



EUMETSAT and Copernicus Marine Data

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IOCCG Summer Lecture Series 2024

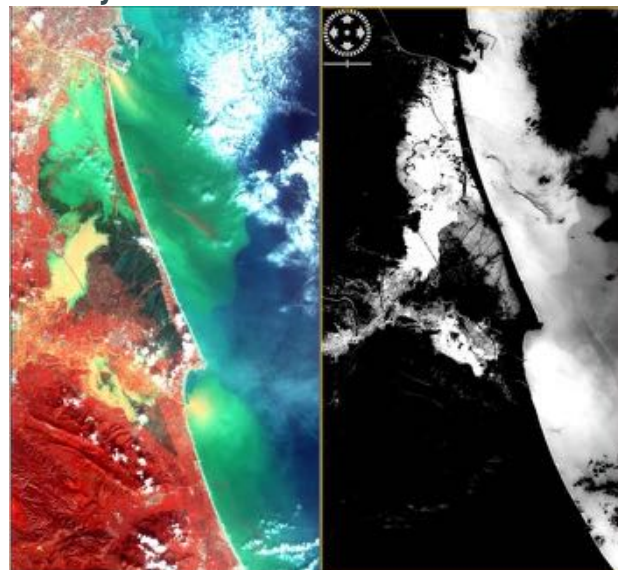




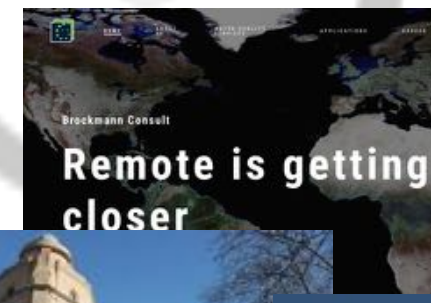
Who am I?



- My complete name is Ana Belén Ruescas Orient
- I am from Valencia, in Spain
- I graduated in History and Geography in the XX century
- My PhD was defended in the XXI century “Applications of Thermal Remote Sensing in the Western Mediterranean Basin”



- I was a trainee in ESRIN-ESA for 2 years, now I give lectures for them
- I joined Brockmann Consult as remote sensing specialist after that



- Now, I am an associate professor at the University of València where I teach subjects related to Physical Geography (and Remote Sensing)
- External senior consultant for Brockmann Consult

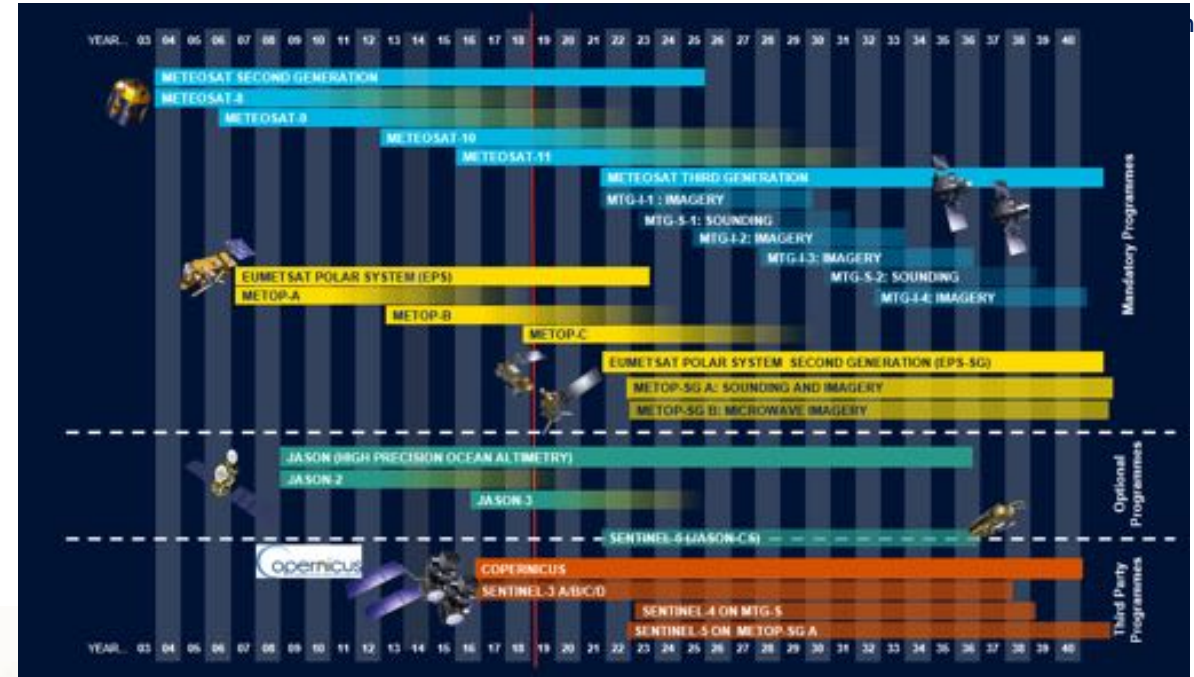




Session	Time
Part 1: Harmful Algal Blooms and introduction to OLCI	09:00-09:45
Hands-on 1: Investigating cyanobacterial algal blooms in the Baltic Sea	09:45-10:30
Coffee break	10:30-11:30
Part 2: The inverse problem in Remote Sensing Ocean Colour (OC)	11:00-12:00
Hands-on 2: Advanced OLCI processing with SNAP and Python	12:00-12:30
Lunch break	12:30-14:00
Hands-on 2 (cont.): Advanced OLCI processing with SNAP and Python	14:00-15:00
Part 3: Machine learning OC with OLCI data	15:00-15:30
Coffee break	15:30-16:00
Hands-on 3: Water quality retrieval with machine learning approaches	16:00-17:30



EUMETSAT – an intergovernmental organisation



- The European Organisation for the Exploitation of Meteorological Satellites
- Located in Darmstadt, Germany
- Founded in 1986
- 30 member states
- Two mandates:
 - Weather and Climate data for member states
 - Additional capabilities with EU and beyond:
- Copernicus programme



etsat.int



European Earth Observation missions





Current EUMETSAT satellites

OPTIONAL AND THIRD-PARTY PROGRAMMES (INCLUDING COPERNICUS)

SENTINEL-3A & -3B (98.7° incl.)

Low Earth, sun-synchronous orbit

Copernicus satellites delivering marine data services from 814km altitude

JASON-3 (63° incl.)

Low Earth, non-synchronous orbit

Copernicus ocean surface topography mission (shared with CNES, NOAA, NASA and Copernicus)

Sentinel-6 Michael Freilich (66° incl.)

Low Earth, non-synchronous orbit

Copernicus ocean surface topography mission (shared with NASA, NOAA, ESA and Copernicus with support from CNES)



MANDATORY PROGRAMMES

METEOSAT-10, -11

Geostationary orbit

Meteosat Second Generation

Two-satellite system

Full disc imagery mission (15 mins) (Meteosat-11 (0°))

Rapid scan service over Europe (5 mins) (Meteosat-10 (9.5° E))

METEOSAT-9 (45.5° E)

Geostationary orbit

Meteosat Second Generation providing Indian Ocean data coverage

METOP-B & -C (98.7° incl.)

Low Earth, sun-synchronous orbit

EUMETSAT Polar System (EPS)/ Initial Joint Polar System

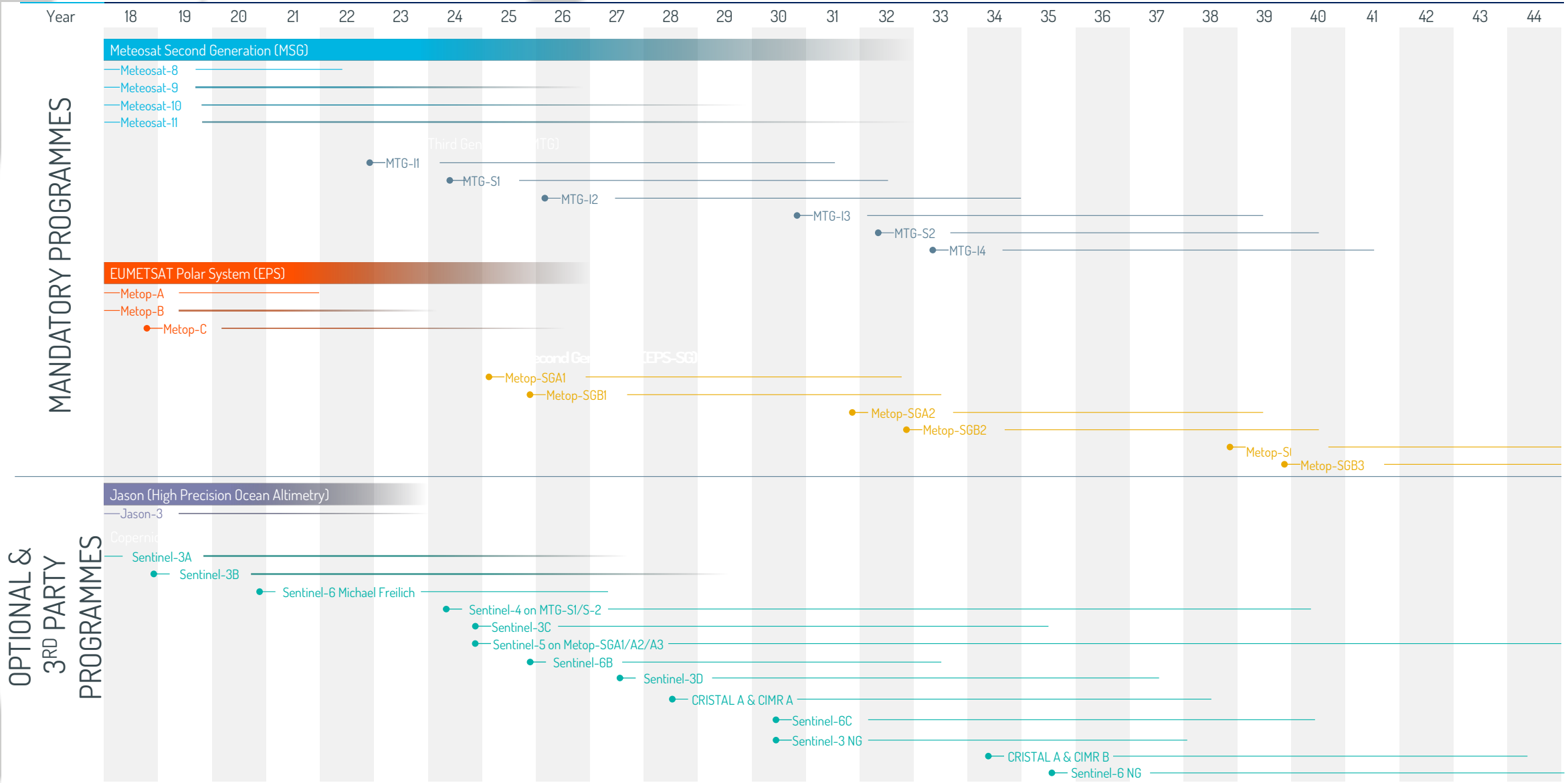
MTG-II

Geostationary orbit

Meteosat Third Generation imaging mission, currently in commissioning phase



EUMETSAT mission planning





Data distribution and downstream processing

www.eumetsat.int

- EUMETSAT distribute level-1b and level2 data from our missions directly to users.
- The major users of the Sentinel data are the Copernicus Marine Service who produce level-3 and level-4 products, as well as model outputs. Well validated satellite data is crucial.
- EUMETSAT provides further marine relevant products via our ocean and sea ice satellite applications facility (OSI SAF)





Introduction to OLCI

Ana B. Ruescas^{1,2}

¹*Brockmann Consult, GmbH, Germany*

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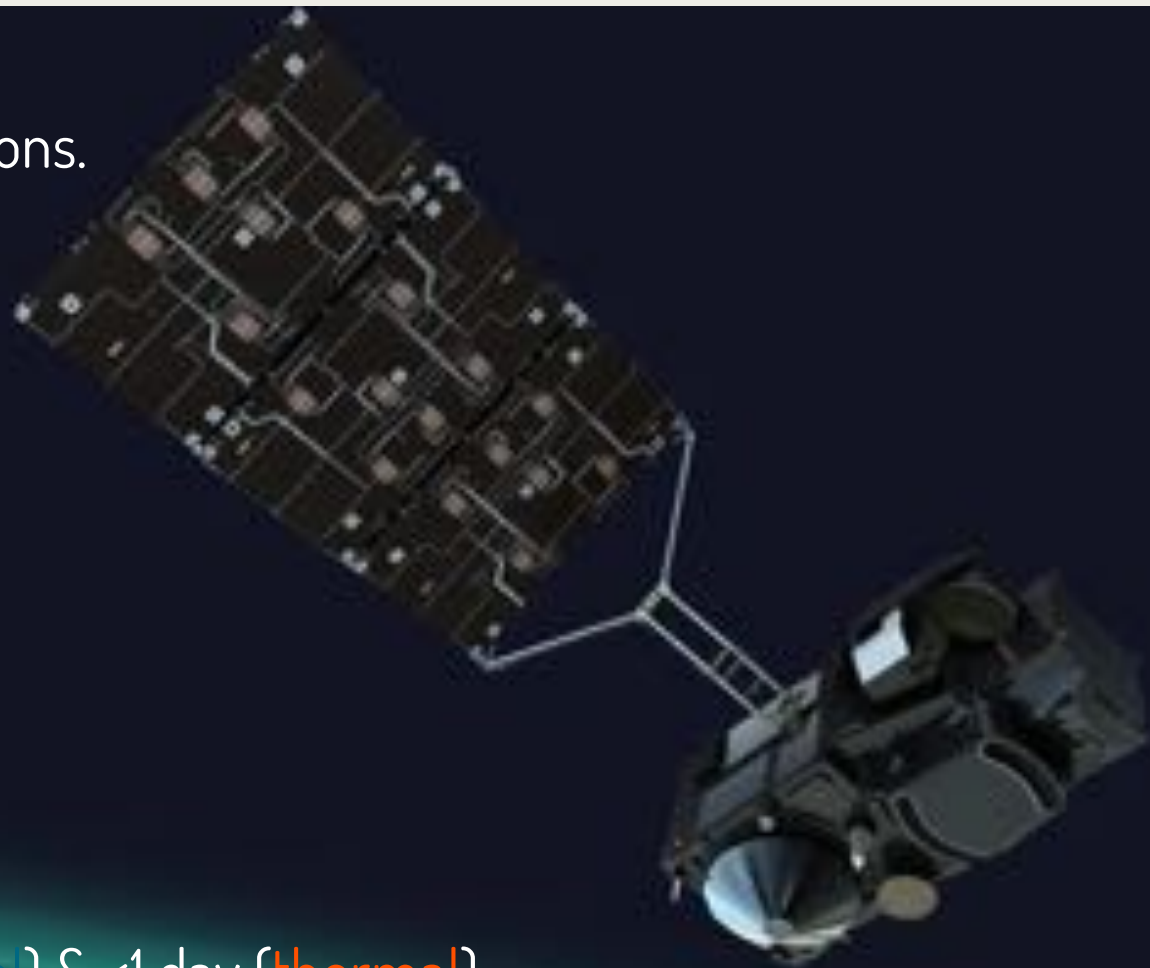
EUMETSAT series of short courses: Applying Case 2 Regional Coast Colour (C2RCC) Algorithms to EUMETSAT OLCI Products





Sentinel-3 mission and configuration

- The “blue” sentinel, carrying a suite of instruments designed for ocean observations.
- Main marine objectives: acquire sea-surface topography, sea surface temperature & ocean colour data, with high accuracy
- Constellation of two platforms:
 - Sentinel-3A launched February 2016
 - Sentinel-3B launched April 2018
- Near global coverage; <2 day revisit (optical) & <1 day (thermal).
- Sun-synchronous 98.65° polar orbit, 27 day cycle.



PROGRAMME OF
THE EUROPEAN UNION



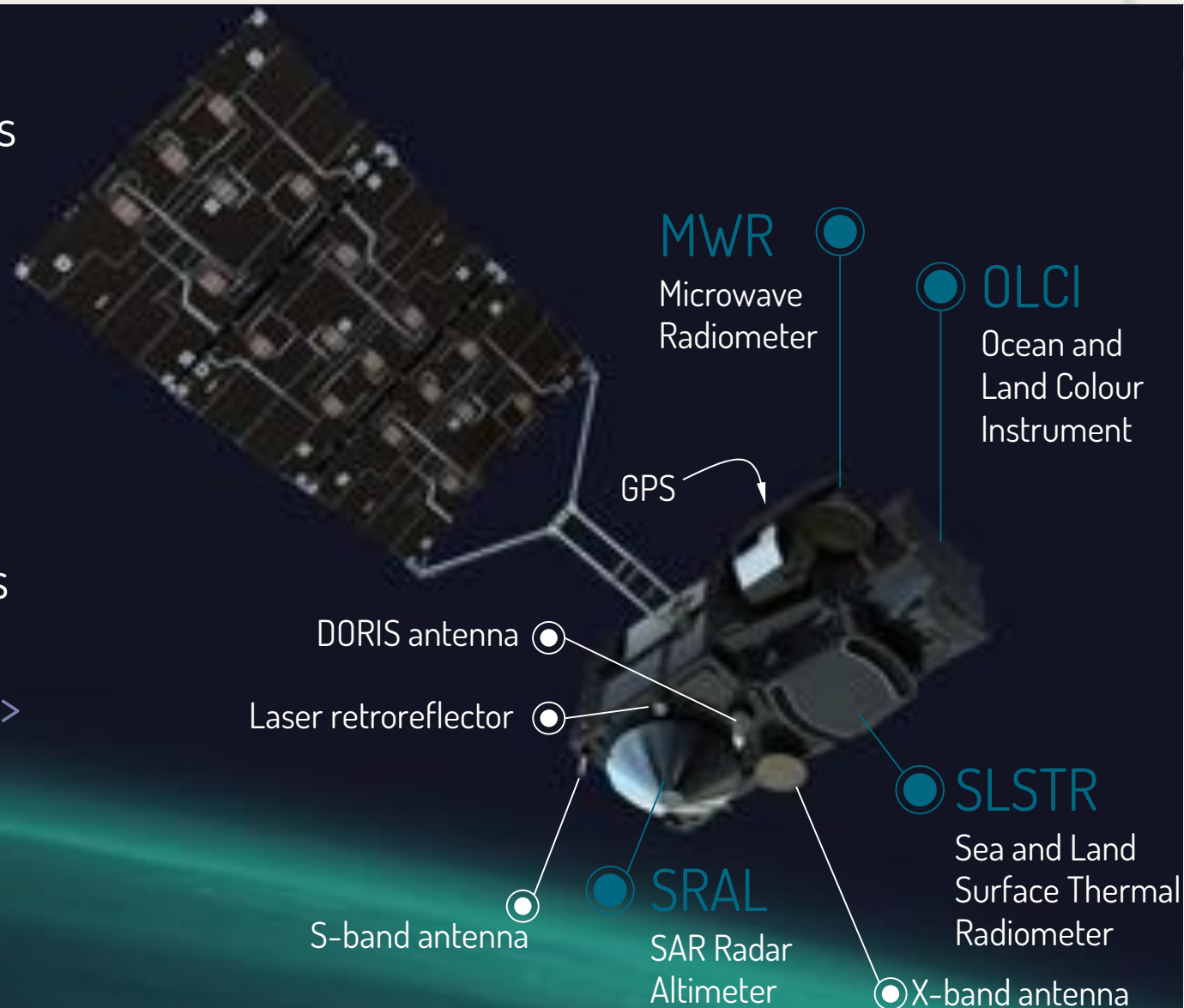
IMPLEMENTED BY





Sentinel-3 instruments and variables

- **OLCI** >> visible radiometry
 - ocean colour: radiances & reflectances
 - chlorophyll, suspended sediment (TSM), CDOM, IOPs
 - PAR / kd490
- **SLSTR** >> thermal radiometry
 - radiances & brightness temperatures
 - Sea and sea-ice surface temperatures
- **SRAL / MWR / POD (DORIS/GNSS/LRR)** >> surface topography mission
 - Sea surface height
 - Significant wave height
 - Wind speed



PROGRAMME OF
THE EUROPEAN UNION



IMPLEMENTED BY





Sentinel-3 operations and data distribution

- EUMETSAT operates the satellite & provides the marine data stream at **level-1** and **level-2**
- Supports the generation of **level-3** and **level-4** products by the **Copernicus Marine Service** (primary user)
- Operational and reprocessed data made directly available to users via the **EUMETSAT Data Store**
- Redistributed (and used) by NOAA
- Atmospheric products also available through EUMETSAT
- Land products available through ESA



PROGRAMME OF
THE EUROPEAN UNION

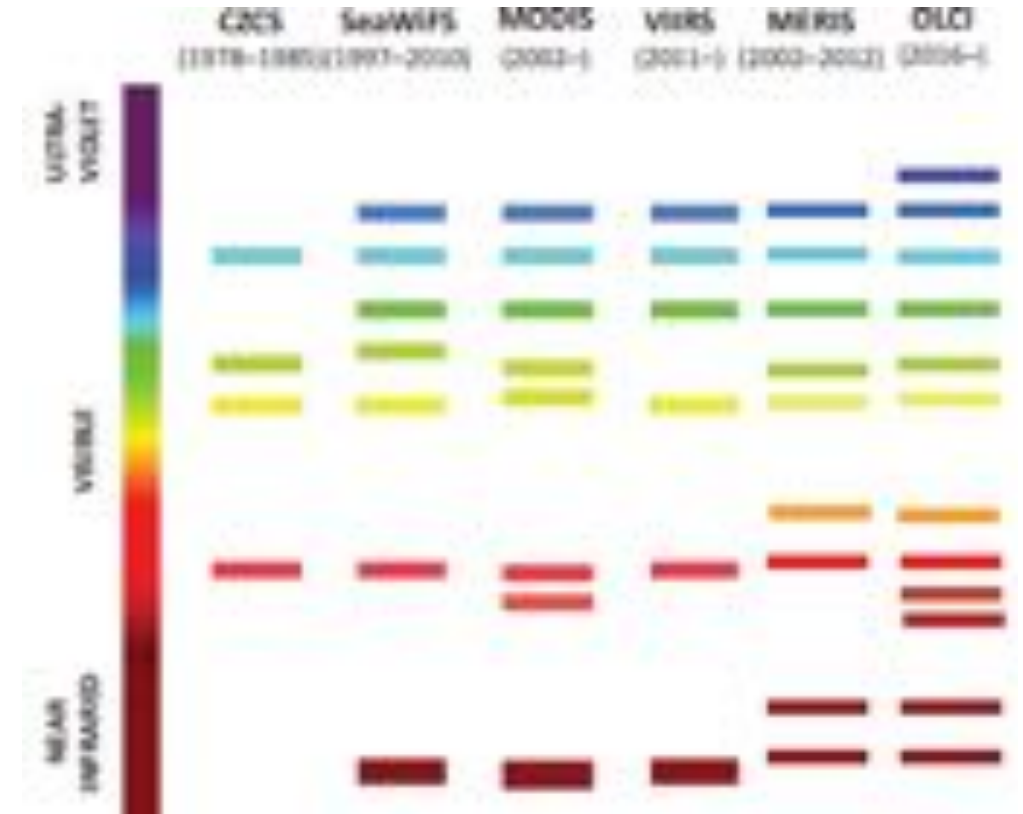


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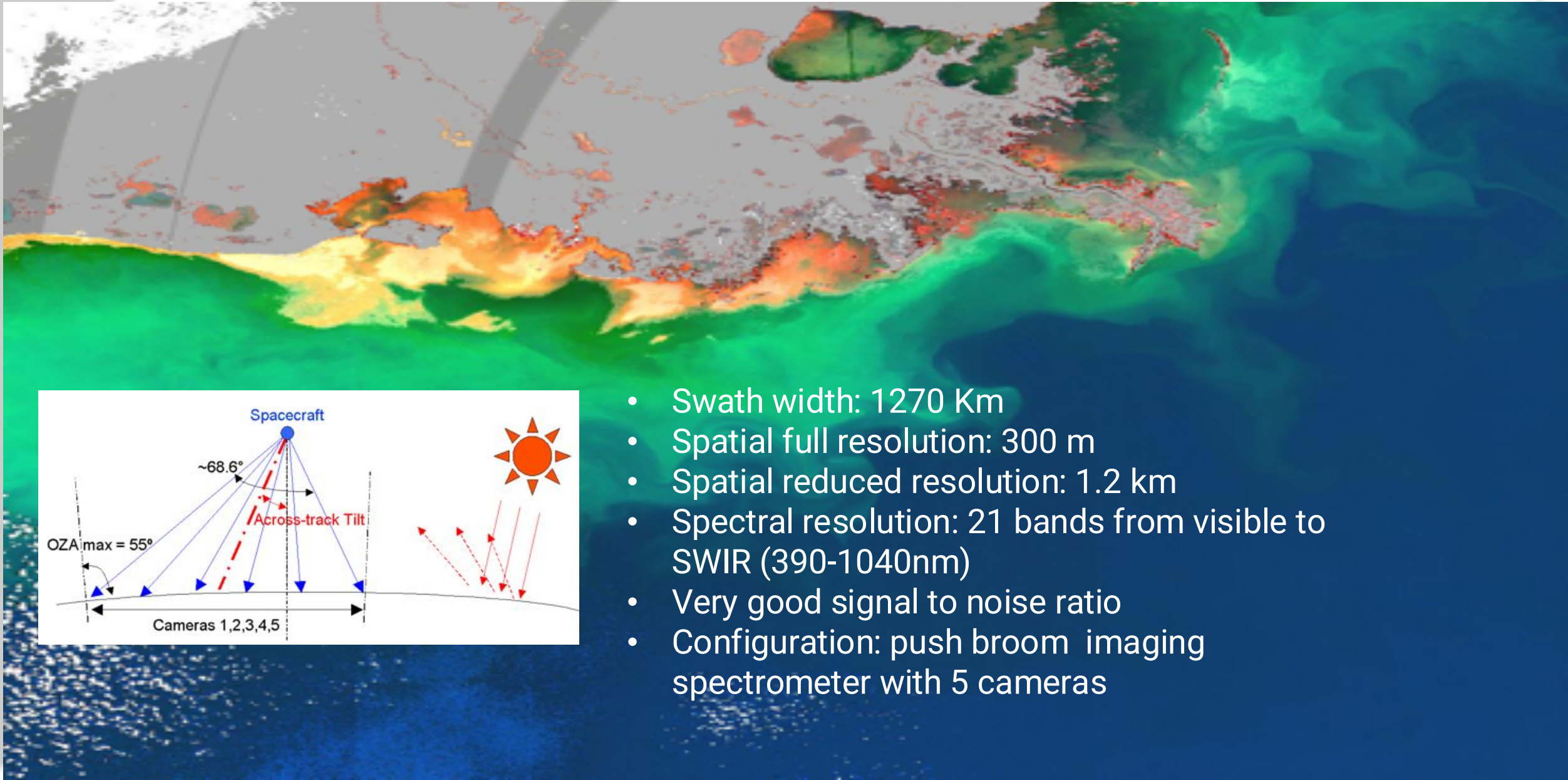




- The workhorse of operational oceanography in Copernicus
 - Daily, reasonably high resolution, OC, SST, Altimetry in NRT (and STC/NTC/REP)
 - Features in many downstream products from Copernicus Marine Service.
- For Ocean Colour in complex waters:
 - High number of bands, with good S:N
 - Good number of options for flexible processing.
 - Standard: complex water products
 - Other Atmospheric correction – C2RCC, Polymer, Acolite
 - Other options (cloud detection, adjacency, etc.)



<https://sentiwiki.copernicus.eu/web/s3-olci-instrument>



- Swath width: 1270 Km
- Spatial full resolution: 300 m
- Spatial reduced resolution: 1.2 km
- Spectral resolution: 21 bands from visible to SWIR (390-1040nm)
- Very good signal to noise ratio
- Configuration: push broom imaging spectrometer with 5 cameras



OLCI in movement

www.eumetsat.int





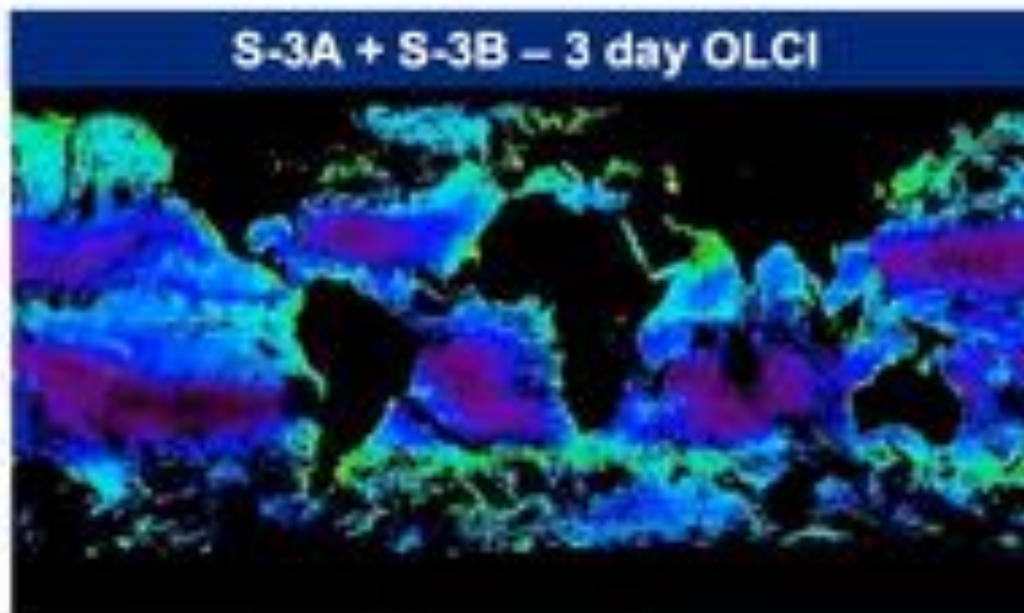
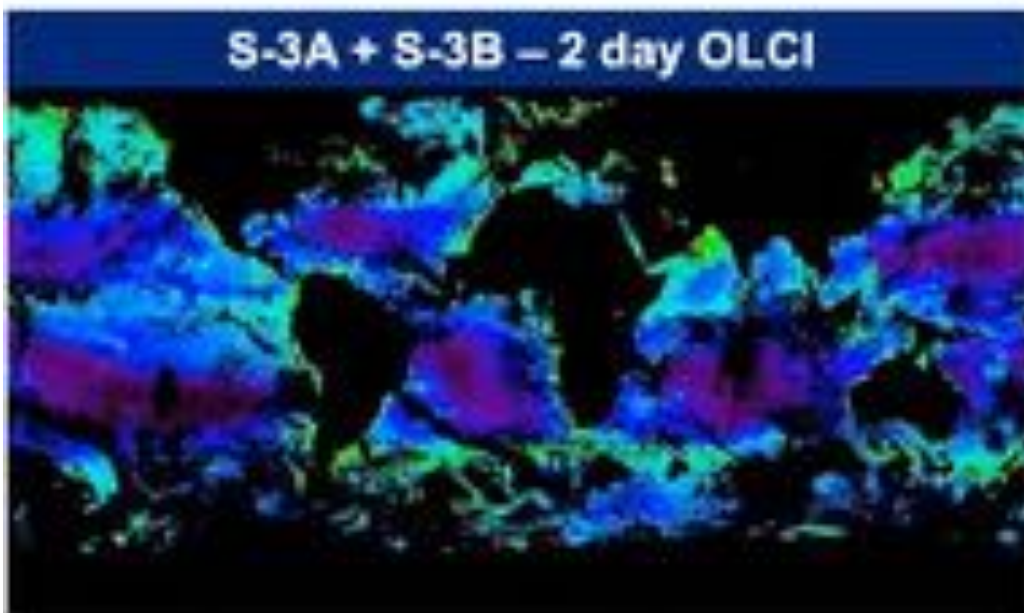
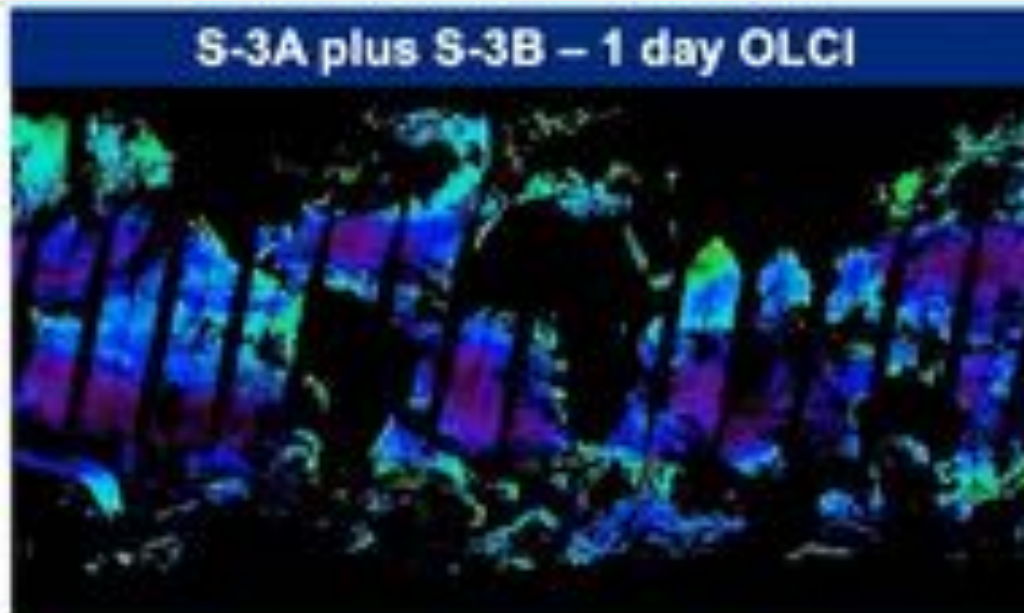
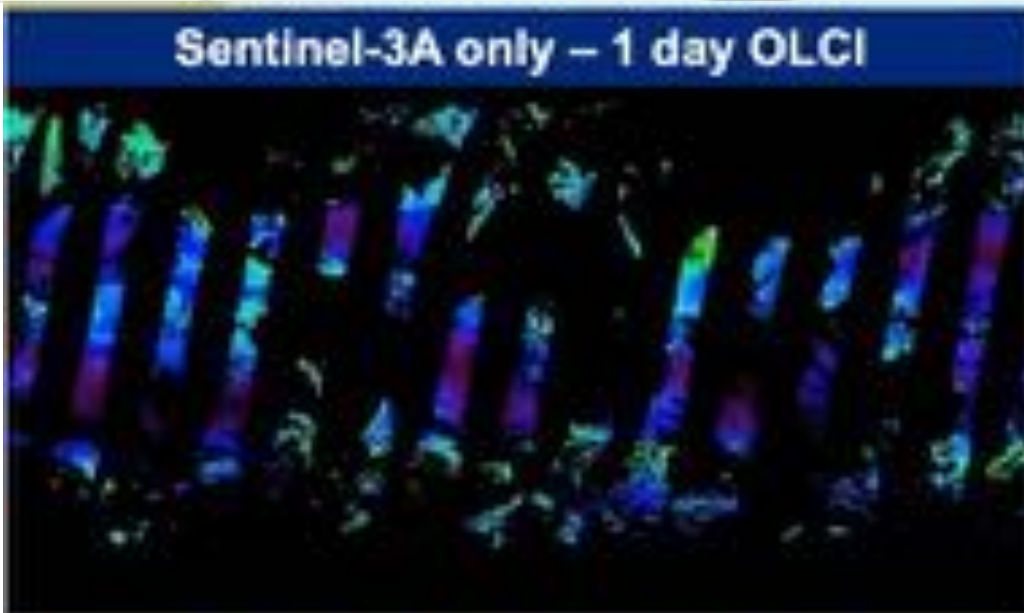
Earth is cloudy!





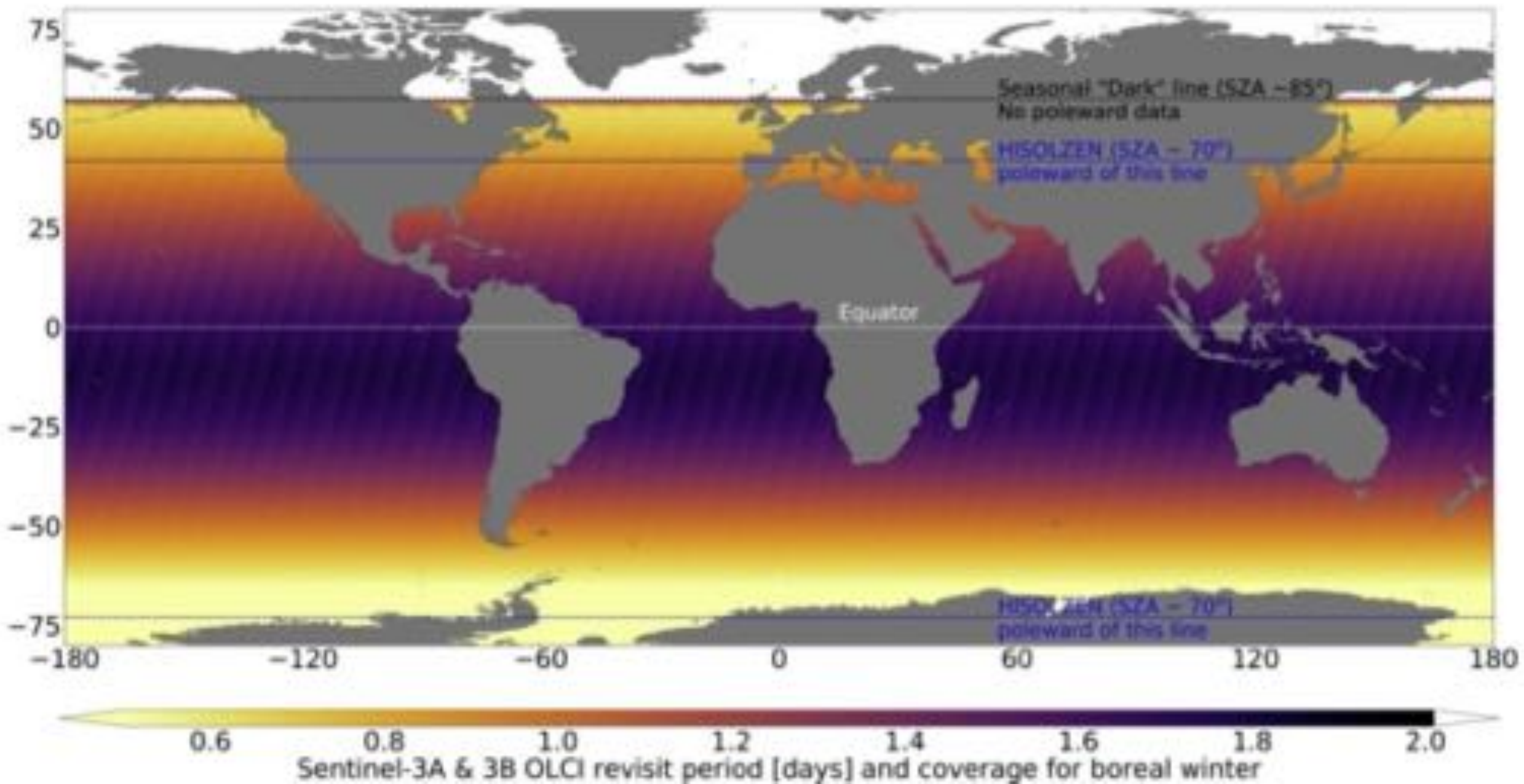
Sentinel-3A and Sentinel-3B constellation

www.eumetsat.int



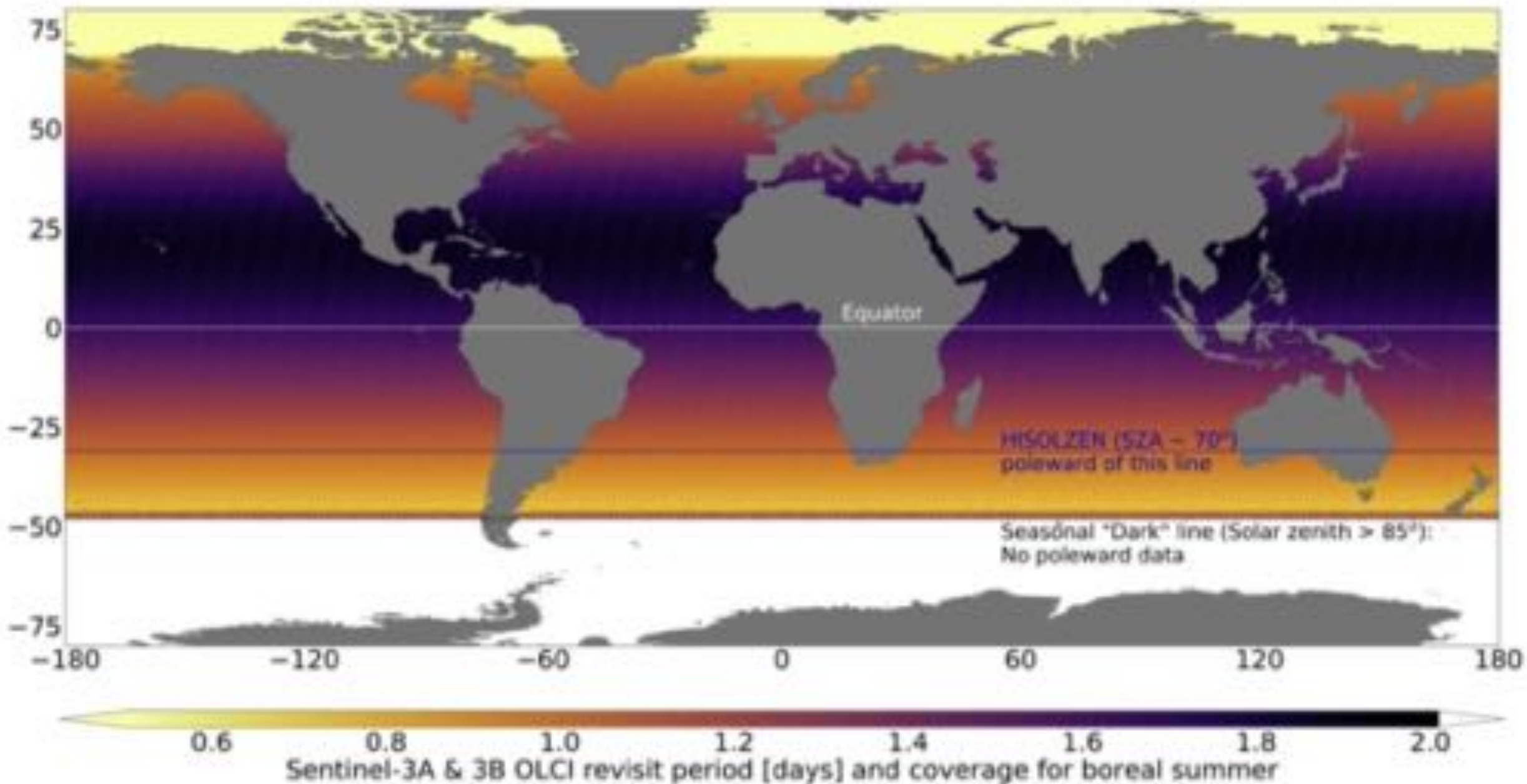


Coverage maps: OLCI Northern Hemisphere Winter





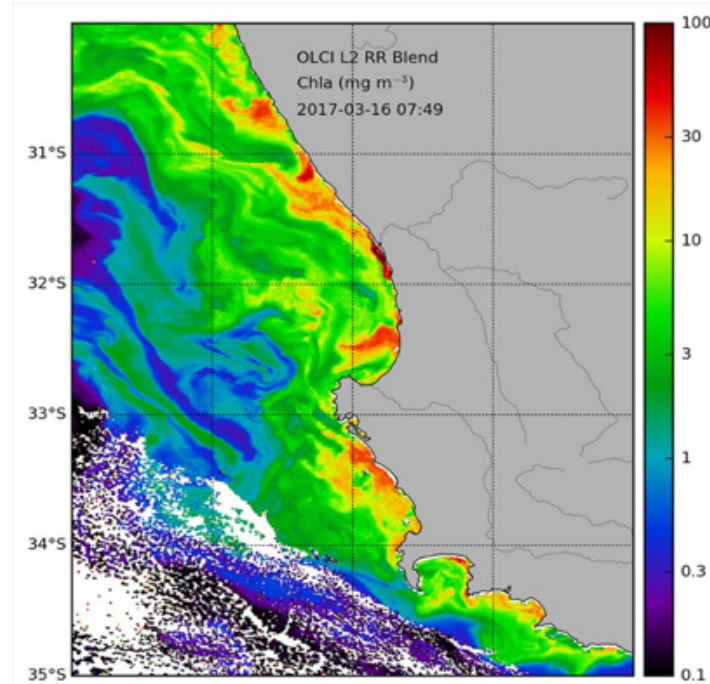
Coverage maps: OLCI Northern Hemisphere Summer





OLCI for Ocean Colour

- OLCI sensor – Algal Pigment Chlorophyll-a Concentrations:
 - Full Resolution (FR) 300m
 - 21 spectral bands (RGB - SWIR)
 - Excellent Signal to Noise Ratio.
 - Measures to 1 optical depth; determined by what is suspended in surface waters (and how much).
 - Many further details about calibration etc can be found in the OLCI handbook, in the EUMETSAT Application User guides and through product notices, like S3VT-OC communications

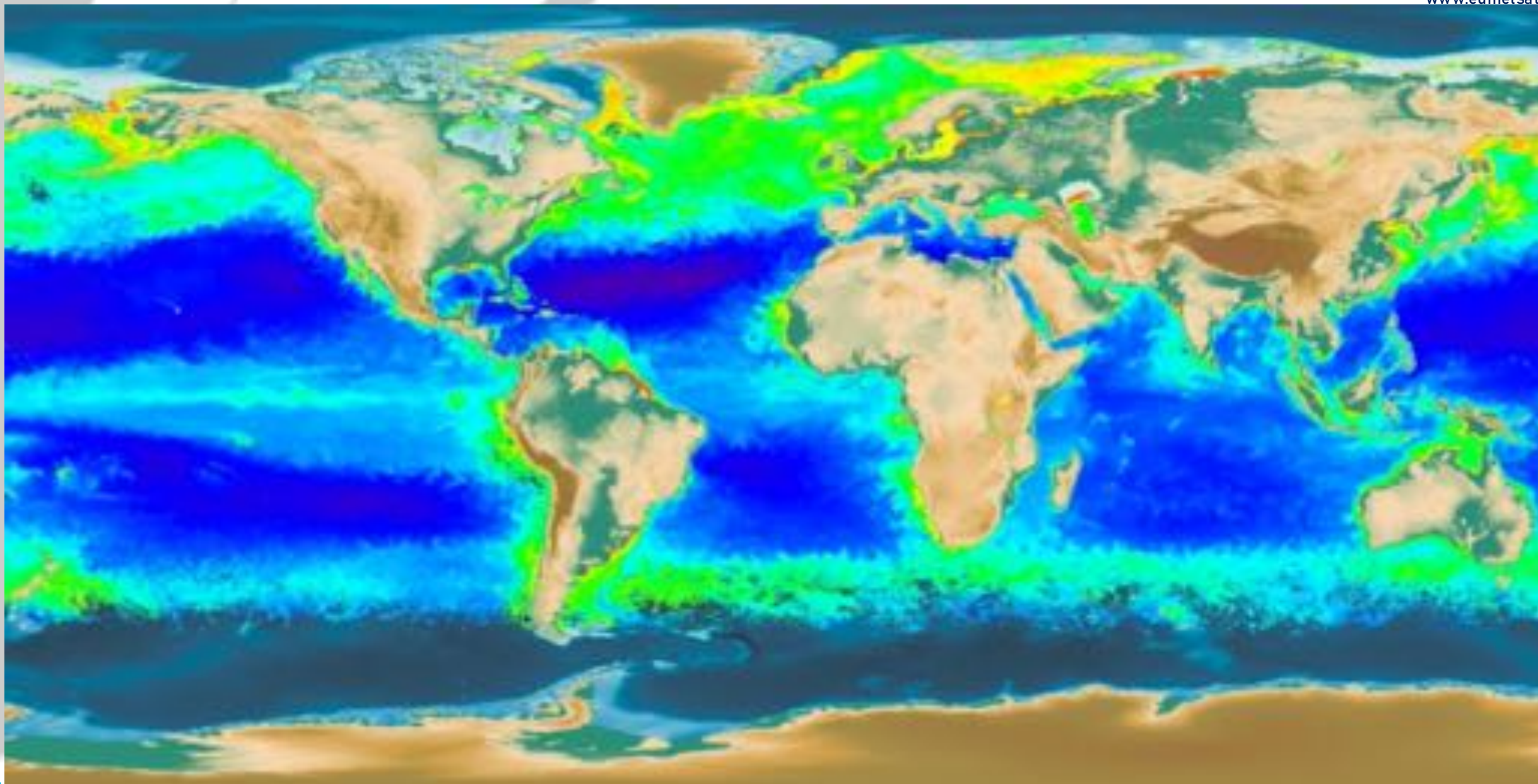


Band #	λ center	Width	Lmin	Lref	Lsat	SNR @ Lref
	nm	nm	W/(m ² .sr.µm)	W/(m ² .sr.µm)	W/(m ² .sr.µm)	
Oa1	400	15	21.60	62.95	413.5	2188
Oa2	412.5	10	25.93	74.14	501.3	2061
Oa3	442.5	10	23.96	65.61	466.1	1811
Oa4	490	10	19.78	51.21	483.3	1541
Oa5	510	10	17.45	44.39	449.6	1488
Oa6	560	10	12.73	31.49	524.5	1280
Oa7	620	10	8.86	21.14	397.9	997
Oa8	665	10	7.12	16.38	364.9	883
Oa9	673.25	7.5	6.87	15.70	443.1	707
Oa10	681.25	7.5	6.65	15.11	350.3	745
Oa11	708.75	10	5.66	12.73	332.4	785
Oa12	753.75	7.5	4.70	10.33	377.7	605
Oa13	761.25	2.5	2.53	6.09	369.5	232
Oa14	764.375	3.75	3.00	7.13	373.4	305
Oa15	767.5	2.5	3.27	7.58	250.0	330
Oa16	778.85	15	4.22	9.18	277.5	812
Oa17	865	20	2.88	6.17	229.5	666
Oa18	885	10	2.80	6.00	281.0	395
Oa19	900	10	2.05	4.73	237.6	308
Oa20	940	20	0.94	2.39	171.7	203
Oa21	1020	40	1.81	3.86	163.7	152



Chlorophyll-a concentration

www.eumetsat.int





Processing Level	Description
Level 0	Reconstructed, unprocessed instrument and payload data at full resolution, with communications artefacts removed. Not distributed.
Level 1 (a+b+c)	Reconstructed, unprocessed, top-of-atmosphere instrument data at full resolution, time-referenced, and annotated with ancillary information.
Level 2 (+p)	Derived geophysical variables at the same resolution and location as Level 1 source data. Usually atmospherically corrected.
Level 3	Variables mapped on uniform space-time grid scales , usually with some completeness and consistency. Except topography (L4)
Level 4	Model output or results from analyses of lower-level data (e.g., variables derived from multiple measurements, gap filled, temporally aggregated)

NOTE: There are differences in how parts of the remote sensing community define processing levels. And different instruments will include different methods at each level. Look at individual handbooks, product guides, ATBDs etc for more information.



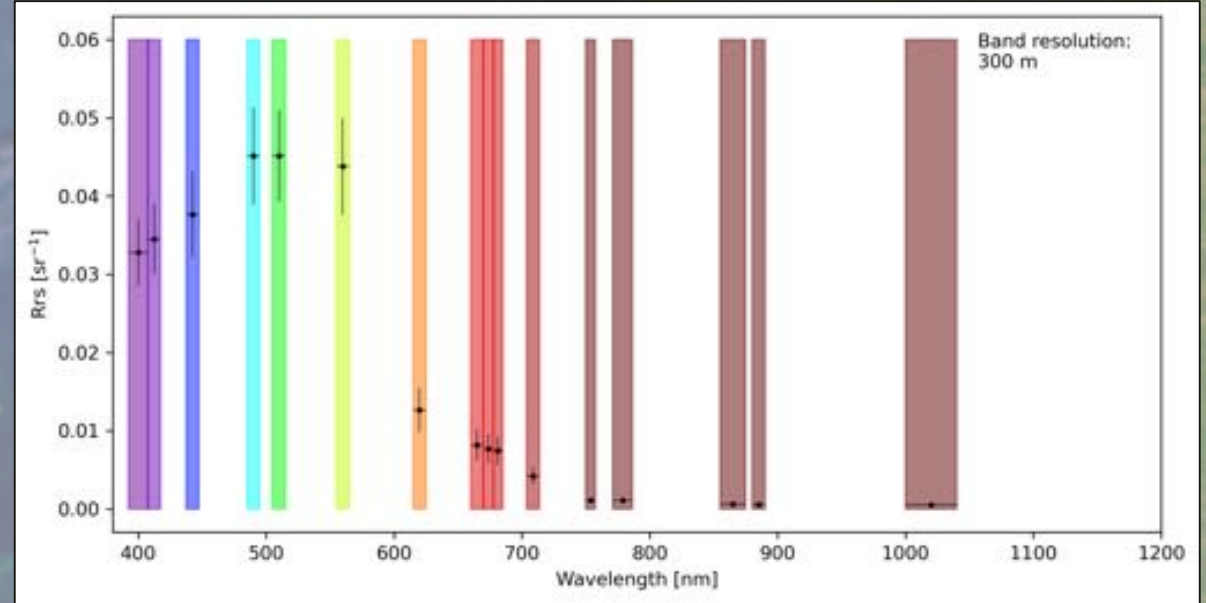
Copernicus marine ocean colour products: summary

Level-1B

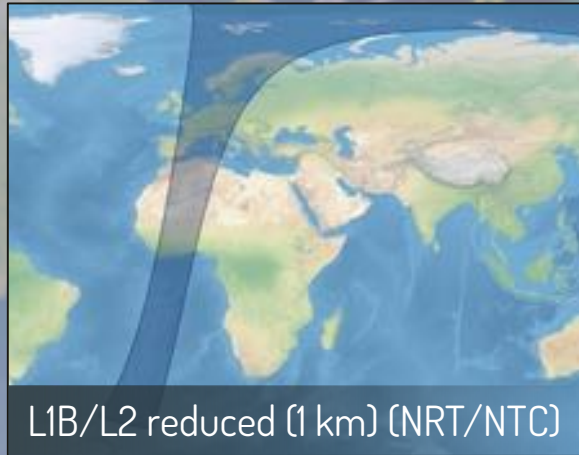
- TOA radiances (21 channels)
- Quality flags

Level 2:

- Reflectances (16 channels)
- standard AC: CHL_OC4ME, TRSP, IOP_LSD
- neural network : CHL_NN, TSM_NN, IOP_NN
- Quality and science flags
- Atmospheric variables: T865, A865, IWV



L1B/L2 full (300 m) NRT/NTC



L1B/L2 reduced (1 km) (NRT/NTC)

Data Store Collection	Description
EO:EUM:DAT:0407	OLCI Level 2 Ocean Colour Full Res (OPE)
EO:EUM:DAT:0556	OLCI Level 2 Ocean Colour Full Res (REP:BC003)
EO:EUM:DAT:0408	OLCI Level 2 Ocean Colour Reduced Res (OPE)
EO:EUM:DAT:0557	OLCI Level 2 Ocean Colour Reduced Res (REP:BC003)
EO:EUM:DAT:0409	OLCI Level 1B Full Res (OPE)
EO:EUM:DAT:0577	OLCI Level 1B Full Res (REP:BC002)
EO:EUM:DAT:0410	OLCI Level 1B Reduced Res (OPE)
EO:EUM:DAT:0578	OLCI Level 1B Reduced Res (REP:BC002)



Custom vs operational processing with C2RCC

copernicus.eumetsat.int

- To reduce the size of level-2 products, we do not distribute the level-2 reflectances for the complex water processor.
- The EUMETSAT operational implementation of C2RCC exploits the same neural network demonstrated here.
- However, you may see differences in your own retrievals due to:
 - Differences in parameter selections
 - Differences in ancillary/auxiliary data sources used
 - Differences in flagging applied
- We encourage you to view our guidance on how to flag operational products from the complex water processor: <https://tinyurl.com/OLCI-PB>
- You can find more information on OLCI processing on our user portal: <https://user.eumetsat.int/> (or <http://olci.eumetsat.int/>)



22 Feb 2024

estimated Q2 2025

S3 OLCI Ocean Colour Collection-3

- Previous OPE processing

S3 OLCI Ocean Colour Collection-3 evolution, 3.04

- Current OPE processing
- IOP new parameters
- Product “_unc” update

S3 OLCI Ocean Colour Collection-4

- Standard atmospheric correction redevelopment
- BRDF correction of water reflectance products
- Chlorophyll algorithm improvements
- Fluorescence new parameter
- Flags: cloud, cloud shadow, bright water
- Offline WEkEO: dPAR planar above water and uncertainties, dPAR scalar under water, iPAR

S3 OLCI L1 reprocessing

S3 OLCI L2 reprocessing
Collection-4

New water Inherent Optical Property (IOP) parameters

- Implementation follows S3VT-OC, QWG and CMEMS requests
- New NetCDF file in the OLCI L2 SAFE directory: iop_lsd.nc
 - a_{nw} a_{phy} a_{cdm} b_{bp} at 443 nm and b_{bp} slope from the three-step semi analytical algorithm by [Jorge et al., 2021](#)
 - a_{cdm} at 443 nm by [Bonelli et al., 2021](#)
 - K_d 490 nm by Jamet et al., 2012, Loisel et al., 2018
 - Optical Water Class based on Mélin and Vantrepotte, 2015
- New parameter-specific flag: IOP_LSD_FAIL
- Uncertainties in the parameter attribute
- Scientific algorithm development and validation: <https://www.eumetsat.int/S3-OLCI-IOP>.

IOP parameters meet the mission requirements (journal publication in preparation)

New uncertainty parameters

- Level 1b products now include per-band radiometric uncertainties



OLCI updates and planning: L2 Collection-4

www.eumetsat.int

Redevelopment of Standard Atmospheric Correction (OC-SAC)

- Addressing the problems with the Standard Atmospheric Correction

<https://www.eumetsat.int/oc-sac>



Switch to Remote sensing reflectance (Rrs)

- Switch from water reflectance ρ_w to Rrs, where $\rho_w = \pi \times Rrs$

BRDF correction applied

- BRDF correction developed with an extension to complex waters

<https://www.eumetsat.int/brdf-correction-s3-olci-water-reflectance-products>



Chlorophyll improvements

- Blended chlorophyll algorithm based on Optical Water Classes



Fluorescence new parameter

- New NetCDF file in the OLCI L2 SAFE directory: fluorescence.nc

<https://www.eumetsat.int/S3-OLCI-FLUO>



Flagging improvements

- Updated CLOUD NN and new CLOUD_SHADOW flag
- New BRIGHT_WATER flag

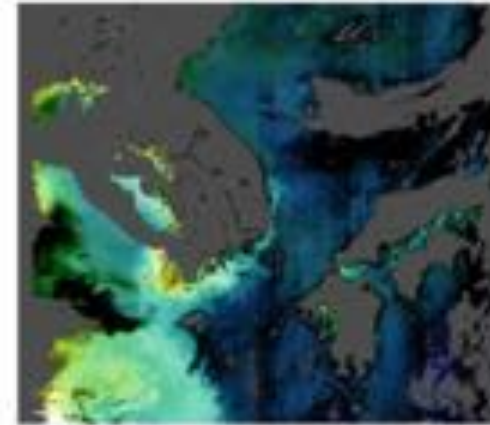


PAR upgrades on WEkE0

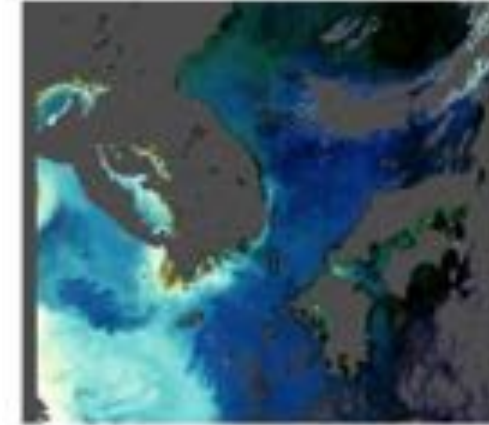
- Daily PAR planar above water and uncertainties
- Daily PAR scalar under water, instantaneous PAR
- <https://www.eumetsat.int/daily-photosynthetically-available-radiation-s3-olci-ocean-colour>



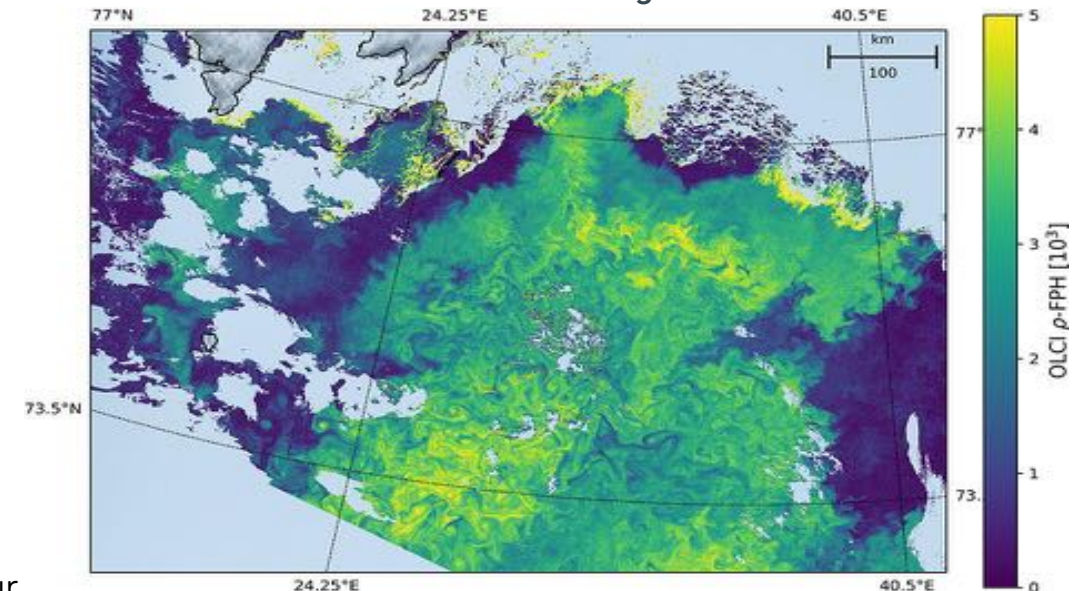
OPE Collection-3



OC-SAC Collection-4



OLCI Fluorescence Peak Height in Barents Sea



As part of the [FRM4SOC-2](#) project, EUMETSAT have co-developed two new toolkits:

Fiducial Reference Measurements for Satellite Ocean Colour

ThoMaS

- ThoMaS is a pan-sensor (OLCI / PACE OCI / VIIRS / MODIS) python toolkit for conducting match-up validation analysis of ocean colour products.
- Exploits data available from the EUMETSAT Data Store and NASA EarthData portal.
- Available at <https://gitlab.eumetsat.int/eumetlab/oceans/ocean-science-studies/ThoMaS>

HyperCP

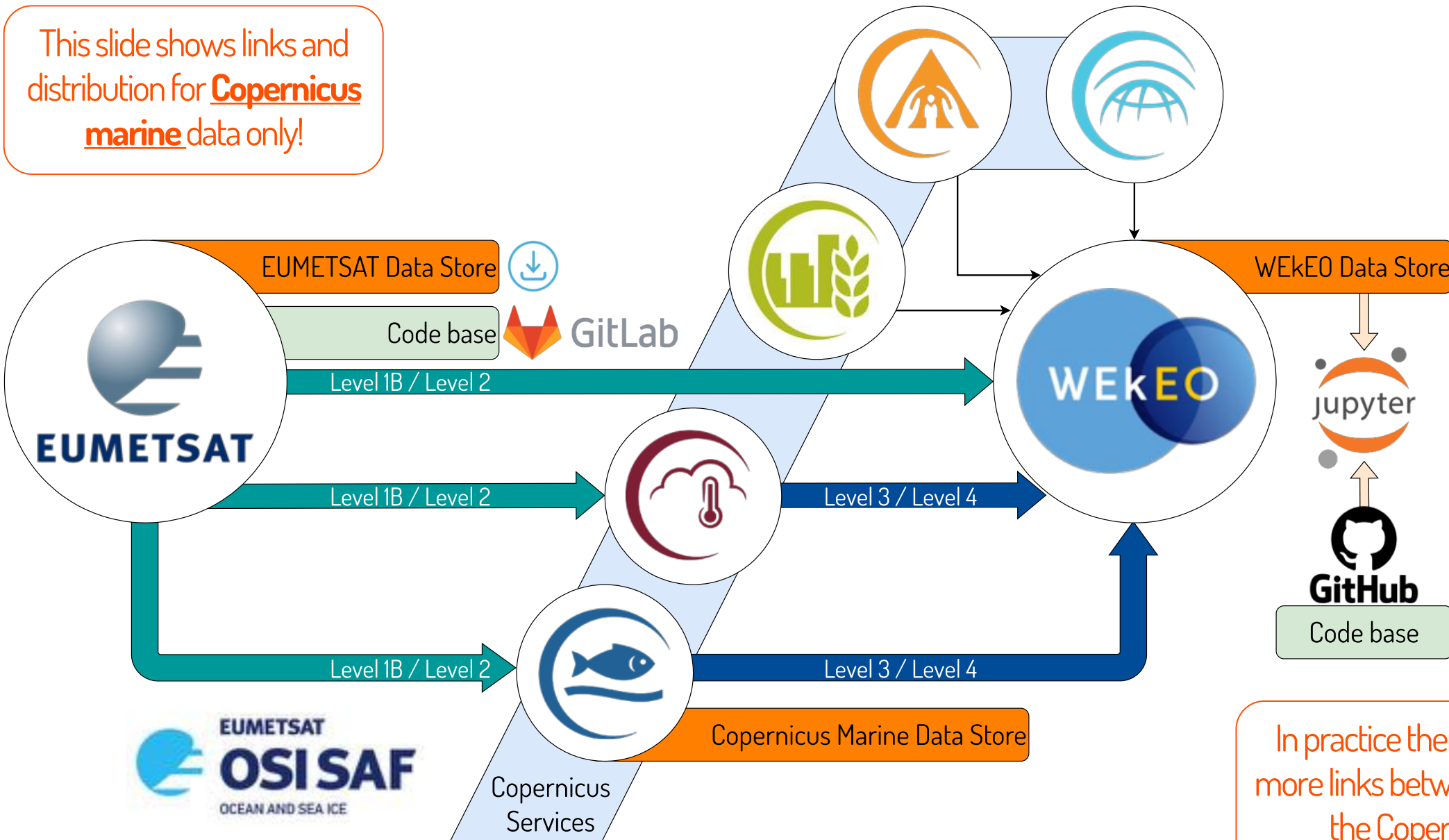
- The HyperCP toolkit processes above water hyperspectral ocean colour radiometry to support PACE OCI and Sentinel-3 OLCI.
- It is available at <https://github.com/nasa/HyperCP>
- Output data from HyperCP can be used as in situ validation data for ThoMaS

If you operate your own fleet of radiometers, or are planning validation campaigns, please contact us for further information on **opportunities** within FRM4SOC-2.



EUMETSAT Copernicus marine data distribution

This slide shows links and distribution for **Copernicus marine** data only!



In practice there are many, many more links between EUMETSAT and the Copernicus Services



The **EUMETSAT Data Store** provides single point of access to a growing catalogue of EUMETSATs meteorological, climate and ocean data.

- All operational Sentinel-3 data can be accessed.
- Reprocessed data added as reprocessings complete
- For OLCI, a complete level-2 archive is already available.
- Feeds in to WEkEO harmonised data access
- Sentinel-6 reprocessing available, operational feed coming soon.

Data collections

Near real-time products

Historic & reprocessed products

Climate data records

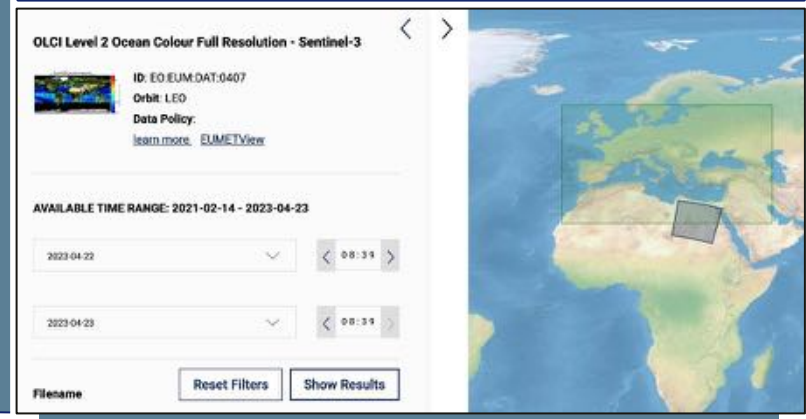
EUMETSAT Data Access Client (eumdac)

Service available at: <https://data.eumetsat.int>



Data Store Interfaces

Online web user interface

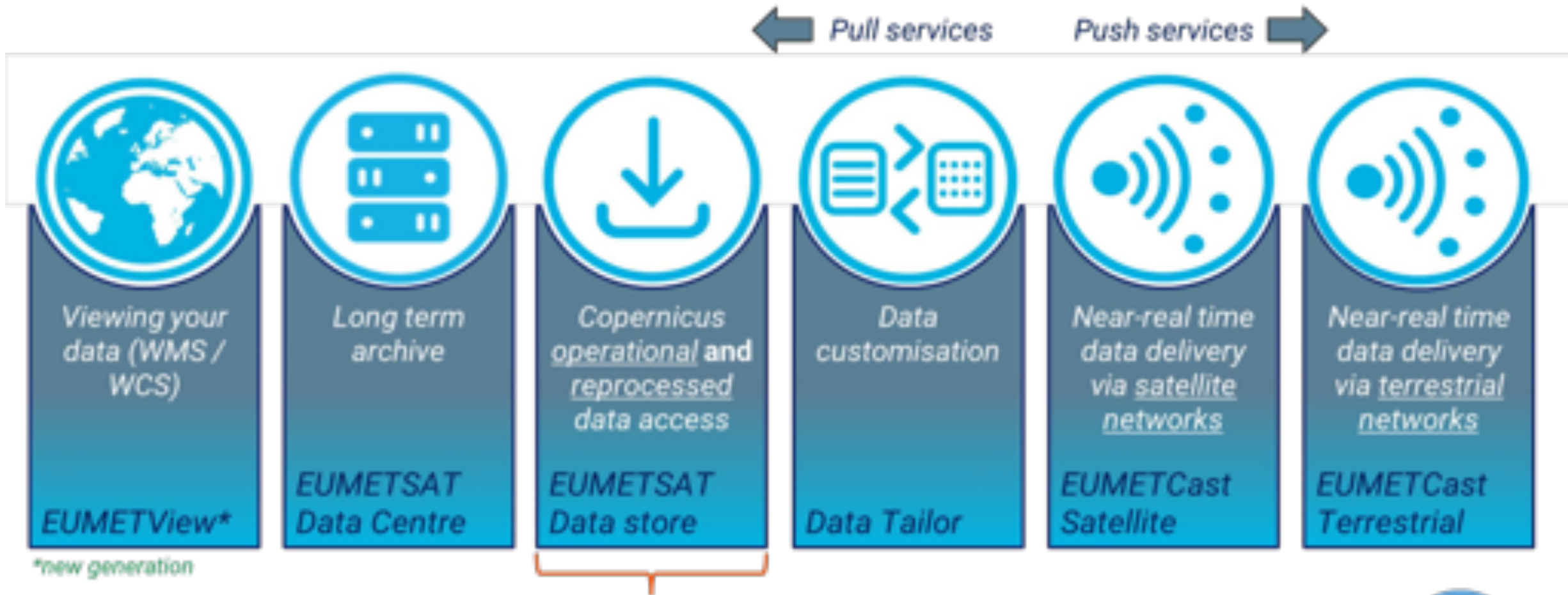


1 Browse API

2 OpenSearch API

3 Download API

4 Subscription API



Data Store has replaced the CODA and CODAREP services used by many Sentinel-3 users, offering unified access to operational and reprocessed data. It will allow access long time-series of the most up to data products, via a single point without the use of Data Centre in most cases (including to WEkEO).





The Copernicus Ecosystem

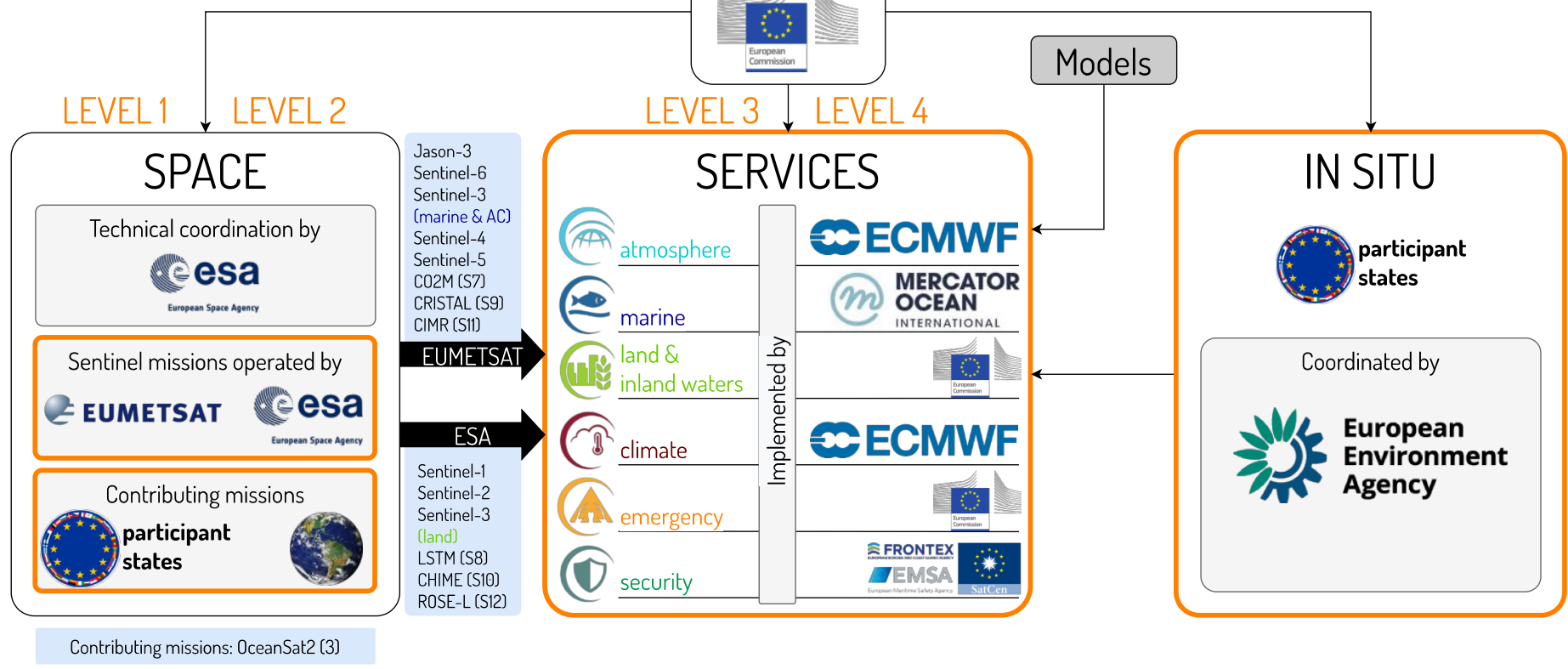
Ocean data is available across the Copernicus Programme ecosystem

EUMETSAT operates a number of Sentinel satellites and delivers data at levels 1 and 2




- 2 marine consortia (nominal, N/W & S/E)
- User driven data delivery/ services for marine environment
- Partnerships with government and industry

Satellite data processed by EUMETSAT feeds in to the Copernicus services and many downstream applications



Contributing missions: OceanSat2 (3)



The Copernicus Marine Service (CMEMS)

www.eumetsat.int



SINGLE ACCESS POINT

The screenshot shows the Copernicus Marine Service website. At the top, there is a navigation bar with links for Resources, News, Events, Contact, and Register. Below this is a secondary navigation bar with links for Services, Opportunities, Access Data, User Cases, User Corner, and About. The main banner features the Copernicus Marine Service logo and the text: "Copernicus Marine Service. Providing free and open marine data and services to enable marine policy implementation, support Blue growth and scientific innovation." A prominent "Access Data" button is visible. Below the banner, there are four main service categories: Ocean Products, Ocean State Report, Ocean Monitoring Indicators, and Ocean Visualization. At the bottom, a "Quick Links" section provides shortcuts to the User corner, Policy tools, Services, and User learning services.

Online catalogue
marine.copernicus.eu

More than 300
scientifically
qualified products

User driven

Common format
(Netcdf)

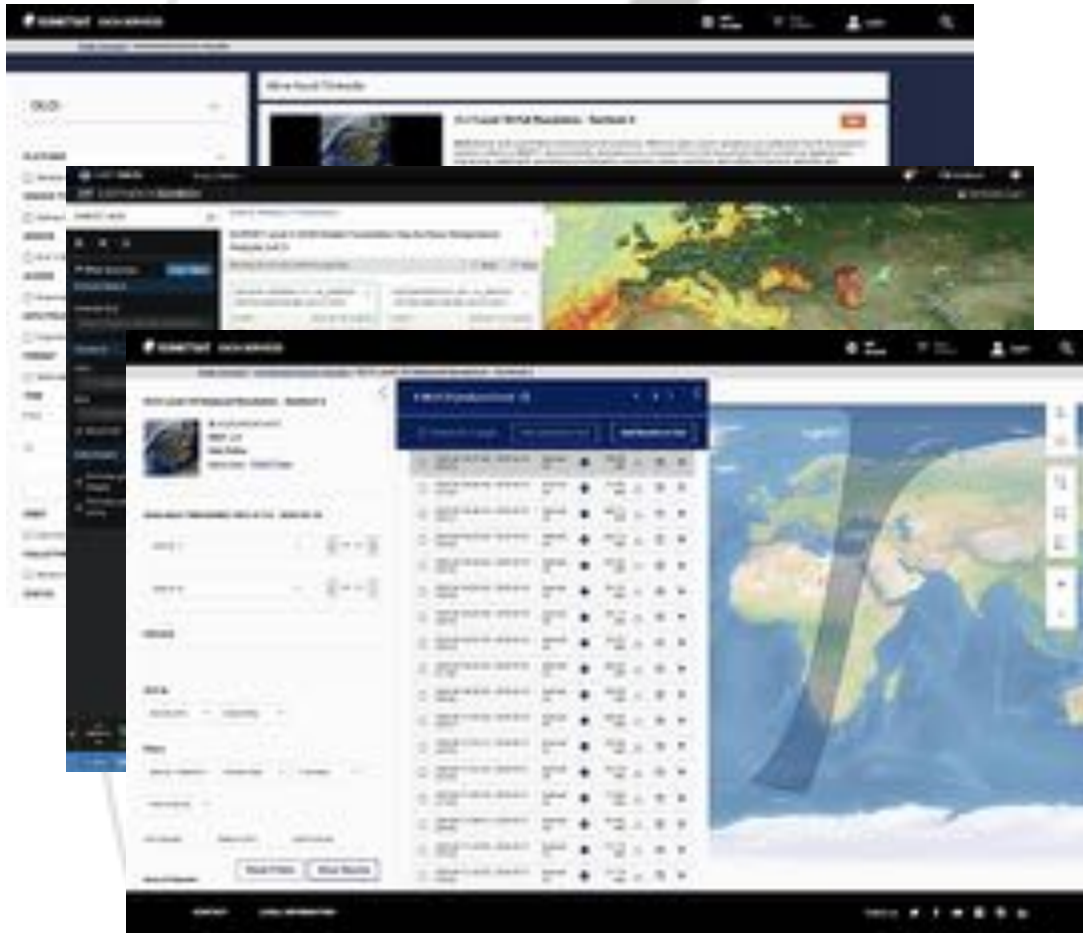
Open and Free

<https://marine.copernicus.eu/>





WebUI: machine to human




API: machine to machine





Jupyter Notebooks with EUMDAC (GitLab)

- APIS can be hard to use, so we wrote EUMDAC (EUMETSAT Data Access Client) to facilitate automated data Access.
- Source code available at: <https://gitlab.eumetsat.int/eumetlab/data-services/eumdac> 
- We offer a series of examples showing how to EUMDAC via:
 - Command line (see user guides)
 - Python library – supporting Jupyter notebooks available
- Within the learn-OLCI repository folders we show:
 - Advanced search and filtering options
 - Navigating operational and reprocessed collections to acquire time series
- EUMDAC embedded in ThoMaS toolkit

README.md

etsat.int

EUMDAC - EUMETSAT Data Access Client

EUMDAC is the EUMETSAT Data Access Client. It provides simple access to the EUMETSAT data of all satellite missions. As a Python library, it comes with many methods and helpers to use EUMETSATs APIs and services, like Data Store and Data Tailor. As a CLI, it provides a variety of useful command line utilities for data search, translation and processing.

Please consult the following documentation for more information:

- [EUMDAC User Guide](#) - Installing and using the CLI and library.
- [EUMDAC API Reference](#) - Detailed information on classes, functions, and modules, including method descriptions and parameter usage.

Prerequisites

You will need a python environment to run the library implementation of this code. EUMDAC requires Python 3.7 or higher. We recommend that you install the latest Anaconda Python distribution for your operating system (<https://www.anaconda.com/>). No prerequisites are identified for running the CLI binary.

Installing the EUMDAC library and CLI

Installing with PIP

The EUMDAC Python package is available through PyPI:

```
pip install eumdac
```

Installing with Conda

To install EUMDAC on the Anaconda Python distribution, please visit the [EUMETSAT conda-forge page](#) for install instructions.

```
conda install -c eumetsat-forge eumdac
```

Installing from source

To install EUMDAC from the development source, clone the repository and install it locally.

```
git clone https://gitlab.eumetsat.int/eumetlab/data-services/eumdac.git
cd eumdac
pip install .
```



- Marine data served by EUMETSAT (land served by ESA)
- Available from our Data Store (and from WEkEO).
- New data store service with API access and client.
- Lots of supporting notebooks in learn_olci
- ***NOTE*** - different git clone command - uses submodules 😊
- Notebook example will lead you through access –
 - 1_1a_OLCI_data_access_Data_Store.ipynb
 - 2_2_acquire_OLCI_time_series.ipynb



SNAP
SeNtinel
Applications
Platform





SNAP is

- an ecosystem to analyse, process and communicate Earth Observation data
- an Open-Source Project - github.com/senbox-org
- scalable to run on notebooks up to large production clusters
- used for scientific analysis, operational production and training
- easy to use

SNAP can

- access many satellite-based Earth Observation data products as well as generic raster formats directly in the cloud
- visualise the data in many ways
- analyse data using statistical functions, mathematical operations, correlation, comparison with point and vector data
- process satellite data with instrument specific as well as generic raster data operations
- save sessions and export results in various raster and non-raster formats
- be extended using Java and Python API

SNAP has

- comprehensive documentation - step.esa.int
- > 1 Million users and active community, > 10 000 forum users - forum.step.esa.int
- a long-term commitment of the European Space Agency

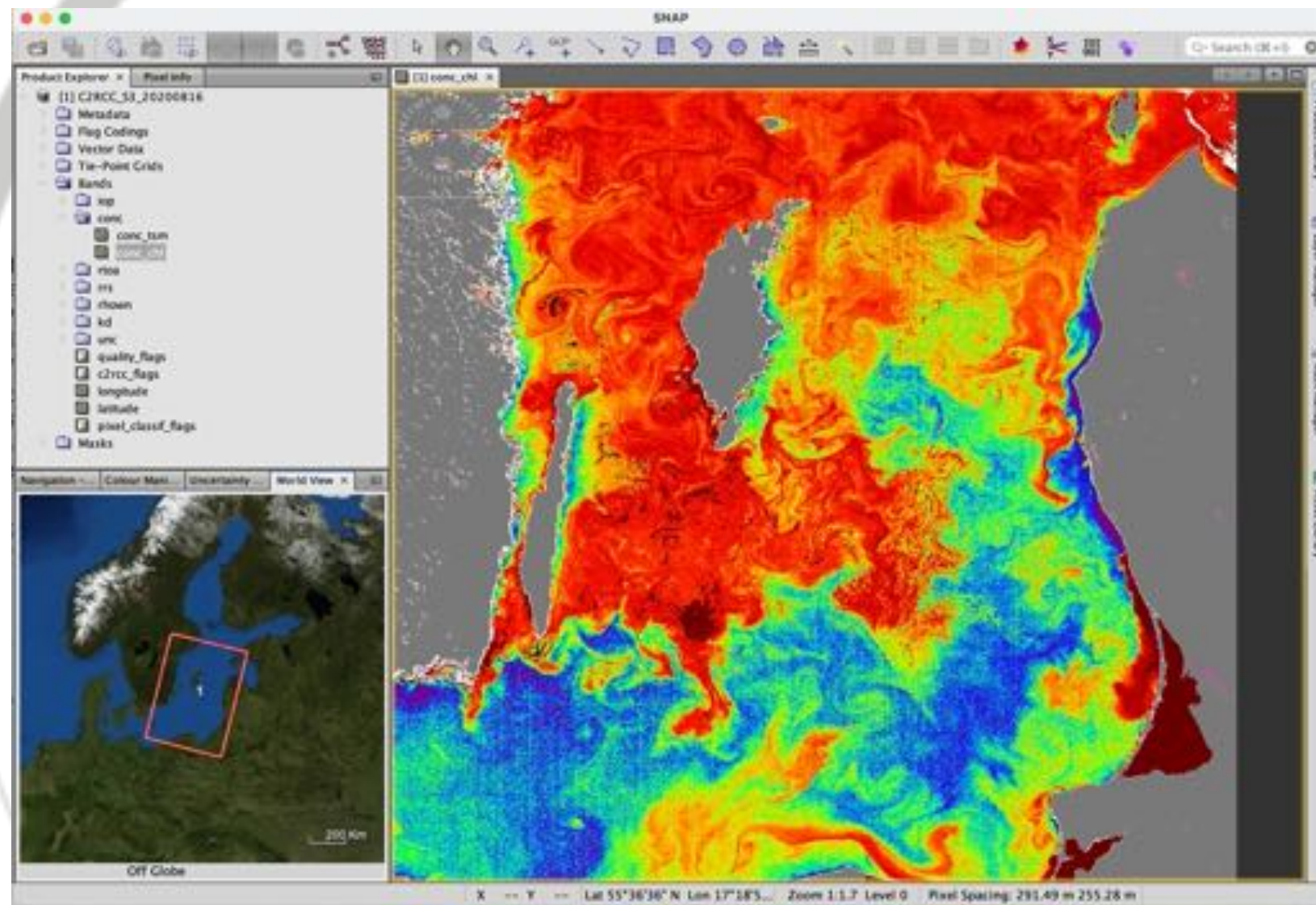




SNAP Desktop is the GUI application which allows access to a large number of EO and generic raster data.

It provides various tools to display the data, and to visually analyse them.

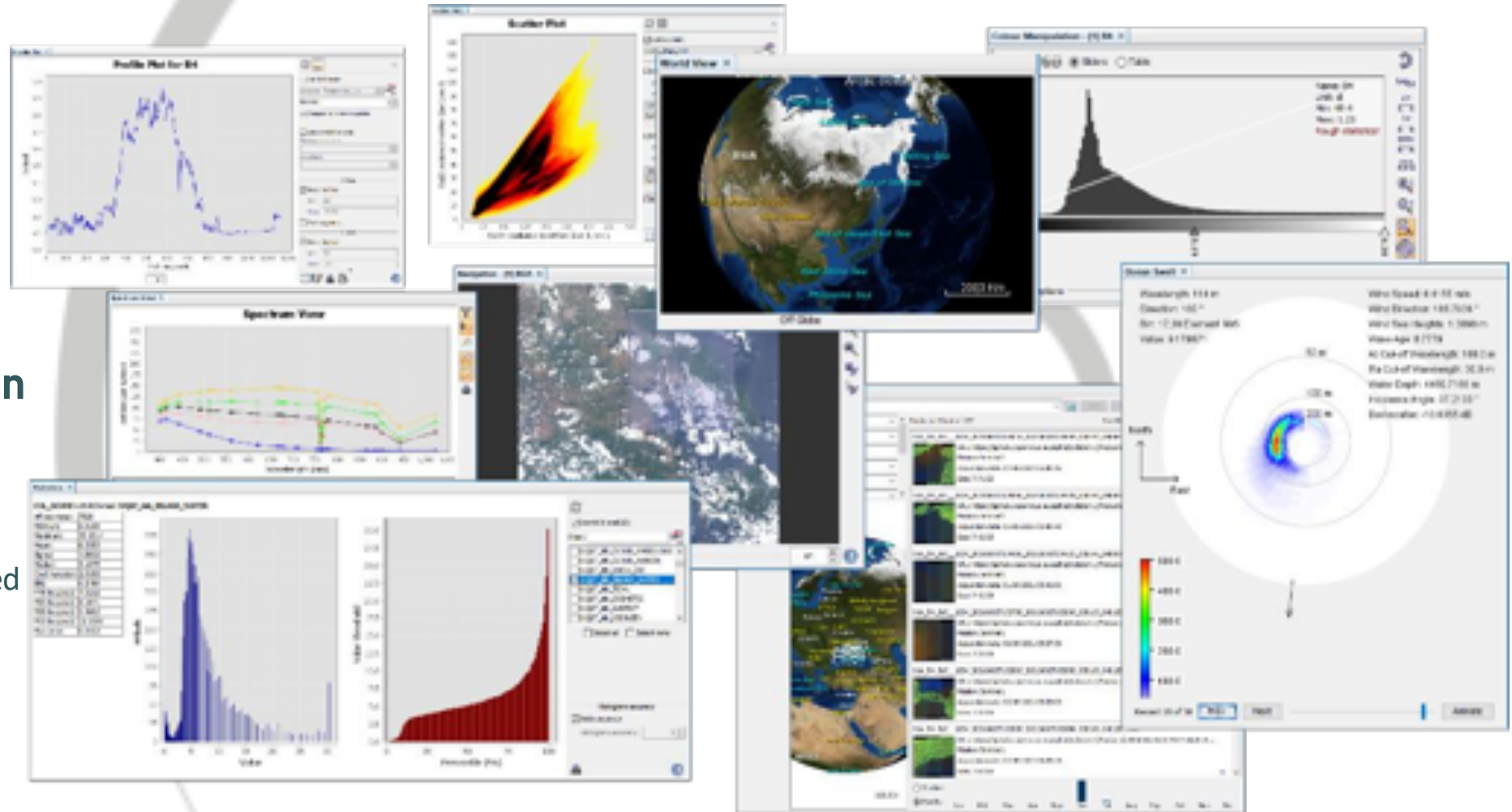
The figure on the right shows the OLCI chlorophyll-a products from C2RCC.





SNAP provides a rich suite of tools for data analysis, including profile and spectrum plots, statistical analysis, extraction of points through time series, and comparison with reference data (match-ups).

The figure shows some of the graphical analysis tools included in SNAP.

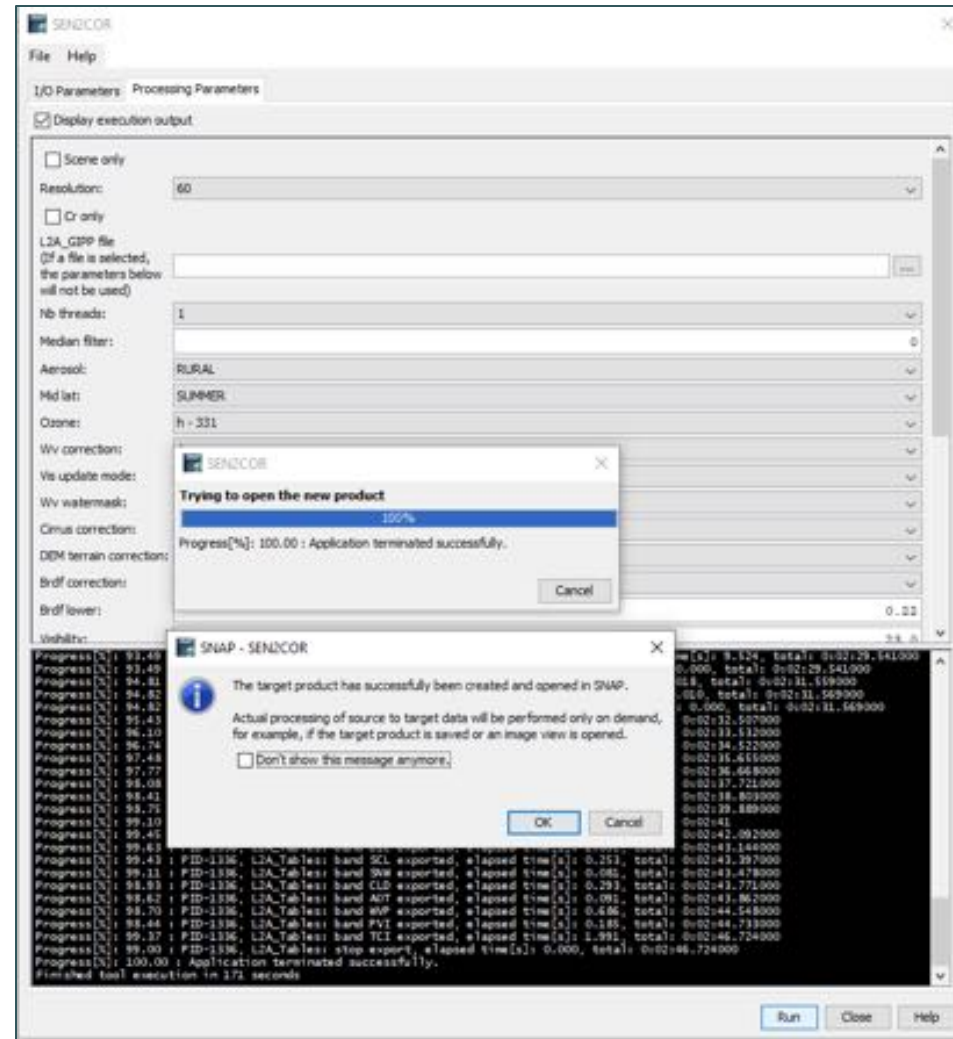




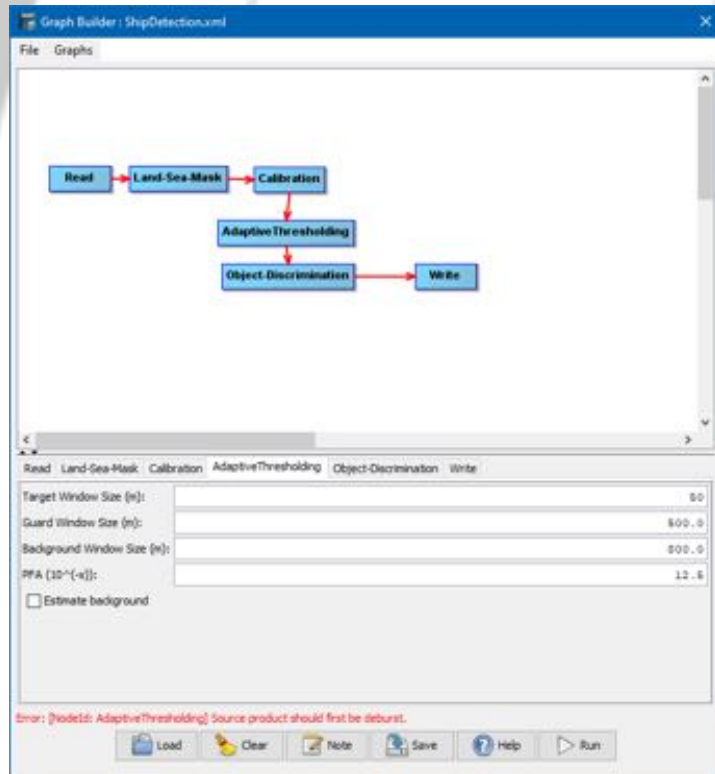
SNAP data processing

SNAP Data Processors analyse one or more input products and generate a new output product. Processors exist for generic operations such as band arithmetic, map projection or temporal aggregation. SNAP also provides a very large number of thematic processors, e.g. for atmospheric correction, biophysical indices calculation or retrieval of water quality. And SNAP supports special calibration of correction of satellite instruments with dedicated processors.

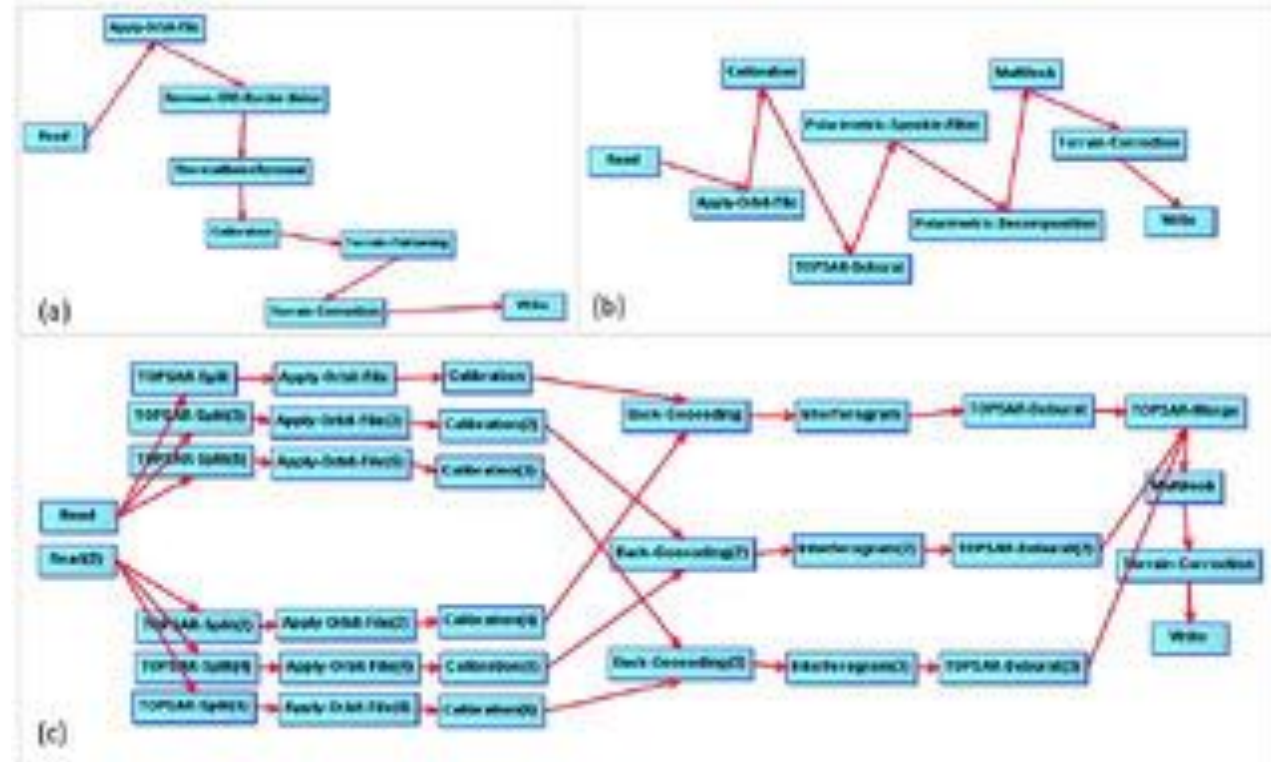
The figure shows the GUI for the Sentinel-2 Atmospheric Correction Processor `sen2cor`. The screenshot was taken when the processor was successfully executed. The black background shows the logging information during execution of the processor.



<https://classroom.eumetsat.int/course/view.php?id=541>



The SNAP graph builder allows to connect SNAP operators in processing graphs. These can be executed locally or in large clusters and cloud systems.



Example: Workflows in the SNAP graph builder tool for producing Synthetic Aperture Radar (SAR) analysis ready data (ARD) products. From Ticehurst, et al (2019). Building a SAR-Enabled Data Cube Capability in Australia Using SAR Analysis Ready Data. Data. 4. 100. 10.3390/data4030100.



User Forum

The screenshot shows the 'step forum' interface. It features a navigation bar with 'all categories', 'Categories', 'Latest', and 'Top'. Below this, there are three main categories listed:

- s1tbx**: The S1 Toolbox category regroups all threads about the Sentinel-1 Toolbox, as SAR readers or processors. It has 29 threads.
- s2tbx**: The S2 Toolbox category regroups all threads about the Sentinel-2 Toolbox as Sentinel-2 product readers and product manipulation, Sentinel-2 processors as L2A processor for atmospheric correction, L3 processor for temporal synthesis, etc. It has 15 threads.
- s3tbx**: The S3 Toolbox category regroups all threads about the Sentinel-3 Toolbox as readers and processors for Sentinel-3 OLCI & SLSTR L1 & L2. Useful information about Sentinel-3 and the data can be found at the S3VT Documentation page. It has 2 threads.

Issue Tracker

The screenshot shows the 'SNAP' Issue Tracker landing page. It has a navigation bar with 'Ihre Aufgaben', 'Projekte', 'Filter', and 'Dashboard'. The main section is titled 'Landing Page' and lists several projects:

- CHRIS-Box (CHRIS)**: Leitung: Marco Peters
- Sentinel-1 Toolbox (S1TBX)**: Leitung: Luis Vici
- Sentinel-2 Toolbox (S2TBX)**: Leitung: Florian Douzich
- Sentinel-3 Toolbox (S3TBX)**: Leitung: Marco Peters
- Sentinel Application Platform (SNAP)**: Leitung: Marco Peters
- SMOS Toolbox (SMOSTEX)**: Leitung: Tom Block
- SNAP Requirements Monitoring (SRM)**: Leitung: Marco Peters
- SNAP User Feedback (SUF)**: Leitung: Oana Hogoiu

Tutorials

The screenshot shows the 'SNAP' Tutorials page. It has a navigation bar with 'DOCUMENTATION' and 'Tutorials'. The main content area is titled 'Found 70 tutorials' and lists several categories:

- SNAP (GENERAL TOOLBOX USAGE)
- SENTINEL-1 TOOLBOX (SAR APPLICATIONS)
- SENTINEL-2 TOOLBOX (HIGH RESOLUTION OPTICAL APPLICATIONS)
- SENTINEL-3 TOOLBOX (MEDIUM RESOLUTION OPTICAL APPLICATIONS)
- ESA TRAINING COURSES (ESA TRAINING COURSES)
- EXTERNAL RESOURCES (EXTERNAL RESOURCES)
- OTHER (OTHER TUTORIALS)
- ALL (ALL TUTORIALS)**

For Developers

The screenshot shows the 'SNAP' Developers page. It has a navigation bar with 'COMMUNITY' and 'Developers'. The main content area is titled 'Developers' and includes several sections:

- Source code**: We are using Git to keep track of code changes, and the source code is available on GitHub. We highly encourage fixes and new features made to the code for submission to the repository.
- SNAP API Documentation**: For developers who want to extend or patch SNAP we provide the Javadoc here:
 - SNAP System API Documentation
 - SNAP Desktop API Documentation
- License**: The Sentinel Toolboxes and full system code is open source software and is distributed under the GNU GPL license.
- Wiki**: The [SNAP Wiki](#) contains valuable resources for getting familiar with the software.
- Forum**: There is a dedicated section in the [Forum](#) for development-related topics.

SNAP Community and Tutorials

<http://forum.step.esa.int/c/s3tbx>
<http://step.esa.int/main/doc/tutorials/>
<https://senbox.atlassian.net/wiki/spaces/SNAP/pages/1898053693/SNAP+FAQs>

SENTINEL TOOLBOX (GROUND RESOLUTION OPTICAL APPLICATIONS)

ESA TRAINING COURSES (ESA TRAINING COURSES)

EXTERNAL RESOURCES (EXTERNAL RESOURCES)

OTHER (OTHER TUTORIALS)

ALL (ALL TUTORIALS)

Showing [1 ... 6] from 6

Search for specific tutorials...

SENTINEL-3 TOOLBOX
Data conversion and export for Sentinel-3
A small guide on converting and exporting Sentinel-3 data to a format that can be used in GIS software. This guide is made primarily for the users of Sentinel-3 data in the form of SAR products and files in the form of SAR products.

JUNE 25, 2018 HARVEY
READ →

HOW TO VISUALISE SENTINEL-3 DATA
Download & Visualise Sentinel-3 Data
SENTINEL-3 data can be downloaded and visualised using the Sentinel-3 Data Visualisation Tool (SVT) and the Sentinel-3 Data Visualisation Tool (SVT).

MARCH 1, 2017 ANDREA
PLAY →

SENTINEL-3 TOOLBOX
Introduction to Sentinel-3 Toolbox
This document gives a general introduction to the Sentinel-3 Toolbox.

JUNE 1, 2018 ANDREA
READ →

SENTINEL-3 TOOLBOX
Rayleigh Correction Tutorial (S3 OLCI, MERIS, S2 MSI)
This tutorial explains how to calculate Rayleigh correction for Sentinel-3 OLCI, MERIS, and S2 MSI.

JUNE 15, 2017 ANNA S. RUCICALSKI
READ →

SENTINEL-3 TOOLBOX
S3TBX Collocation Tutorial
This tutorial explains how to calculate collocation for Sentinel-3 OLCI and MERIS.

OCTOBER 1, 2017 ANNA S. RUCICALSKI
READ →

step forum

FAQ GDPR

Dear SNAP users,

We would love to have your feedback on your SNAP experience. It would help us to know which are the things that should be improved and taken into consideration for the future, so that you will be satisfied when using SNAP.

Please take an anonymous survey in order to help us helping you:
[SNAP User Survey](#)

Many thanks from SNAP Team!

all categories Categories Latest New (2) Unread (275) Top + New Topic

Category Topics Latest

s1tbx 5.6k 81 unread

The S1 Toolbox category regroups all threads about the Sentinel-1 Toolbox, as SAR readers or processors.

- Problem Reports 12 unread
- Interferometry 2 unread
- Polarimetry 1 unread
- SwathSAR 1 unread
- PyRate 1 unread
- snaphu 2 unread

s2tbx 2.5k 81 unread

The S2 Toolbox category regroups all threads about the Sentinel-2 Toolbox as Sentinel-2 product readers and product manipulation, Sentinel-2 processors as L2A processor for atmospheric correction, L3 processor for temporal synthesis, etc.

- sen2cor 10 unread
- sen2time 1 unread
- Problem Reports 1 unread
- sen2time 1 unread

s3tbx 579 21 unread 1 new

The S3 Toolbox category regroups all threads about the Sentinel-3 Toolbox as readers and processors for Sentinel-3 OLCI & SLSTR L1 & L2. Useful information about Sentinel-3 and the data can be found at the [S3VT Documentation](#) page.

- Problem Reports 1 unread

snap 2.2k 114 unread 1 new

This category contains all topic about the Sentinel-3 Application (SNAP) not related to a specific Sentinel-3 Toolbox.

Failure to import ICEYE H5 file and solution 0 10h

- Problem Reports

Error while running snaphu-unwrapping 0 11h

- snaphu

COSMO-SkyMed Coreg_fg_subset Error 10 20h

- s1tbx

Snap2stamps error 239 20h

- SwathSAR

Mosaicking of SAR SLC images 0 22h

- Interferometry

NESZ of Radarsat-2 0 22h

- s1tbx

Atmospheric Correction for InSAR 119 23h

- s1tbx

Uav_sar_snap 0 1d

- swat

ps_plot velocity 12 1d

- SwathSAR

Phase to displacement theory 0 1d

- Show Room

SNAP software Back-Geocoding Error 0 1d

- Problem Reports

No_initial_PS_candidates (sentinel-1) 0 1d

- Problem Reports

UNITS of sentinel 3 0 1d

- s3tbx

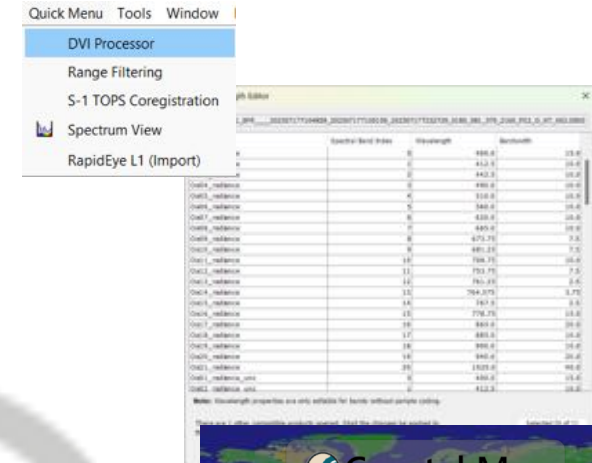


SNAP plugins



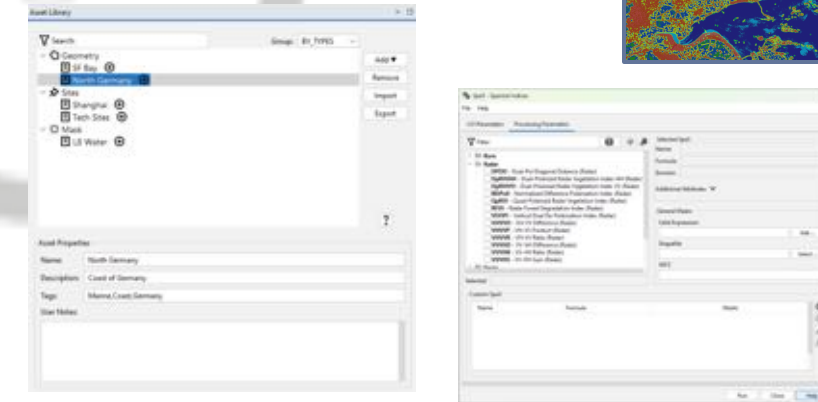
The **Basic Toolbox** (free) provides various tools to ease the daily work and to save valuable time while working with SNAP

- The **Quick Menu** provides quick access to the most often used menu actions.
- The **Band Maths Extensions** Adds new functionalities like access to map coordinates, window calculations, min, max and mean functions, and checking if pixels are invalid.
- The **Wavelength Editor** Allows to edit the wavelength properties of multiple bands and apply the changes to compatible products.



The **Pro Toolbox** provides sophisticated tools to analyse and process data and to retrieve scientific results

- The **Asset Library** allows to manage the resources you most often use like geometries, sites and masks. You can easily add them to your data.
- The **Coastal Map** provides Land-water, coastline and tidal flat indicators and a vicinity indicator for land close to water and water close to land.
- **SpeX** allows you to easily manage and compute spectral indices (>240).



- **Super-Resolve Scenes to 5 Meter**
- **View Geometry Upscaling**
- **Surface Reflectance Normalisation**

Read more in the EOMasters blog:
www.eomasters.org/blog



The screenshot displays the EUMETSAT User Portal interface. On the left is a dark blue sidebar with the EUMETSAT logo and navigation options. The main content area is white and includes a featured article titled 'Keen to start using MTG FCI data?' with a satellite image. Below this are sections for 'Using MTG data', 'News', and 'Getting started'. The 'News' section contains several articles with circular icons. At the bottom, there is a grid of promotional banners for 'Data Store', 'Data centre', 'EUMETSAT Africa', 'EUMETSAT Europe', 'EUMETSAT Terrestrial', 'EUMETSAT View', 'European Weather Cloud', 'Registration portal', and 'WEKEO'.



More information: User Support and Training Resources

www.eumetsat.int

EUMETSAT Helpdesk

OPS@eumetsat.int

Contact the EUMETSAT helpdesk with any questions about EUMETSAT data products or services

User portal (coming soon)

Copernicus & mandatory missions
Data access



Courses



moodle



EUMETSAT User Support Resources

Code distribution

CONDA



GitLab



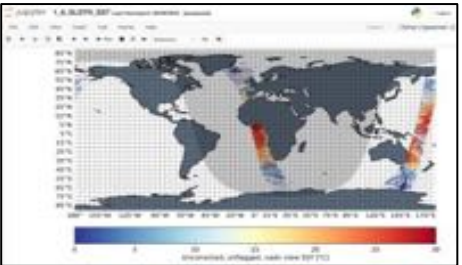
Video tutorials



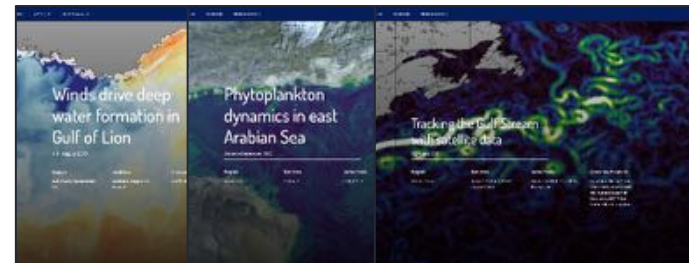
YouTube



Jupyter Notebooks



Case studies



Cloud services binder WEKEO





Thank you for attending! What's next?

To...

- ...find out more information on our training programmes and collaborating on events contact: training@eumetsat.int
- ...ask questions about EUMETSAT data and services contact ops@eumetsat.int
- ...see what in-person and online training events we have coming up, check our training calendar at <https://trainingevents.eumetsat.int/trui/>