# Technical Note on Quality Assessment for OceanSat-2 OCM (Quarterly report for Q3 and Q4 2019)

Author(s):

**Samantha Lavender**

*Task 2 Mission Expert*


Approval:

**Andrea Melchiorre**

*Task 2 Lead*


Accepted:

**Clement Albinet**

*EOP-GMQ EDAP Technical Officer*

*Technical Note on Quality Assessment for OceanSat-2*
*OCM (Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

## AMENDMENT RECORD SHEET

The Amendment Record Sheet below records the history and issue status of this document.

| ISSUE | DATE | REASON |
|:---:|:---:|:---|
| 0.1 | 03/01/2020 | First EDAP version (Report No. 4) |
| 1.0 | 11/05/2020 | Version 1 report following ESA review |
| | | |

## TABLE OF CONTENTS

*Technical Note on Quality Assessment for OceanSat-2*
*OCM (Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

# 1. INTRODUCTION

This document is the Q3 2019 (August – December 2019) quarterly Quality Assessment (**QA**) report for the latest Ocean Colour Monitor (**OCM**) instrument, OCM-2, on-board the Indian satellite, OceanSat-2.

This QA provides a series of product checks, using a sample of OCM-2 products retrieved through ESA's *Online Dissemination* service, that relate to product format consistency as well as product content consistency and quality. This QA also provides a derivation of product quality statistics.

## 1.1 Reference Documents

The following is a list of documents with a direct bearing on the content of this report. Where referenced in the text, these are identified as RD.n, where 'n' is the number in the list below:

[RD.1] Oceansat-2 Quarterly Report No.1, IDEAS+-VEG-OQC-REP-2655, Issue 1.0, 5 December 2016.

[RD.2] EDAP Mission Quality Assessment Guidelines, Issue 1.2, 19 July 2019.

[RD.3] Oceansat-2 Quarterly Report No.5, IDEAS+-VEG-OQC-REP-2892, Issue 1.0, December 2017.

[RD.4] EO-SIP Specialisation for OceanSat-2 Mission, EMSS-EOPG-TN-15-002, Issue 1.0, 19 October 2015.

[RD.5] Technical Note on Quality Assessment for OceanSat-2 OCM (Quarterly report for Q4 2018), EDAP.REP.004, Issue 0.2, March 2019.

[RD.6] Natural Earth datasets, accessible at http://www.naturalearthdata.com/

[RD.7] Chauhan *et al.* 2002. Surface chlorophyll a estimation in the Arabian Sea using IRS-P4 Ocean Colour Monitor (OCM) satellite data, *International Journal of Remote Sensing*, 23:8, 1663-1676, DOI: 10.1080/01431160110075866.

[RD.8] DIMITRI Software User Manual, v3.1.1, 20 February 2015.

[RD.9] Technical Note on DIMITRI Quality Assessment for OceanSat-2 OCM (Internal report), EDAP.REP.014, Issue 1.0, January 2020.

[RD.10] Zibordi *et al.* 2009. AERONET-OC: A Network for the Validation of Ocean Color Primary Products. *J. Atmos. and Oceanic Technology*. 26: 1634-1651 (DOI:10.1175/2009JTECHO654.1).

[RD.11] Technical Note on Quality Assessment for OceanSat-2 OCM (Quarterly report for Q1 2019), EDAP.REP.005, Issue 0.21, April 2019.

[RD.12] OCM-2 (OCEANSAT-2) LEVEL-2 HDF Data Products Format, v1.4, April 2017.

[RD.13] Preethi Latha *et al.* 2014. Validation of Chlorophyll-a concentrations in the Estuarine Waters of Bay of Bengal using OCM-2 Data: A case study in the Godavari basin, *J. Indian Soc. Remote Sens.*, 42(1): 129-138.

[RD.14] O'Reilly *et al.* 1998. Ocean color chlorophyll algorithms for SeaWiFS. *Journal of Geophysics*, 103: 24937–24963.

*Technical Note on Quality Assessment for OceanSat-2*
*OCM (Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

[RD.15] Shanthi et al. 2013. Validation of OCM-2 sensor performance in retrieving chlorophyll and TSM along the southwest Bay of Bengal coast, *J. Earth Syst. Sci.,* 122(2): 479–489.

[RD.16] Baret *et al.* 2009. Report on the CEOS Land Product Validation Sub-group Meeting. *The Earth Observer*, 21(6): 26-30.

[RD.17] Bailey, S.W. and Werdell, P.J. 2006. A multi-sensor approach for the on-orbit validation of ocean color satellite data products. *Rem. Sens. Environ*, 102: 12-23.

*Technical Note on Quality Assessment for OceanSat-2*
*OCM (Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

## 2. EXECUTIVE SUMMARY

The aim has been to ensure, principally, that the format and content (i.e. radiance and geophysical data) of OCM-2 products (L1B, L2B and L2C), already available to users, are of a suitable quality.

This Quarterly QA report updates the previous reporting (Q1 & Q2 2019) to include the daily data acquired during July to December 2019; performed in accordance with the QA process and tools (e.g. QA scripts) detailed in [RD.1] and since improved upon within this report.

Going forward, within EDAP, the aim is to expand the quarterly reporting to include an:

- EDAP Quality Assessment: summary in Section 2.1 with a detailed analysis in Section 3.
- Improve the absolute and relative geometric assessment: not started.
- Expand the sensor comparison to include Top of Atmosphere data: started and detailed in Section 4.3.1.
- Expand the in-situ comparison to a greater number of AERONET-OC stations and alongside BOUSSOLE: detailed in Section 4.3.2.

## 2.1 EDAP Quality Assessment

A preliminary assessment has been performed using the National Physical Laboratory (**NPL**) EDAP guidelines [RD.2], with the summary reported in Figure 1 and detailed analysis within Section 3. It is classed as a 'preliminary assessment' as it's the first iteration, and so feedback from ESA and NPL will be sought on the analysis and updates performed in subsequent reports.

| Product Details | Product Generation | Ancillary Information | Uncertainty Characterisation | Validation |
|---|---|---|---|---|
| Product Information | Sensor Calibration & Characterisation Pre-Flight | Product Flags | Uncertainty Characterisation Method | Reference Data Representativeness |
| Availability & Accessibility | Sensor Calibration & Characterisation Post-Launch | Additional Information | Uncertainty Sources Included | Reference Data Quality |
| Product Format | Retrieval Algorithm Method | If target mission data product is Level 2 | Uncertainty Values Provided | Validation Method |
| User Documentation | Retrieval Algorithm Tuning | | Geolocation Uncertainty | Validation Results |
| Metrological Traceability Documentation | Additional Processing | | | |

| Key | |
|---|---|
| Not Assessed | |
| Not Assessable | |
| Basic | |
| Intermediate | |
| Good | |
| Excellent | |

🔒 Information Not Public

**Figure 1 – OCM-2 Quality Evaluation Matrix (preliminary assessment)**

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

## 2.2 OCM-2 Detailed Assessment

For this QA period, OCM-2 products were assessed from July to December 2019 with older products included within the plots. The Product Format Consistency Check was not repeated as the focus was on improving the Product Content Check.

The results are summarised in Table 1.

**Table 1. OCM-2 January 2019 QA Summary Results**

| OCM-2 Product Type | Product Format Consistency Check | Product Content Check | Comment |
|---|---|---|---|
| L1B | No Issues Detected – detailed analysis in [RD.2], not reassessed for this report | N/A | - |
| L2B | No Issues Detected – see above, for scenes being analysed | N/A | - |
| L2C | No Issues Detected – see above, for scenes being analysed | Minor Issues Detected – analysed 38 new files for Path 3 Row 11 and 40 new files for Path 4 Row 10 from the July to December 2019 period | As expected, see Sections 4.2 and 4.3 |

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

## 3.    EDAP QUALITY ASSESSMENT

## 3.1    Product Details (preliminary assessment)

| Product Information | |
|---|---|
| Product Name | Oceansat-2 OCM2 Level 1 (**L1**) Local Area Coverage (**LAC**) products downlinked then processed on behalf of ESA, by GAF/NSG, to Level 2 (**L2**) |
| Sensor Name | OCM2 |
| Sensor Type | Optical – Multichannel spectrometer |
| Product Version Number | Not provided |
| Product ID | OC2_OPER_OCM2 |
| Processing level of product | L1 B and L2 B & C |
| Measured Quantity Name | L1: Radiance<br>L2: CL for Chlorophyll-a concentration; DA for Vertical Diffuse attenuation coefficient (Kd) at 490-nm; SE for Total Suspended Matter concentration; AO for Aerosol Optical Depth |
| Measured Quantity Units | L2 nLw: W cm$^{-2}$ nm$^{-1}$ sr$^{-1}$<br>L2: CL (mg m$^{-3}$); DA 0.01-0.50 m$^{-1}$; SE 0.0-200 mg L$^{-1}$; AO 0.0-1.0 unitless |
| Stated Measurement Quality | Not provided |
| Spatial Resolution | L1 A & B: 360 by 236 m<br>L2 C: 360 by 360 m |
| Spatial Coverage |  |
| Temporal Resolution | Daily |
| Temporal Coverage | October 2015 onwards |
| Mission coverage | Global |
| Point of Contact | ESA Helpdesk |
| Product locator (DOI/URL) | ESA:  https://tpm-ds.eo.esa.int/oads/access/collection/OceanSat2<br>Space Applications Centre, India:<br>https://mosdac.gov.in/data/Missions/oceansat/oscat_home.jsp<br>Global Area Coverage (**GAC**) available free of charge, while LAC data is charged for. |

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

| Conditions for access and use | ESA Single Sign-On (**SSO**) account |
|---|---|
| Limitations on public access | Registration with ESA |
| Product Abstract | N/A |

| **Product Availability & Accessibility** | |
|---|---|
| Compliant with FAIR principles | ESA archive is available for download after registration |
| Data Management Plan | Not available to users |
| Availability Status | Near-Real-Time availability within the ESA archive |

| **Product Format** | |
|---|---|
| Product File Format | HDF |
| Metadata Conventions | Metadata file provided ("filename.meta" within product directory) – list of parameters detail in the product specification documents |
| Analysis Ready Data? | Yes – L2C |

| Product User Documentation | | |
|---|---|---|
| *Document* | *Reference* | *QA4ECV Compliant* |
| Product User Guide (**PUG**) | • OceanSat-2-Level-1-Product-Specifications, Ver. 1.1, Jun 2010<br>• OceanSat-2-Level-2-Product-Specifications, Ver. 1.4, Apr. 2017<br>• PDF on IOCCG website: www.ioccg.org/sensors/OCM-2.pdf | N/A |
| Algorithm Theoretical Basis Document (**ATBD**) | Not publicly available, but peer-reviewed papers are published, see Section 3.2 | N/A |

| **Metrological Traceability Documentation** | |
|---|---|
| Document Reference | Error budget mentioned from Sriperambudur et al. (2015) http://dx.doi.org/10.4236/ojms.2015.54035 |
| Traceability Chain / Uncertainty Tree Diagram Available | Level 1: not provided<br>Level 2:<br>• Normalized water leaving radiance (nLw) < 5% - not provided as a product<br>• CL <30%; DA < 15%; SE < 20%; AO < 20% |

## 3.2  Product Generation (preliminary assessment)

| **Sensor Calibration & Characterisation – Pre-Flight** |
|---|

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

| Summary | Sensor characterisation: spatial and radiometric |
|---|---|
| References | • Pre-launch calibration & Post-launch performance, May 2013 https://iocs.ioccg.org/wp-content/uploads/1450-samir-pal-ocm-2.pdf |

| Sensor Calibration & Characterisation – Post-Launch | |
|---|---|
| Summary | Sensor characterisation includes: <br> • On-board calibration using Light-Emitting Diodes (**LEDs**) <br> • Vicarious calibration using an oceanographic buoy <br> • Lunar calibration <br> • Spatial and radiometric Image-based characterization system |
| References | • Pre-launch calibration & Post-launch performance, May 2013 https://iocs.ioccg.org/wp-content/uploads/1450-samir-pal-ocm-2.pdf <br> • Post-launch calibration of Ocean Colour Monitor 2 using Kavaratti CAL-VAL site observations, Jan 2013 https://www.currentscience.ac.in/Volumes/104/01/0023.pdf <br> • Update of post-launch vicarious, lunar calibrations & current status, June 2015 https://iocs.ioccg.org/2015/files/THU-935-BO9-Chauhan-Calibration.pdf <br> • Cross-calibration of the Oceansat-2 Ocean Colour Monitor (OCM) with Terra and Aqua MODIS, May 2016, https://doi.org/10.1117/12.2224046 |

| Retrieval Algorithm Method *(Include for Level 2 Products Only)* | |
|---|---|
| Summary | ATBD is not made publicly available, processor Sriperambudur et al. (2015) lists SeaDAS (https://seadas.gsfc.nasa.gov/) as the process for HDF files |
| References | • Sriperambudur et al. (2015) *http://dx.doi.org/10.4236/ojms.2015.54035* - |

| Retrieval Algorithm Tuning *(Include for Level 2 Products Only)* | |
|---|---|
| Summary | N/A |
| References | N/A |

| Additional Processing | | |
|---|---|---|
| *Additional Processing 1* | | |
| Description | N/A | |
| Reference | N/A | |
| *Additional Processing 2* | | |
| Description | N/A | |
| Reference | N/A | |

## 3.3   Ancillary Information (preliminary assessment)

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

| Product Flags | |
|---|---|
| Product Flag Documentation | OceanSat-2-Level-2-Product-Specifications, Ver. 1.4, Apr. 2017 |
| Comprehensiveness of Flags | Section 5.1.8, L2 Flag Data Group – brief description of the L2 product flags |

| Additional Information | |
|---|---|
| Ancillary Data Documentation | None provided |
| Comprehensiveness of Data | N/A |
| Uncertainty Quantified | N/A |

## 3.4   Uncertainty Characterisation (not assessed in this version)

| Uncertainty Characterisation Method | |
|---|---|
| Summary | N/A |
| Reference | N/A |

| Uncertainty Sources Included | |
|---|---|
| Summary | N/A |
| Reference | N/A |

| Uncertainty Values Provided | |
|---|---|
| Summary | N/A |
| Reference | N/A |
| Analysis Ready Data? | N/A |

| Geolocation Uncertainty | |
|---|---|
| Summary | N/A |
| Reference | N/A |

## 3.5   Validation (preliminary assessment)

| Validation Activity #1 |
|---|

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

| Independently Assessed? | Yes – within this report for the derived L2 Chlorophyll-a product |
|---|---|
| *Reference Data Representativeness* | |
| Summary | For this report, we have used data from two AERONET-OC stations and BOUSSOLE with further expansion expected in future iterations. Other, referenced, papers have used cruise measurements. |
| Reference | Section 4.3.2 |
| *Reference Data Quality & Suitability* | |
| Summary | The AERONET-OC stations and BOUSSOLE have known origins while the data quality of the reference data used within the cited peer-reviewed papers is less quantifiable; one paper uses fluorometrically derived Chlorophyll while the other is based on High Performance Liquid Chromatography (**HPLC**). |
| Reference | Section 4.3.2 |
| *Validation Method* | |
| Summary | Follows the marine approach that is defined in [RD.17] |
| Reference | Section 4.3.2 |
| *Validation Results* | |
| Summary | Simple plots at this stage. |
| Reference | Section 4.3.2 |

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

## 4. DETAILED OCM-2 ASSESSMENT

This QA is performed using a sample of OCM-2 L1B (local area coverage radiance products), L2B (local area coverage products as four geophysical parameters: Chlorophyll-a concentration (**clo**), aerosol optical depth (**aod**), total suspended matter (**tsm**) and depth attenuation coefficient (**dac**)) and L2C (local area coverage geo-referenced products as four geophysical parameters) products that have been downloaded for all scenes (i.e. all tracks and frames) applicable to a selection of dates between the 01 January 2017 and 01 August 2019 (dates chosen within this reporting period, based on presence of reduced cloud cover).

## 4.1 Product Format Consistency Checks

At this stage of the QA process, product format consistency checks are performed on the retrieved OCM-2 products in order to ensure that, as far as possible, the correct input files were used in the relevant processing stage(s) and that the product format conforms to the format defined in the *EO-SIP Specialisation for OceanSat-2 Mission* document [RD.4].

### 4.1.1 Product Format Consistency Check Results

For the format consistency check*, a total of 549 OCM-2 products were checked previously (Table 2), and all were shown to have used the correct input files and be of the correct product format; see Table 2. For the previous period [RD.5], additional files have been checked (in this version: 28th July 2018) since the last report to ensure nothing has changed.

**Table 2. OCM-2 EO-SIP Consistency Check [RD.5]**

| OCM-2 Product Type | Product SIP Information File | Product Metadata File | Product HDF File** |
|:---:|:---:|:---:|:---:|
| **L1B** | 183/183 | 183/183 | N/A |
| **L2B** | 183/183 | 183/183 | N/A |
| **L2C** | 183/183 | 183/183 | 183/183 |

*The consistency check does not include checking for the existence of a QL/browse image (.png file).*

**The consistency check for *each L2C product includes an additional check of the HDF files found, and their validity, within the (further zipped) product folder.*

## 4.2 Product Content Checks

At this stage of the QA process, product content checks are performed. These checks are performed, using both the QLs and GeoTIFFs (to produce daily composites) provided by the OCM-2 L2C products retrieved, in order to visually assess product content (i.e. radiance and geophysical data) in terms of consistency and quality.

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

### 4.2.1 Product Content Check Results

A selection of QLs, associated with the OCM-2 L2C products retrieved for this reporting period, are shown in Figure 2.

It is important to note that the Chlorophyll-a concentration values provided in these QLs are restricted by a pre-specified range (i.e. $0 \leq clo \leq 5$ mg.m$^{-3}$) and not the true range. Therefore, consistency and quality assessments on Chlorophyll-a concentration values cannot be accurately performed using the QLs alone.

The aforementioned consistency and quality assessments on Chlorophyll-a concentration values are best performed using the Chlorophyll-a concentration composites (which do not enforce a pre-specified range and, usefully, include the use of a Natural Earth [RD.6] vector coastline layer at 50 m resolution) generated for this assessment (shown in Figure 3). Overall, the OCM-2 composites are comparable to the estimations derived from the ocean colour products produced by NASA's MODIS-Aqua and VIIRS sensors (see Figure 4). The values in the Baltic are high because of the cyanobacteria blooms that occur at this time of year.

Note: In previously analysed imagery, as expected, poor Chlorophyll-a concentration estimations are seen to dominate high latitude regions where radiance retrievals are impacted largely by the high solar zenith angles. Also, those regions that have dense cloud cover, coastlines and turbid coastal waters; as expected when using an 'open ocean' band ratio algorithm, e.g. [RD.7].
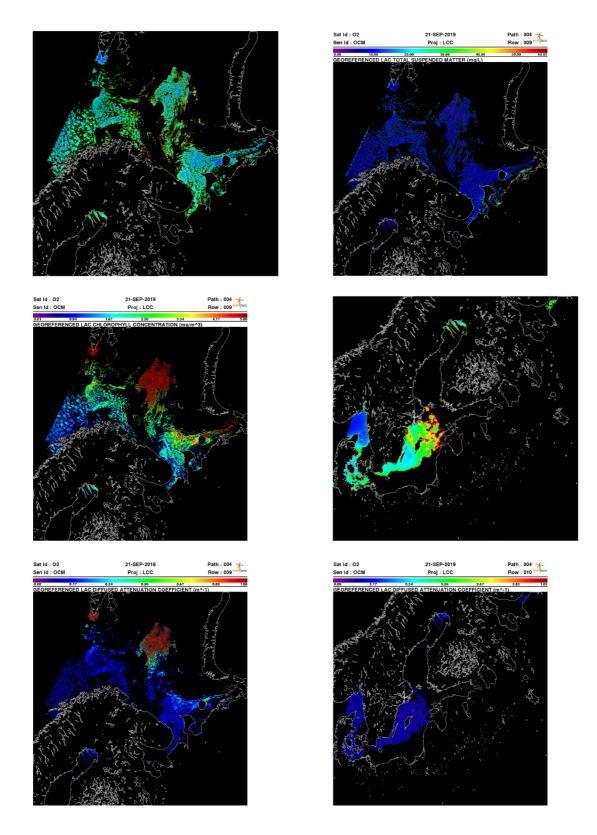
**Technical Note on Quality Assessment for OceanSat-2 OCM**
**(Quarterly report for Q3 and Q4 2019)**
**11 May 2020**
**Issue 1.0**

**Figure 2. A sample OCM-2 QLs for the 21st September 2019 Path 4 Row 10.**

*Technical Note on Quality Assessment for OceanSat-2 OCM*
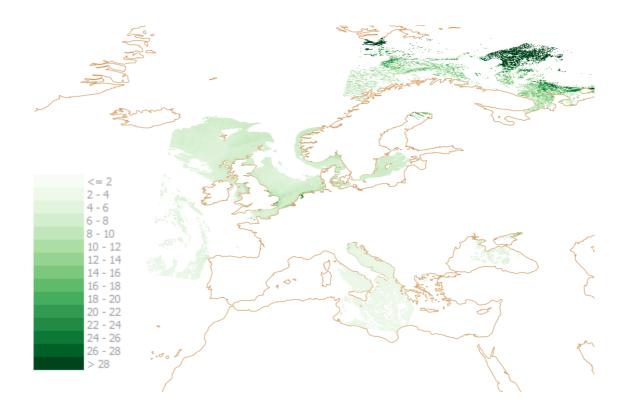*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*



**Figure 3. A snapshot from QGIS showing the daily Chlorophyll-a (mg/m³) composite using data from 21ˢᵗ September 2019.**
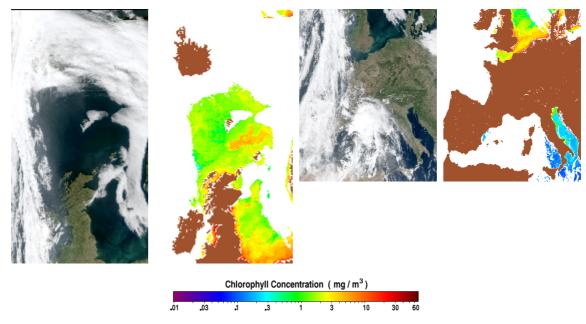


**Figure 4. MODIS-Aqua and Suomi-NPP VIIRS Chlorophyll-a products from the 21ˢᵗ September 2019 (left to right, respectively) over the Northern Europe (including the Acqua Alta Oceanographic Tower location in the VIIRS image) as the true colour composite and then chlorophyll product.**

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

## 4.3 Product Quality Assessment

### 4.3.1 Top of Atmosphere DIMITRI Assessment

Initial activities have started related to expanding the sensor comparison to include Top of Atmosphere (**TOA**), through the Database for Imaging Multi-spectral Instruments and Tools for Radiometric Intercomparison (**DIMITRI**) software [RD.8]. The software has been received from ARGANS and has been updated to a newer version of IDL with OceanSat-2 data ingestion and processing included. An internal report [RD.9] has been produced to show the progress.

### 4.3.2 Level 2 Product Validation

A Python script was developed to produce product quality statistics for inclusion in these quarterly OCM-2 QA reports; in this report, the time-series has been expanded to include February 2019 onwards with historical data also processed for the newly included Gustav Dalen AERONET location in the Baltic. As described by [RD.10], the AERONET-OC network consists of globally distributed autonomous radiometer systems maintained at fixed offshore sites.

The script extracts a point of interest from a set of supplied L2C OCM-2 products, with the plot showing time-series values that correspond to the mean and standard deviation of the point of interest specified (a kernel that is three by three pixels in size and is centred on the supplied latitude/longitude).

For Figure 5, 218 products were analysed for the period from 3rd January 2017 to 23rd December 2019 (38 new products from the start of August to the end of December 2019); the values shown correspond to the location of the AERONET-OC Acqua Alta Oceanographic Tower. The OCM-2 Chlorophyll-a (clo) concentration and Aerosol Optical Depth (aod) for each chosen date (appeared cloud-free) have been plotted. In addition, the plot shows AERONET-OC (*in-situ* sensor) estimated Chlorophyll-a values; provided as part of the AERONET-OC dataset.

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
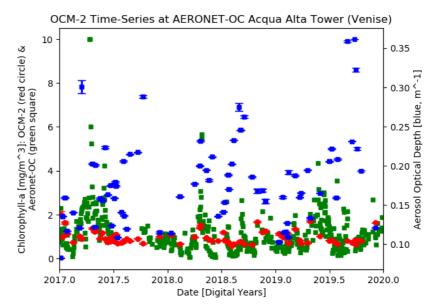*11 May 2020*
*Issue 1.0*



**Figure 5. Time-series plot of the OCM-2 Chlorophyll-a (clo) and Aerosol Optical Depth (aod) products extracted from the Level 2C files, and AERONET-OC estimated Chlorophyll-a for the location of the AERONET-OC Acqua Alta Oceanographic Tower; data courtesy of AERONET website[1]/Giuseppe Zibordi.**

Additional plots have now also been produced for Gustav Dalen (Figure 6) and BOUSSOLE (Figure 7). BOUSSOLE uses the same path and row as the Acqua Alta Oceanographic Tower, while Gustav Dalen uses Path 4 Row 10. One hundred and fifty-eight scenes were analysed from 2017 to 2019, to overlap with available AERONET-OC data, with the Gustav Dalen AERONET-OC instrument operating during the summer months (May to September); for this report, another 40 dates were downloaded for 2019.

---

[1]*https://aeronet.gsfc.nasa.gov/cgi-bin/type_one_station_seaprism_new?site=Venise&nachal=0&year=25&aero_water=0&level=1&if_day=0&if_err=0&year_or_month=1*

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
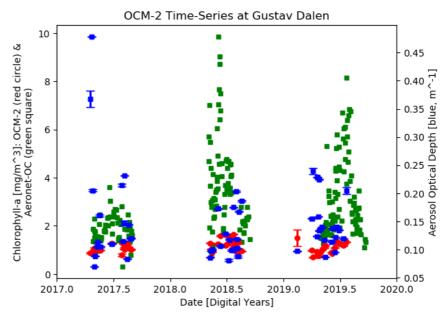*11 May 2020*
*Issue 1.0*

**Figure 6. Time-series plot of the OCM-2 Chlorophyll-a (and Aerosol Optical Depth from the Level 2C files, and AERONET-OC estimated Chlorophyll-a for the Gustav Dalen Tower; data courtesy of AERONET website/Giuseppe Zibordi.**

BOUSSOLE is a data buoy rather than AERONET-OC station, and so the in-situ data has been acquired differently; currently, the surface sampling (fluorometrically and HPLC derived Chlorophyll) is being plotted; surface sampling data only available up until Jan 2018.
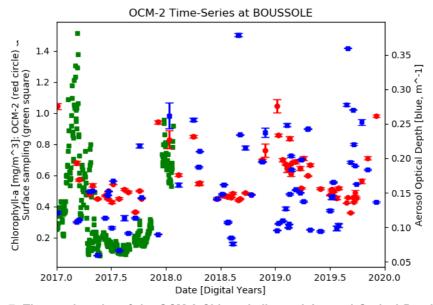


**Figure 7. Time-series plot of the OCM-2 Chlorophyll-a and Aerosol Optical Depth from the Level 2C files, and surface sampling Chlorophyll-a for BOUSSOLE; data courtesy of BOUSSOLE website[2].**

---

[2] *http://www.obs-vlfr.fr/Boussole/html/boussole_data/other_useful_files.php*

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

There are several sources of uncertainty, e.g. the AERONET-OC bands are not the same are the OCM-2 bands. However, overall, the plots for both the Acqua Alta Oceanographic Tower and Gustav Dalen show that the AERONET-OC estimated Chlorophyll-a concentrations are significantly higher than the OCM-2 estimates, which could mean that the OCM-2 output is underrepresenting the natural phytoplankton variability.

## 4.4 Conclusion

The conclusions from this Quality Assessment for OceanSat-2 OCM report (Quarterly report for Q3 2019) are:

- **No specific issues have been detected for the L1B or L2B products**: at this stage, they have been checked in terms of product format consistency rather than scientific data quality; although it is acknowledged the L1 quality will have an impact on the L2 analysis and so needs to be analysed going forward.

- **L2C: No Issues have been detected with the product format consistency with minor issues detected for the product content**:
  - From the Q1 report [RD.11], poor Chlorophyll-a concentration estimations are seen to dominate high latitude regions where radiance retrievals are impacted largely by high solar zenith angles not correctly accounted for within the atmospheric correction; acknowledged as an issue within version 1.4 of the L2 Product Spec [RD.12].
  - Inaccurately estimated OCM-2 Chlorophyll-a concentrations also dominate in those regions with dense cloud cover, coastlines and turbid coastal waters – a combination of cloud pixels not masked, or pixels affected by nearby clouds alongside a simplistic (band ratio) algorithm that doesn't account for changes in the water reflectance due to components other than Chlorophyll-a. Overestimating chlorophyll-a in complex Case 2 waters was noted by Preethi Latha et al. (2014) [RD.13] where OCM-2 L2 LAC data was processed using SeaDAS and chlorophyll algorithms like OC2 and OC4-V4 O'Rielly et al. (1998) [RD.14].
  - The Product Quality Assessment analysed 202 products across 3 sites. There are several sources of uncertainty, but, overall, the OCM-2 Chlorophyll-a concentration product appears to be underrepresenting the natural phytoplankton variability. It is difficult to assess the cause as the L2 Bottom of Atmosphere (**BOA**) radiance/reflectance product is not provided as part of the L2C product, but by increasing this analysis to a greater number of locations in future reports, we'll be able to provide statistical comparison details. Lower chlorophyll estimates, than expected in open ocean waters, were reported by Shanthi *et al.* (2013) [RD.15] where cloud-free L2 processed, OCM data covering the southwest Bay of Bengal demonstrated underestimates for high (in-situ) chlorophyll concentrations and overestimates the low (in-situ) chlorophyll concentrations.

These findings potentially limit the applicability of the Oceansat-2 data in terms of it being classed as a 'Climate Quality' dataset. However, the derived biogeochemical products are comparable to a number of other ocean colour missions and so are of value to more operational applications.

Going forward, within EDAP, the aim is to continue to expand the quarterly reporting to include a more in-depth analysis of the product quality:

- Improve the assessment of the absolute and relative geometric accuracy: on hold until the DIMITRI code is running.

*Technical Note on Quality Assessment for OceanSat-2 OCM*
*(Quarterly report for Q3 and Q4 2019)*
*11 May 2020*
*Issue 1.0*

- Expand the sensor comparison to include TOA data: DIMITRI has been updated to handle OceanSat-2, and the approach is being tested / results analysed – current focus, planning to show results in the Q1 2020 report.
- Expand the in-situ comparison to a greater number of AERONET locations BOUSSOLE, and Gustav Dalen were added as new sites in the last report; once the DIMITRI analysis is complete, this will be considered again.

An increased number of in-situ validation points will allow us to reach the Committee for Earth Observation Satellites (**CEOS**) Land Product Validation Sub-group Stage 1 Validation, where product accuracy is assessed from a small (typically < 30) set of locations and time periods by comparison with in-situ or other suitable reference data [RD.16]. The validation approach will continue to follow the marine approach that defined in [RD.17].