-A spatial along-track misregistration at each camera transition (left) and maximur Amplitude of the along-track error within each camera (left)				
Figure 60: overall OLCI-B georeferencing RMS performance time series over the whole monitoring perion (left) and corresponding number of validated control points (right)				
Figure 61: across-track (left) and along-track (right) OLCI-B georeferencing biases time series for Camer				
-igure 62: same as Figure 61 for Camera 2 5				
-igure 63: same as Figure 61 for Camera 3 5				
-igure 64: same as Figure 61 for Camera 4 5				
gure 65: same as Figure 61 for Camera 5 5				
Figure 66: OLCI-B spatial across-track misregistration at each camera transition (left) and maximur amplitude of the across-track error within each camera (left).				
Figure 67: OLCI-B spatial along-track misregistration at each camera transition (left) and maximur emplitude of the along-track error within each camera (left).				
Figure 68: summary of S3ETRAC products generation for OLCI-A (number of OLCI-A L1 products Ingested plue – number of S3ETRAC extracted products generated, green – number of S3ETRAC runs withougeneration of output product (data not meeting selection requirements), yellow – number of runs ending error, red, one plot per site type).				
Figure 69: summary of S3ETRAC products generation for OLCI-B (number of OLCI-B L1 products Ingested vellow — number of S3ETRAC runs without				



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: x

Figure 70: OSCAR Rayleigh S3A and S3B Calibration results as a function of wavelength for September 2022. The results are obtained with a new climatology derived from CMEMS OLCI monthly CHL products. ———————————————————————————————————	generation of output product (data not meeting selection requirements), green – number of runs e in error, red, one plot per site type)	_
Figure 71. OSCAR Rayleigh S3A and S3B Calibration results as a function of wavelength for Jan – August 2022. Average and standard deviation over all scenes currently (re)processed with the new climatology. 66. Figure 72: DeGeb time series over current report period 67. Figure 73: ITCat time series over current report period 69. Figure 74: ITIsp time series over current report period 69. Figure 75: ITSro time series over current report period 70. Figure 76: ITTra time series over current report period 70. Figure 76: ITTra time series over current report period 71. Figure 77: SPAII time series over current report period 71. Figure 78: UKNFo time series over current report period 71. Figure 79: USNe1 time series over current report period 72. Figure 80: USNe2 time series over current report period 72. Figure 81: USNe3 time series over current report period 73. Figure 82: DeGeb time series over current report period 74. Figure 83: ITCat time series over current report period 75. Figure 84: ITIsp time series over current report period 75. Figure 85: ITSro time series over current report period 75. Figure 86: ITTra time series over current report period 75. Figure 86: ITTra time series over current report period 75. Figure 87: SPAII time series over current report period 76. Figure 89: USNe1 time series over current report period 76. Figure 89: USNe2 time series over current report period 77. Figure 89: USNe3 time series over current report period 77. Figure 90: USNe2 time series over current report period 77. Figure 91: USNe3 time series over current report period 77. Figure 92: Temperature and cloud cover Rome, October 2022 (source: https://www.meteoprog.com/weather/Rome/month/October/) 79. Figure 93: Average temperature, rainy days, and rainfall over Rome, October 2022 (source: https://www.meteoprog.com/weather/Rome/month/October/) 79. Figure 94: Sky camera acquisitions over Rome during Sentinel-3 OLCI overpass 81. Figure 95: Classified sky camera acquisitions over Rome during Sentinel-3 OLCI overpass 82. Figure	Figure 70: OSCAR Rayleigh S3A and S3B Calibration results as a function of wavelength for Septe 2022. The results are obtained with a new climatology derived from CMEMS OLCI monthly CHL products.	mber ducts.
Figure 72: DeGeb time series over current report period 69 Figure 73: ITCat time series over current report period 69 Figure 74: ITIsp time series over current report period 70 Figure 75: ITSro time series over current report period 70 Figure 76: ITTra time series over current report period 71 Figure 77: SPAli time series over current report period 71 Figure 78: UKNFo time series over current report period 71 Figure 79: USNe1 time series over current report period 72 Figure 80: USNe2 time series over current report period 73 Figure 81: USNe3 time series over current report period 73 Figure 82: DeGeb time series over current report period 74 Figure 82: DeGeb time series over current report period 74 Figure 83: ITCat time series over current report period 75 Figure 84: ITIsp time series over current report period 75 Figure 85: ITSro time series over current report period 75 Figure 86: ITTra time series over current report period 75 Figure 87: SPAli time series over current report period 76 Figure 88: UKNFo time series over current report period 76 Figure 89: USNe1 time series over current report period 77 Figure 89: USNe1 time series over current report period 77 Figure 89: USNe2 time series over current report period 77 Figure 91: USNe3 time series over current report period 77 Figure 92: Temperature and cloud cover Rome, October 2022 (source: https://www.meteoprog.com/weather/Rome/month/October/) 79 Figure 93: Average temperature, rainy days, and rainfall over Rome, October 2022 (source: https://www.weather25.com/europe/italy/lazio/rome?page=month&month=October) 80 Figure 94: Sky camera acquisitions over Rome during Sentinel-3 OLCI overpass 81 Figure 95: Classified sky camera acquisitions over Rome during Sentinel-3 OLCI overpass 82 Figure 97: Confusion matrix showing validation results for OLCI L2 cloud screening including margin	Figure 71. OSCAR Rayleigh S3A and S3B Calibration results as a function of wavelength for Jan $-$ A 2022. Average and standard deviation over all scenes currently (re)processed with the new climate	ugust ology.
Figure 73: ITCat time series over current report period — 69 Figure 74: ITIsp time series over current report period — 70 Figure 75: ITSro time series over current report period — 70 Figure 76: ITTra time series over current report period — 71 Figure 77: SPAli time series over current report period — 71 Figure 78: UKNFo time series over current report period — 71 Figure 79: USNe1 time series over current report period — 72 Figure 80: USNe2 time series over current report period — 72 Figure 80: USNe3 time series over current report period — 73 Figure 81: USNe3 time series over current report period — 74 Figure 82: DeGeb time series over current report period — 74 Figure 83: ITCat time series over current report period — 75 Figure 84: ITIsp time series over current report period — 75 Figure 85: ITSro time series over current report period — 75 Figure 86: ITTra time series over current report period — 76 Figure 87: SPAli time series over current report period — 76 Figure 88: UKNFo time series over current report period — 76 Figure 89: USNe1 time series over current report period — 77 Figure 90: USNe2 time series over current report period — 77 Figure 91: USNe3 time series over current report period — 78 Figure 92: Temperature and cloud cover Rome, October 2022 (source: https://www.meteoprog.com/weather/Rome/month/October/) — 79 Figure 93: Average temperature, rainy days, and rainfall over Rome, October 2022 (source: https://www.meteoprog.com/weather/Rome/month/October/) — 79 Figure 93: Average temperature, rainy days, and rainfall over Rome, October 2022 (source: https://www.meather25.com/europe/italy/lazio/rome?page=month&month=October) — 80 Figure 93: Confusion matrix showing validation results for OLCI L2 cloud screening including margin against SC1 automated classification — 83 Figure 97: Confusion matrix showing validation results for OLCI L2 cloud screening including margin		
Figure 74: ITIsp time series over current report period		
Figure 75: ITSro time series over current report period		
Figure 76: ITTra time series over current report period————————————————————————————————————		
Figure 77: SPAli time series over current report period		
Figure 78: UKNFo time series over current report period		
Figure 89: USNe2 time series over current report period		
Figure 81: USNe3 time series over current report period		
Figure 82: DeGeb time series over current report period		
Figure 82: DeGeb time series over current report period — 74 Figure 83: ITCat time series over current report period — 75 Figure 84: ITIsp time series over current report period — 75 Figure 85: ITSro time series over current report period — 75 Figure 86: ITTra time series over current report period — 76 Figure 87: SPAli time series over current report period — 76 Figure 88: UKNFo time series over current report period — 77 Figure 89: USNe1 time series over current report period — 77 Figure 90: USNe2 time series over current report period — 78 Figure 91: USNe3 time series over current report period — 78 Figure 92: Temperature and cloud cover Rome, October 2022 (source: https://www.meteoprog.com/weather/Rome/month/October/) — 79 Figure 93: Average temperature, rainy days, and rainfall over Rome, October 2022 (source: https://www.weather25.com/europe/italy/lazio/rome?page=month&month=October) — 80 Figure 94: Sky camera acquisitions over Rome during Sentinel-3 OLCI overpass — 81 Figure 95: Classified sky camera acquisitions over Rome during Sentinel-3 OLCI overpass — 82 Figure 96: Confusion matrix showing validation results for OLCI L2 cloud screening including margin against SC1 automated classification — 83 Figure 97: Confusion matrix showing validation results for OLCI L2 cloud screening excluding margin		
Figure 83: ITCat time series over current report period — 75 Figure 84: ITIsp time series over current report period — 75 Figure 85: ITSro time series over current report period — 75 Figure 86: ITTra time series over current report period — 76 Figure 87: SPAli time series over current report period — 76 Figure 88: UKNFo time series over current report period — 77 Figure 89: USNe1 time series over current report period — 77 Figure 90: USNe2 time series over current report period — 78 Figure 91: USNe3 time series over current report period — 78 Figure 92: Temperature and cloud cover Rome, October 2022 (source: https://www.meteoprog.com/weather/Rome/month/October/) — 79 Figure 93: Average temperature, rainy days, and rainfall over Rome, October 2022 (source: https://www.weather25.com/europe/italy/lazio/rome?page=month&month=October) — 80 Figure 94: Sky camera acquisitions over Rome during Sentinel-3 OLCI overpass — 81 Figure 95: Classified sky camera acquisitions over Rome during Sentinel-3 OLCI overpass — 82 Figure 96: Confusion matrix showing validation results for OLCI L2 cloud screening including margin against SC1 automated classification — 83 Figure 97: Confusion matrix showing validation results for OLCI L2 cloud screening excluding margin		
Figure 84: ITIsp time series over current report period		
Figure 85: ITSro time series over current report period		
Figure 87: SPAli time series over current report period		
Figure 88: UKNFo time series over current report period	Figure 86: ITTra time series over current report period	76
Figure 89: USNe1 time series over current report period	Figure 87: SPAli time series over current report period	76
Figure 89: USNe1 time series over current report period	Figure 88: UKNFo time series over current report period	77
Figure 91: USNe3 time series over current report period	Figure 89: USNe1 time series over current report period	77
Figure 91: USNe3 time series over current report period	Figure 90: USNe2 time series over current report period	78
https://www.meteoprog.com/weather/Rome/month/October/)		
https://www.weather25.com/europe/italy/lazio/rome?page=month&month=October)	· · · · · · · · · · · · · · · · · · ·	
Figure 95: Classified sky camera acquisitions over Rome during Sentinel-3 OLCI overpass		
Figure 96: Confusion matrix showing validation results for OLCI L2 cloud screening including margin against SC1 automated classification 83 Figure 97: Confusion matrix showing validation results for OLCI L2 cloud screening excluding margin	Figure 94: Sky camera acquisitions over Rome during Sentinel-3 OLCI overpass	81
against SC1 automated classification 83 Figure 97: Confusion matrix showing validation results for OLCI L2 cloud screening excluding margin	Figure 95: Classified sky camera acquisitions over Rome during Sentinel-3 OLCI overpass	82
		_



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: xi

Figure 98: Upper: Scatter plot of the IWV products, derived from OLCI (A left, B right) above land and from SUOMI NET GNSS measurements. Middle: Histogram of the difference between OLCI (A: left, B: right) and
GNSS (blue: original OLCI, orange: bias corrected OLCI). Lower: Positions of the GNSS (A: left, B: right). 85
Figure 99: Temporal evolution of different quality measures for OLCI A (left) and OLCI B (right) with respect to SUOMI Net. From top to bottom: systematic deviation factor, bias, root mean squared difference (with and without bias correction), explained variance (number in boxes are the numbers of matchups) 86
Figure 100: Scatter density plots between SY_V10 S3A (top) or S3B (bottom) and PROBA-V C2 S10-TOC for BLUE, RED, NIR and SWIR bands (left to right), October/2022 vs. October/2019
Figure 101: Temporal evolution of APU statistics between SY_2_V10 S3A (left) or S3B (right) and PROBA-V S10-TOC for BLUE, RED, NIR and SWIR bands (top to bottom), January/2021- October/2022 vs. January/2018- October/2019
Figure 102: Validation statistics for all matchups (left), matchups with SZA<=70° (middle) and matchups with SZA>70° (right)90
Figure 103: Validation results for SZA above 70° (upper left), with SZA increasing by one degree (towards lower right)91
Figure 104: Scatter density plots for all matchups (upper panel). For two elevations, 1000m (middle panel) and 2500 (lower panel), validation statistics for matchups below and above chosen elevation 92
Figure 105: Scatter density plot for all matchups and groups of matchups where AOD is retrieved with different approaches: dual, single applied to nadir (singleN) and single applied to oblique (singleO) 93
Figure 106: Scatter density plot for syAOD outliers defined as syAOD-aAOD >1 for all matchups, dual and singleN groups of matchups 93
Figure 107: AERONET stations with positive (red) and negative (blue) syAOD outliers. Stations where both positive and negative outliers are observed are marked with green (left) and fraction of outliers (right).
Figure 108: Examples of the SyAOD spatial distribution for the cases when matchup with AERONET station (pixels within the magenta circles) reveals SyAOD outlier

Optical MPC

Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: xii

List of Tables

Table 1: OLCI-A SNR figures as derived from Radiometric Calibration data. Figures are given for each
camera (time average and standard deviation), and for the whole instrument. The requirement and its
reference radiance level are recalled (in mW.sr ⁻¹ .m ⁻² .nm ⁻¹)49
Table 2: OLCI-B SNR figures as derived from Radiometric Calibration data. Figures are given for each camera (time average and standard deviation), and for the whole instrument. The requirement and its reference radiance level are recalled (in mW.sr ⁻¹ .m ⁻² .nm ⁻¹)52
Fable 3: S3ETRAC Rayleigh Calibration sites
Table 4. OSCAR Rayleigh calibration results for S3A and S3B (average and standard deviation over all 2022
acquisitions) over all scenes currently (re)processed with the new climatology and observed difference (in
%) between OLCIA and OLCIB 67



Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 1

1 Processing Baseline Version

1.1 Sentinel3-A

IPF	IPF / Processing Baseline version	Date of deployment
OL1	06.13 / OLL1003.00.00 (with uncertainties activated)	23/08/2022
OL2 LAND	06.16 / OLL2L.002.10.01	23/08/2022
SY2	06.23 / SYN_L2002.16.00	23/08/2022
SY2_VGS	06.11 / SYN_L2V.002.08.00	23/08/2022
SY2_AOD	01.06 / AOD_NTC.002.06.01	23/08/2022

1.2 Sentinel3-B

IPF	IPF / Processing Baseline version	Date of deployment
OL1	06.13 / OLL1003.00.00 (with uncertainties activated)	31/08/2022
OL2 Land	06.16 / OLL2L.002.10.01	05/09/2022
SY2	06.23 / SYN_L2002.16.00	09/09/2022
SY2_VGS	06.11 / SYN_L2V.002.08.00	09/09/2022
SY2_AOD	01.06 / AOD_NTC.002.06.01	09/09/2022



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 2

2 Instrument monitoring

2.1 CCD temperatures

2.1.1 OLCI-A

The long-term monitoring of the CCD temperatures is based on 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 reporting period (rightmost data points) do not show any specificity.

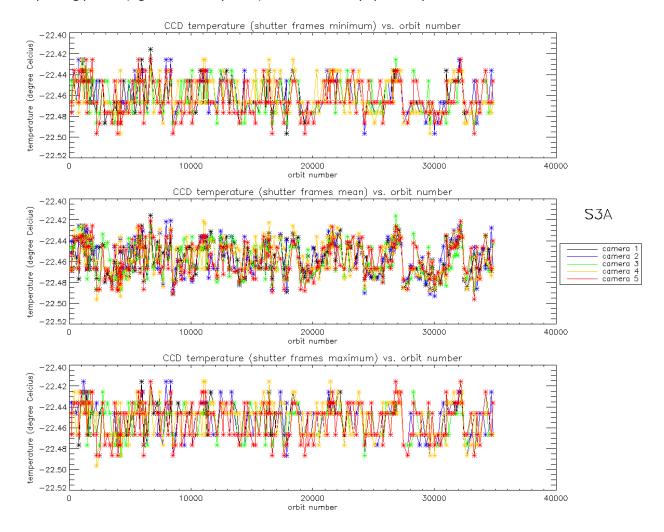


Figure 1: long term monitoring of OLCI-A CCD temperatures using minimum value (top), time averaged values (middle), and maximum value (bottom) provided in the annotations of the Radiometric Calibration Level 1 products, for the shutter frames, all radiometric calibrations so far except the first one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



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

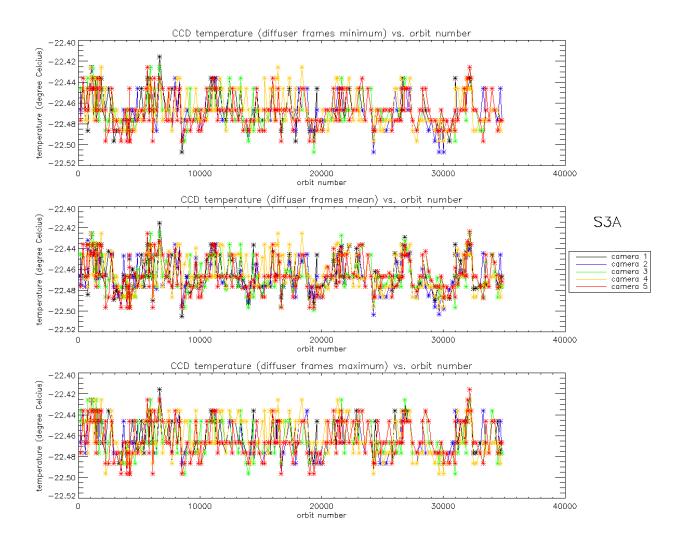


Figure 2: Same as Figure 1 for diffuser frames.

Optical MPC

Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 4

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 reporting period (rightmost data points) do not show any specificity.

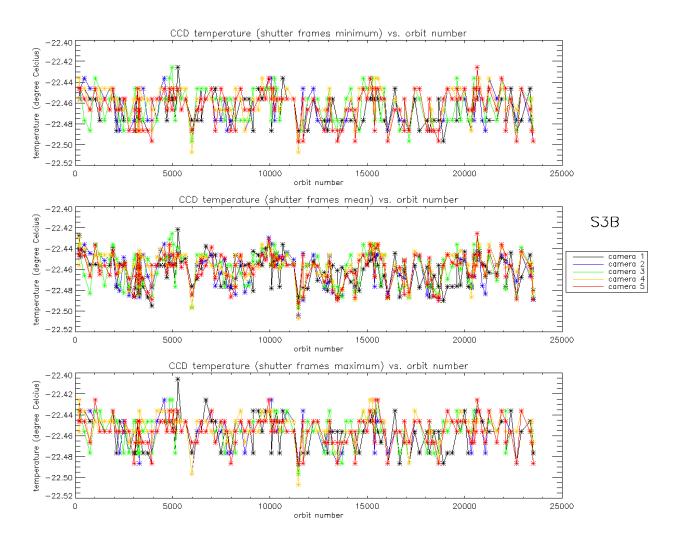


Figure 3: long term monitoring of OLCI-B CCD temperatures using minimum value (top), time averaged values (middle), and maximum value (bottom) provided in the annotations of the Radiometric Calibration Level 1 products, for the Shutter frames, all radiometric calibrations so far except the first one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



Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 5

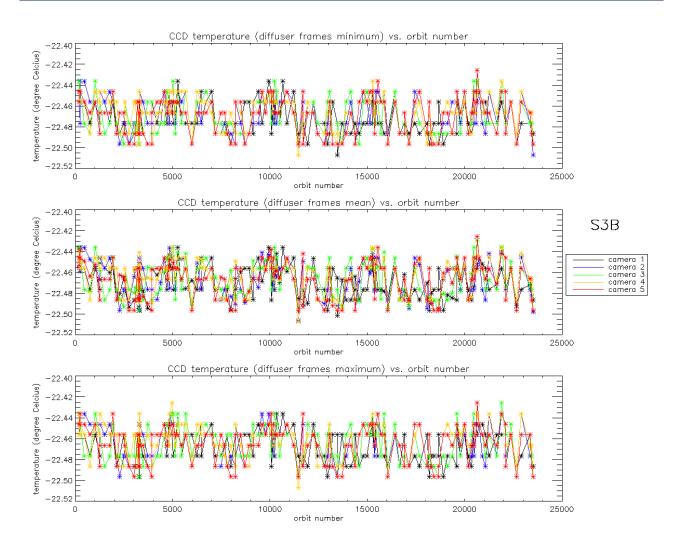


Figure 4: same as Figure 3 for diffuser frames.

2.2 Radiometric Calibration

For OLCI-A, two Radiometric Calibration sequences have been acquired during the reported period:

- S01 sequence (diffuser 1) on 14/10/2022 01:15 to 01:17 (absolute orbit 34668)
- S01 sequence (diffuser 1) on 24/10/2022 23:51 to 23:52 (absolute orbit 34824)

For OLCI-B, three Radiometric Calibration sequences have been acquired during the reported period:

- S01 sequence (diffuser 1) on 19/10/2022 13:35 to 13:37 (absolute orbit 23353)
- S01 sequence (diffuser 1) on 24/10/2022 14:46 to 14:48 (absolute orbit 23425)
- So1 sequence (diffuser 1) on 30/10/2022 17:13 to 17:15 (absolute orbit 23512)

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).

Optical MPC

Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

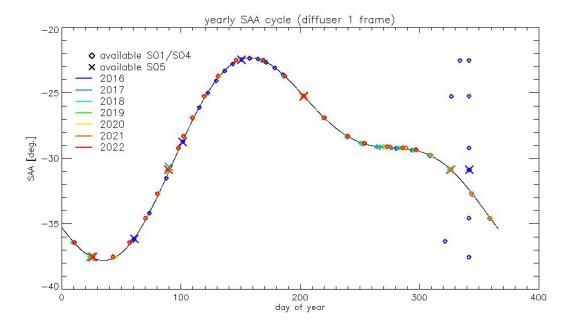


Figure 5: Sun azimuth angles during acquired OLCI-A Radiometric Calibrations (diffuser frame) on top of nominal yearly cycle (black curve). Diffuser 1 with diamonds, diffuser 2 with crosses. Different colours correspond to different years of acquisition (see the legend inside the figure).

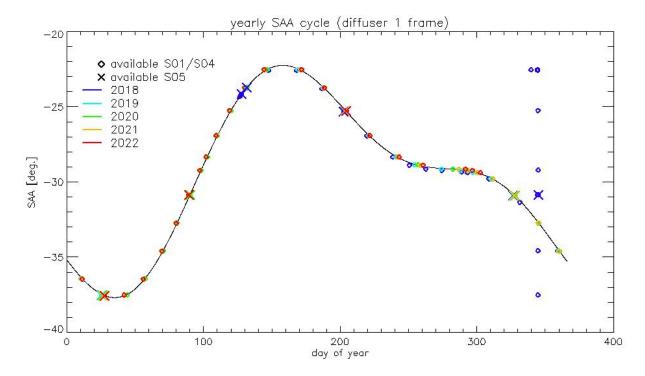


Figure 6: same as Figure 5 for OLCI-B.

Optical MPC

Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 7

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

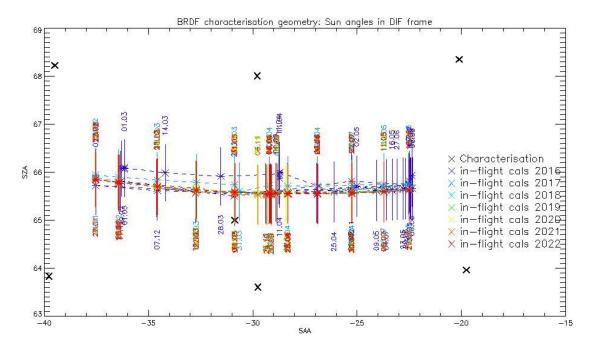


Figure 7: OLCI-A Sun geometry during radiometric Calibrations on top of characterization ones (diffuser frame)

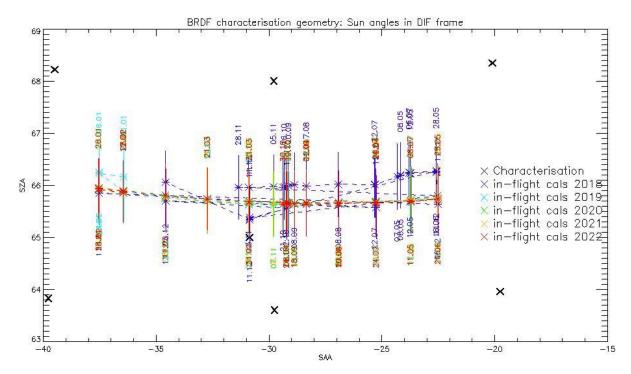


Figure 8: same as Figure 7 for OLCI-B



Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 8

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.

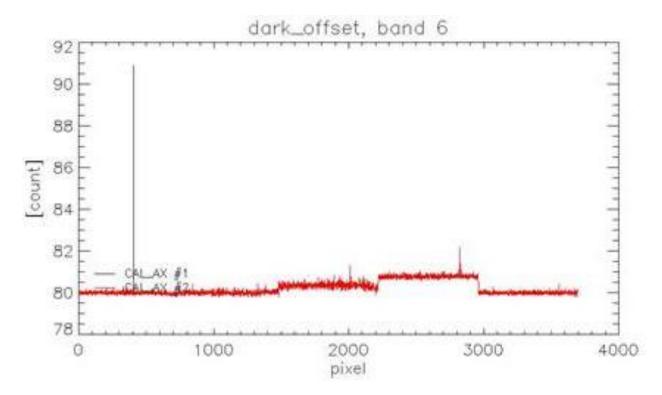


Figure 9: Dark Offset table for band Oa06 with (red) and without (black) HEP filtering (Radiometric Calibration of 22 July 2017). The strong HEP event near pixel 400 has been detected and removed by the HEP filtering.

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

Optical MPC

Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 9

2.2.1.2 OLCI-A

Dark offsets

Dark offsets are continuously affected by the global offset induced by the Periodic Noise on the OCL (Offset Control Loop) convergence. Current reporting period 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.

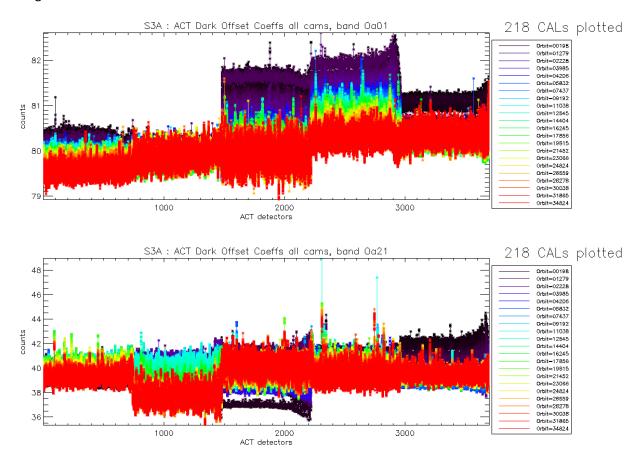


Figure 10: OLCI-A Dark Offset for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.

OPT-MPC Page 10 Performance Cluster Optical Musican Performance Cluster

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

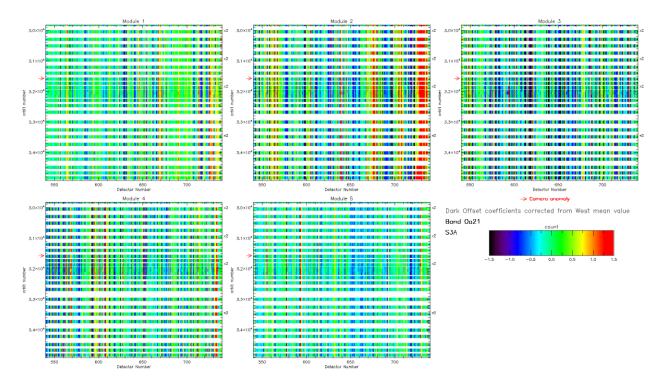


Figure 11: map of OLCI-A periodic noise for the 5 cameras, for band Oa21. X-axis is detector number (East part, from 540 to 740, where the periodic noise occurs), Y-axis is the orbit number. Y-axis range is focused on the most recent 5000 orbits. The counts have been corrected from the West detectors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



Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 11

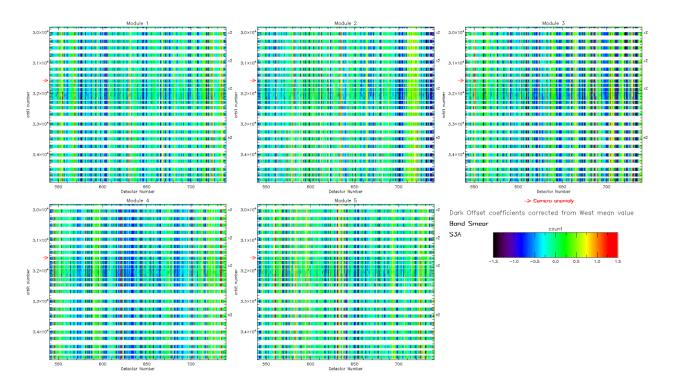


Figure 12: same as Figure 11 for smear band.

Figure 11 and Figure 12 show the so-called 'map of periodic noise' in the 5 cameras, for respectively band 21 and smear band. These maps have been computed from the dark offsets after removal of the mean level of the WEST detectors (not impacted by PN) in order to remove mean level gaps from one CAL to the other and consequently to highlight the shape of the PN. Maps are focused on the last 200 EAST detectors where PN occurs and on a time range covering only the last 5000 orbits in order to better visualize the CALs of the current reporting period.

Figure 11 and Figure 12 show that at this stage of the mission the PN is very stable in all cameras. There is no special behaviour noticed during the reporting period.

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 reporting period except the small regular increase (almost linear), for all detectors, since the beginning of the mission (see Figure 14).

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

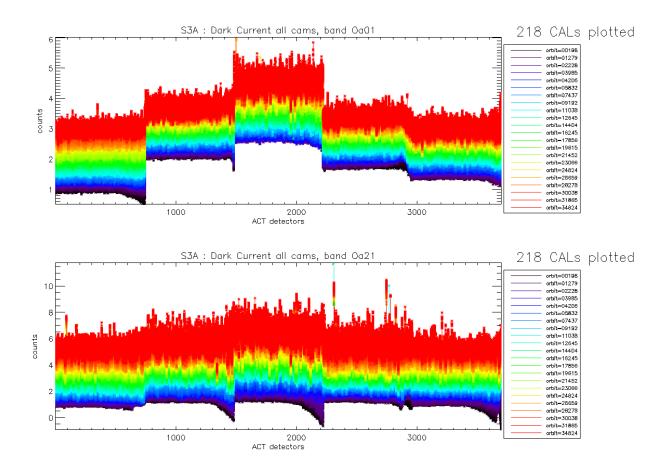


Figure 13: OLCI-A Dark Current for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 183) for which the instrument was not thermally stable yet.

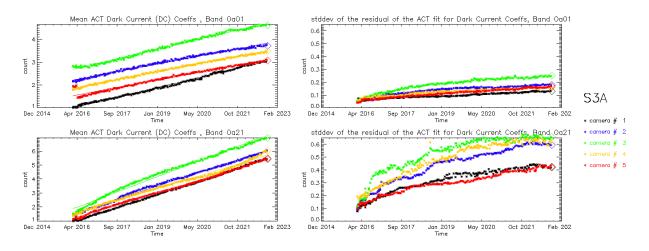


Figure 14: left column: ACT mean on 400 first detectors of OLCI-A Dark Current coefficients for spectral band Oa01 (top) and Oa21 (bottom). Right column: same as left column but for Standard deviation instead of mean.

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



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 13

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

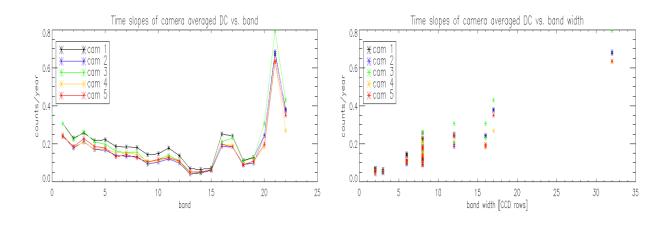


Figure 15: OLCI-A Dark current increase rates with time (in counts per year) vs. band (left) and vs. band width (right)

2.2.1.3 OLCI-B

Dark Offsets

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

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

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

Despite this overall stabilization, small evolutions are still noticeable in some bands/camera, like for example camera 1 in band Oa21 (upper left map in Figure 17) or in camera 1 band smear (upper left map in Figure 18).

Globally, OLCI-B PN is slightly less stabilized than OLCI-A PN.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

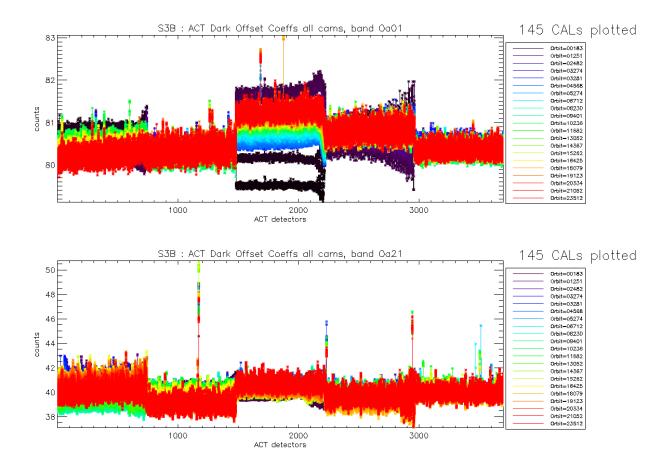


Figure 16: OLCI-B Dark Offset for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 167) for which the instrument was not thermally stable yet.

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

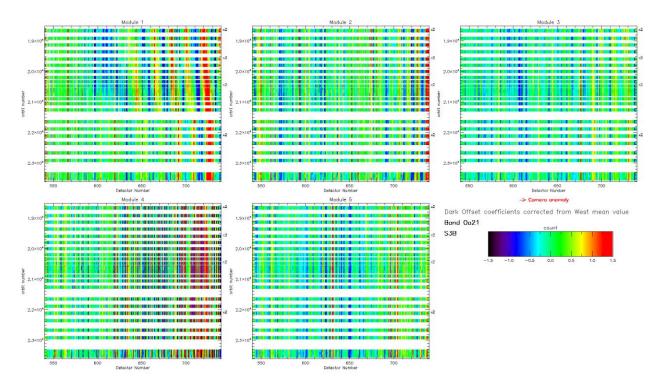


Figure 17: OLCI-B map of periodic noise for the 5 cameras, for band Oa21. X-axis is detector number (East part, from 540 to 740, where the periodic noise occurs), Y-axis is the orbit number. The counts have been corrected from the West detectors mean value (not affected by periodic noise) in order to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

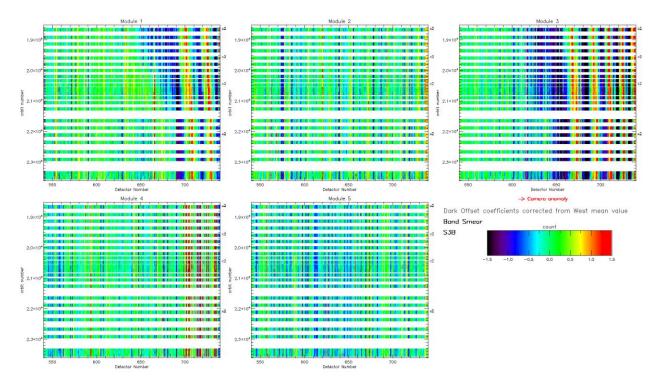


Figure 18: same as Figure 17 for smear band.

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 16

Dark Currents

As for OLCI-A there is no significant evolution of the Dark Current coefficients (Figure 19) during the current reporting period 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).

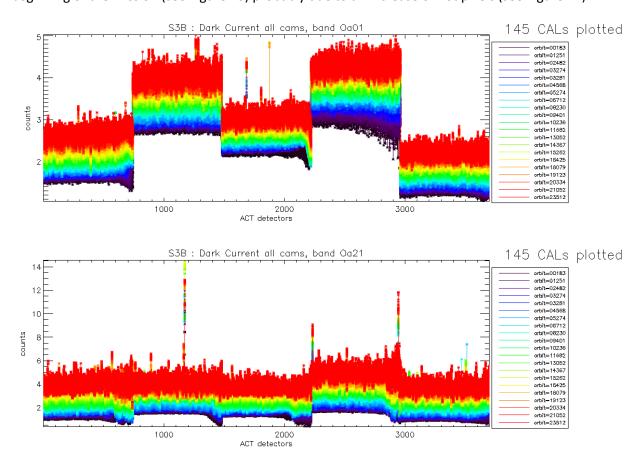


Figure 19: OLCI-B Dark Current for band Oa1 (top) and Oa21 (bottom), all radiometric calibrations so far except the first one (orbit 167) for which the instrument was not thermally stable yet.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

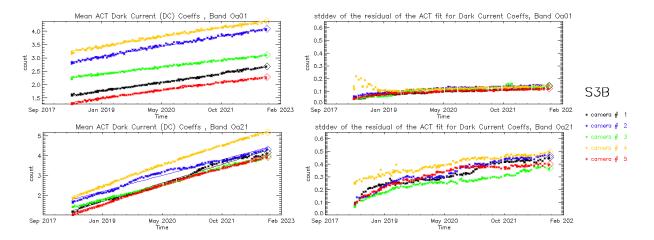


Figure 20: left column: ACT mean on 400 first detectors of OLCI-B Dark Current coefficients for spectral band Oa01 (top) and Oa21 (bottom). Right column: same as left column but for Standard deviation instead of mean.

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

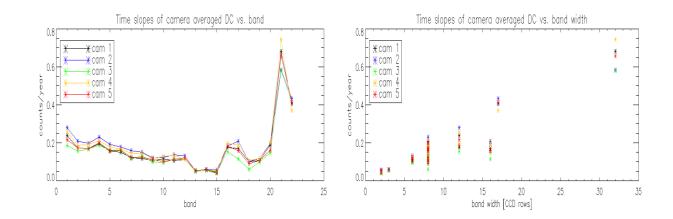


Figure 21: OLCI-B Dark Current increase rates with time (in counts per year) vs. band (left) and vs. band width (right)



Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 18

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.

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 19

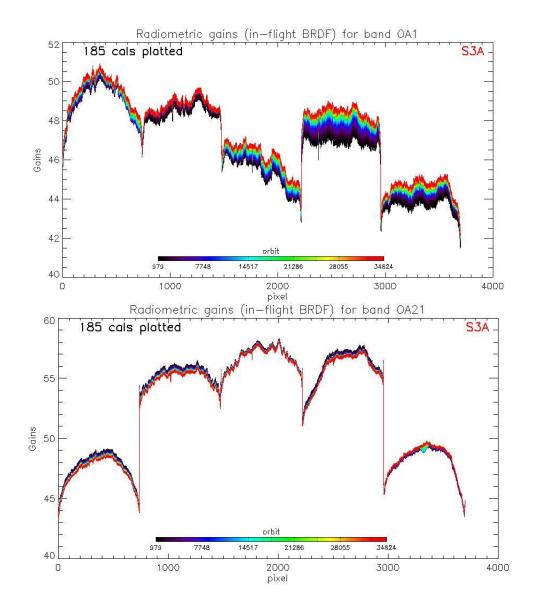


Figure 22: OLCI-A Gain Coefficients for band Oa1 (top) and Oa21 (bottom), derived using the in-flight BRDF model. The dataset is made of all diffuser 1 radiometric calibrations since orbit 979.

Figure 23 displays a summary of the time evolution of the cross-track average of the gains (in-flight BRDF, taking into account the diffuser ageing), for each module, relative to a given reference calibration (the 25/04/2016, change of OLCI channel settings). It shows that, if a significant evolution occurred during the early mission, the trends tend in general to stabilize, with some exceptions (e.g. band 1 of camera 1 and 4, bands 2 & 3 of camera 5).



Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 20

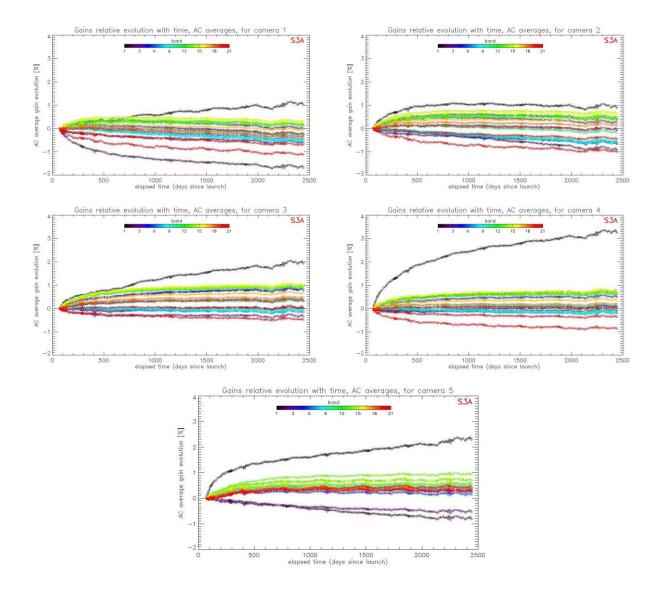


Figure 23: camera averaged gain relative evolution with respect to calibration of 25/04/2016 (change of OLCI channel settings), as a function of elapsed time since the beginning of the mission; one curve for each band (see colour code on plots), one plot for each module. The diffuser ageing is taken into account.

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.

Optical MPC

Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 21

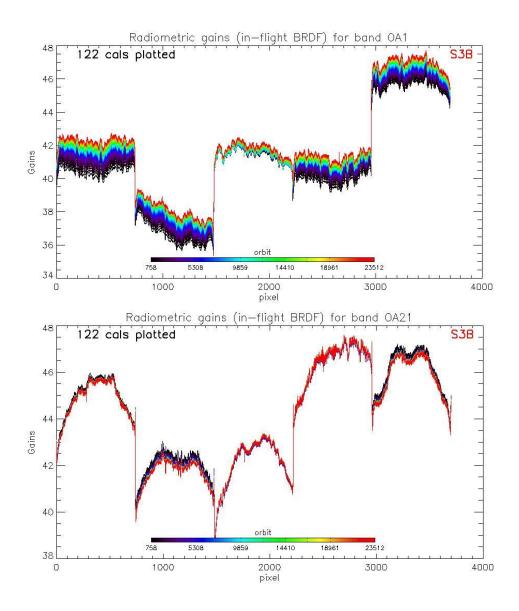


Figure 24: OLCI-B Gain Coefficients for band Oa1 (top) and Oa21 (bottom), derived using the in-flight BRDF model. The dataset is made of all diffuser 1 radiometric calibrations since orbit 758.

Figure 25 displays a summary of the time evolution of the cross-track average of the gains (in-flight BRDF, taking into account diffuser ageing), for each module, relative to a given reference calibration (first calibration after channel programming change: 18/06/2018). It shows that, if a significant evolution occurred during the early mission, the trends tend to stabilize. The large amount of points near elapsed time = 220 days is due to the yaw manoeuvre campaign. The slight discontinuity near "day 920 since launch" is due to the upgrade of the Ageing model.

OPT-MPC Paulous Performance Cluster Optical Mission Performance Cluster

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

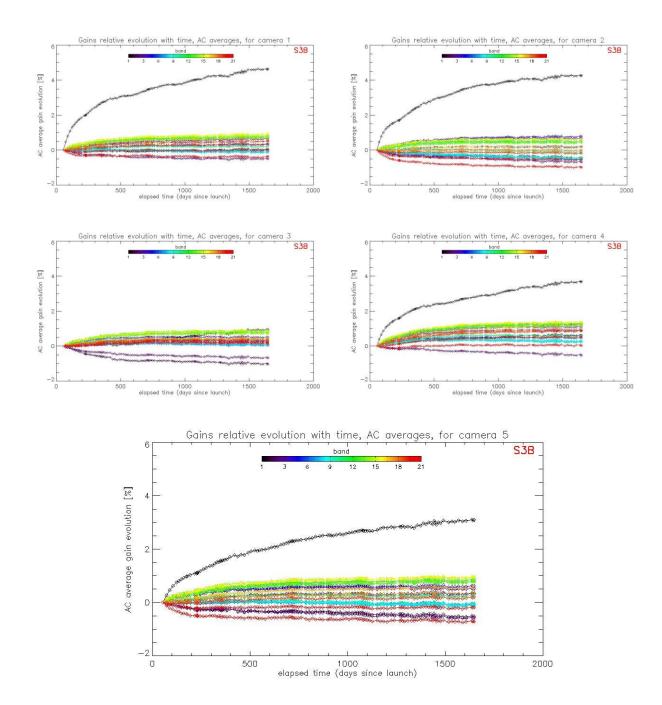


Figure 25: OLCI-B camera averaged gain relative evolution with respect to first calibration after channel programming change (18/06/2018), as a function of elapsed time since the beginning of the mission; one curve for each band (see colour code on plots), one plot for each module. The diffuser ageing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

Optical MPC

Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 23

2.2.2.2 Instrument evolution modelling

2.2.2.2.1 OLCI-A

A new OLCI-A Radiometric Gain Model has been put in operations at PDGS the 19/07/2022 (Processing Baseline 3.09). This model has been derived on the basis of a more recent (compared to the previous model) Radiometric Calibration dataset, going from 23/10/2018 to 30/04/2022. It includes the correction of the diffuser ageing for the six bluest bands (Oa1 to Oa6) for which it is clearly measurable. The model performance over the complete dataset (including the 11 calibrations in extrapolation over about 6 months) remains better than about 0.1% for all bands at the exception of Oa01 which shows the presence of a strong peak near orbit 33000 reaching about 0.16%. This peak is also present for other bands but with a smaller amplitude. The presence of this peak makes it difficult to assess if any small drift of the model with respect to the most recent data is already visible or not. The previous model, trained on a Radiometric Dataset limited to 03/10/2021, shows a clear drift of the model with respect to most recent data (Figure 27), that motivated the change. Comparison of the two figures shows the improvement brought by the updated model over almost all the mission. Performance shown on Figure 26 adopts, as for OLCI-B, the multiple model approach, i.e. different models (three for OLCI-A since PB, three for OLCI-B since PB 1.57) are used to cover the whole mission (red dashed line on Figure 26), each model being fitted on a partial dataset (green dashed line on Figure 26) whose coverage is optimised to provide best performance.

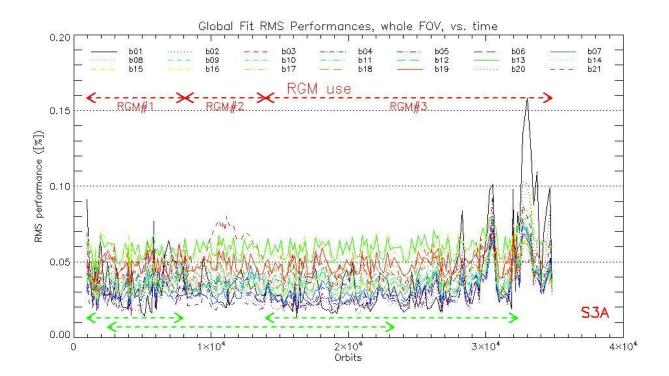


Figure 26: RMS performance of the OLCI-A Gain Model of the current processing baseline as a function of orbit.



Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 24

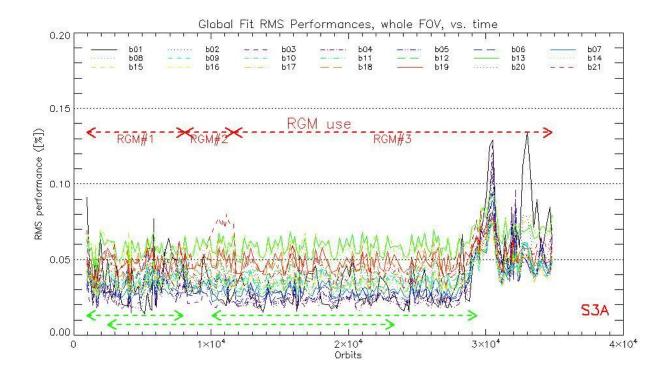


Figure 27: RMS performance of the OLCI-A Gain Model of the previous Processing Baseline as a function of orbit.

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

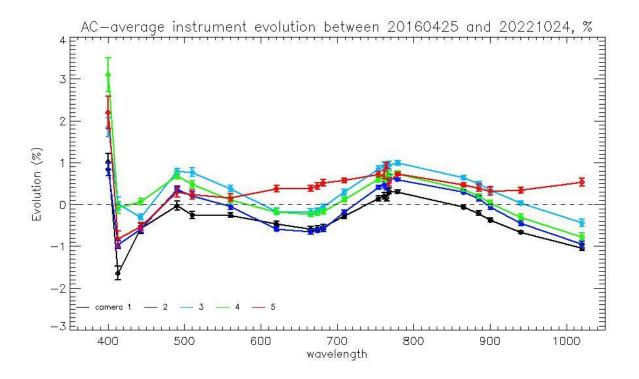


Figure 28: OLCI-A Camera-averaged instrument evolution since channel programming change (25/04/2016) and up to the most recent calibration (24/10/2022) versus wavelength.

OPT-MPC Paragraphic Support Control Mission Performance Cluster Optical Mission Performance Cluster

Optical MPC

Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 25

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

Finally, Figure 30 to Figure 32 show the detail of the model performance, with across-track plots of the model over data ratios at each orbit, one plot for each channel.

Comparisons of Figure 30 to Figure 32 with their counterparts in DQR of July 2022 clearly demonstrate the improvement brought by the new model whatever the level of detail.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

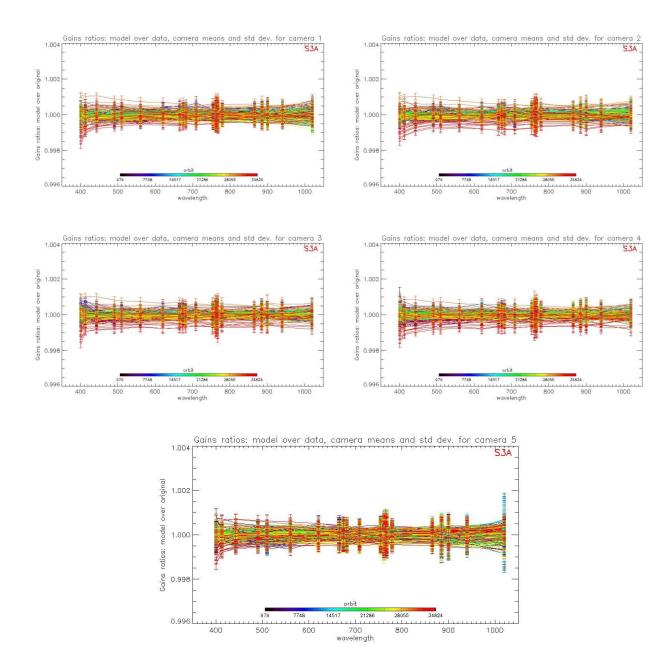


Figure 29: For the 5 cameras: OLCI-A Evolution model performance, as camera-average and standard deviation of ratio of Model over Data vs. wavelength, for each orbit of the test dataset, including 11 calibrations in extrapolation, with a colour code for each calibration from blue (oldest) to red (most recent).



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

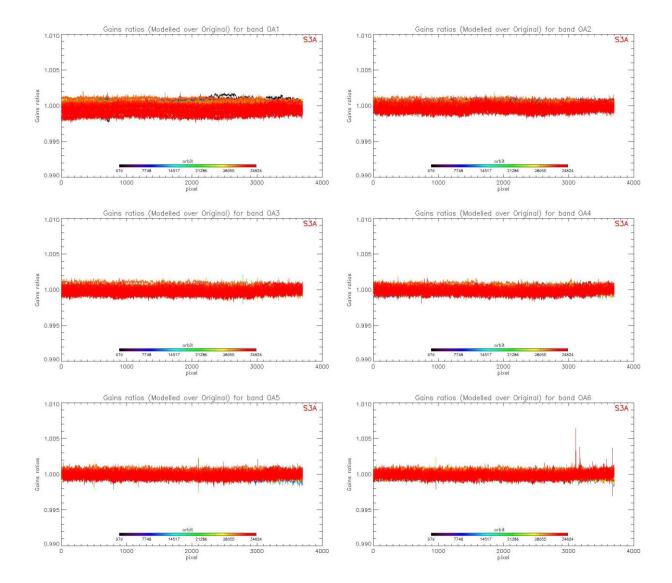


Figure 30: OLCI-A evolution model performance, as ratio of Model over Data vs. pixels, all cameras side by side, over the whole current calibration dataset (since instrument programming update), including 11 calibrations in extrapolation, channels Oa1 to Oa6.

OPT-MPC Particle Mixton Performance Cluster Optical Mixton Performance Cluster

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

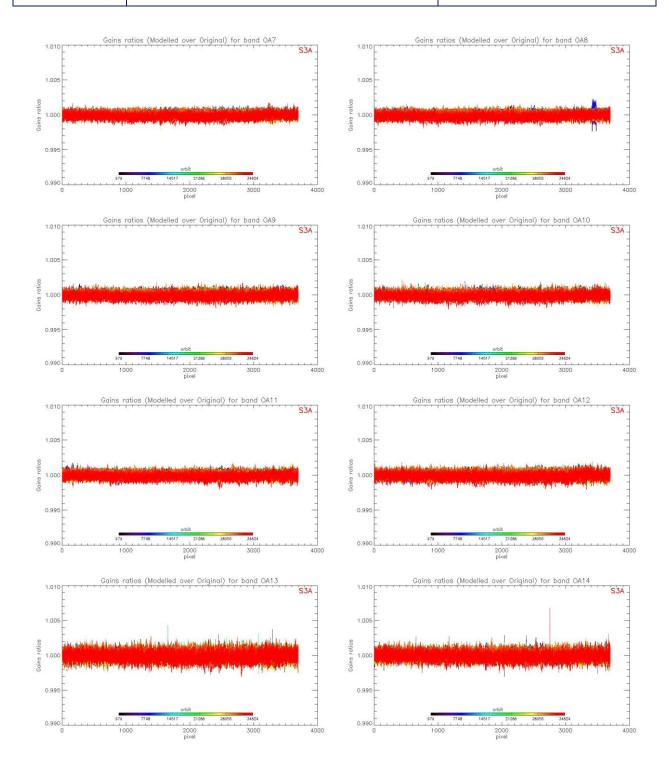


Figure 31: same as Figure 30 for channels Oa7 to Oa14.

OPT-MPC Parties Source Control of Control o

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

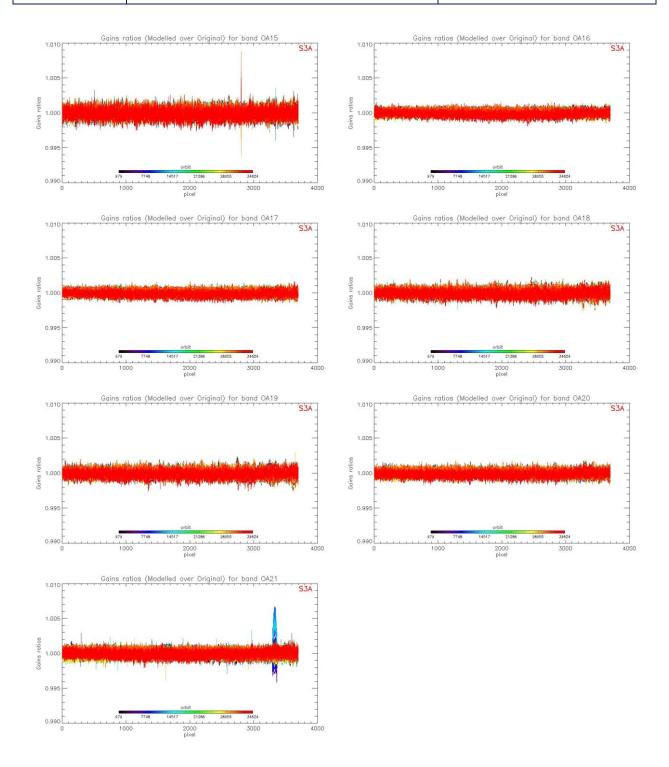


Figure 32: same as Figure 30 for channels Oa15 to Oa21.

Optical MPC

Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 30

2.2.2.2. OLCI-B

A new OLCI-B Radiometric Gain Model, has been put in operations at PDGS on 19/07/2022 (Processing Baseline 3.09). This model has been derived on the basis of an extended Radiometric Calibration dataset (from 13/04/2019 to 29/04/2022). It includes the correction of the diffuser ageing for the five bluest bands (Oa1 to Oa5) for which it is clearly measurable. The model performance over the complete dataset (including 11 calibrations in extrapolation over about 6 months) is illustrated in Figure 33. It remains better than 0.12% when averaged over the whole field of view for all bands. No clear drift of the model with respect to the most recent data is visible so far for any band. The previous model, trained on a Radiometric Dataset limited to 16/09/2021, shows a pronounced drift of the model with respect to most recent data, especially for band Oa01 (Figure 34). Comparison of the two figures shows the improvement brought by the updated Model over all the mission.

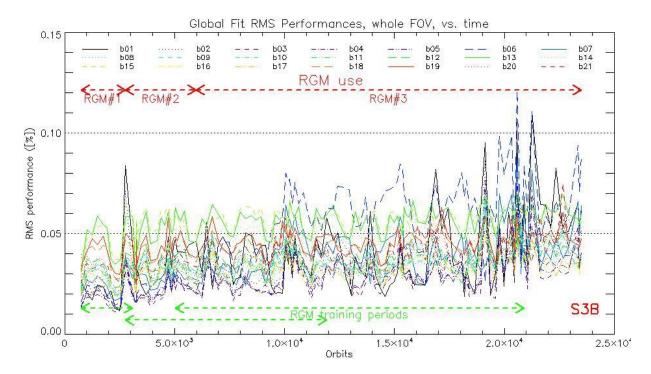


Figure 33: RMS performance of the OLCI-B Gain Model of the current processing baseline as a function of orbit.



Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

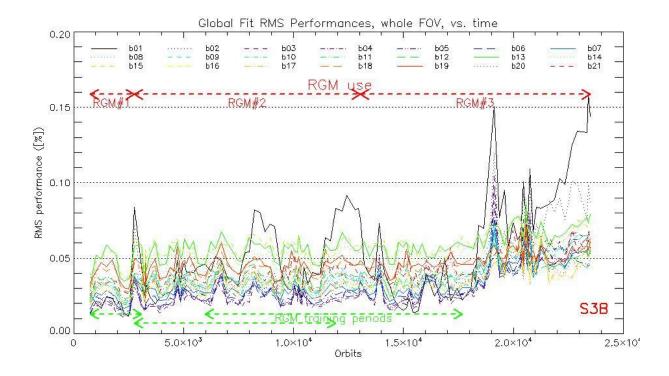


Figure 34: RMS performance of the OLCI-B Gain Model of the previous processing baseline as a function of orbit (please note the different vertical scale with respect to Figure 33).



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 32

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

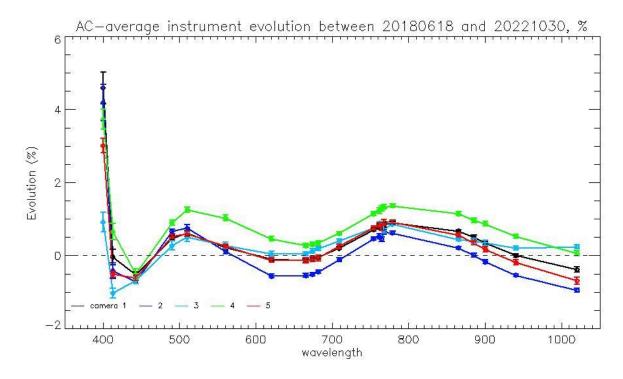


Figure 35: OLCI-B Camera-averaged instrument evolution since channel programming change (18/06/2018) and up to most recent calibration (30/10/2022) versus wavelength.

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

Finally, Figure 37 to Figure 39 show the detail of the model performance, with across-track plots of the model over data ratios at each orbit, one plot for each channel.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

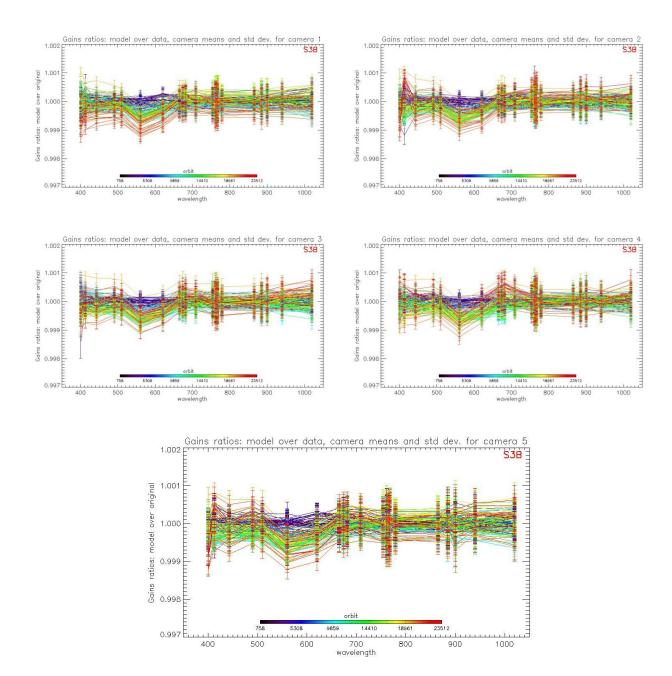


Figure 36: For the 5 cameras: OLCI-B Evolution model performance, as camera-average and standard deviation of ratio of Model over Data vs. wavelength, for each orbit of the test dataset, including 11 calibrations in extrapolation, with a colour code for each calibration from blue (oldest) to red (most recent).

OPT-MPC Page 100 Control Musican Performance Cluster

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

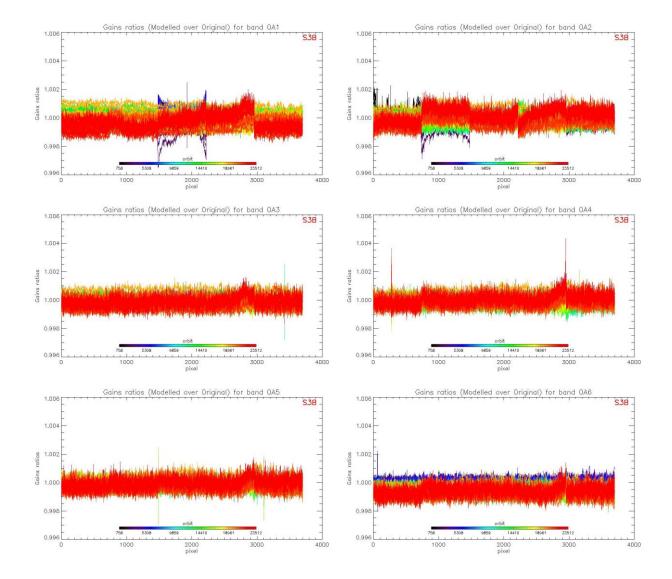


Figure 37: OLCI-B evolution model performance, as ratio of Model over Data vs. pixels, all cameras side by side, over the whole current calibration dataset (since instrument programming update), including 11 calibrations in extrapolation, channels Oa1 to Oa6.

OPT-MPC Page 10 Performance Cluster Optical Musican Performance Cluster

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

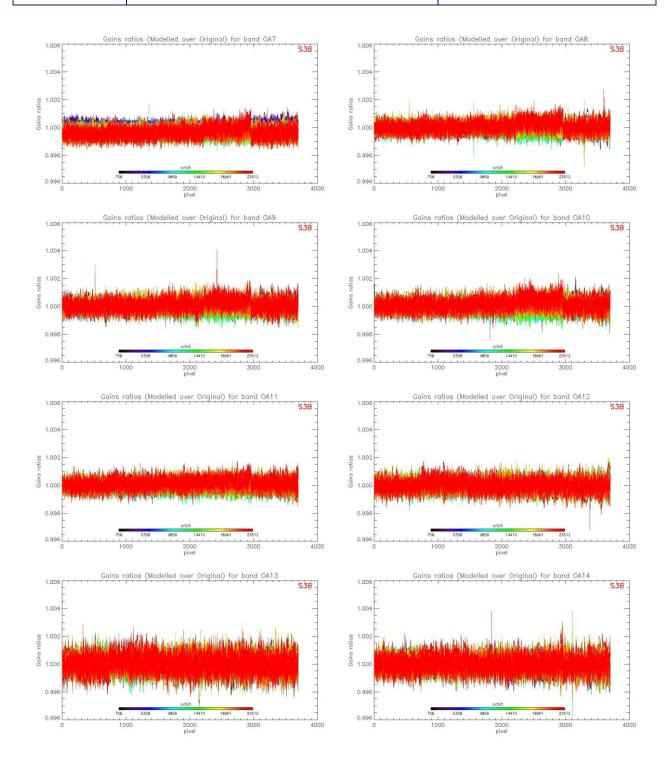


Figure 38: same as Figure 37 for channels Oa7 to Oa14.

OPT-MPC To be the second of t

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

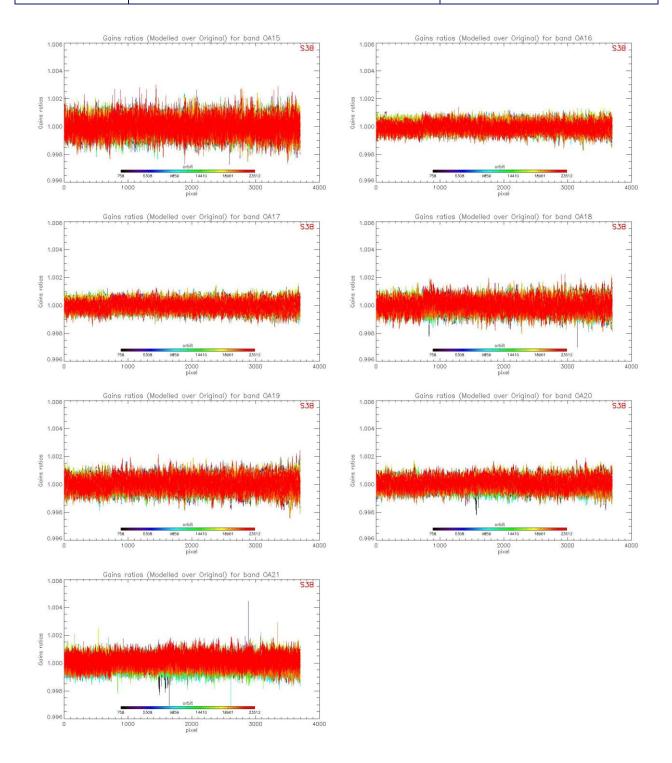


Figure 39: same as for channels Oa15 to Oa21.



Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

10/11/2022 Date:

37 Page:

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

2.2.3.1 OLCI-A

There has been no calibration sequence S05 (reference diffuser) for OLCI-A during the current reported period.

Consequently, the previous ageing results, presented in July 2022 DQR, stay valid.

2.2.3.2 OLCI-B

There has been no calibration sequence S05 (reference diffuser) for OLCI-B during the current reported period.

Consequently, the previous ageing results, presented in July 2022 DQR, stay valid.

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

2.2.4.1 OLCI-A

No CAL_AX ADF has been delivered during the report period for OLCI-A.

2.2.4.2 OLCI-B

No CAL_AX ADF has been delivered during the report period for OLCI-B.

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 38

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

2.3.1 OLCI-A

There has been no S02+S03 nor S09 Spectral Calibration for OLCI-A in the reporting period.

However, during the previous period (month of September), there was one SO2+SO3 Spectral Calibration for OLCI-A:

- S02 sequence (diffuser 1) on 21/09/2022 11:15 to 11:17 (absolute orbit 34346)
- \$ S03 sequence (Erbium doped diffuser) on 21/09/2022 12:56 to 12:58 (absolute orbit 34347)

and one Spectral calibration S09:

\$ S09 sequence on 21/09/2022 09:04:51 to 09:04:57 (absolute orbit 34345)

The analysis of these OLCI-A spectral calibrations was not presented in the previous DQR. It is presented in the current DQR together with the analysis of the OLCI-B spectral calibration acquisitions of October the 1st 2022.

The S02/S03 data have been processed and analyzed to assess OLCI-A spectral long-term evolution. The absolute results are presented in Figure 40 while its long-term evolution is presented Figure 41.

The processing of the S09 calibration sequence (spectral calibration using O_2 absorption and Fraunhofer lines) is illustrated in Figure 43.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

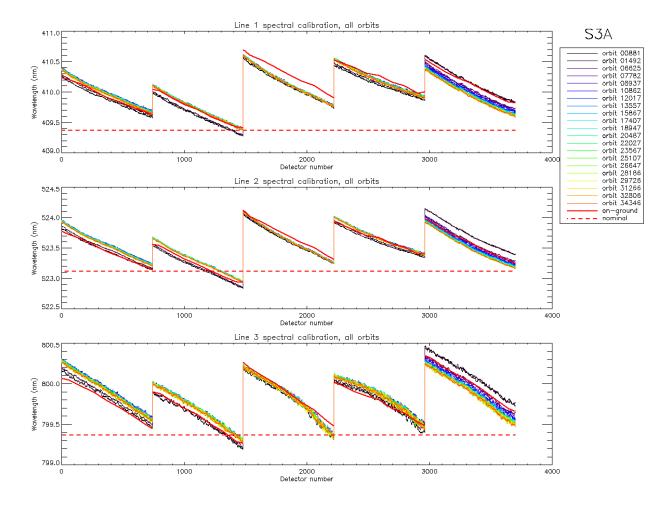


Figure 40: OLCI-A across track spectral calibration from all S02/S03 sequences since the beginning of the mission.

Top plot is spectral line 1, middle plot is spectral line 2 and bottom plot spectral line 3. The nominal spectral calibration is plotted as a red horizontal dotted line and the on-ground spectral calibration as a red thick line.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

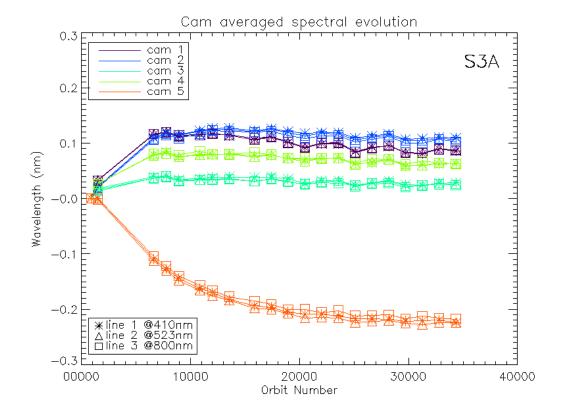


Figure 41: OLCI-A camera averaged spectral calibration evolution as a function of time since launch (all spectral S02/S03 calibrations since the beginning of the mission are included). The data are normalized with the first Spectral Calibration of the plot.

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

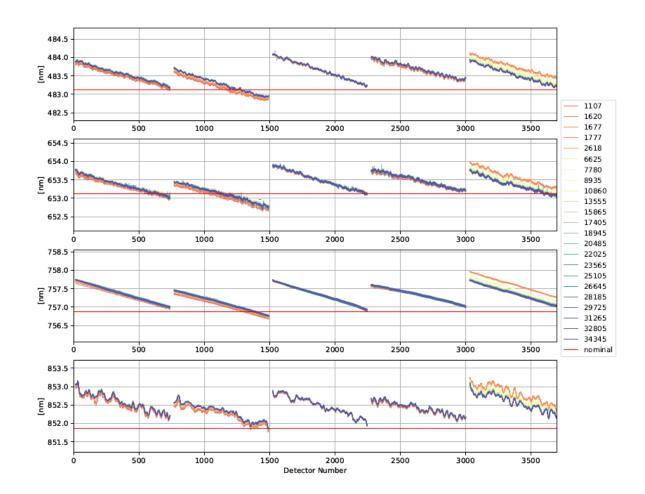


Figure 42: OLCI-A across track spectral calibration from all S09 sequences since the beginning of the mission. The used features are the atmospheric oxygen at 759nm and the Fraunhofer lines at 485nm, 656nm and 854nm. The nominal spectral calibration is plotted as a red dotted line.

Optical MPC

Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 42

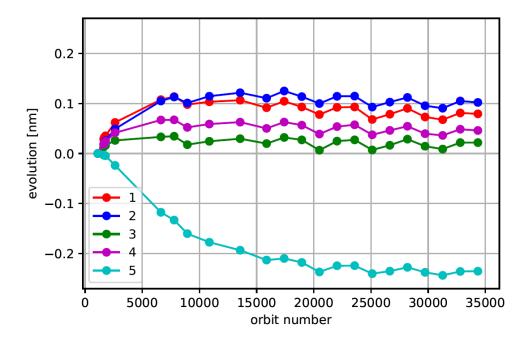


Figure 43: OLCI-A camera averaged spectral calibration evolution as a function of orbit number from S09 calibrations since the 4th May 2016. The last calibration for S09 is from 05 June 2022. For each camera, the spectral evolution corresponding derived from spectral lines at 485 nm, 656 nm, 770 nm and 854 nm have been averaged. The data are normalized with the first Spectral Calibration of the plot.

We see that the long term evolution of the spectral calibration obtained with sequence S09 (Figure 43) is in rather good agreement with the one obtained with sequence S02/S03 (Figure 41). Indeed, for camera 1, 2, 3 and 4, we observe for the two methods a positive trend of the spectral calibration at the beginning of the mission, which is now rather stabilized, and for camera 5, an obvious negative trend since almost the beginning of the mission which is also stabilizing but more progressively. In all cases, the spectral calibration drift since the beginning of the mission is smaller than ≈0.23 nm and the change with respect to the values included in the Auxiliary Data files is less than 0.1 nm. However, camera 5 still evolves but with a slower rate; only further monitoring will allow to assess the need for an evolution of the Auxiliary Parameters impacted by the instrument spectral model, reflecting the current or future state of the instrument.

2.3.2 OLCI-B

There has been one SO2+SO3 Spectral Calibration for OLCI-B in the reporting period:

- S02 sequence (diffuser 1) on 01/10/2022 11:18 to 11:20 (absolute orbit 23095)
- \$ S03 sequence (Erbium doped diffuser) on 01/10/2022 12:59 to 13:01 (absolute orbit 23096)

and one Spectral calibration S09:

S09 sequence on 01/10/2022 09:06:47 to 09:06:53 (absolute orbit 23094)

Optical MPC

Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 43

The SO2/SO3 data have been processed and analyzed to assess OLCI-B spectral long-term evolution. The absolute results are presented in Figure 44, while its long term evolution is presented on Figure 45. The processing of the SO9 calibration sequence (spectral calibration using O2 absorption and Fraunhofer lines) is now available and presented in Figure 46 and Figure 47.

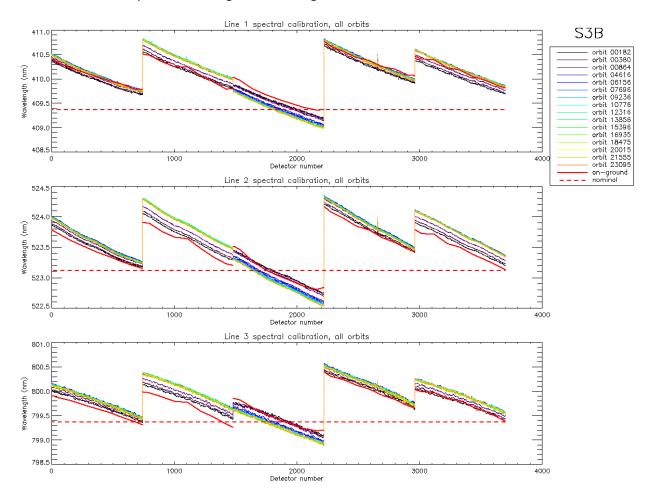


Figure 44: OLCI-B across track spectral calibration from all S02/S03 sequences since the beginning of the mission.

Top plot is spectral line 1, middle plot is spectral line 2 and bottom plot spectral line 3. The nominal spectral calibration is plotted as a red dotted line and the on-ground spectral calibration as a red thick line.



Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

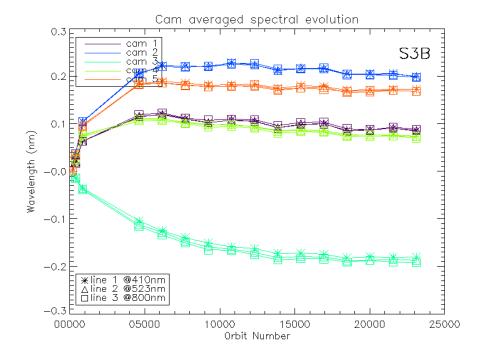


Figure 45: OLCI-B camera averaged spectral calibration evolution as a function of time since launch (all spectral S02/S03 calibrations since the beginning of the mission are included). The data are normalized with the first Spectral Calibration.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

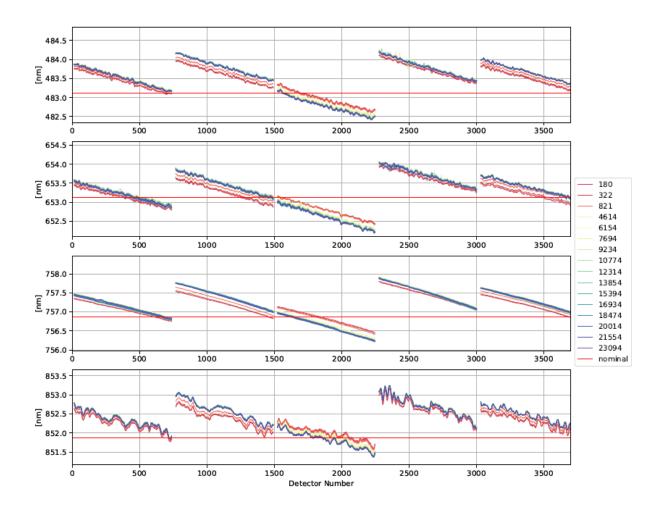


Figure 46: OLCI-B across track spectral calibration from all (few during commissioning have been left out for the sake of clearness) S09 sequences since the beginning of the mission. The used features are the atmospheric oxygen at 759nm and the Fraunhofer lines at 485nm, 656nm and 854nm. The nominal spectral calibration is plotted as a red dotted line.

Optical MPC

Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 46

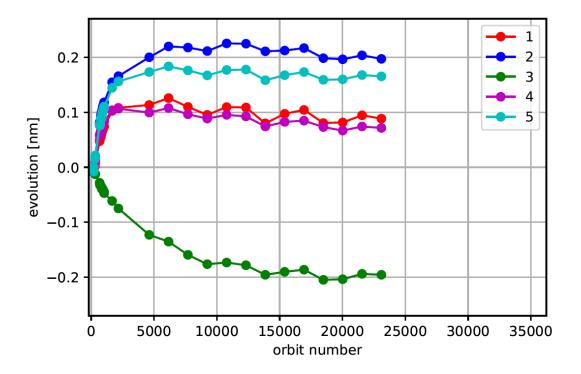


Figure 47: OLCI-B camera averaged spectral calibration evolution as a function of orbit number since launch from S09 calibrations since the beginning of the mission. The last calibration for S09 is from 15 June 2022. For each camera, the spectral evolution corresponding derived from spectral lines at 485 nm, 656 nm, 770 nm and 854 nm have been averaged. The data are normalized with the first Spectral Calibration.

Figure 44 to Figure 47 show that:

- As for OLCI-A camera 5, the wavelength calibration drift of OLCI-B camera 3 goes in the opposite direction than for the other cameras.
- It seems than the quick drift of the early mission has stabilized especially for camera 1, 2, 4 and 5.
 The stabilization for camera 3 is now also clearly visible even though it took more time to stabilize than for other camera.
- The results obtained with the S02/S03 method and the one obtained with the S09 method are rather similar.

The spectral calibration drift is smaller than ≈0.23 nm for all cases.

OPT-MPC Optical MPC Data Quality Report - Ser

Data Quality Report –Sentinel-3 OLCI October 2022

Issue: 1.0

Ref.:

Date: 10/11/2022

OMPC.ACR.DQR.03.10-2022

Page: 47

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 48.

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

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

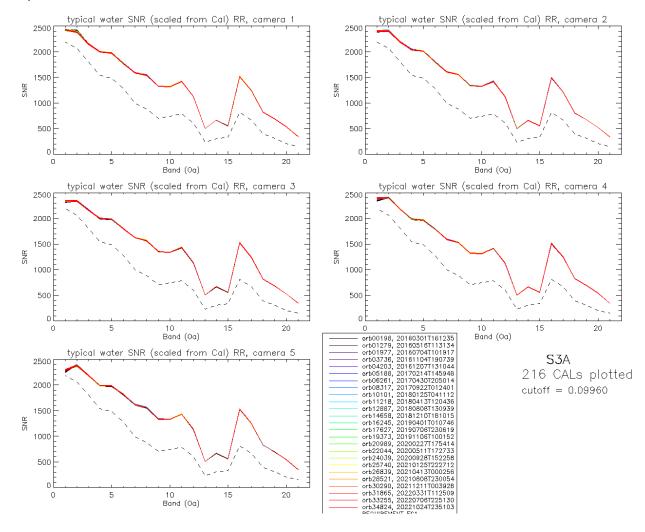


Figure 48: OLCI-A Signal to Noise ratio as a function of the spectral band for the 5 cameras. These results have been computed from radiometric calibration data. All calibrations except first one (orbit 183) are presents with the colours corresponding to the orbit number (see legend). The SNR is very stable with time: the curves for all orbits are almost superimposed. The dashed curve is the ESA requirement.

Optical MPC

Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 48

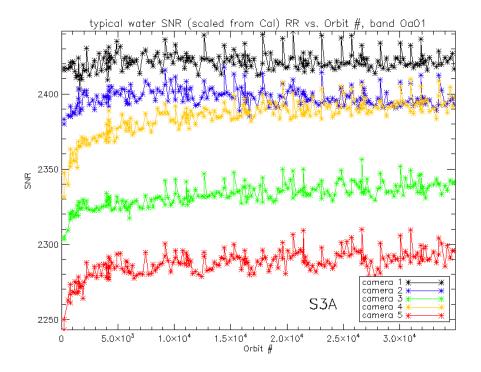


Figure 49: long-term stability of the SNR estimates from Calibration data, example of channel Oa1.

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.

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

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

	L_{ref}	SNR	C1		C2		C3		C4		C5		All	
nm	LU	RQT	avg	std	avg	std	avg	std	avg	std	avg	std	avg	std
400.000	63.0	2188	2421	6.0	2398	6.2	2332	7.8	2384	12.0	2287	9.2	2364	6.8
412.000	74.1	2061	2387	9.3	2403	7.2	2339	5.0	2401	5.0	2379	9.3	2382	5.7
442.000	65.6	1811	2157	6.1	2196	6.1	2163	4.9	2185	4.1	2193	5.9	2179	4.2
490.000	51.2	1541	1999	4.7	2036	4.8	1998	4.1	1984	4.3	1988	4.4	2001	3.1
510.000	44.4	1488	1979	5.3	2014	4.8	1986	4.5	1967	4.4	1985	4.2	1986	3.4
560.000	31.5	1280	1775	4.6	1802	4.1	1803	4.7	1794	3.8	1819	3.3	1799	3.0
620.000	21.1	997	1591	4.1	1608	4.4	1624	3.1	1593	3.3	1615	3.4	1606	2.6
665.000	16.4	883	1545	4.2	1557	4.6	1566	4.0	1533	3.6	1561	3.6	1552	3.0
674.000	15.7	707	1328	3.4	1336	3.7	1350	2.8	1323	3.3	1343	3.3	1336	2.4
681.000	15.1	745	1319	3.6	1325	3.3	1338	2.7	1314	2.5	1334	3.3	1326	2.1
709.000	12.7	785	1420	4.2	1420	4.1	1435	3.3	1414	3.5	1431	3.0	1424	2.7
754.000	10.3	605	1127	3.1	1121	2.8	1136	3.1	1125	2.5	1139	2.7	1130	2.2
761.000	6.1	232	502	1.1	498	1.1	505	1.1	501	1.1	508	1.3	503	0.8
764.000	7.1	305	663	1.5	658	1.5	668	2.0	662	1.5	670	2.0	664	1.3
768.000	7.6	330	558	1.4	554	1.3	563	1.3	557	1.3	564	1.3	559	1.0
779.000	9.2	812	1516	4.6	1498	4.4	1527	5.1	1512	4.9	1527	4.8	1516	4.0
865.000	6.2	666	1243	3.5	1213	3.4	1239	3.8	1246	3.5	1250	2.8	1238	2.7



Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 50

	L _{ref}	SNR	C1		C2		C3		C4		C5		All	
885.000	6.0	395	823	1.7	801	1.6	814	1.9	824	1.5	831	1.6	819	1.1
900.000	4.7	308	691	1.6	673	1.3	683	1.6	693	1.5	698	1.4	688	1.0
940.000	2.4	203	534	1.2	522	1.2	525	1.0	539	1.1	542	1.3	532	0.7
1020.000	3.9	152	345	0.9	337	0.8	348	0.7	345	0.8	351	0.8	345	0.5

2.4.1.2 OLCI-B

SNR computed for all OLCI-B calibration data (S01, S04 (but not the dark-only S04) and S05 sequences) as a function of band number is presented in Figure 50.

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 51.

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

OPT-MPC Page 15 Copical Mission Performance Cluster

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

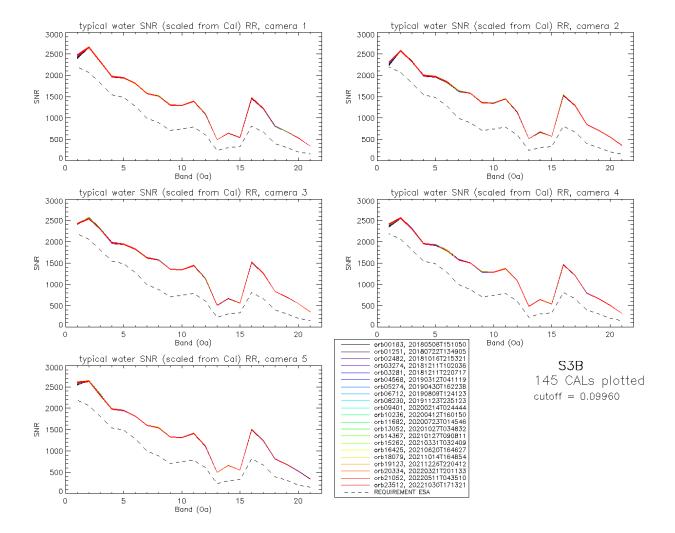


Figure 50: OLCI-B Signal to Noise ratio as a function of the spectral band for the 5 cameras. These results have been computed from radiometric calibration data. All calibrations except first one (orbit 167) are presents with the colours corresponding to the orbit number (see legend). The SNR is very stable with time: the curves for all orbits are almost superimposed. The dashed curve is the ESA requirement.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

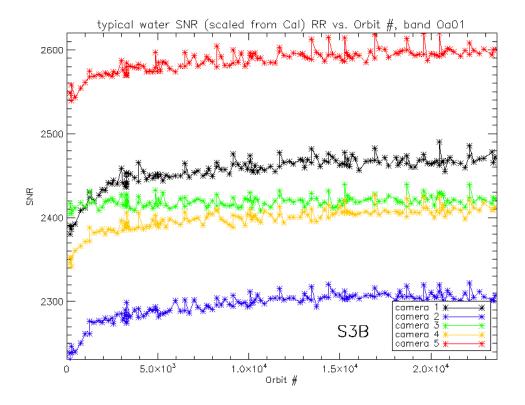


Figure 51: long-term stability of the OLCI-B SNR estimates from Calibration data, example of channel Oa1.

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

Optical MPC

Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

	L_{ref}	SNR	C1		C2		C3		C4		C5		All	
nm	LU	RQT	avg	std	avg	std	avg	std	avg	std	avg	std	avg	std
400.000	63.0	2188	2456	18.8	2295	16.5	2419	6.4	2398	13.9	2587	14.0	2431	12.9
412.000	74.1	2061	2654	7.0	2569	6.3	2543	8.4	2550	6.2	2637	7.5	2591	5.5
442.000	65.6	1811	2324	6.6	2316	6.2	2299	6.6	2302	6.9	2308	6.6	2310	5.6
490.000	51.2	1541	1966	4.8	1990	5.6	1971	5.1	1952	4.6	1979	4.5	1972	3.9
510.000	44.4	1488	1939	4.7	1968	5.8	1942	4.9	1924	4.9	1951	4.7	1945	3.9
560.000	31.5	1280	1813	4.7	1848	4.9	1829	4.6	1804	4.7	1817	4.0	1822	3.6
620.000	21.1	997	1572	4.3	1626	4.6	1624	3.9	1576	3.7	1601	3.5	1600	2.9
665.000	16.4	883	1513	4.2	1578	3.8	1573	3.8	1501	3.0	1546	3.8	1542	2.8
674.000	15.7	707	1300	3.8	1358	3.6	1353	3.2	1292	2.6	1328	2.9	1326	2.3
681.000	15.1	745	1293	3.5	1347	3.2	1343	2.9	1285	2.7	1316	2.9	1317	2.1
709.000	12.7	785	1390	4.0	1447	4.1	1443	4.0	1373	2.9	1412	3.6	1413	2.9
754.000	10.3	605	1096	3.6	1143	3.6	1142	3.3	1089	2.8	1116	3.2	1117	2.8
761.000	6.1	232	488	1.2	509	1.2	509	1.4	485	1.2	498	1.4	498	1.0
764.000	7.1	305	643	1.6	672	1.9	672	1.8	641	1.7	658	1.8	657	1.5
768.000	7.6	330	541	1.4	568	1.4	564	1.3	541	1.3	555	1.5	554	1.0
779.000	9.2	812	1467	4.2	1535	4.6	1527	5.3	1467	4.0	1507	4.3	1501	3.8
865.000	6.2	666	1221	3.6	1287	3.8	1258	3.6	1205	3.6	1238	2.9	1242	2.8
885.000	6.0	395	808	2.3	847	1.8	834	2.0	799	1.7	815	2.1	821	1.5
900.000	4.7	308	679	1.4	714	1.9	704	1.7	670	1.5	683	1.5	690	1.1
940.000	2.4	203	527	1.2	549	1.5	551	1.3	510	1.1	522	1.3	532	0.9
1020.000	3.9	152	336	8.0	358	1.2	358	8.0	318	0.7	338	0.9	342	0.6

OPT-MPC Data

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

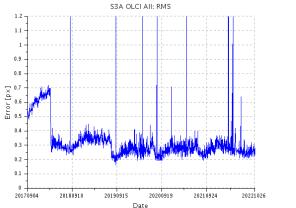
Page: 54

2.5 Geometric Calibration/Validation

2.5.1 OLCI-A

OLCI-A georeferencing performance is compliant since the introduction of MPC Geometric Calibration, put in production on the 14th of March 2018. It has however significantly improved after its last full revision of GCMs (Geometric Calibration Models, or platform to instrument alignment quaternions) and IPPVMs (Instrument Pixels Pointing Vectors) both derived using the GeoCal Tool and put in production on 30/07/2019.

The following figures (Figure 52 to Figure 57) show time series of the overall RMS performance (requirement criterion) and of the across-track and along-track biases for each camera. New plots (Figure 58 and Figure 59) introduce monitoring of the performance homogeneity within the field of view: georeferencing errors in each direction at camera transitions (difference between last pixel of camera N and first pixel of camera N+1) and within a given camera (maximum bias minus minimum inside each camera). The performance improvement since the 30/07/2019 is significant on most figures: the global RMS value decreases form around 0.35 to about 0.2 (Figure 52), the across-track biases decrease significantly for all cameras (Figure 53 to Figure 57), the along-track bias reduces for at least camera 3 (Figure 55) and the field of view homogeneity improves drastically (Figure 58 and Figure 59, but also reduction of the dispersion – distance between the ± 1 sigma lines – in Figure 53 to Figure 57).



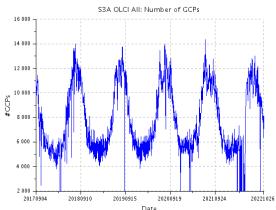


Figure 52: overall OLCI-A georeferencing RMS performance time series (left) and number of validated control points corresponding to the performance time series (right) over the whole monitoring period

Optical MPC

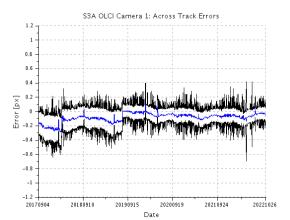
Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022



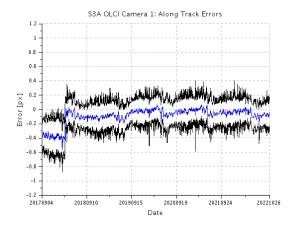
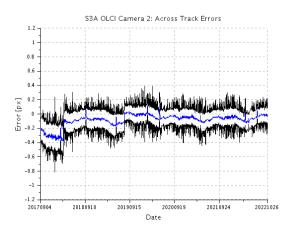


Figure 53: across-track (left) and along-track (right) OLCI-A georeferencing biases time series for Camera 1. Blue line is the average, black lines are average plus and minus 1 sigma.



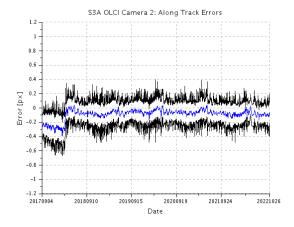
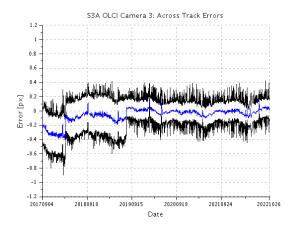


Figure 54: same as Figure 53 for Camera 2.



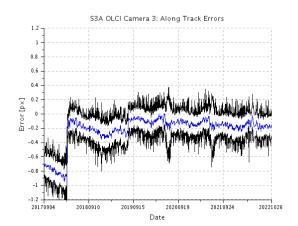


Figure 55: same as Figure 53 for Camera 3.

Optical MPC

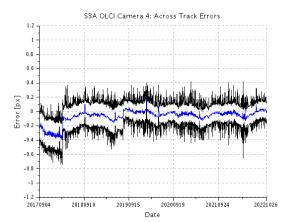
Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022



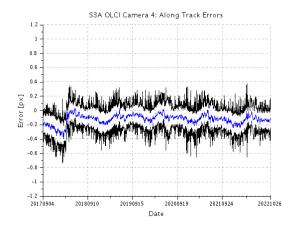
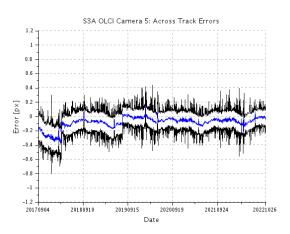


Figure 56: same as Figure 53 for Camera 4.



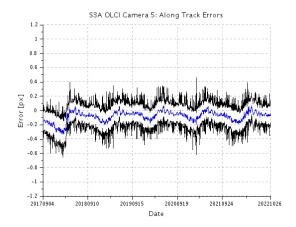
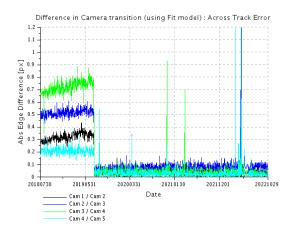


Figure 57: same as Figure 53 for Camera 5.



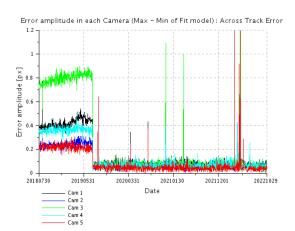


Figure 58: OLCI-A spatial across-track misregistration at each camera transition (left) and maximum amplitude of the across-track error within each camera (left).

Optical MPC

Data Quality Report - Sentinel-3 OLCI

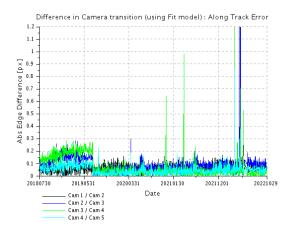
October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 57



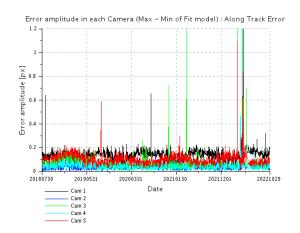


Figure 59: OLCI-A spatial along-track misregistration at each camera transition (left) and maximum amplitude of the along-track error within each camera (left).

2.5.2 OLCI-B

Georeferencing performance of OLCI-B improved significantly with the fourth geometric calibration introduced the 30/07/2019. However, the instrument pointing is still evolving, in particular for camera 2 (Figure 66) and a new geometric calibration has been done and introduced in the processing chain on the 16th of April 2020. Its impact is significant on the along-track biases of all cameras (Figure 61 to Figure 65), but also on the continuity at camera interfaces (Figure 66, left) and on intra-camera homogeneity (Figure 66, right). Since then, further adjustments to the geometric calibration have been introduced, mainly to correct the along-track drifts. The most recent was put in production on 29/07/2021and its effect can be seen e.g. on left graphs of Figure 62, Figure 63 and Figure 65 (across-track biases of cameras 2, 3 & 5).

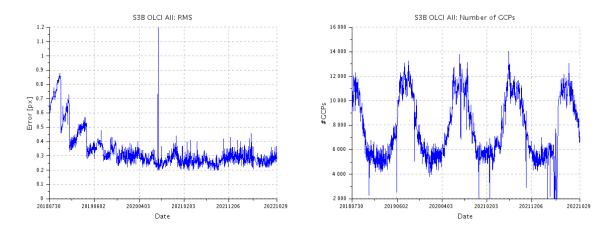


Figure 60: overall OLCI-B georeferencing RMS performance time series over the whole monitoring period (left) and corresponding number of validated control points (right)

Optical MPC

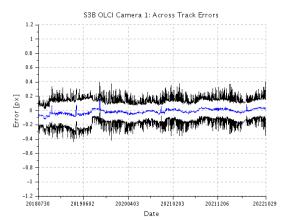
Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022



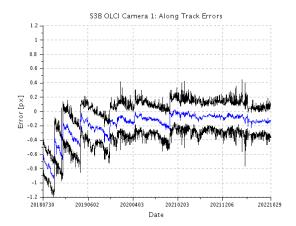
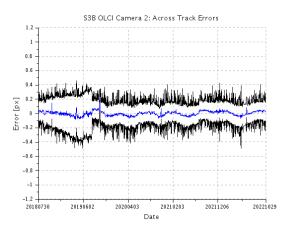


Figure 61: across-track (left) and along-track (right) OLCI-B georeferencing biases time series for Camera 1.



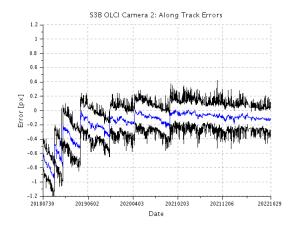
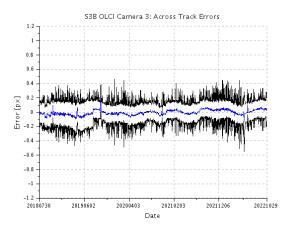


Figure 62: same as Figure 61 for Camera 2.



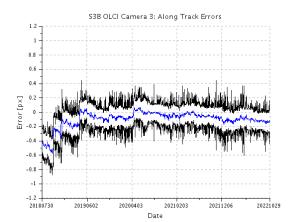


Figure 63: same as Figure 61 for Camera 3.

Optical MPC

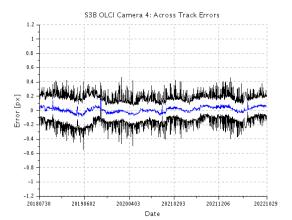
Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022



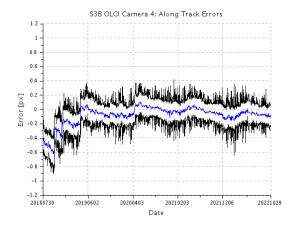
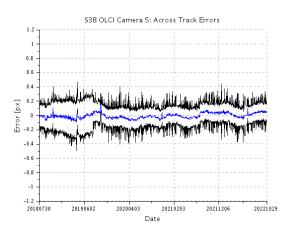


Figure 64: same as Figure 61 for Camera 4.



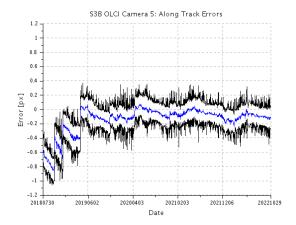
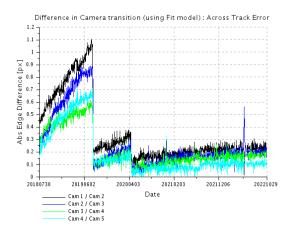


Figure 65: same as Figure 61 for Camera 5.



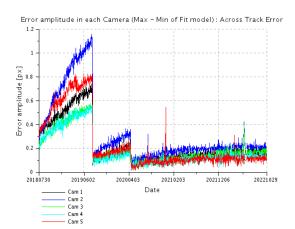


Figure 66: OLCI-B spatial across-track misregistration at each camera transition (left) and maximum amplitude of the across-track error within each camera (left).



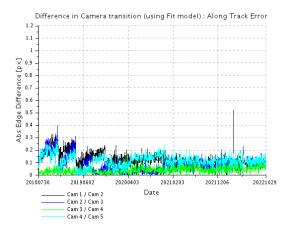
Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022



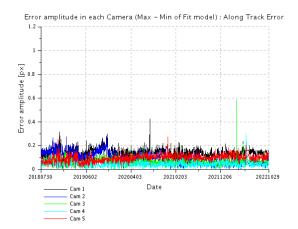


Figure 67: OLCI-B spatial along-track misregistration at each camera transition (left) and maximum amplitude of the along-track error within each camera (left).



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 61

3 OLCI Level 1 Product validation

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

3.1.1 S3ETRAC Service

Activities done

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

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

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

For illustration, we provide below statistics on the number of S3ETRAC/OLCI records generated per type of targets (DESERT, SNOW, RAYLEIGH, SUNGLINT and DCC) for both OLCI-A (Figure 68) and OLCI-B (Figure 69).



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

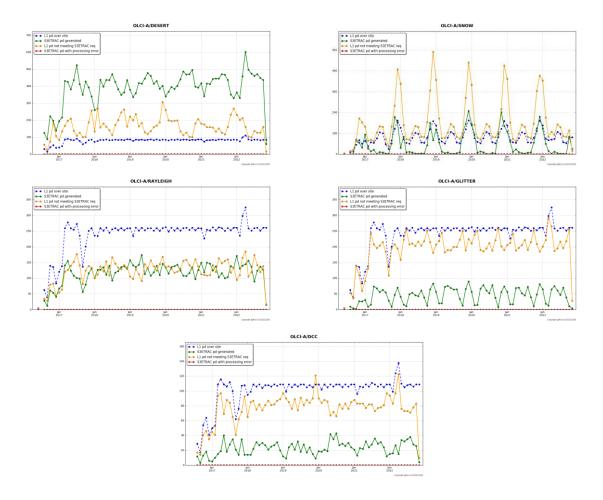


Figure 68: summary of S3ETRAC products generation for OLCI-A

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



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 63

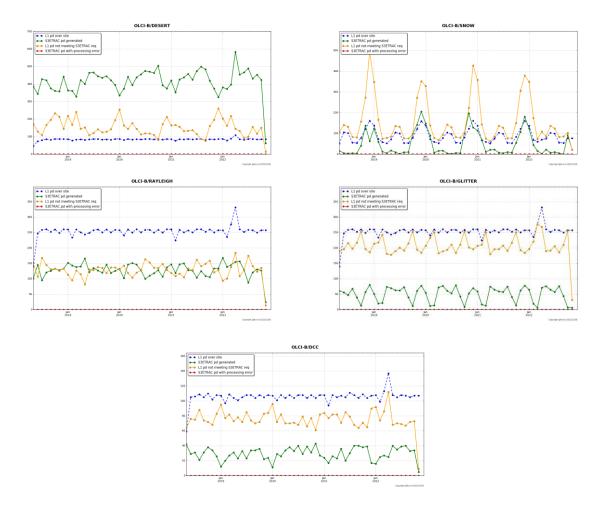


Figure 69: summary of S3ETRAC products generation for OLCI-B

(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).

3.1.2 Radiometric validation with DIMITRI

There has been no new result during the reporting period. Last figures (reported in Data Quality Report for September 2022) are considered valid.

3.1.3 Radiometric validation with OSCAR

OSCAR Rayleigh results

The OSCAR Rayleigh have been applied to the S3A and S3B S3ETRAC data from the 6 oceanic calibration sites (Table 3) using a new chlorophyll climatology which has been derived from the CMEMS OLCI monthly CHL products from considering the years 2017, 2018 and 2019.

OPT-MPC Parties OPT-MPC Optical Mission Performance Cluster Optical Mission Performance Cluster

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 64

Table 3: S3ETRAC Rayleigh Calibration sites

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

In Figure 70 the average OSCAR OLCI-A and OLCI-B Rayleigh results are given for October 2022. In Figure 71 and Table 4 the average of all 2022 scenes currently processed is given.

In the lower wavelengths, S3A/OLCI remains significantly brighter than S3B/OLCI.



Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

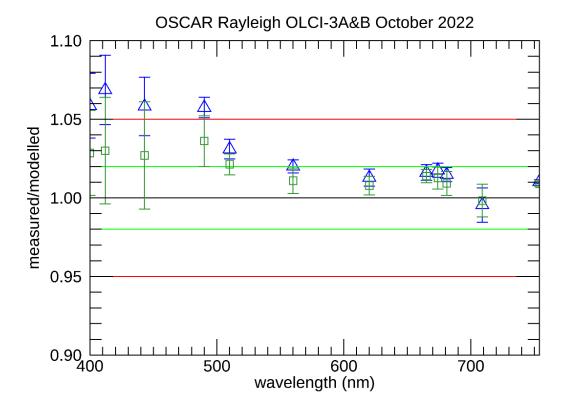


Figure 70: OSCAR Rayleigh S3A and S3B Calibration results as a function of wavelength for September 2022. The results are obtained with a new climatology derived from CMEMS OLCI monthly CHL products.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

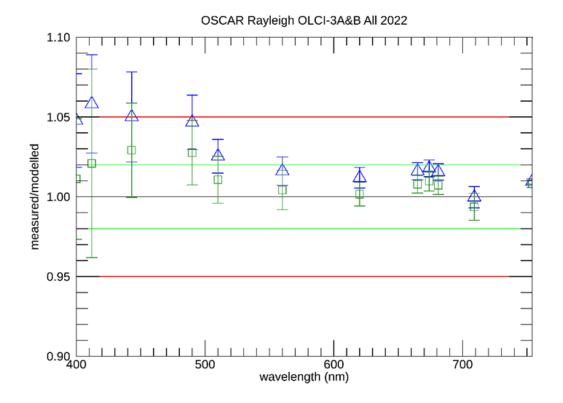


Figure 71. OSCAR Rayleigh S3A and S3B Calibration results as a function of wavelength for Jan – August 2022.

Average and standard deviation over all scenes currently (re)processed with the new climatology.

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 67

Table 4. OSCAR Rayleigh calibration results for S3A and S3B (average and standard deviation over all 2022 acquisitions) over all scenes currently (re)processed with the new climatology and observed difference (in %) between OLCIA and OLCIB

OLCI band	Wavelength	Oscar Rayleigh OLCIA		Oscar Rayleigh OLCIB		% difference OLCIA and
	(nm)	avg	stdev	avg	stdev	OLCIB
Oa01	400	1.048	0.029	1.011	0.038	3.49%
Oa02	412	1.058	0.031	1.021	0.059	3.53%
Oa03	443	1.050	0.028	1.029	0.030	1.99%
Oa04	490	1.047	0.017	1.028	0.020	1.82%
Oa05	510	1.025	0.011	1.011	0.015	1.43%
Oa06	560	1.016	0.009	1.004	0.012	1.16%
Oa07	620	1.012	0.006	1.002	0.007	1.01%
Oa08	665	1.016	0.005	1.008	0.005	0.81%
Oa09	674	1.018	0.005	1.010	0.006	0.79%
Oa10	681	1.016	0.005	1.007	0.006	0.82%
Oa11	709	1.000	0.007	0.994	0.008	0.60%
Oa12	754	1.010	0.002	1.008	0.002	0.15%

3.1.4 Radiometric validation with Moon observations

There has been no new result during the reporting period. Last figures (reported in Data Quality Report for February 2022) are considered valid.

Optical MPC

Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 68

4 Level 2 Land products validation

4.1 [OLCI-L2LRF-CV-300]

4.1.1 Routine extractions

- The focus for this time period has been on the rolling archive Non Time Critical (NT) data until the 31st of July 2022. 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 June 2016 and April 2018 for S3A and S3B respectively.

4.1.1.1 OLCI-A

Figure 72 to Figure 81 below present the Core Land Sites OLCI-A time series over the current period.

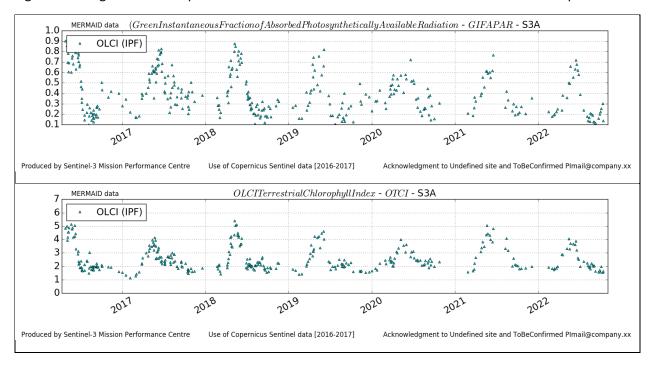


Figure 72: DeGeb time series over current report period

OPT-MPC Pulling Supplies Million Performance Cluster Capital Million Performance Cluster

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

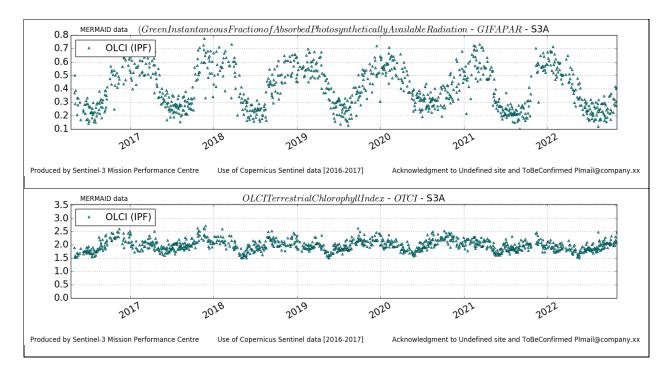


Figure 73: ITCat time series over current report period

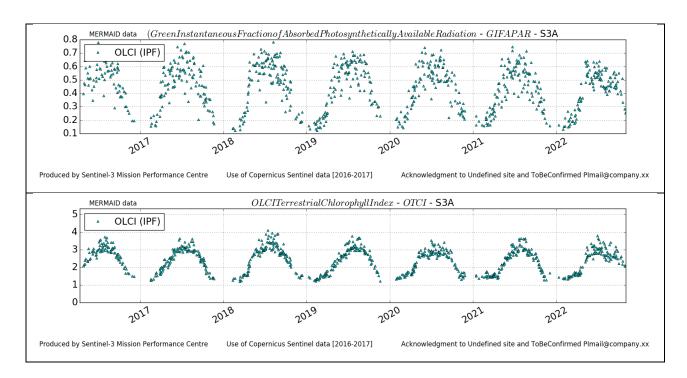


Figure 74: ITIsp time series over current report period

OPT-MPC Pulpul Mixion Performance Cluster Optical Mixion Performance Cluster

Optical MPC

Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

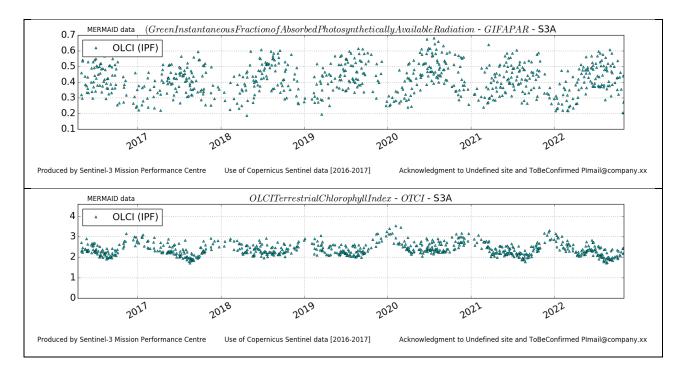


Figure 75: ITSro time series over current report period

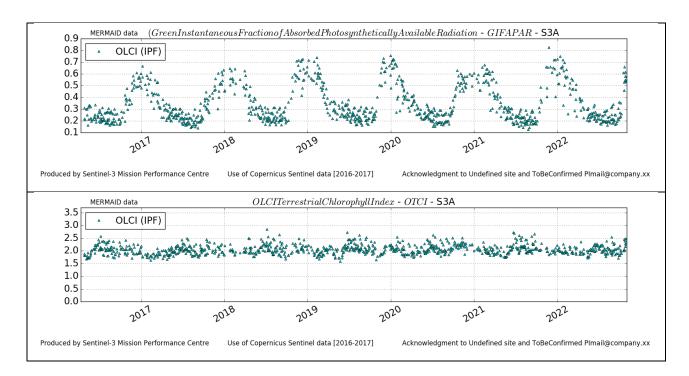


Figure 76: ITTra time series over current report period

Optical MPC

Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

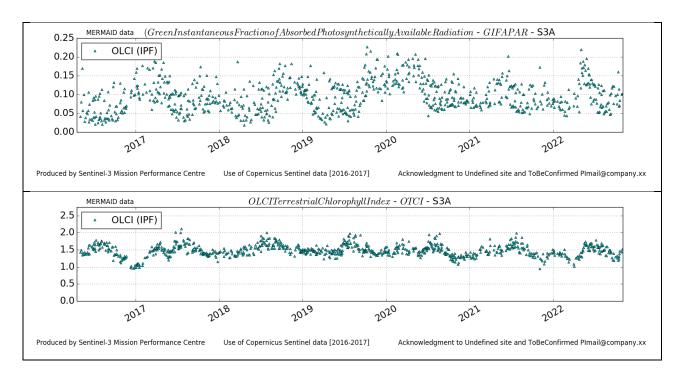


Figure 77: SPAli time series over current report period

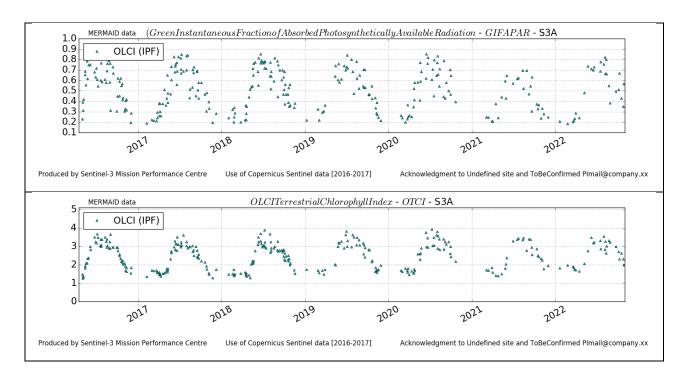


Figure 78: UKNFo time series over current report period

OPT-MPC Pulled Making Performance Cluster Copteal Making Performance Cluster

Optical MPC

Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

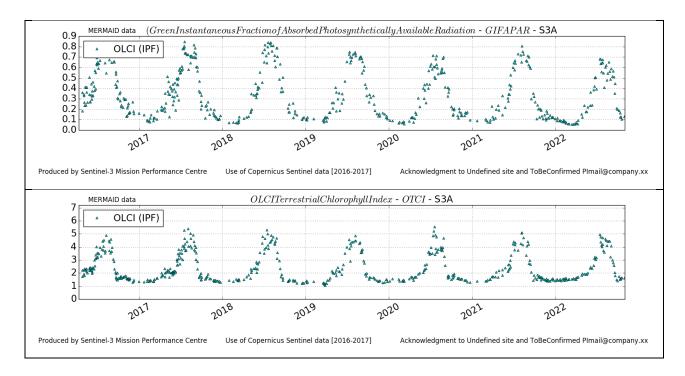


Figure 79: USNe1 time series over current report period

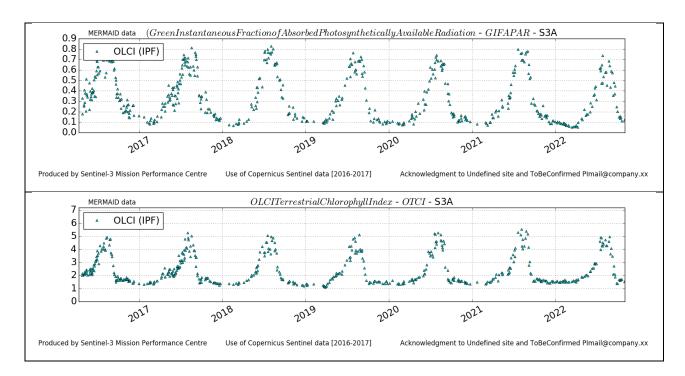


Figure 80: USNe2 time series over current report period



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 73

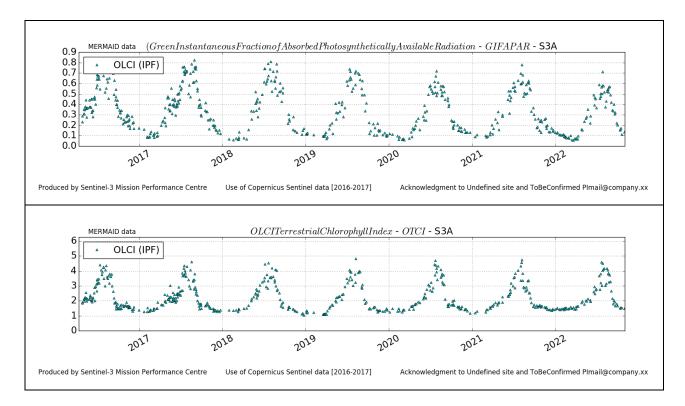


Figure 81: USNe3 time series over current report period

4.1.1.2 OLCI-B

Figure 82 to Figure 91 below present the Core Land Sites OLCI-B time series over the current period.

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

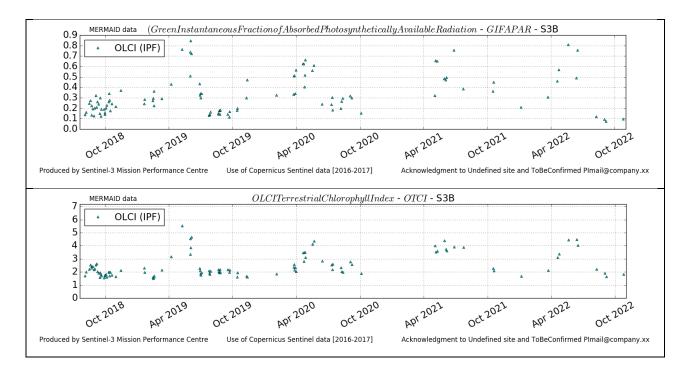


Figure 82: DeGeb time series over current report period

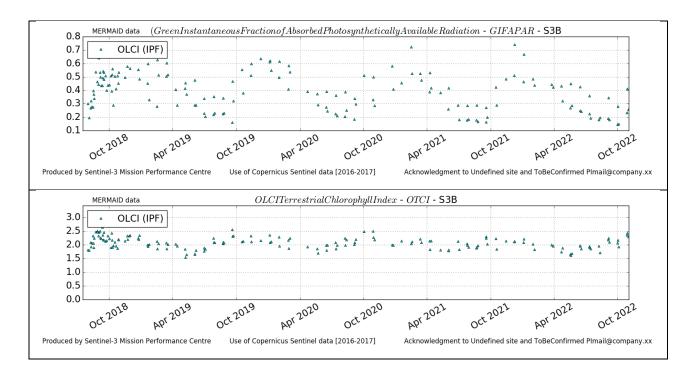


Figure 83: ITCat time series over current report period

OPT-MPC Pullus Control Million Performance Cluster Copical Million Performance Cluster

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

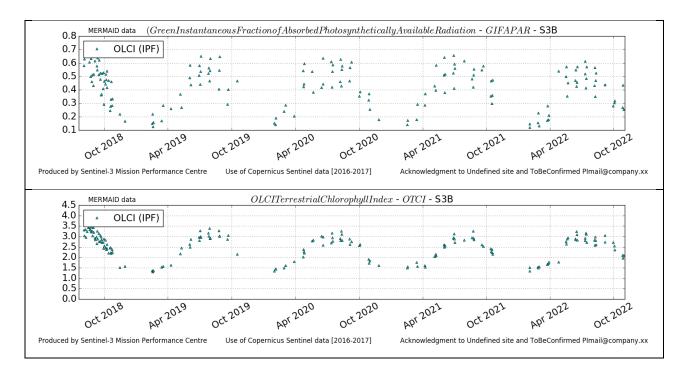


Figure 84: ITIsp time series over current report period

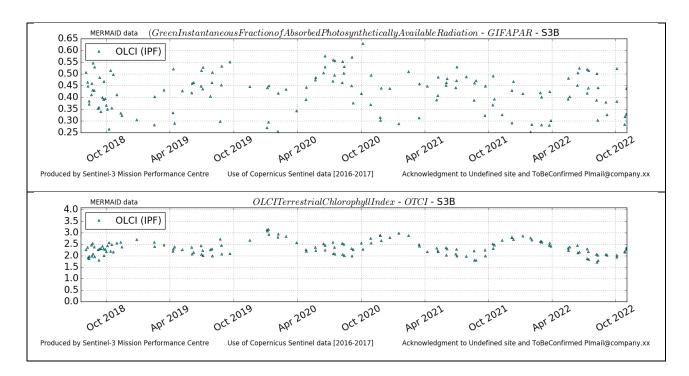


Figure 85: ITSro time series over current report period

OPT-MPC Pulpus Variation Performance Cluster Optical Maission Performance Cluster

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

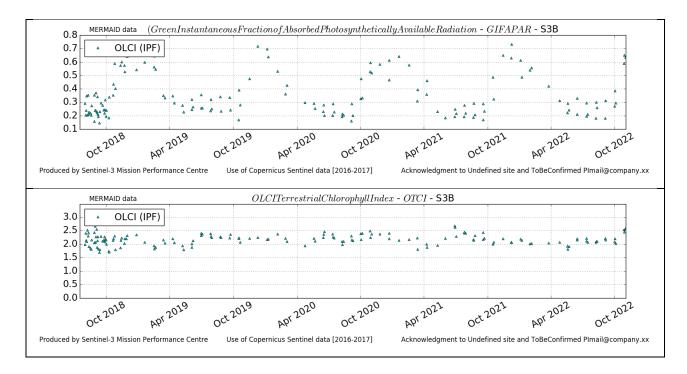


Figure 86: ITTra time series over current report period

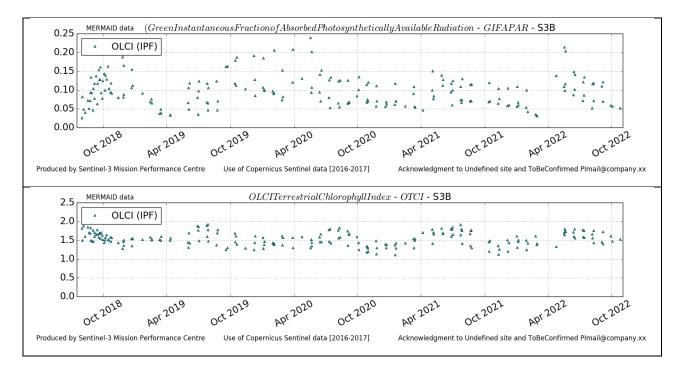


Figure 87: SPAli time series over current report period

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

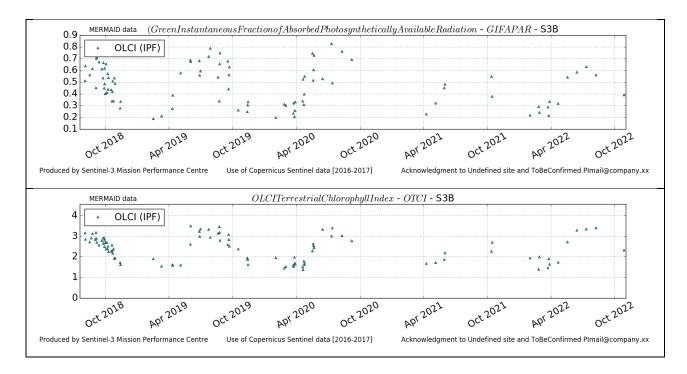


Figure 88: UKNFo time series over current report period

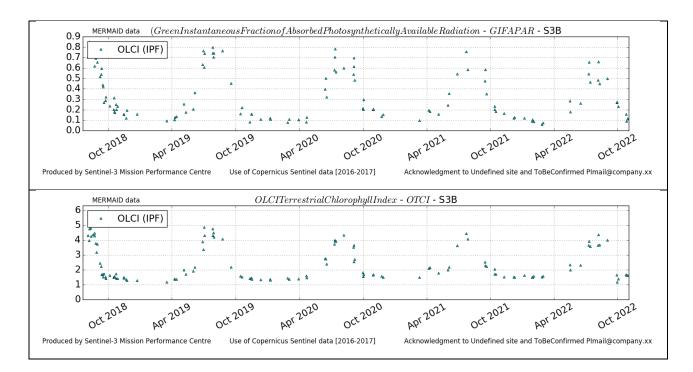


Figure 89: USNe1 time series over current report period

OPT-MPC Pulled Making Performance Cluster Copteal Making Performance Cluster

Optical MPC

Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

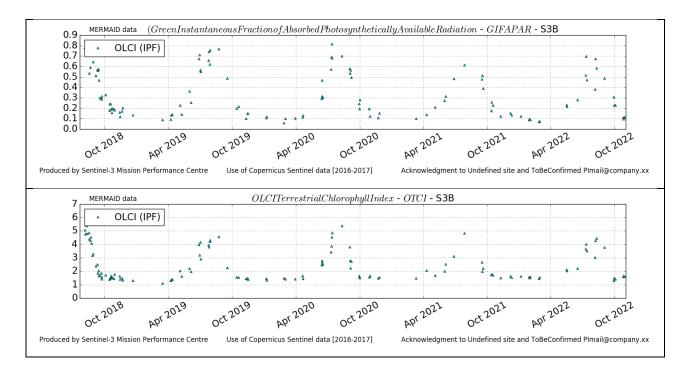


Figure 90: USNe2 time series over current report period

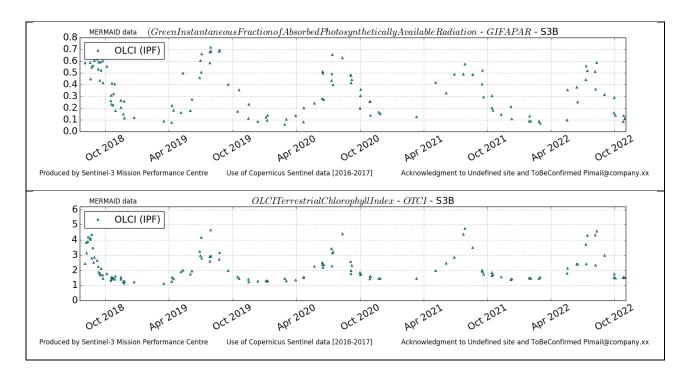


Figure 91: USNe3 time series over current report period



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 79

4.1.2 Comparisons with MERIS MGVI and MTCI climatology

There has been no new result during the reporting period. Last figures (reported in OLCI Data Quality Report covering May 2022) are considered valid.

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

4.2.1 Sky Camera based validation – prototype results for October 2022

According to the methodology presented in DQR of July 2022, the cloud masking validation results based on Sky Cameras is presented for October observations hereafter.

Figure 96 and Figure 97 show the prototype validation results for October 2022. The weather in October around Rome got again a bit more humid with most days being clouded (see Figure 92). The average rainfall for October is between 3 to 8 days, with 5 days between 1st and 31st of October 2022 (see Figure 93).

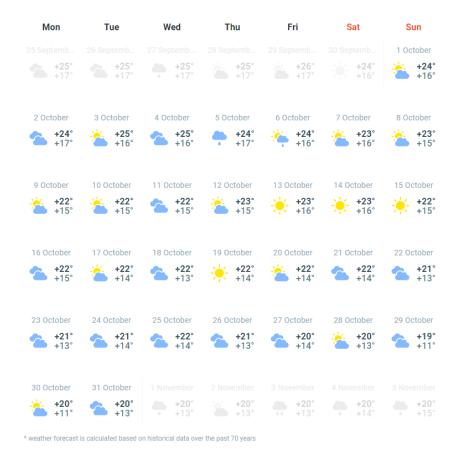


Figure 92: Temperature and cloud cover Rome, October 2022 (source: https://www.meteoprog.com/weather/Rome/month/October/)



Data Quality Report – Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 80

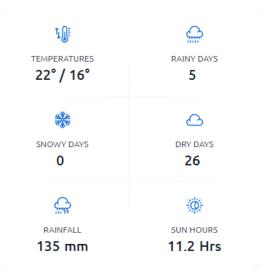


Figure 93: Average temperature, rainy days, and rainfall over Rome, October 2022 (source: https://www.weather25.com/europe/italy/lazio/rome?page=month&month=October)

Only some of the SC observation show a good amount of cloud cover (see Figure 94). Some sky camera images show fractional cloud (cumulus clouds) close to the centre of the camera, but mostly being clear. Since a 500 by 500 pixel window is extracted, this can lead to a cloud free classification of the sky camera for these dates. If one of these clouds, close to the centre of the sky camera is correctly detected by the OLCI cloud mask and then a margin is applied, this can lead to a mismatch between the sky camera classification and the OLCI cloud mask. Therefore, results with and without margin will be analysed. Only matching overpasses between the sky camera (SC) and OLCI between 1st of October and 30th of October could be found. Leaving out the 31st of October.

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

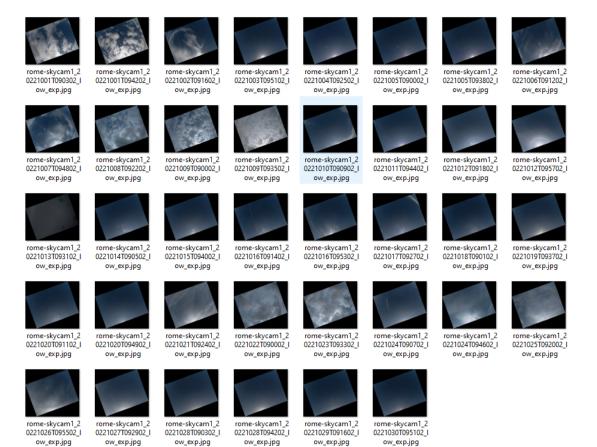


Figure 94: Sky camera acquisitions over Rome during Sentinel-3 OLCI overpass

rome-skycam1_2

0221026T095502 I

ow_exp_rf.png

rome-skycam1_2

0221027T092902 L

ow_exp_rf.png

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 82

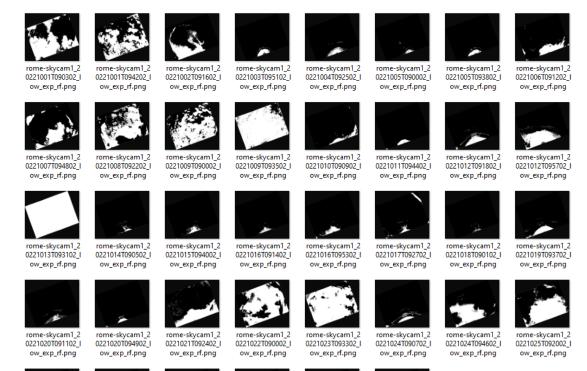


Figure 95: Classified sky camera acquisitions over Rome during Sentinel-3 OLCI overpass

rome-skycam1_2

0221029T091602 I

ow_exp_rf.png

rome-skycam1_2

0221030T095102 L

ow_exp_rf.png

rome-skycam1_2

0221028T094202 I

ow_exp_rf.png

rome-skycam1_2

0221028T090302 I

ow_exp_rf.png

Due to the considerable high clear occurrence there is a great skewness in the distribution again. Calculation of a balanced overall accuracy (BOA) can decrease the effect caused by the skewed distribution.

Figure 96 shows the validation results for the OLCI cloud flags including the margin. As explained in the section before, the combination of clouds close to the centre of the SC and usage of the margin flag, can lead to deviating results. This can be seen in the Producers Accuracy (PA) for clear pixels or User Accuracy (UA) for cloudy pixels, showing a good number of clear pixels (SC; the reference) being detected as cloud. When neglecting the margin (see Figure 97) the performance is better and again agrees with the latest PixBox validation. The results for October also show the general behaviour of the margin flag. The margin helps to flag clouds at the cloud border that still can be influenced by clouds, but also comes with the cost of commissioning errors.

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 83

SC 1 autom. classif. vs. OLCI L2 LFR Cloud & Ambiguous & Margin - Oct 2022 Sky Camera 1

	Class	Clear	Cloud	Sum	U A	E
2 LFR	CLEAR	20	0	20	100.0	0.0
	CLOUD	9	6	15	40.0	60.0
OLCI L2	Sum	29	6	35		
	PΑ	69.0	100.0		OA:	74.29
	E	31.0	0.0		BOA:	84.5

Scotts Pi: 0.387 Krippendorfs alpha: 0.396 Cohens kappa: 0.432

Figure 96: Confusion matrix showing validation results for OLCI L2 cloud screening including margin against SC1 automated classification

SC 1 autom. classif. vs. OLCI L2 LFR Cloud & Ambiguous - Oct 2022 Sky Camera 1

	Class	Clear	Cloud	Sum	U A	Е
	CLEAR	25	0	25	100.0	0.0
-2 LFR	CLOUD	4	6	10	60.0	40.0
OLCI L2	Sum	29	6	35		
	PΑ	86.2	100.0		OA:	88.57
	E	13.8	0.0		BOA:	93.1

Scotts Pi: 0.675 Krippendorfs alpha: 0.68 Cohens kappa: 0.681

Figure 97: Confusion matrix showing validation results for OLCI L2 cloud screening excluding margin against SC1 automated classification



Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 84

5 Validation of Integrated Water Vapour over Land & Water

For the current reporting period we investigated the temporal evolution of quality measures of integrated water vapour, when comparing SUOMI NET (Ware et al. 2000) with reduced resolution data of OLCI L2 non-time-critical. The data acquisition changed form EUMETSAT CODA which was partly malfunctioning from April 2022 (the lat lon based orbit selection did not work for RR orbits) and discontinued in September 2022. We are using EUMETSATS datastore (collection id: EO:EUM:DAT:0410) since Oct 2022. data from Apr 2022 on belongs to that data source.

682000 (OLCI-A) and 372000 (OLCI-B) potential matchups within the period of June 2016 (OLCI-A) January 2019 (OLCI-B) to October 2022 have been analysed yet. The global service of SUOMI-NET has been reduced at the end of 2018, thus OLCI-B colocations are rare outside North America.

For the cloud detection, the standard L2 cloud-mask has been applied (including the cloud ambiguous and cloud margin flags). The comparison of OLCI and GNSS shows a very high agreement (Figure 98). The correlation between both quantities is 0.97-0.98. The root-mean-squared-difference is $1.9-2.1 \text{ kg/m}^2$. The systematic overestimation by OLCI is 11%-12%. The bias corrected *rmsd* is around 1.3 kg/m^2 .

The temporal evolution of several quality measures (Figure 99), indicates small seasonal variations, which are certainly related to retrieval assumptions. Apart from these features, neither systematic temporal changes nor differences between OLCI A and B have been observed.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

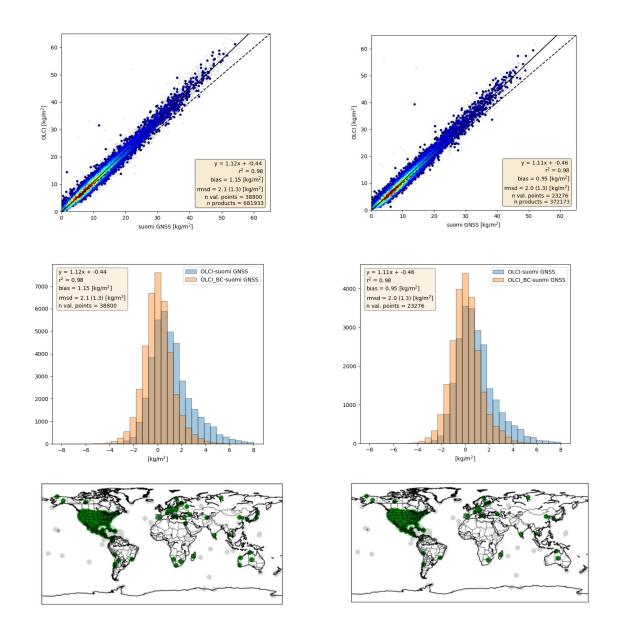


Figure 98: Upper: Scatter plot of the IWV products, derived from OLCI (A left, B right) above land and from SUOMI NET GNSS measurements. Middle: Histogram of the difference between OLCI (A: left, B: right) and GNSS (blue: original OLCI, orange: bias corrected OLCI). Lower: Positions of the GNSS (A: left, B: right).



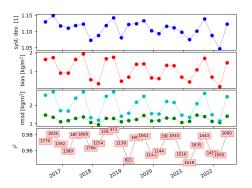
Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022



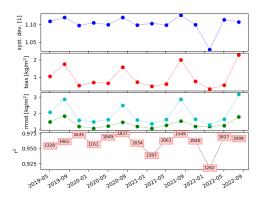


Figure 99: Temporal evolution of different quality measures for OLCI A (left) and OLCI B (right) with respect to SUOMI Net. From top to bottom: systematic deviation factor, bias, root mean squared difference (with and without bias correction), explained variance (number in boxes are the numbers of matchups)



Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 87

6 Level 2 SYN products validation

6.1 SYN L2 SDR products

There has been no new result during the reporting period. Most recent performance figures can be found in the S3MPC OPT Annual Performance Report - Year 2021 (S3MPC.ACR.APR.009, issue 1.0, 08/12/2021), available on-line at:

https://sentinels.copernicus.eu/web/sentinel/user-guides/sentinel-3-olci/document-library.

6.2 SY_2_VGP, SY_2_VG1 and SY_2_V10 products

The similarity of SYN VGT like products with the PROBA-V archive is evaluated through intercomparison of 10-daily composites extractions over LANDVAL [1] sites. Since there is no overlap with the PROBA-V nominal operational phase and no PROBA-V Collection 2 climatology is available yet, direct comparison is done by comparing the SY_2_V10 NTC products starting January/2021 with those of PROBA-V S10-TOC since January/2018.

The temporal evolution of statistics results below is based on intercomparison over the entire periods up to October/2022. The scatterplots are based on intercomparison between SY_2_V10 products of October/2022 with PROBA-V Collection 2 S10-TOC products of October/2019.

Products availability

Availability of SY_2_VG1 and SY_2_V10 products is checked through an automated query and download via the Copernicus Collaborative Node and the Copernicus Open Access Hub feeding the products database Belgian Collaborative Ground Segment (Terrascope, www.terrascope.be). For the month October/2022, there are a number of data quality issues with a deviating amount of missing data and empty tiles in the product listed below.

• S3A_SY_2_VG1___20221001T000000_20221001T235959_20221003T*___PS1_O_NT_002.SEN3

Statistical consistency

The scatter density plots with geometric mean regression equation, coefficient of determination (R^2) and APU statistics based on intercomparison between SY_2_V10 products of October/2022 with PROBA-V Collection 2 products of October/2019 are shown in Figure 100. The APU statistics are defined as: Accuracy (A) or average bias, Precision (P) or the standard deviation of the bias, and Uncertainty (U) or the Root Mean Squared Distance. Accuracy is best for BLUE (< 1%), less good for RED and NIR (~2%) and worse for SWIR (~-8%). The relatively large values for Precision (large scatter, low R^2) are caused by the fact that products of two different years are compared. The disagreement for the SWIR band is related to the SLSTR calibration offset (in bands S5 and S6).



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 88

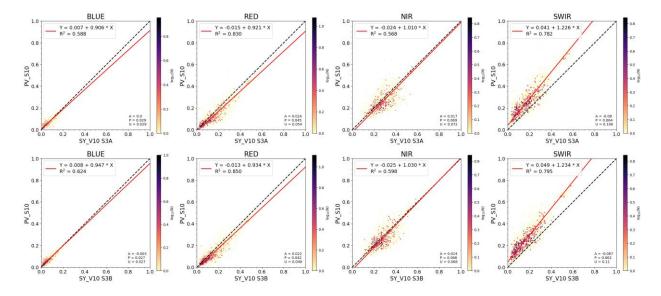


Figure 100: Scatter density plots between SY_V10 S3A (top) or S3B (bottom) and PROBA-V C2 S10-TOC for BLUE, RED, NIR and SWIR bands (left to right), October/2022 vs. October/2019

Temporal consistency

The temporal evolution of APU statistics derived from intercomparison of SY_2_V10 NTC products January/2021 — October/2022 with those of PROBA-V S10-TOC January/2018 — October/2019 (Figure 101). The APU statistics show stable evolution over time, although some seasonal pattern is observed for the mainly the SWIR channel, and to a lesser extent the RED and NIR channel. The temporal behaviour is stable.

OPT-MPC Page 10 Optical Mission Performance Cluster

Optical MPC

Data Quality Report -Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 89

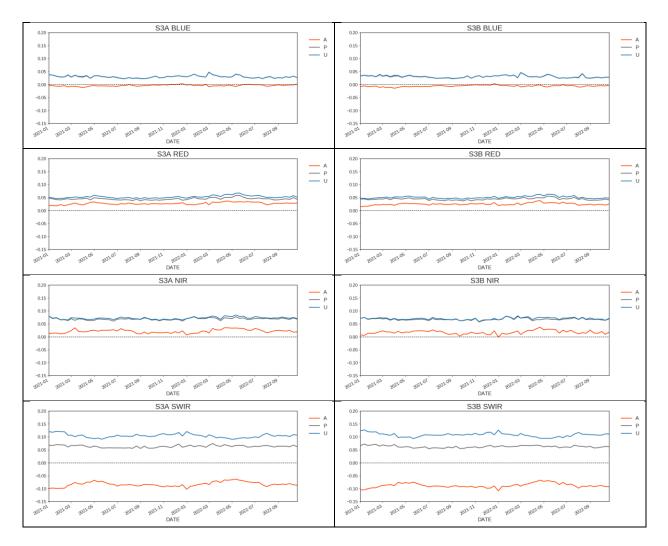


Figure 101: Temporal evolution of APU statistics between SY_2_V10 S3A (left) or S3B (right) and PROBA-V S10-TOC for BLUE, RED, NIR and SWIR bands (top to bottom), January/2021- October/2022 vs. January/2018-October/2019

References

[1] B. Fuster *et al.*, "Quality Assessment of PROBA-V LAI, fAPAR and fCOVER Collection 300 m Products of Copernicus Global Land Service," *Remote Sens.*, vol. 12, no. 6, p. 1017, Mar. 2020, doi: 10.3390/rs12061017.

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 90

6.3 SYN L2 AOD NTC products

6.3.1 Testing sun zenith angle (SZA) applicable limit

What is known: Radiative transfer codes are less accurate for SZA>70°-75°

Question: Shall we remove retrieved AOD for cases when SZA is above certain limit? How to define this limit?

We inter-compared validation statistics for all matchups, matchups with SZA<=70° and matchups with SZA>70° (Figure 102).

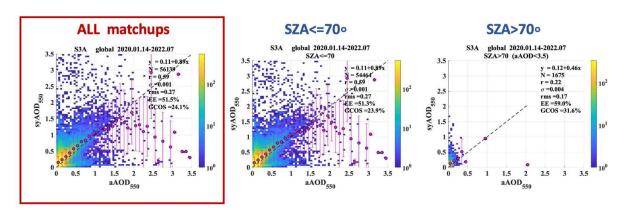


Figure 102: Validation statistics for all matchups (left), matchups with SZA<=70° (middle) and matchups with SZA>70° (right)

For SZA>70° matchups:

- "-" Correlation coefficient for is lower (positive outliers)
- "+" RMS is lower
- "+" Fraction of matchups in EE is higher
- "+" Fraction of matchups which satisfy GCOS requirements is higher

Fraction of SZA>70° matchups is small (<3%)

Conclusion: Removal of SZA>70° matchups from all matchups does not improve validation statistics, although it removes some outliers. However, those outliers might be caused by other reasons than a high SZA.

We tested if a SZA limit exists at which validation results for SZA>limit would become noticeably worth.

For groups which differ from the neighbouring group by 1° SZA (Figure 103), validation results are similar.

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 91

Conclusion: Following GRASP approach, we choose SZA=78° as a limit. We suggest using a flag in the AOD product for pixels retrieved at SZA>70° conditions

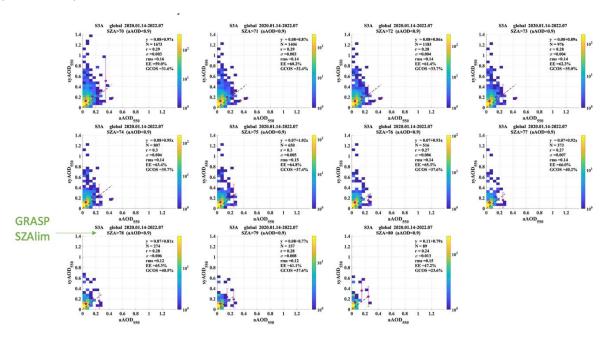


Figure 103: Validation results for SZA above 70° (upper left), with SZA increasing by one degree (towards lower right)

6.3.2 Testing validation results for "elevated" matchups

What is known: Retrieval of aerosols in elevated (=mountain) areas is not trivial for several reasons (e.g., surface heterogeneity, small aerosol loading, possible cloud and ice contamination).

Our approach: We tested two arbitrary elevation levels, 1000m and 2500m, for which we inter-compared validation statistics for all matchups with two groups of matchups, above and below tested layer (Figure 104).



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 92

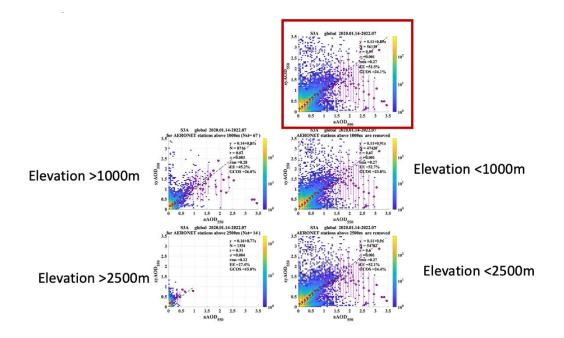


Figure 104: Scatter density plots for all matchups (upper panel). For two elevations, 1000m (middle panel) and 2500 (lower panel), validation statistics for matchups below and above chosen elevation.

Conclusions: Validation statistics are not worse for elevated matchups. Removing of "elevated" matchups will not improve statistics.

6.3.3 Analysis of the outliers

What we know: most of the positive syAOD outliers are retrieved with singleN approach; most of the negative syAOD outliers are retrieved with dual approach (Figure 105; LAW report, Sogacheva et al., 2022).

Optical MPC

Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 93

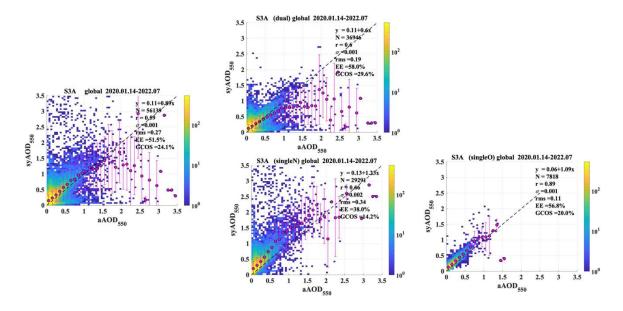


Figure 105: Scatter density plot for all matchups and groups of matchups where AOD is retrieved with different approaches: dual, single applied to nadir (singleN) and single applied to oblique (singleO)

Analysis of the outliers defined as |syAOD-aAOD|>1, as in Figure 106, was performed.

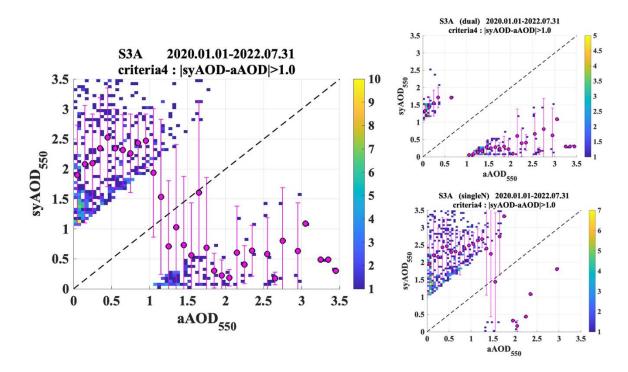


Figure 106: Scatter density plot for syAOD outliers defined as |syAOD-aAOD|>1 for all matchups, dual and singleN groups of matchups



Data Quality Report –Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 94

In Figure 107 we show the location of the AERONET stations where syAOD outliers are observed. Positive outliers are widely distributed. The most common locations of the positive outliers are Europe, eastern part of the North America, South America, South Africa, coastal areas in Asia. Western part of the Northern America is the region where negative outliers are observed more often. Over bright surfaces, e.g., northern Africa, northern India, western part of the Northern America, outliers of both signs are observed. Over bright surfaces, fraction of the outliers from the total number of the matchup per station is higher (Figure 107, right).

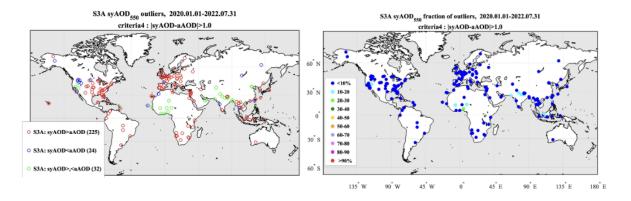


Figure 107: AERONET stations with positive (red) and negative (blue) syAOD outliers. Stations where both positive and negative outliers are observed are marked with green (left) and fraction of outliers (right).

Visual inspection of the syAOD spatial distribution around AERONET stations, in case syAOD was classified as an outlier, has been performed. More than 200 cases were inspected. Typical syAOD spatial distribution for positive syAOD outliers is shown in Figure 108. In the majority of the cases, AOD outliers were retrieved in possibly cloud contaminated area.

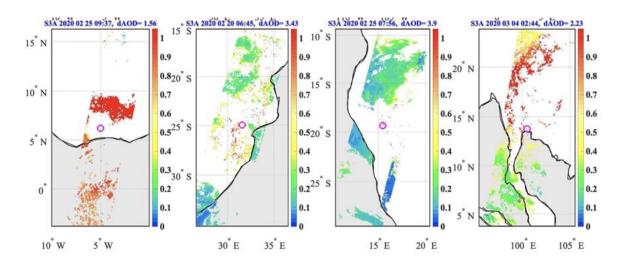


Figure 108: Examples of the SyAOD spatial distribution for the cases when matchup with AERONET station (pixels within the magenta circles) reveals SyAOD outlier.

Conclusion: Areas where the cloud screening is not optimal and there is residual cloud contamination present, seem to cause positive syAOD outliers.



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 95

7 Events

For OLCI-A, two Radiometric Calibration sequences have been acquired during the reported period:

- S01 sequence (diffuser 1) on 14/10/2022 01:15 to 01:17 (absolute orbit 34668)
- S01 sequence (diffuser 1) on 24/10/2022 23:51 to 23:52 (absolute orbit 34824)

For OLCI-B, three Radiometric Calibration sequences have been acquired during the reported period:

- So1 sequence (diffuser 1) on 19/10/2022 13:35 to 13:37 (absolute orbit 23353)
- S01 sequence (diffuser 1) on 24/10/2022 14:46 to 14:48 (absolute orbit 23425)
- S01 sequence (diffuser 1) on 30/10/2022 17:13 to 17:15 (absolute orbit 23512)

There has been no S02+S03 nor S09 Spectral Calibration for OLCI-A in the reporting period.

There has been one SO2+SO3 Spectral Calibration for OLCI-B in the reporting period:

- S02 sequence (diffuser 1) on 01/10/2022 11:18 to 11:20 (absolute orbit 23095)
- S03 sequence (Erbium doped diffuser) on 01/10/2022 12:59 to 13:01 (absolute orbit 23096)

and one Spectral calibration S09:

So sequence on 01/10/2022 09:06:47 to 09:06:53 (absolute orbit 23094)



Data Quality Report - Sentinel-3 OLCI

October 2022

Ref.: OMPC.ACR.DQR.03.10-2022

Issue: 1.0

Date: 10/11/2022

Page: 96

8 Appendix A

Other reports related to the Optical mission are:

- S2 L1C MSI Data Quality Report, October 2022 (ref. OMPC.CS.DQR.01.10-2022 i80r0)
- S2 L2A MSI Data Quality Report, October 2022 (ref. OMPC.CS.DQR.02.10-2022 i54r0)
- \$3 SLSTR Data Quality Report, October 2022, (ref. OMPC.RAL.DQR.04.10-2022)

All Data Quality Reports, as well as past years Data Quality Reports and Annual Performance Reports, are available on dedicated pages in Sentinel Online website, at:

- https://sentinel.esa.int/web/sentinel/technical-guides/sentinel-3-olci/data-quality-reports
- https://sentinels.copernicus.eu/web/sentinel/technical-guides/sentinel-3-slstr/data-quality-reports
- OPT Annual Performance Report Year 2021 (PDF document)

End of document