EUMETSAT

PROGRAMME OF THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth

EUMETSAT Marine data resources and handling

Olivier Membrive
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Météo-France
Contributions from Hayley Evers-King and Ben Loveday
03/07/2023

EUMETSAT

The European Organisation for the Exploitation of Meteorological Satellites.

- An international organisation with 30 member states.
- Providing observations and data services for operational weather and Earth system monitoring and forecasting, and for climate services.
- Establishing additional capabilities in partnerships with the European Union and other satellite operators to achieve synergy with our own satellite missions for the common benefit of Member States and partners.
- Strong international collaborations within Europe, the US, and Africa & others.

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)

www.eumetsat.int

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

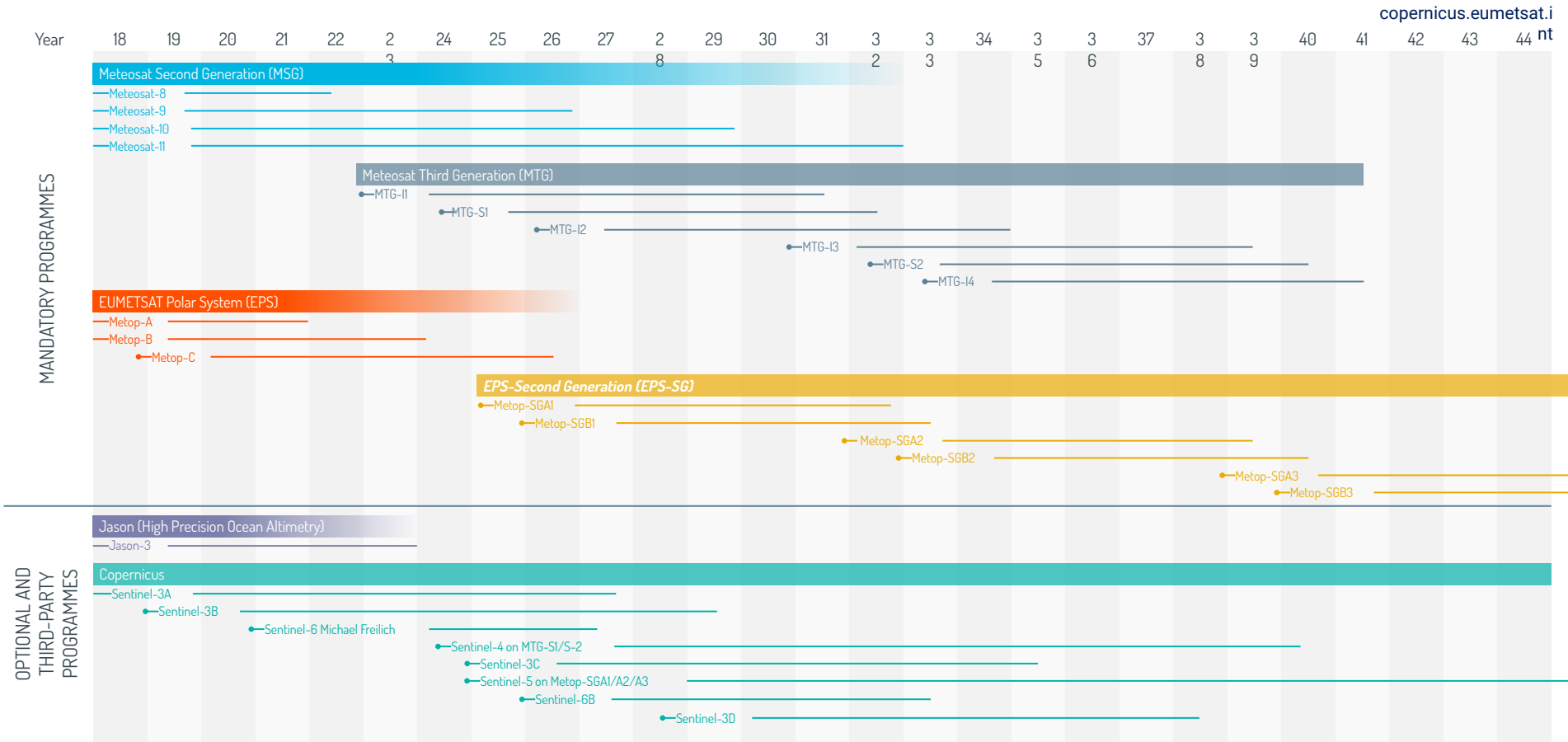
METOP-B & -C (98.7° incl.)
Low Earth, sun-synchronous orbit

EUMETSAT Polar System (EPS)/ Initial Joint Polar System

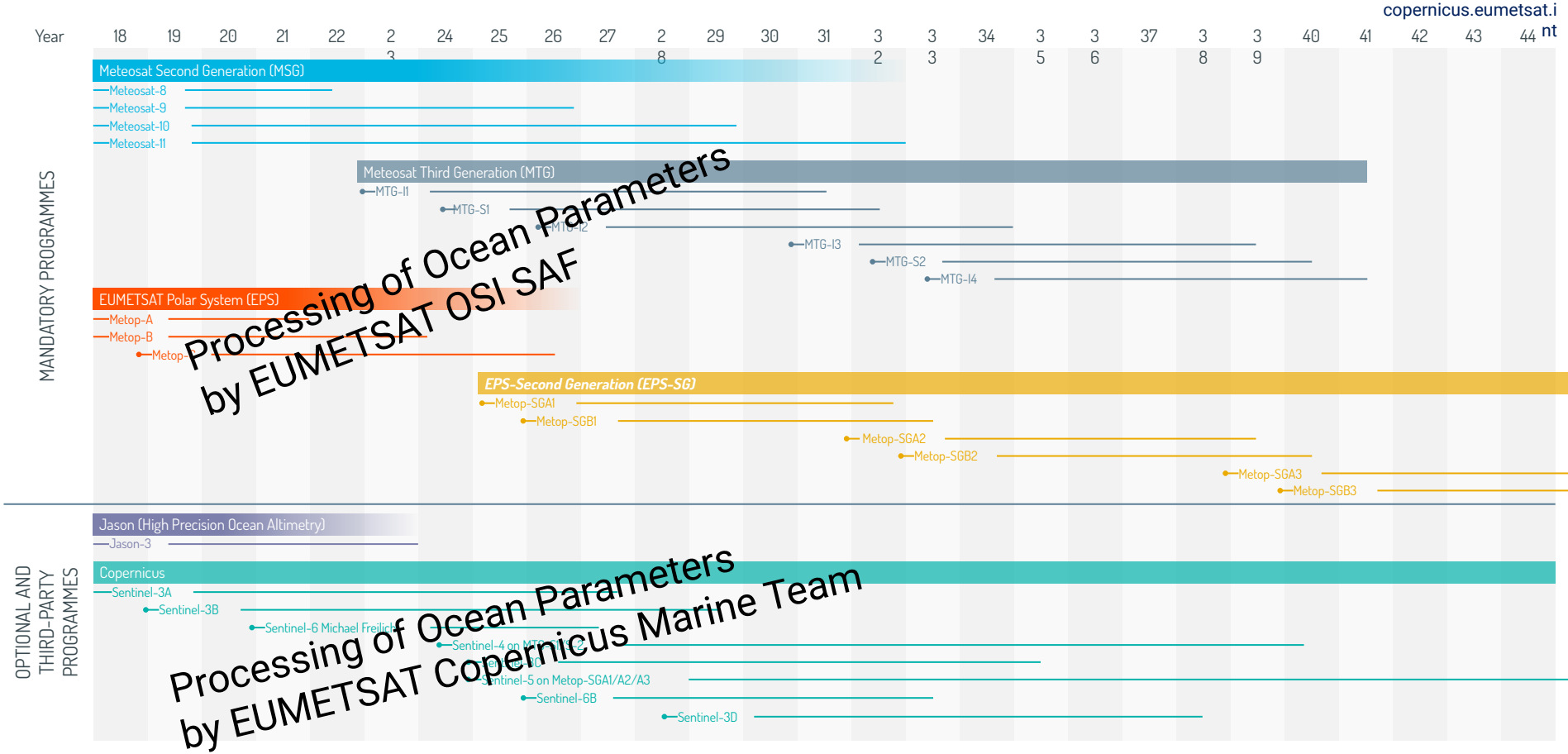
MTG-I1
Geostationary orbit

Meteosat Third Generation imaging mission, currently in commissioning phase

EUMETSAT mission planning

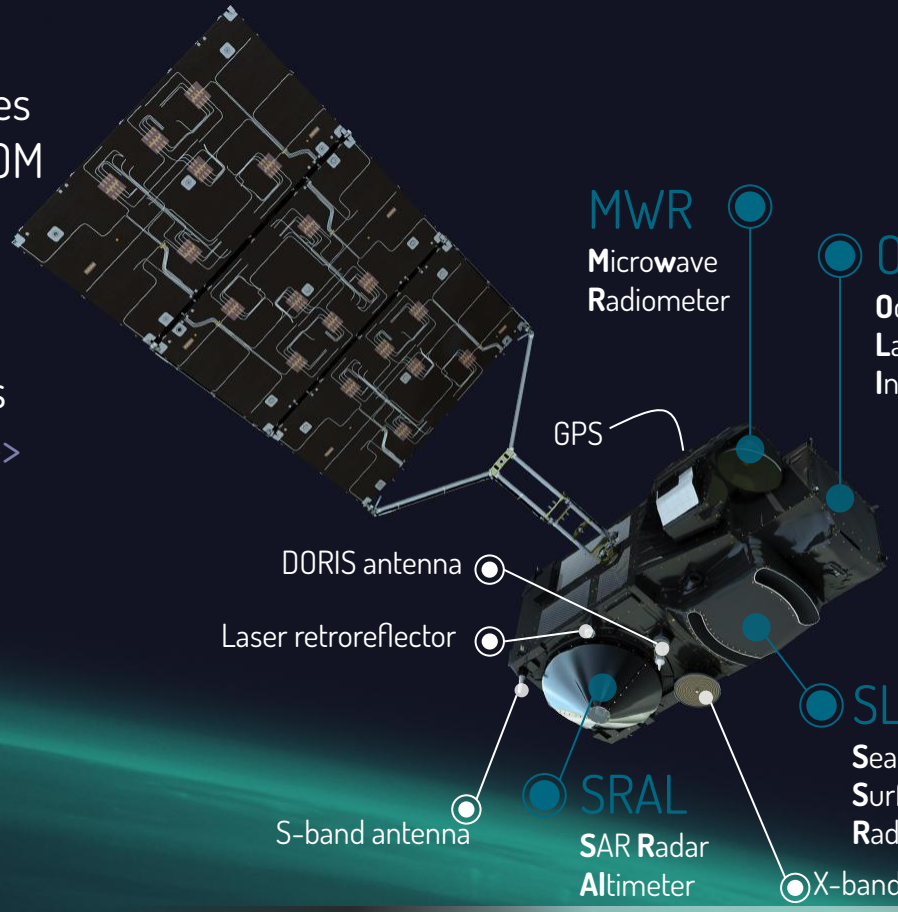


EUMETSAT mission planning



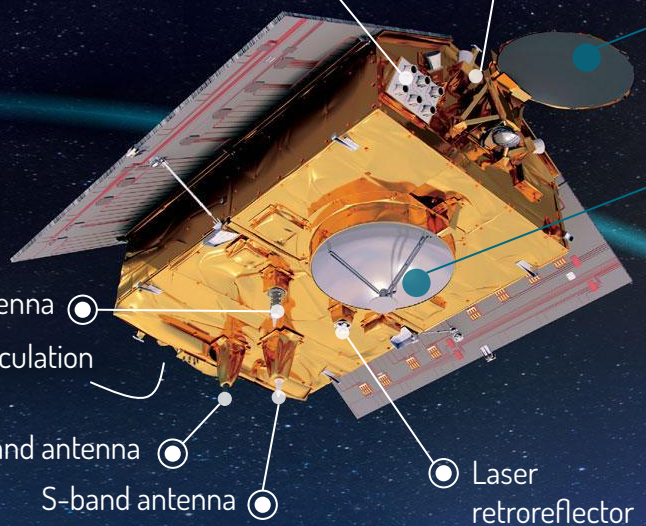
Sentinel-3 instruments and variables

- OLCI >> visible radiometry
  - **ocean colour**: radiances & reflectances
  - chlorophyll, suspended sediment, CDOM
  - 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



Sentinel-6 instruments & variables

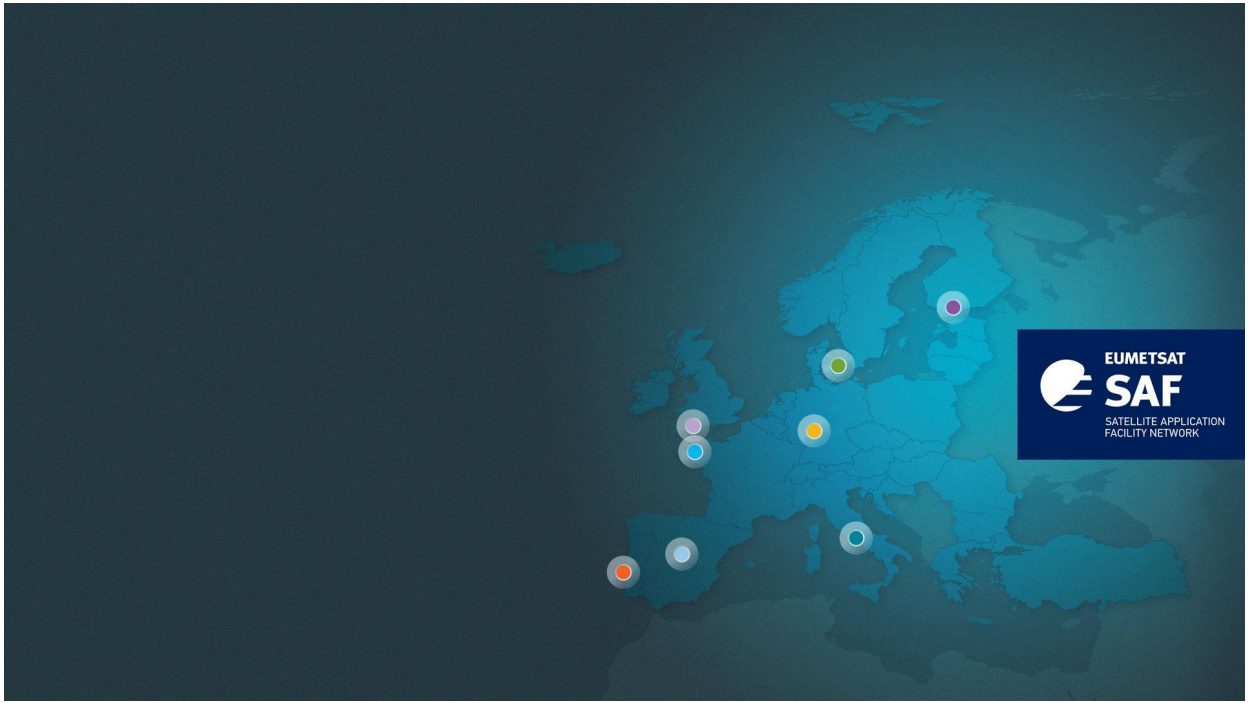
- POS-4 / AMR-C / POD (DORIS/GNSS/LRR) >> surface topography mission
  - Sea surface height
  - Significant wave height
  - Wind speed
- POS-4 ;
  - back compatible (climate continuity)
  - state-of-the-art (open burst transmission, low noise, improved resolution)



Satellites Application Facilities

To carry out its activities on a European scale, and expand its ground segment, EUMETSAT has relied on the skills of the meteorological services of the Member States. Utilising specialist expertise from the Member States, Satellite Application Facilities (SAFs) are dedicated centres of excellence for processing satellite data. They form an integral part of the distributed EUMETSAT Application Ground Segment.

There are eight of them, each of which has taken charge of the development of a set of products derived from satellite data, or software using these data, with the ultimate goal of providing them to users in an operational framework.



https://www.eumetsat.int/about-us/satellite-application-facilities-safs

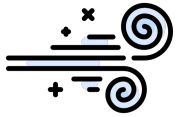
OSI SAF - About

The OSI SAF (Ocean and Sea Ice Satellite Application Facility) is the dedicated EUMETSAT centre for processing satellite data at the ocean-atmosphere interface.

EUMETSAT OSI SAF
OCEAN AND SEA ICE

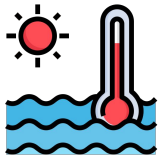
METEO FRANCE
Ifremer
Norwegian Meteorological Institute
Danish Meteorological Institute
Royal Netherlands Meteorological Institute
Ministry of Infrastructure and the Environment

OSI SAF Products



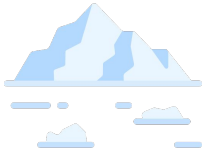
Sea Surface Winds

- *Speed and Direction*



Sea Surface Temperature

- *Surface temperature*



Sea Ice Parameters

- *Concentration, Edge, Type, Emissivity, Drift*
- *IST - Sea Ice Surface Temperature*

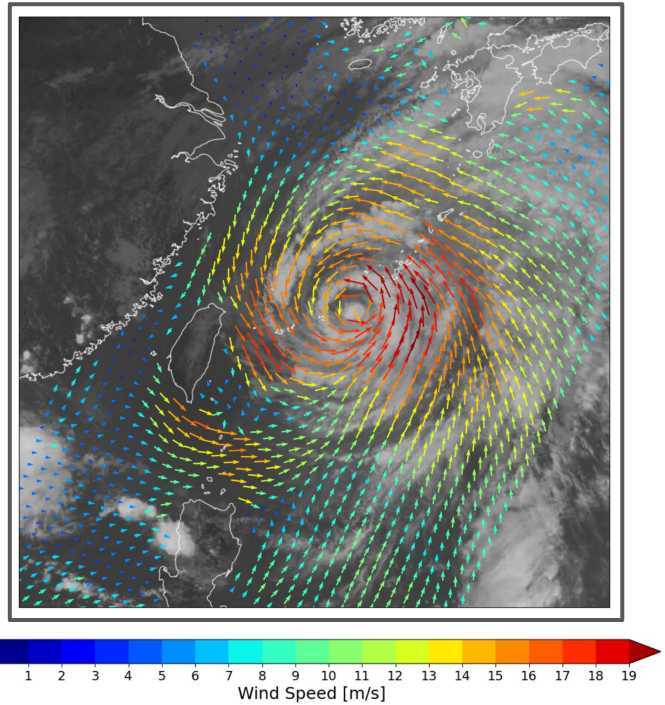
Radiative fluxes

- *Downward longwave irradiance*
- *Surface solar irradiance*

Operational and quality controlled products

OSI SAF Winds - Overview

Typhoon Mawar - HY-2B - 01/06/2023



Winds are derived from scatterometer missions.

To ensure global coverage, the objective is to process most of them.

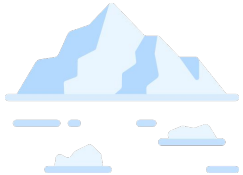
Currently:

- Metop-B and -C satellites,
- HY-2B, HY-2C, and soon HY-2D

Continuity with:

- CFOSAT,
- Oceansat-3,
- windRAD,
- Metop-SG-B/SCA and MWI

OSI SAF Sea Ice - Overview



Sea Ice Products

- Near real time
- Climate data records

- Sea Ice Concentration
- Sea Ice Edge
- Sea Ice Drift
- Sea Ice Type
- Sea Ice Emissivity
- Ice Surface Temperature

At both poles

Satellites

- DMSP/SSMIS + GCOM2/AMSR2, Metop/ASCAT

Continuity with:

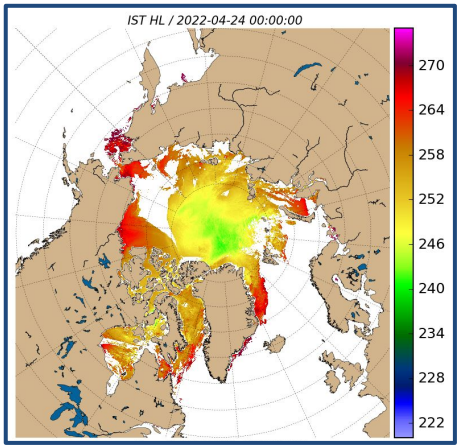
- (MWRI), Metop-SG-B/SCA and MWI

New foreseen products

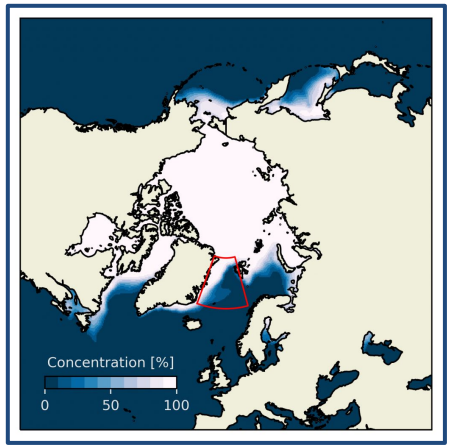
- Sea Ice Age
- Sea Ice Index
- Icebergs

OSI SAF Sea Ice - Gallery

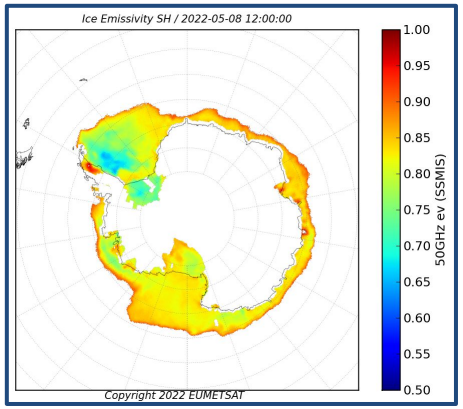
Ice surface temperature



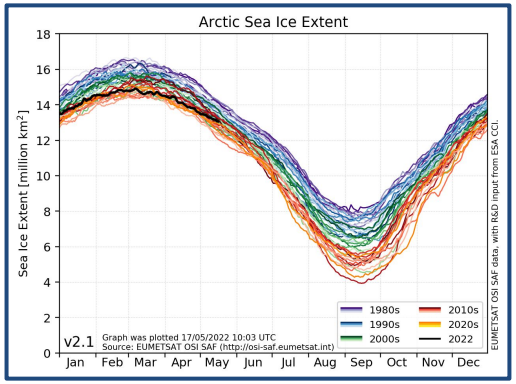
Sea Ice Concentration



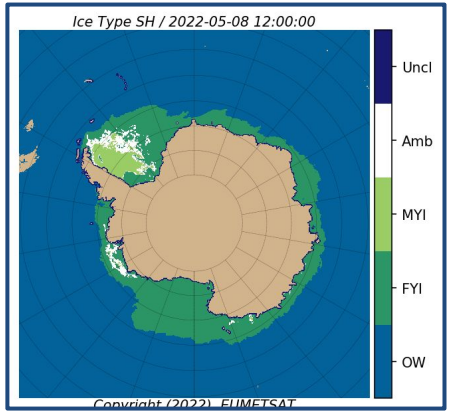
Ice Emissivity



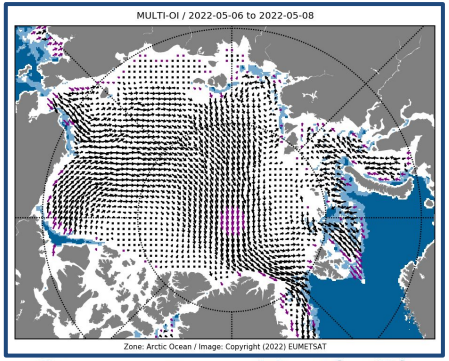
Sea Ice Extent



Sea Ice Type



Sea Ice Drift



EUMETSAT OSI SAF
OCEAN AND SEA ICE

Data use examples

Ocean State Report & Data redistribution

Case Studies & Distribution

The Antarctic ice is completing the seasonal melting phase, following the Antarctic summer. The extent of the sea ice at the end of February 2022 is the lowest in the last 44 years - the period when satellites have been used to monitor the ice.

Published on 02 March 2022

By Signe Aaboe and Thomas Lavergne (MET Norway), Christine Träger-Chatterjee (EUMETSAT)

The Satellite Application Facility on Ocean and Sea Ice (OSI SAF) is producing several satellite-derived products to monitor the evolution of sea ice in polar regions.

In February 2022 the OSI SAF Sea Ice Index (Figure 1) showed that the extent of the Antarctic sea ice was at its lowest since the beginning of satellite-based observations in 1979 (Figure 2).

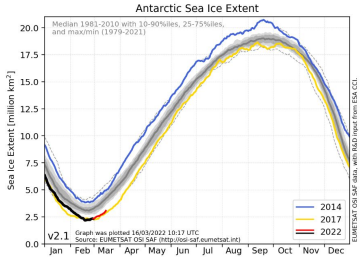
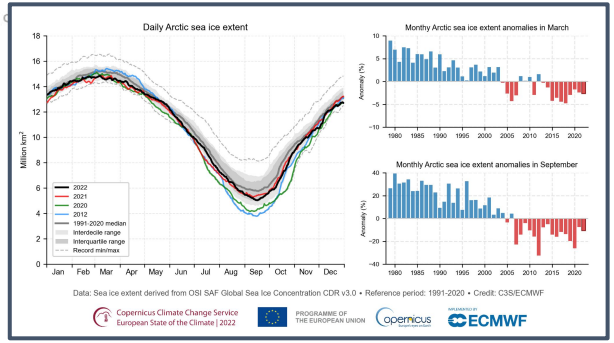
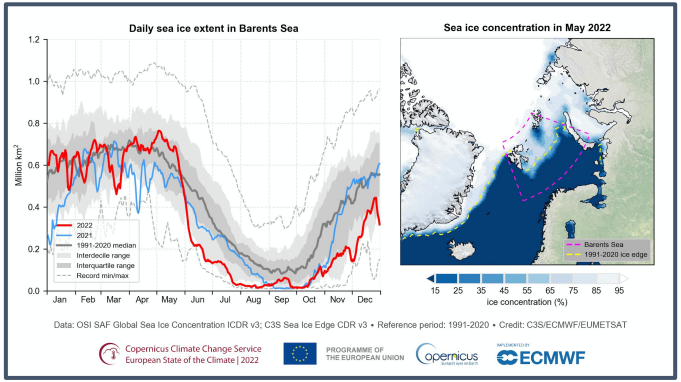


Figure 1: The Antarctic Sea Ice Index. Yellow line shows previous record minimum year (2017), red line shows the recent measurements

European State of Climate Reports & Data redistribution





OSI SAF SST - Overview

Satellites

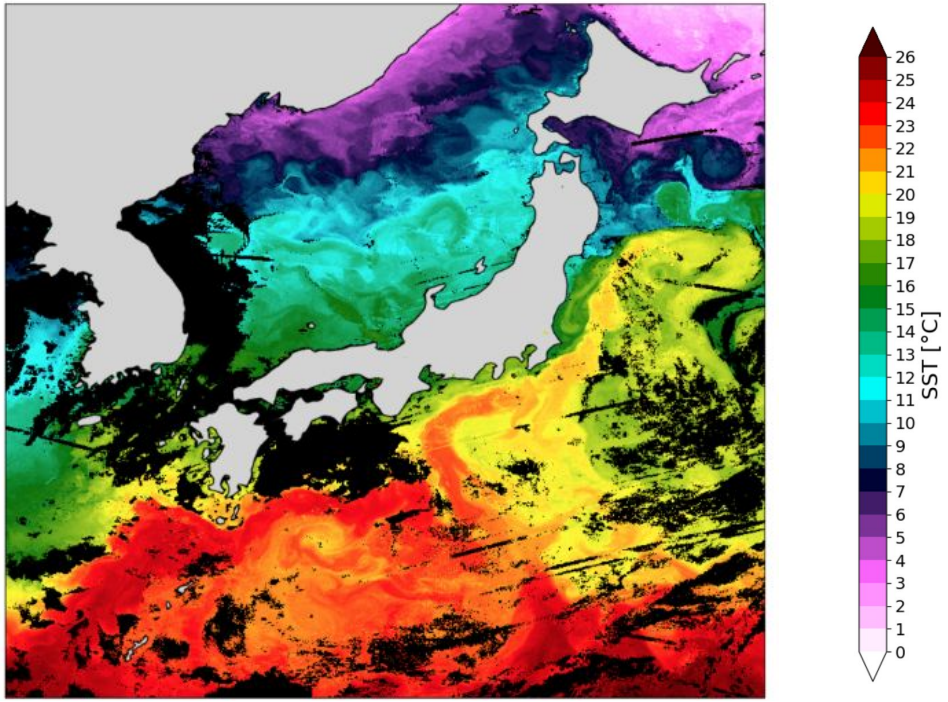
- Metop, NOAA, MSG-0°, MSG-IO, GOES-East

Continuity with:

- MTG
- Metop-SG

SST Products

- L2 products
- L3 Regional Products
- L3 Global Products



Sea Surface Temperature Metop-B - 02/05/2023

OSI SAF SST - Continuity

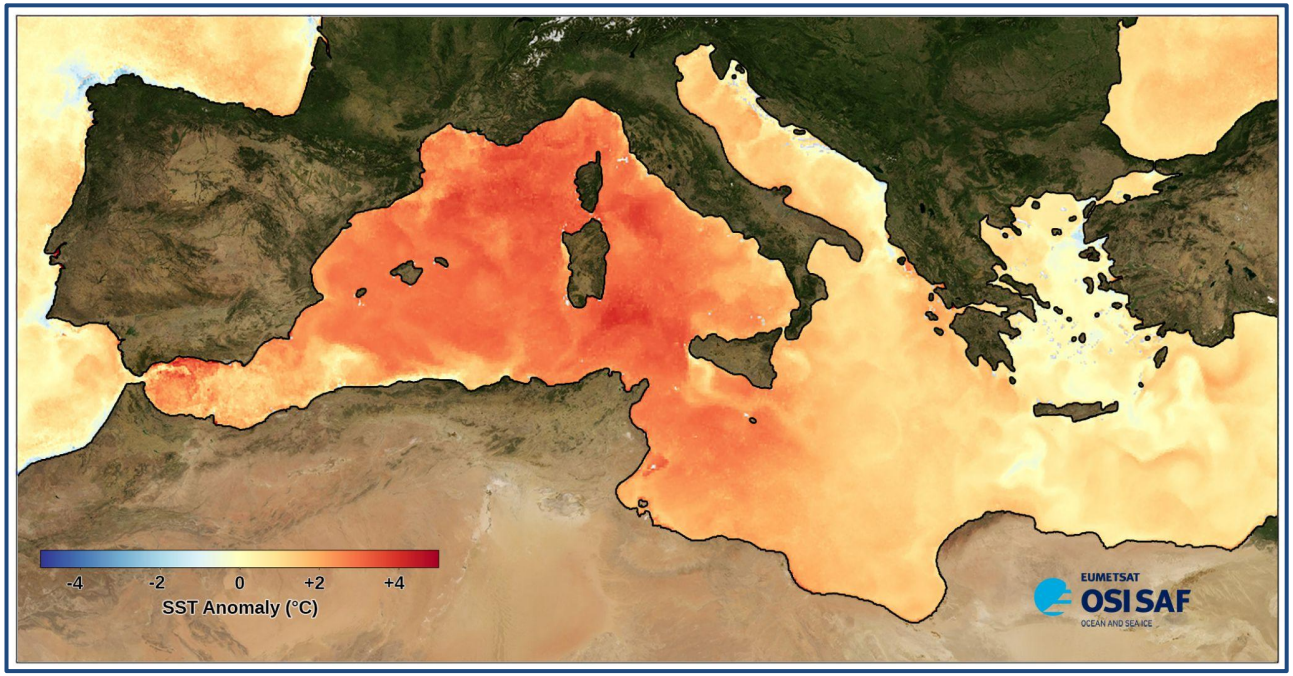
Climate Application

- Monitoring surface temperature anomalies

Continuity

- MTG high resolution SST for coastal applications

- Harmonization of the depth of the retrieval
- Homogenization of Single Sensor Error Statistics (SSES)



Mean SST Anomaly - Metop-B - August 2022

OSI SAF Data Access

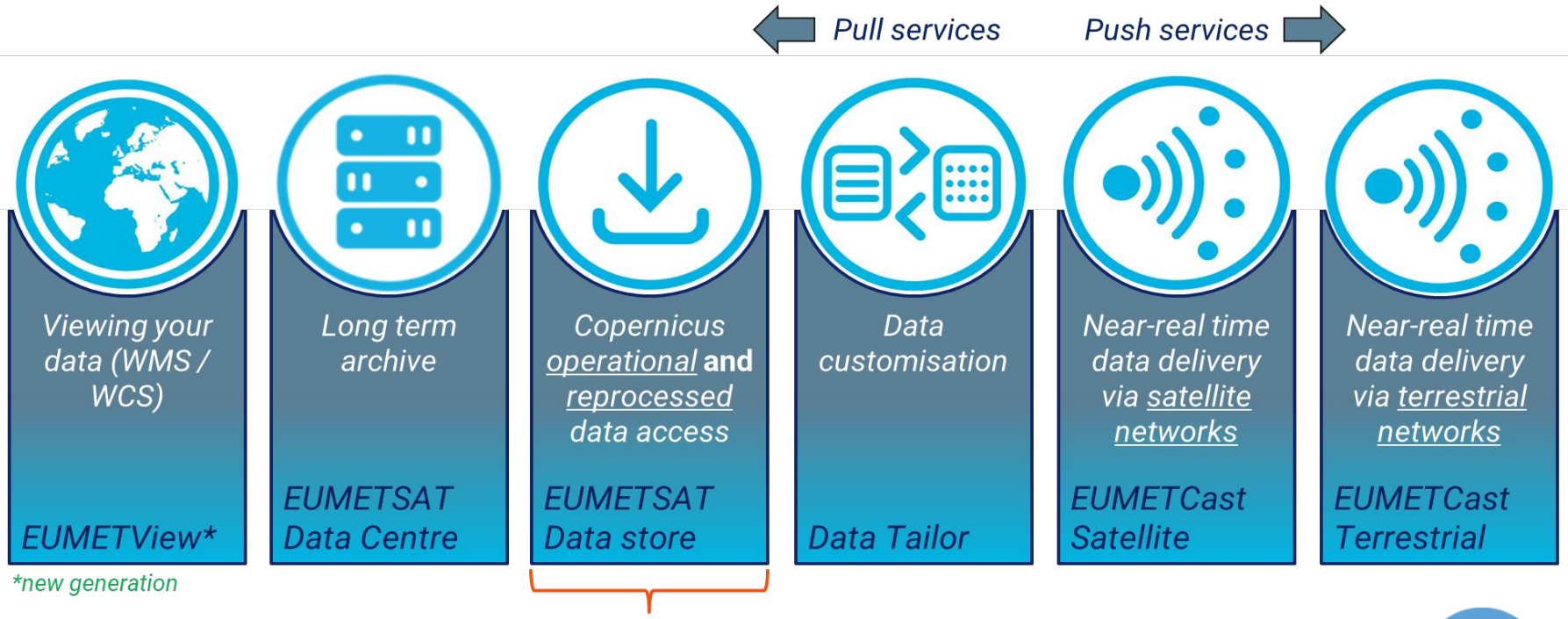
Access our data, stay informed :
Register on https://osi-saf.eumetsat.int

Products
- NetCDF format

Access means
- FTP access
- EUMETCast / EUMETSAT Data Centre and Store
- Thredds

Redistribution
- Copernicus
  - Marine and Climate Change Service
- NASA PODAAC

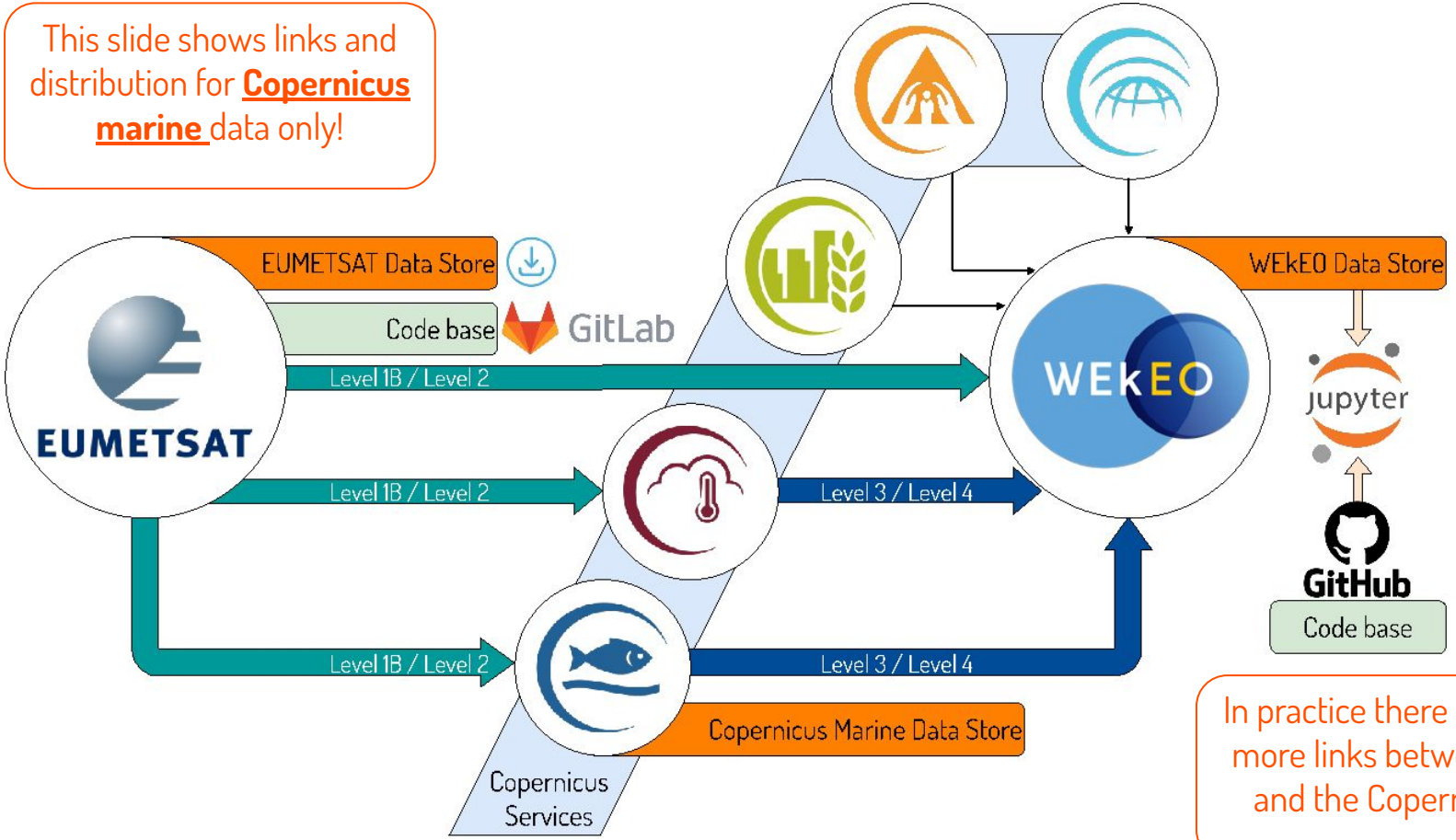
EUMETSAT Data Access



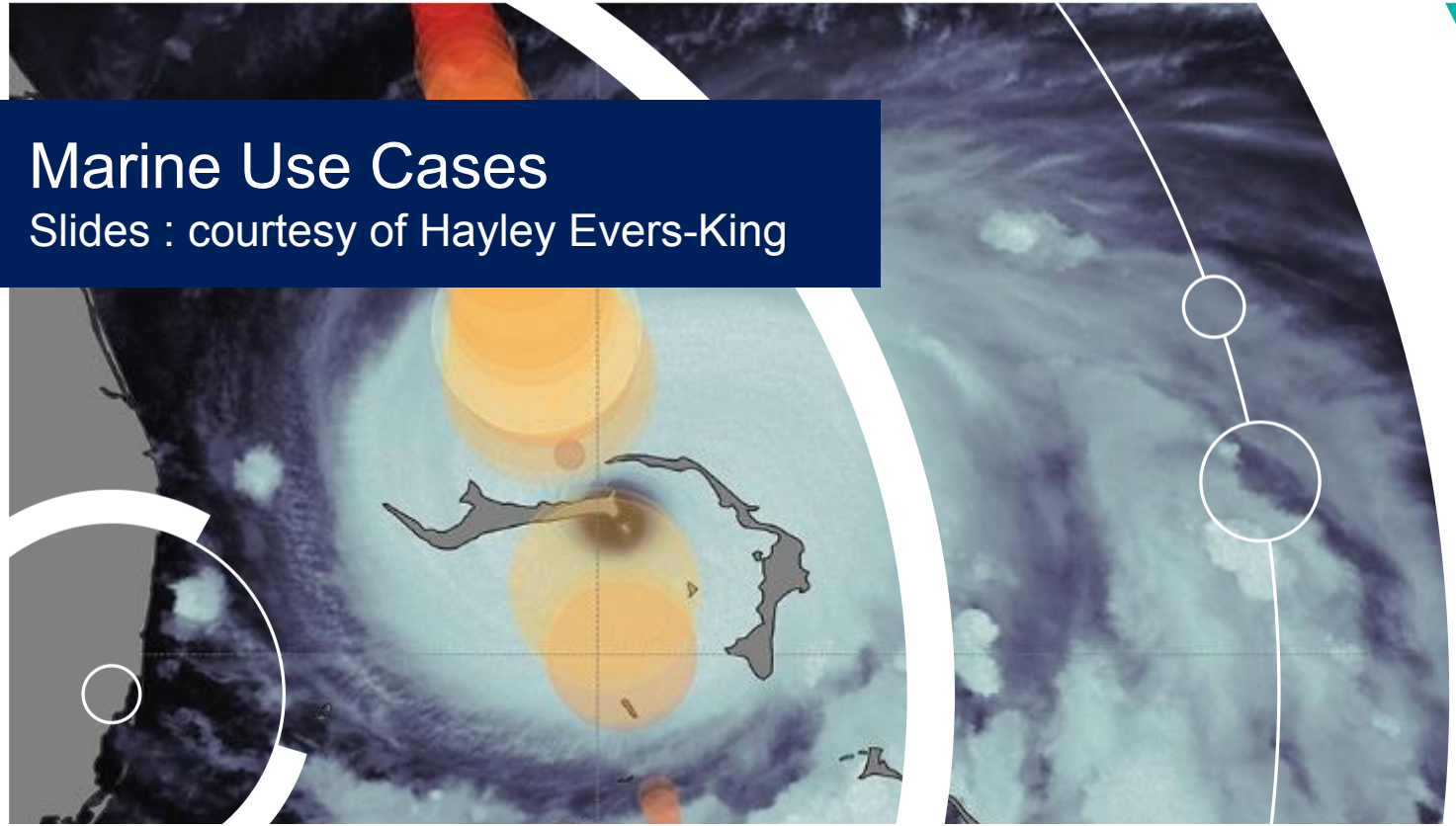
Data Store has replaced the CODA and CODAREP services used by many Sentinel-3 users, offering unified access to operational and reprocessed data. It will allow access long time-series of the most up to data products, via a single point without the use of Data Centre in most cases (including to WEkEO).

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



Marine Use Cases

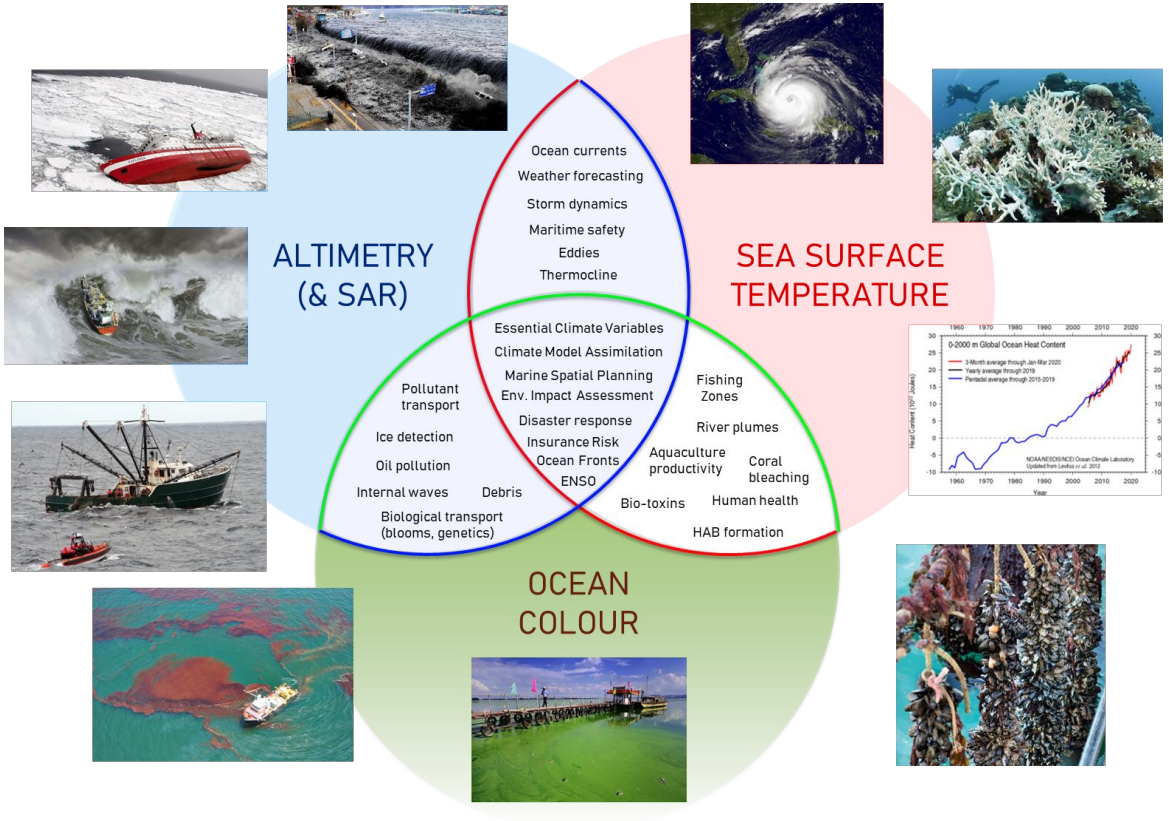
Slides : courtesy of Hayley Evers-King

Marine applications of satellite data

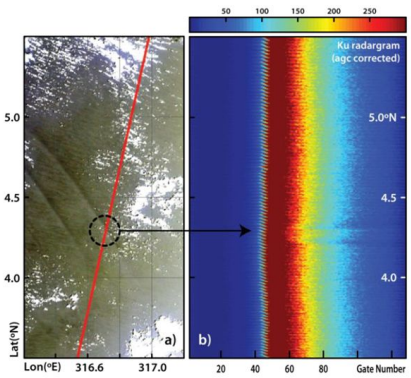
Data from EUMETSAT operated Copernicus satellites (Sentinel-3 and 6) suits applications where rapid availability (within 3 hrs) and highest spatial resolution is key. Synergy applications benefit from multi-sensor platform of Sentinel-3.

Data features heavily in downstream level-3 and 4 products from Copernicus Marine Service.

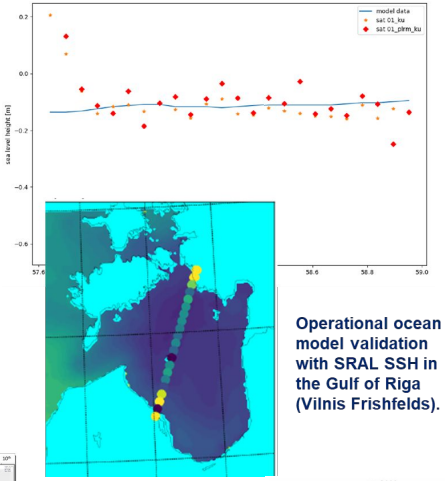
Also used a lot for studies seeking to improve remote sensing measurements and processing



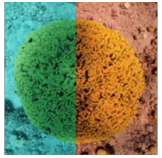
L1 and L2 scientific research and applications



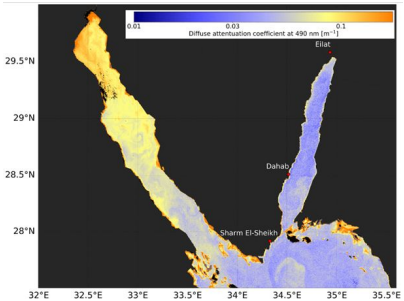
SRAL & OLCI: detection of internal waves (Santos-Ferreira et al., 2018)

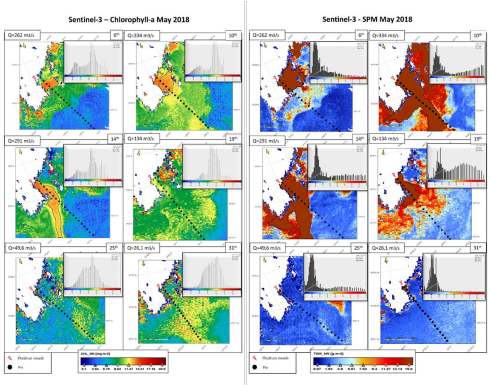


Operational ocean model validation with SRAL SSH in the Gulf of Riga (Vilnis Frishfelds).

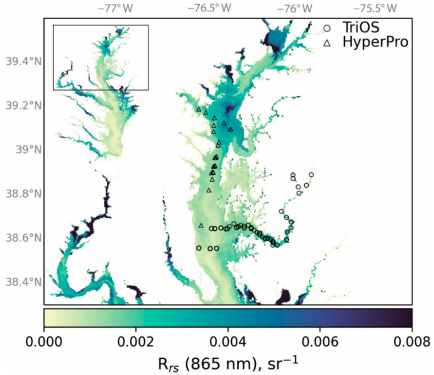


OLCI attenuation data used to correct underwater imagery. (Derya Akkaynak)

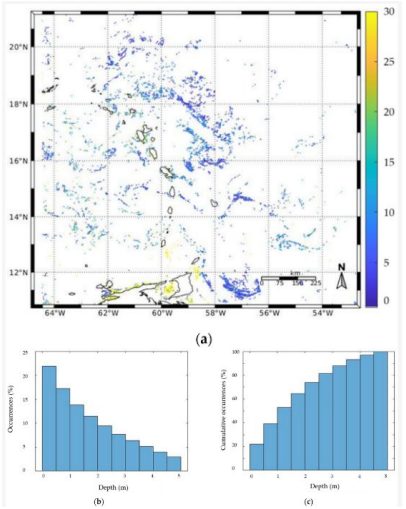




Comparing OLCI data with river discharge measurements (Noemi Marsico)



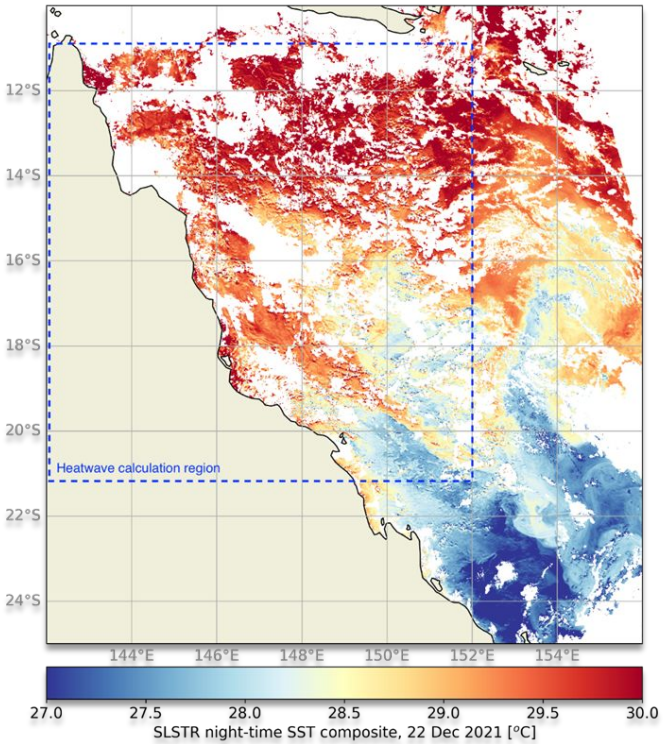
OLCI validation in Chesapeake Bay (Anna Windle)

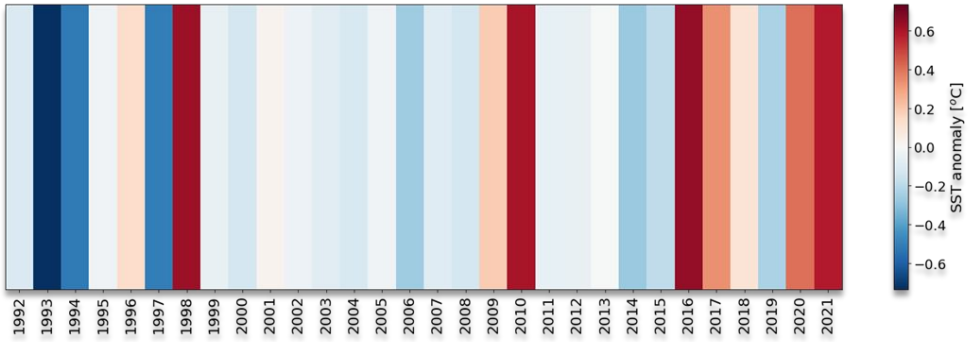


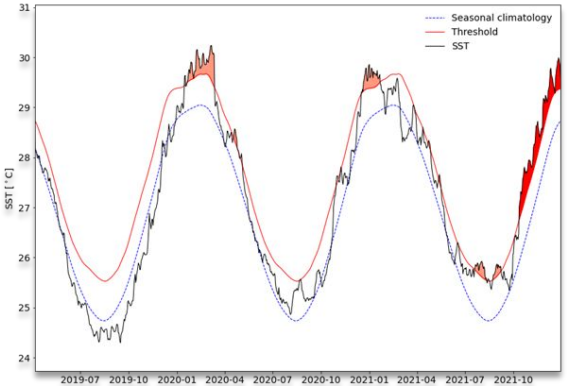
Detection of submerged sargassum (Lea Schamberger)

EUMETSAT: UNOD case study – challenge 2 – protect and restore ecosystems and biodiversity

- **Marine heatwaves can be monitored from space to inform marine management**



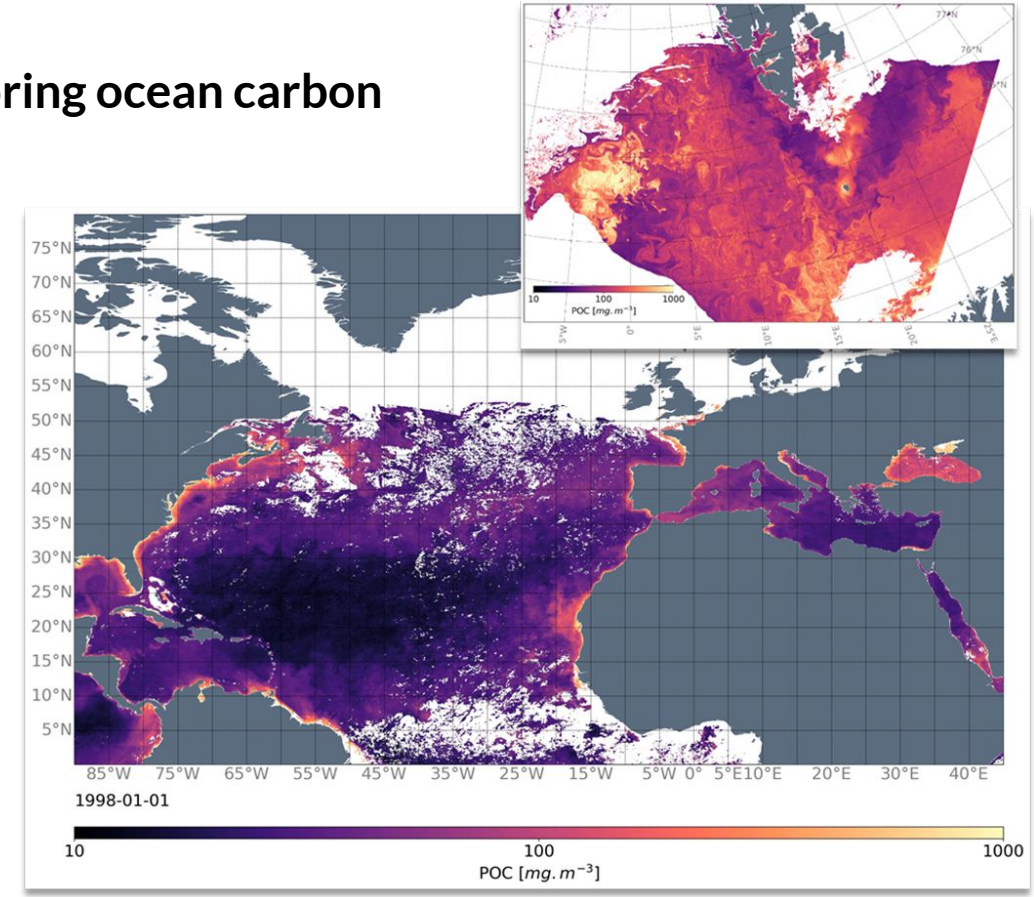




- Need to identify and monitor events relative to historical baselines.
- Impacts on ecosystems and dependent industries.
- Notebook shows how to access NRT data, as well as longer reprocessed series and conduct analysis.

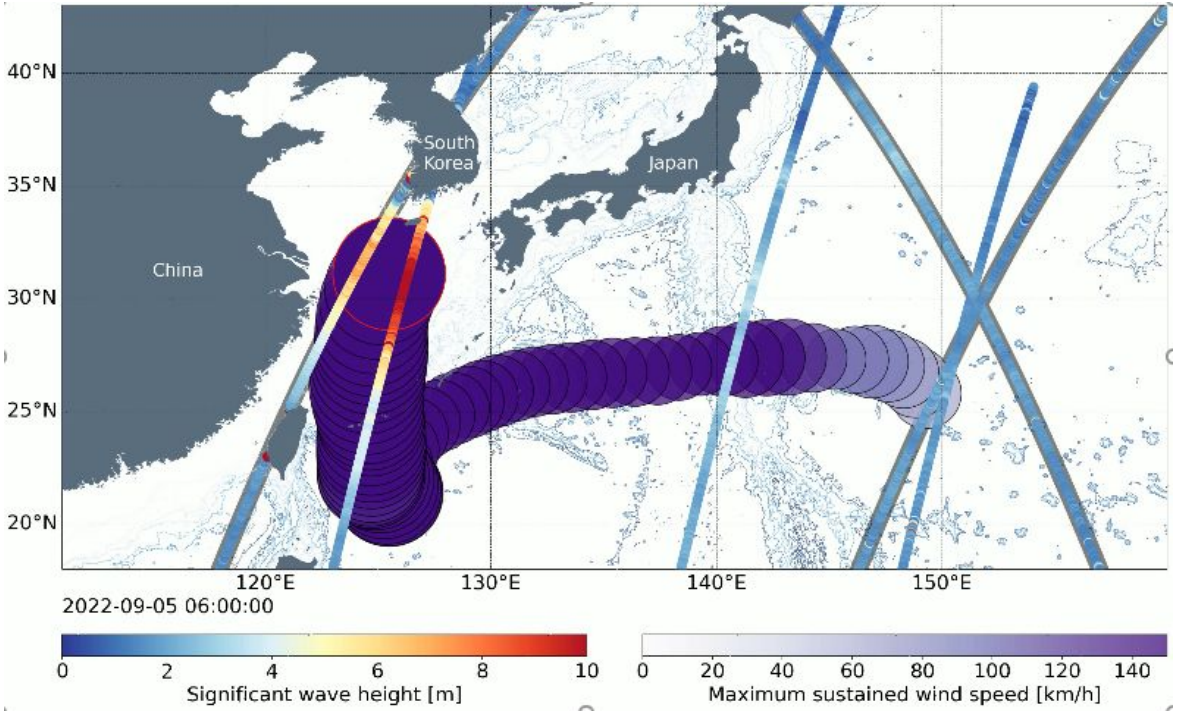
EUMETSAT: UNOD case study – challenge 5 – ocean solutions to climate change

- **Satellite data contributing to monitoring ocean carbon uptake**
  - Ocean colour data can be used to derive information about carbon pools e.g. POC, PIC
  - Other data can be used towards studies of carbonate system (ocean acidification).
  - Data offers insight in to event scale dynamics and long-term trends.
  - Notebook shows access to ocean colour data and applications of a simple, published algorithm for POC.



- **Monitoring extreme weather and impacts on oceans and coasts**

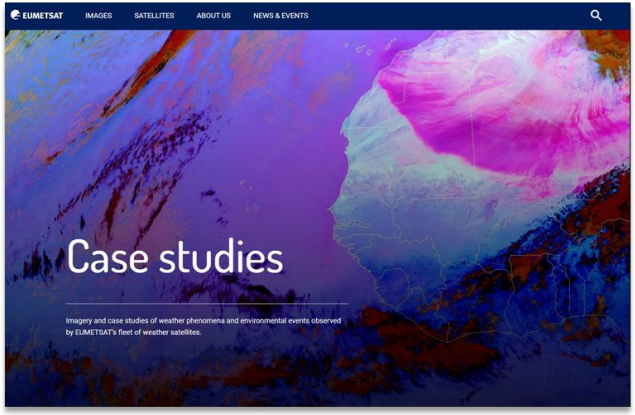
- Altimetry data captures the impacts of storms on the ocean and coasts.
- This data feeds in to forecasts and warning systems.
- Notebook shows how users can access this data and follow a storm in NRT.

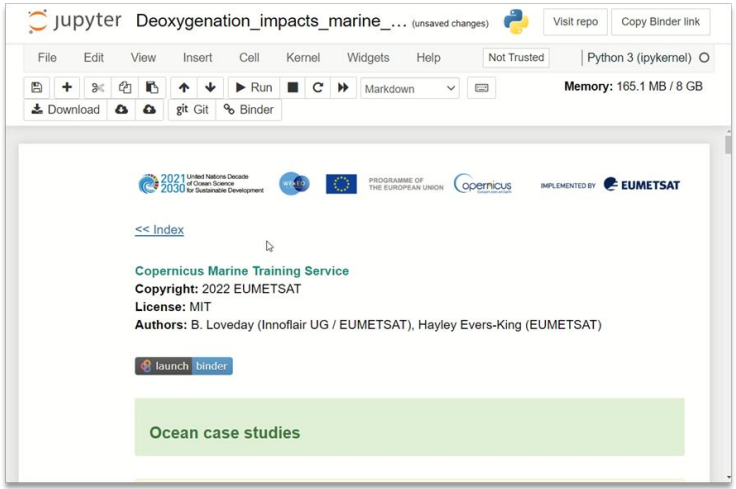


Case study examples from EUMETSAT

Case studies:
https://www.eumetsat.int/case-studies
Gitlab: https://gitlab.eumetsat.int/ eumetlab/oceans/ oceantraining/applications/ ocean-case-studies

README contains guidance on running.
Also compatible with WEkEO JupyterLab and Binder.





Notebooks

GitLab

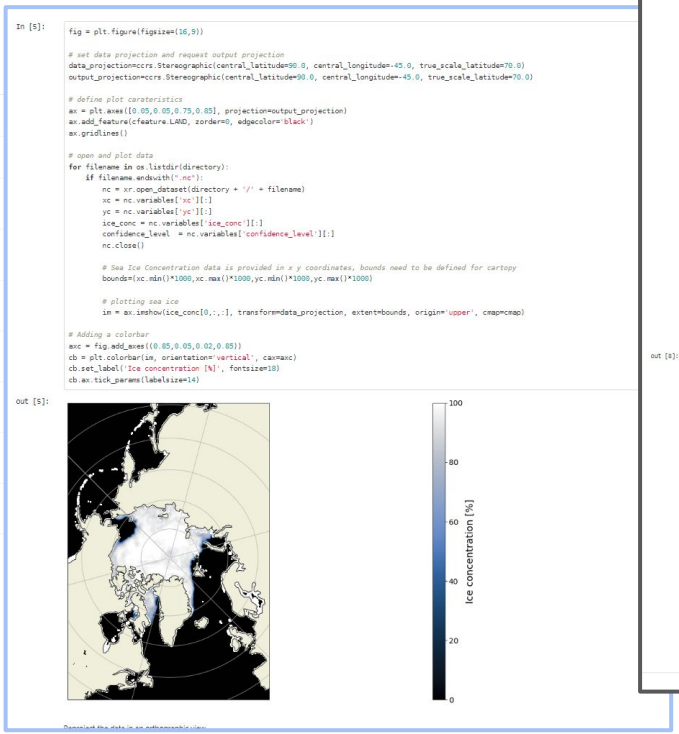
https://gitlab.eumetsat.int/eumetlab/oceans

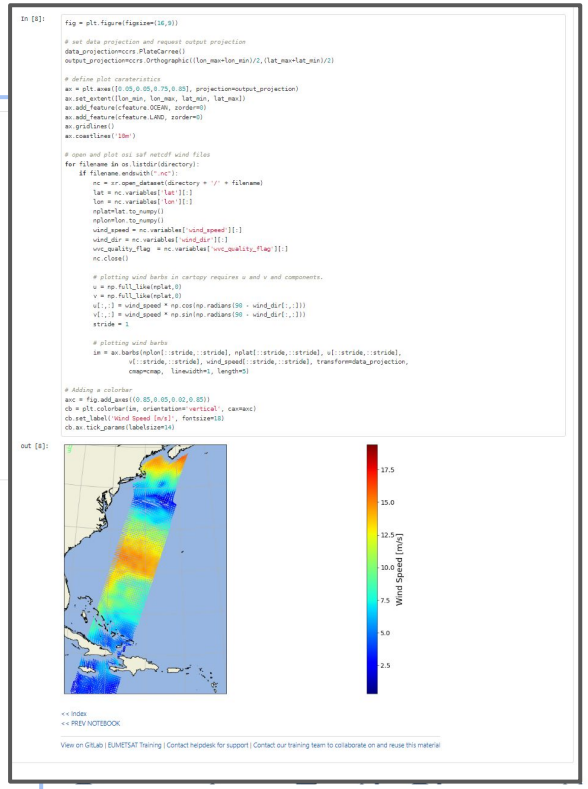
Ocean Training
Group ID: 851

This group contains various projects where you can learn about ocean satellite data and how to use it.

Subgroups and projects | Shared projects | Archived projects

- applications
- sensors
  - learn-olci — Repository for all training content associated with the Copernicus Sentinel-3 OLCI s... ★ 0
  - learn-osi-saf-sea-ice — Repository for all training content associated with EUMETSAT Ocean and Sea Ice Sa... ★ 0
  - learn-osi-saf-sst — Repository for all training content associated with EUMETSAT Ocean and Sea Ice Sa... ★ 0
  - learn-osi-saf-wind — Repository for all training content associated with EUMETSAT Ocean and Sea Ice Sa... ★ 0
  - learn-s6 — Repository for all training content associated with the Copernicus Sentinel-6 Posei... ★ 0
  - learn-slstr — Repository for all training content associated with the Copernicus Sentinel-3 SLSTR... ★ 0
  - learn-sral — Repository for all training content associated with the Copernicus Sentinel-3 SRAL ... ★ 0
- tools





https://osi-saf.eumetsat.int/community/stories/online-training-jupyter-notebooks

OSI SAF Sea Ice - Ressources

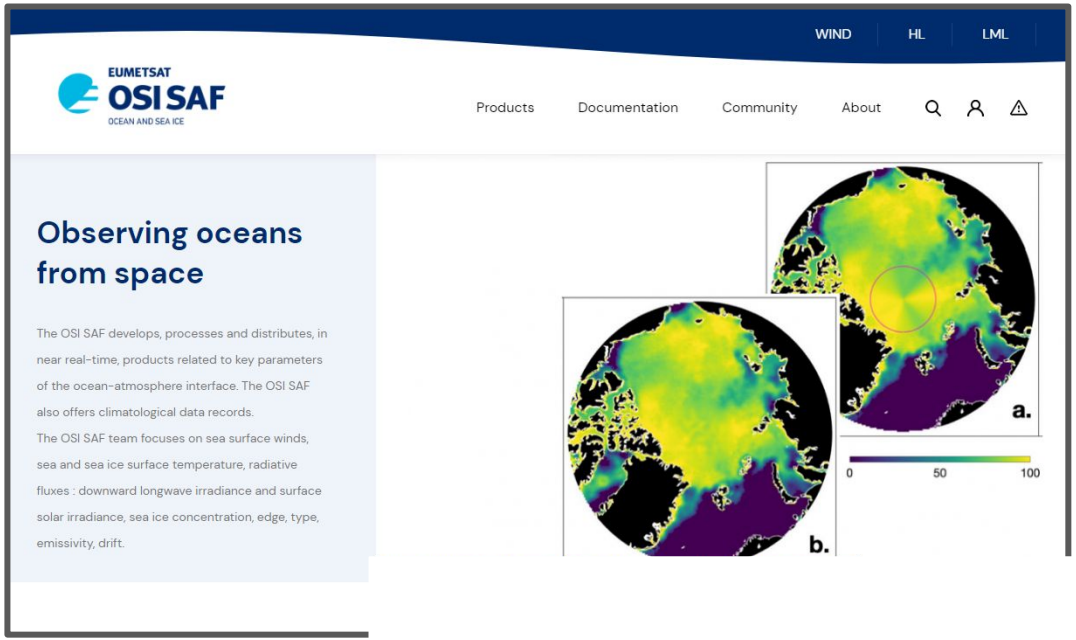
Stories
- *Regular news*

Social Media [@OSISAF](#)
- *Twitter feed & user support*

Newsletter

Training activities
- *Webinar & short courses*
- *Development of notebooks*

Stay in touch, register
https://osi-saf.eumetsat.int/



Contacts
olivier.membrive@meteo.fr
osi-saf.helpdesk@meteo.fr

EUMETSAT User Support and Training ressources

copernicus.eumetsat.int

Helpdesk: ops@eumetsat.int

Training resources

Knowledge Bases

Sentinel-3
Sentinel-6
Data access

Courses

moodle

https://training.eumetsat.int/

Code distribution

CONDA

GitLab

https://gitlab.eumetsat.int/eumetlab/oceans

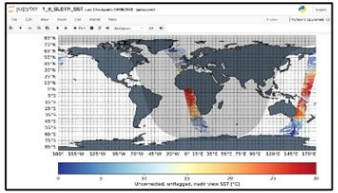
Video tutorials

YouTube

https://www.youtube.com/eumetsat1

Jupyter Notebooks

jupyter



Cloud hosting

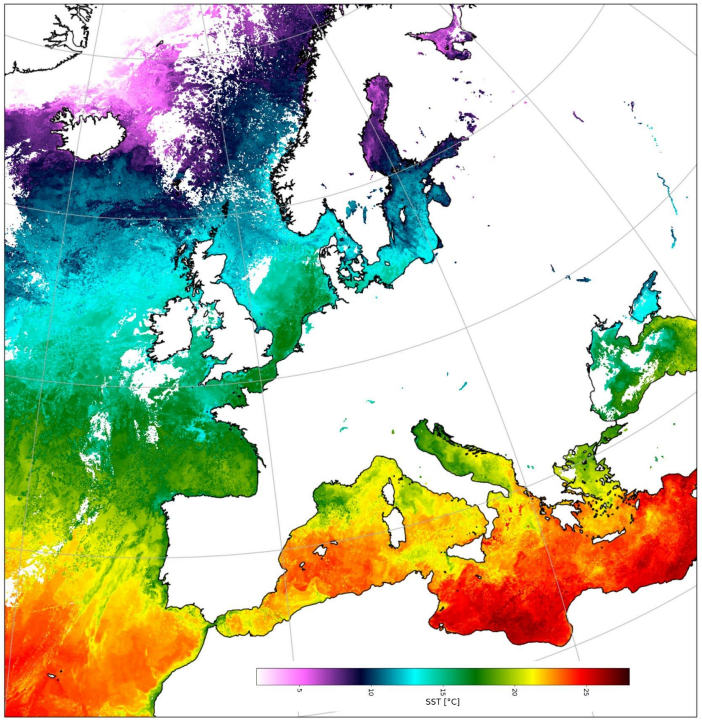
WEkEO

binder

TrainHub

Case studies

https://www.eumetsat.int/case-studies



Thank you !

Looking forward to hear your feedback about EUMETSAT marine products !