Marine Data Literacy Course
Data Harvesting and Data Harnessing

Online Data Portals

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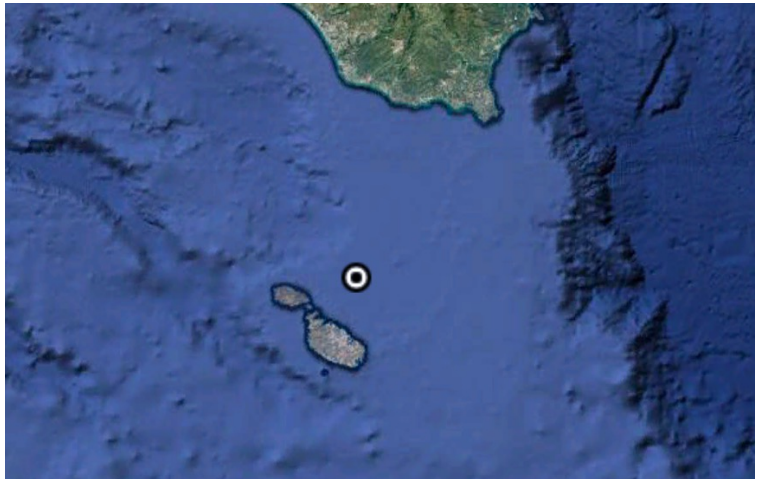
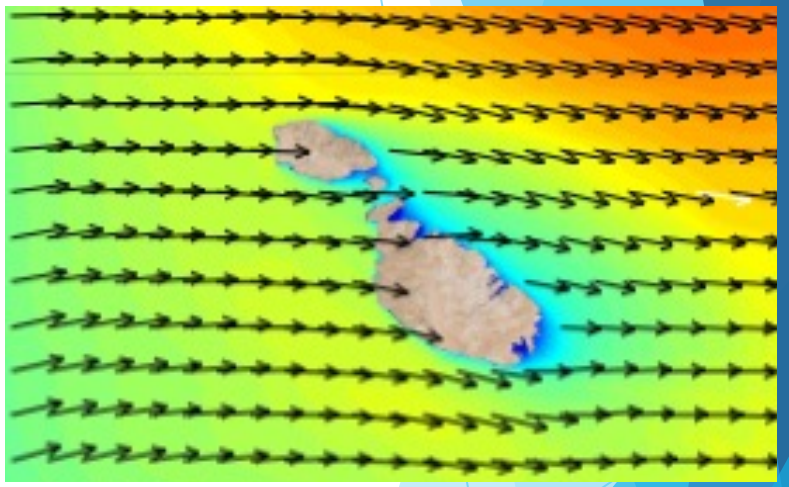
> Data is acquired and prepared once to be used by many.

> You can't manage what you can't measure.

Outline

- **COPERNICUS Marine Data Portal**
  - NetCDF
  - PANOPLY
  - Matlab scripts
- **The European Space Agency (ESA) Data Hub**
  - Sentinel Application Platform (SNAP)
  - Oil spill detection
  - CHL / TSM
- EMODnet
  - EMODnet Bathymetry / Human-Activities / Physics / Ingestion
  - QGIS
- **World Ocean Database / EmodNET**
  - Ocean Data View (ODV)

Data

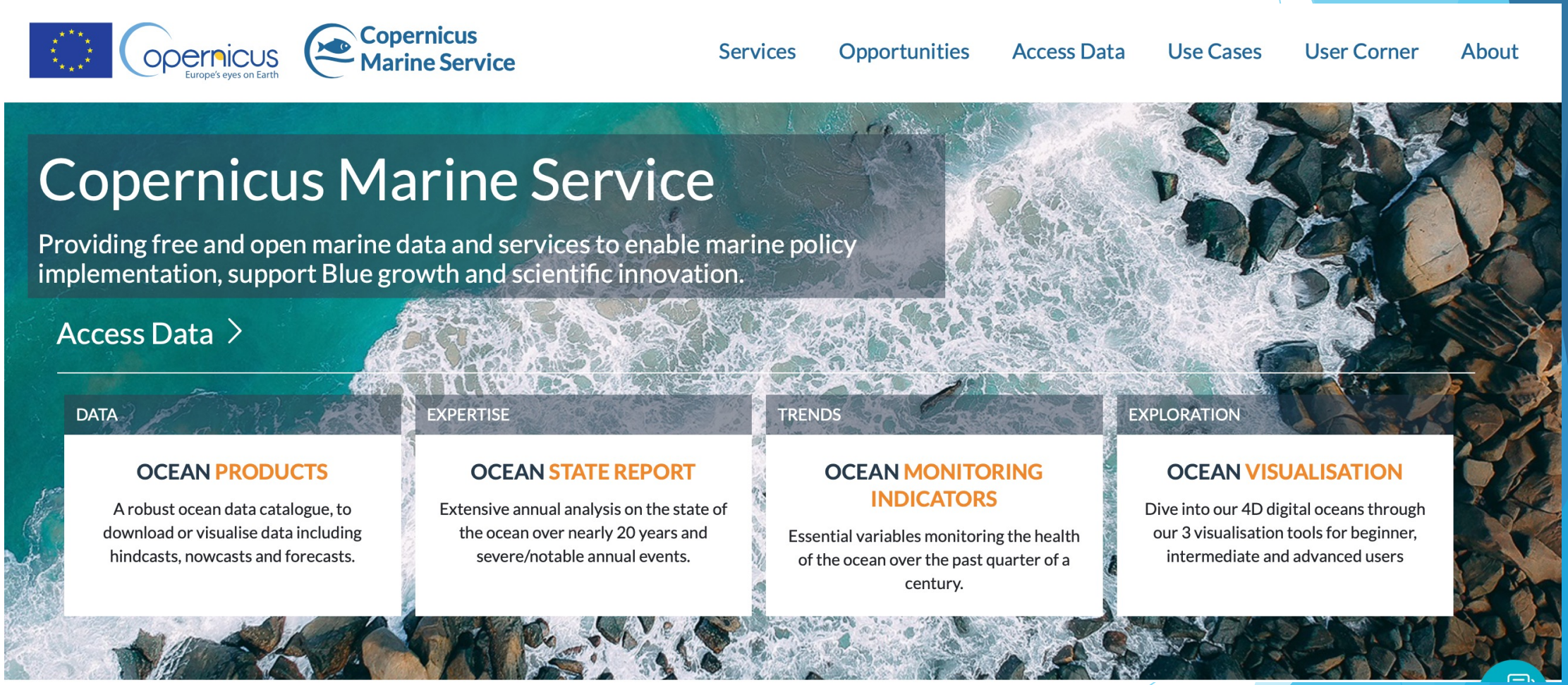
In-Situ	Remote Sensing	Models
		

Copernicus

Copernicus Marine Environment Monitoring Service (CMEMS)

- Integrated Service
- Open and Free
- Single Catalogue of Products
- Reliable
- Sustainable

Copernicus



marine.copernicus.eu

Copernicus [Ocean State Report]

Copernicus [Ocean Monitoring Indicators]

Ocean Monitoring Indicators

The gateway to essential ocean variables to monitor the health of the ocean.

Home > Access data > Ocean Monitoring Indicators

Ocean Monitoring Indicators (OMIs) are free downloadable trends and data sets covering the past quarter of a century. These are key variables used to track the vital health signs of the ocean and changes in line with climate change.

Monitoring Indicators

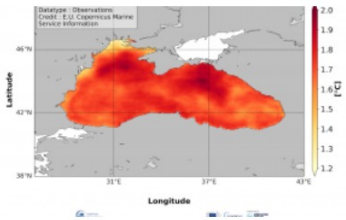
- [ ] All monitoring indicators
- [ ] Climate Variability
- [ ] Currents
- [ ] North Atlantic
- [ ] Ocean Health
- [ ] Ocean Heat Content
- [ ] Sea Ice
- [ ] Sea Level
- [ ] Sea State
- [x] Temperature and Salinity
- [ ] Water Mass and Heat Exchange

Regions

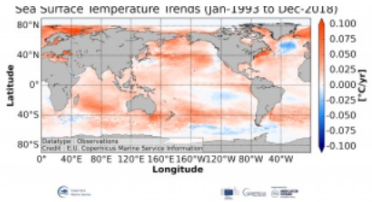
- [x] All regions
- [ ] Antarctic Ocean
- [ ] Arctic Ocean
- [ ] Atlantic-European North West Shelf-Ocean

Search

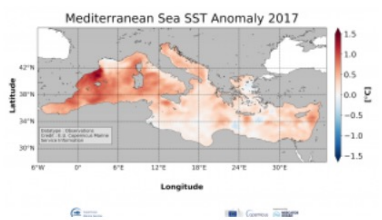
Temperature and Salinity



Black Sea Cumulative Trend Map of Sea Surface Temperature



Global Ocean Trend Map of Sea Surface Temperature

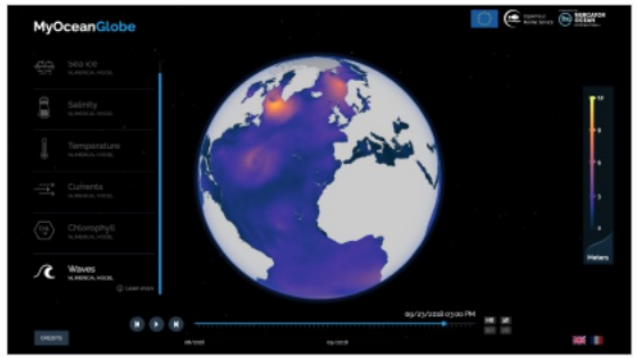


Mediterranean Sea Surface Temperature Anomaly

Copernicus [Data Visualising Tools]

MYOCEAN LEARN

(BEGINNER) GLOBE

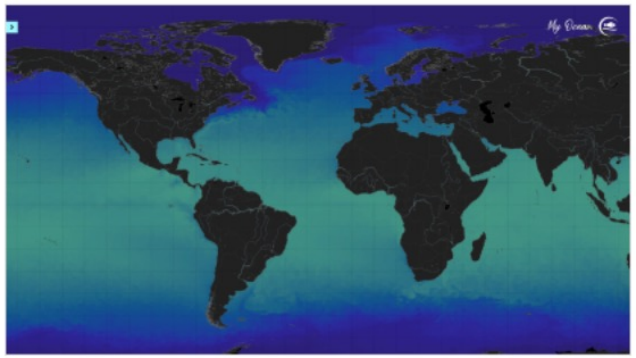


Understand key variables

Explore MyOcean Learn

MYOCEAN LIGHT

(INTERMEDIATE) PLANISPHERE

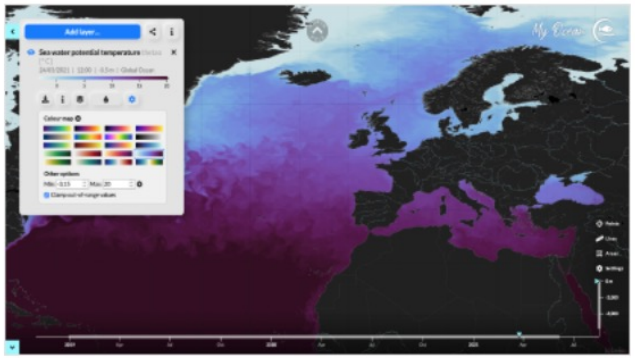


Access key variables

Explore MyOcean Light

MYOCEAN PRO

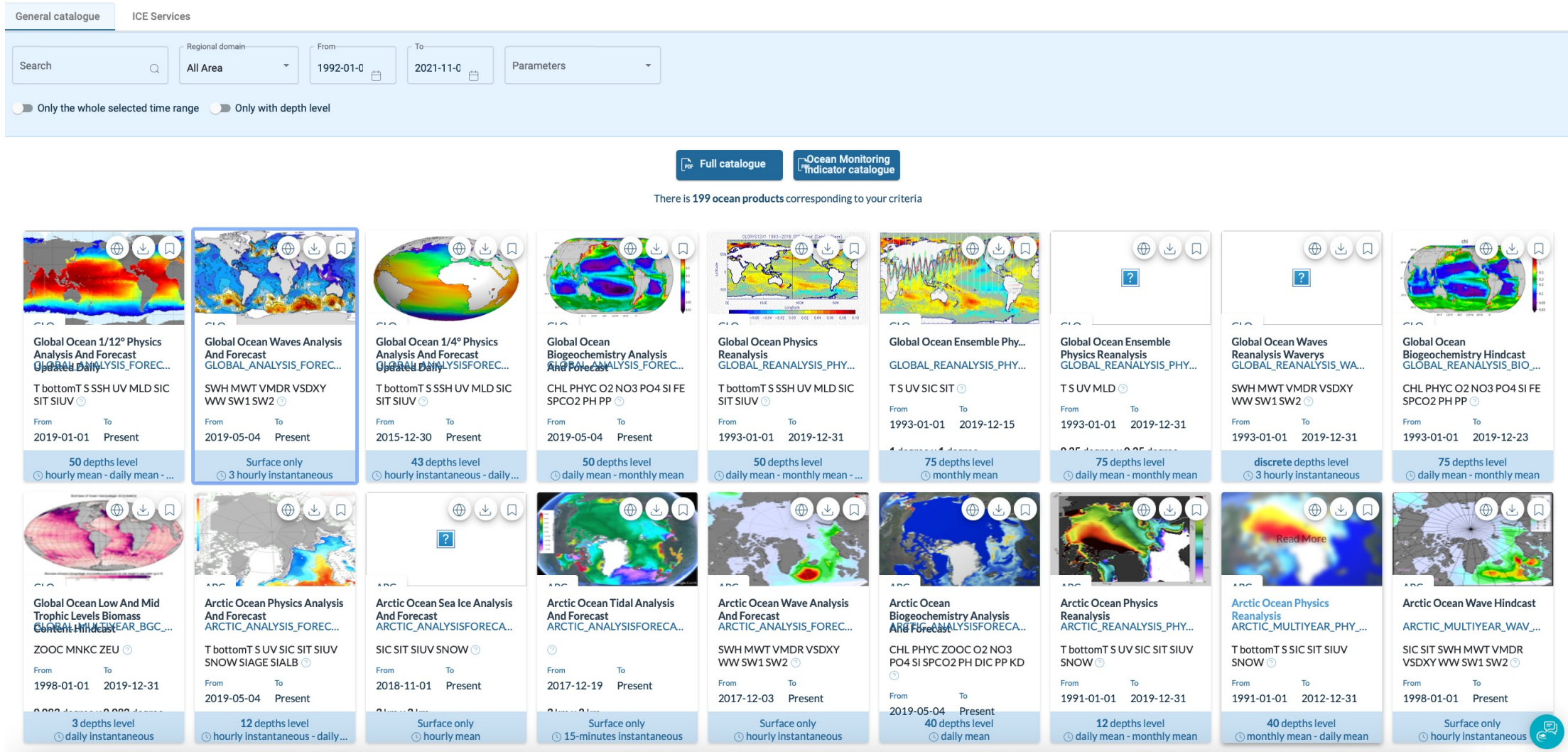
(EXPERT) PLANISPHERE



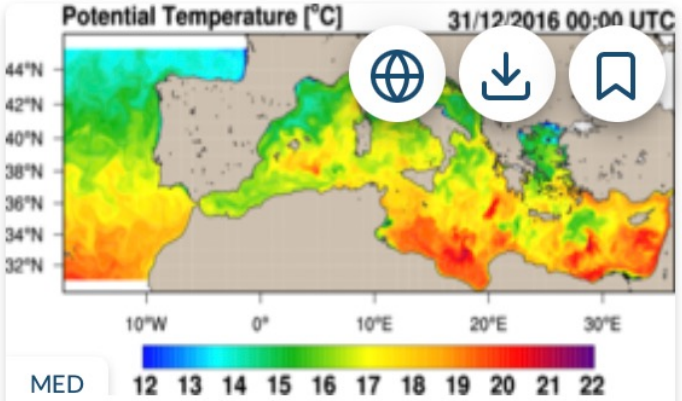
Access full catalogue

Explore MyOcean Pro

Copernicus [Ocean Products]



Copernicus [Ocean Products]



MED

Mediterranean Sea Physics Analysis And Forecast

MEDSEA_ANALYSISFORECAST_PHY_006_013

T bottomT S SSH UV MLD

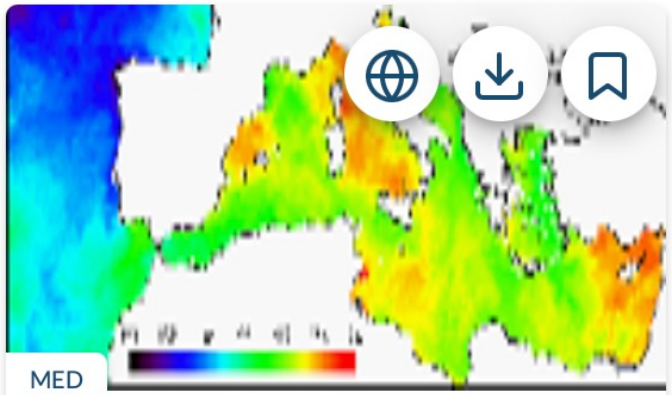
From 2019-05-04

To Present

0.042 degree x **0.042** degree

Model assimilation

141 depths level
hourly mean - daily mean - monthly mean - 15-minutes ...
Sub-setting WMS



MED

Mediterranean Sea High Resolution And Ultra High Resolution Sea Surface Temp...

SST_MED_SST_L4_NRT_OBSERVATIONS_010_004

SST

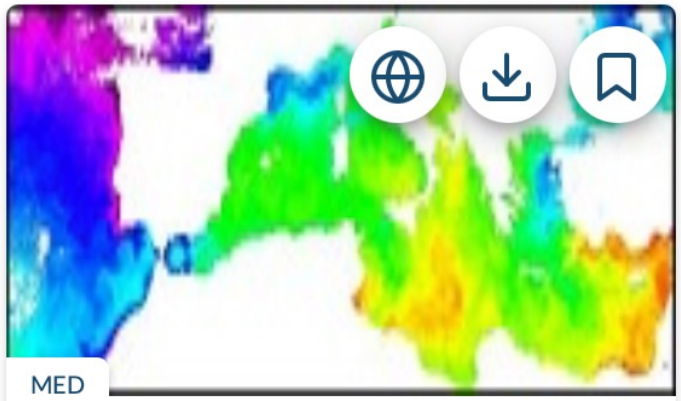
From 2008-01-01

To Present

0.01 degree x **0.01** degree

Observation
L4

Surface only
daily mean
Sub-setting WMS



MED

Mediterranean Sea - High Resolution And Ultra High Resolution L3s Sea Surface T...

SST_MED_SST_L3S_NRT_OBSERVATIONS_010_012

SST

From 2008-01-01

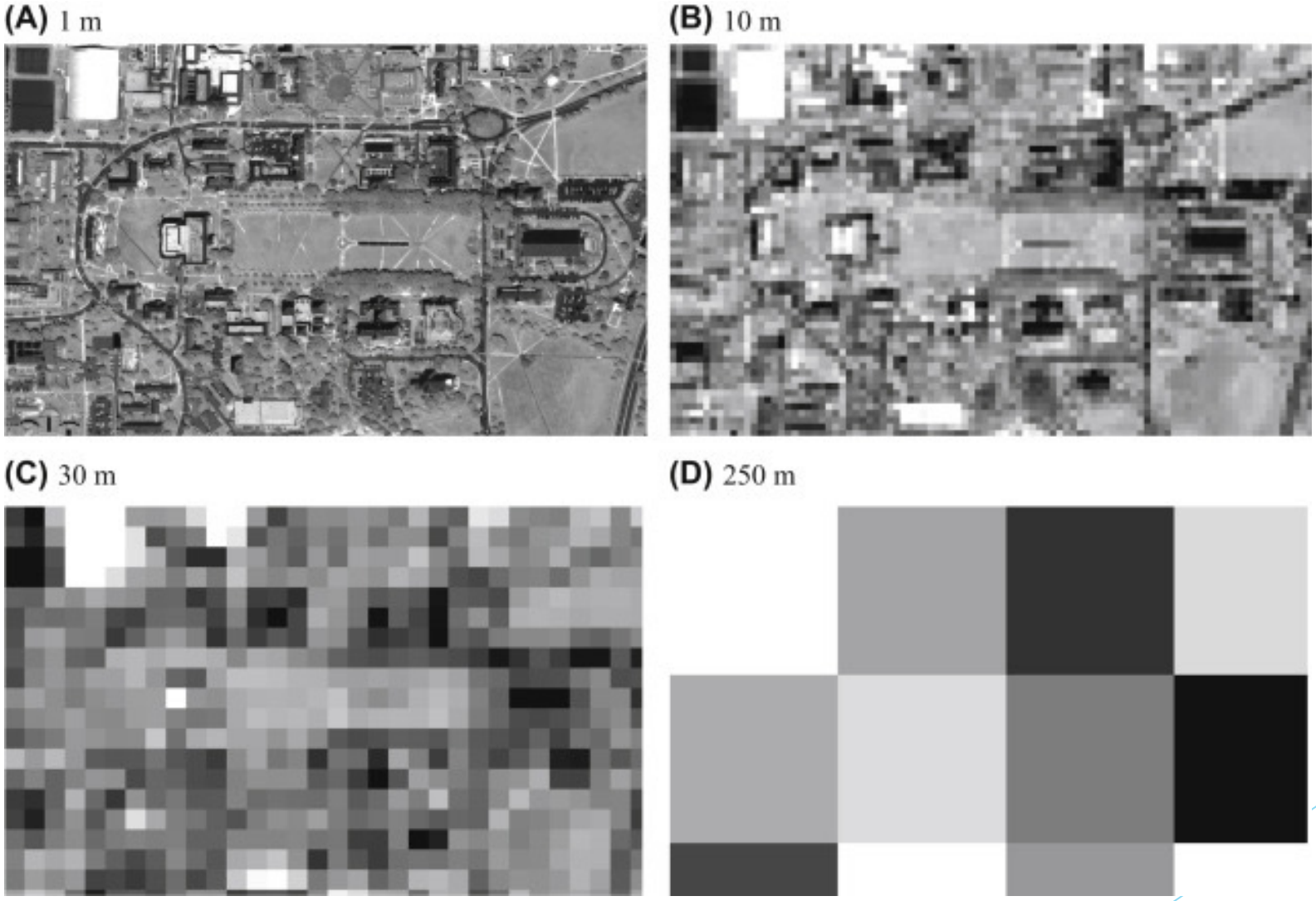
To Present

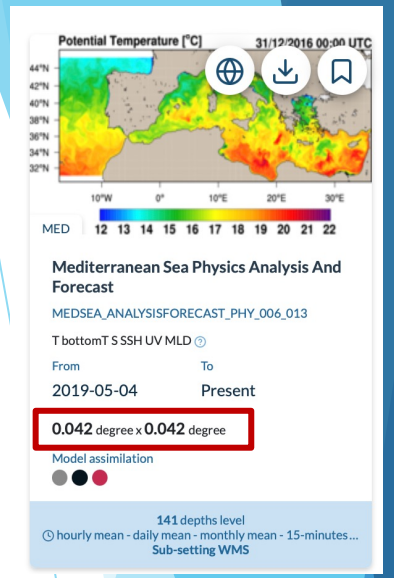
0.01 degree x **0.01** degree

Observation
L3

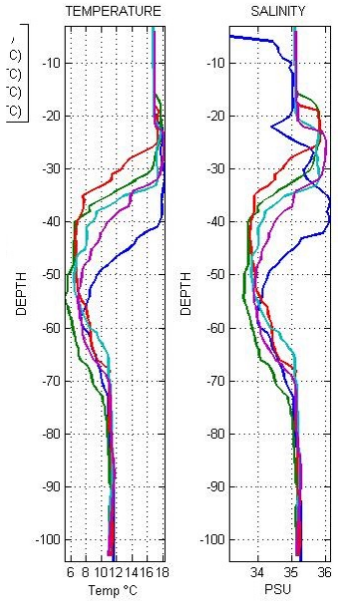
Surface only
daily mean
Sub-setting WMS

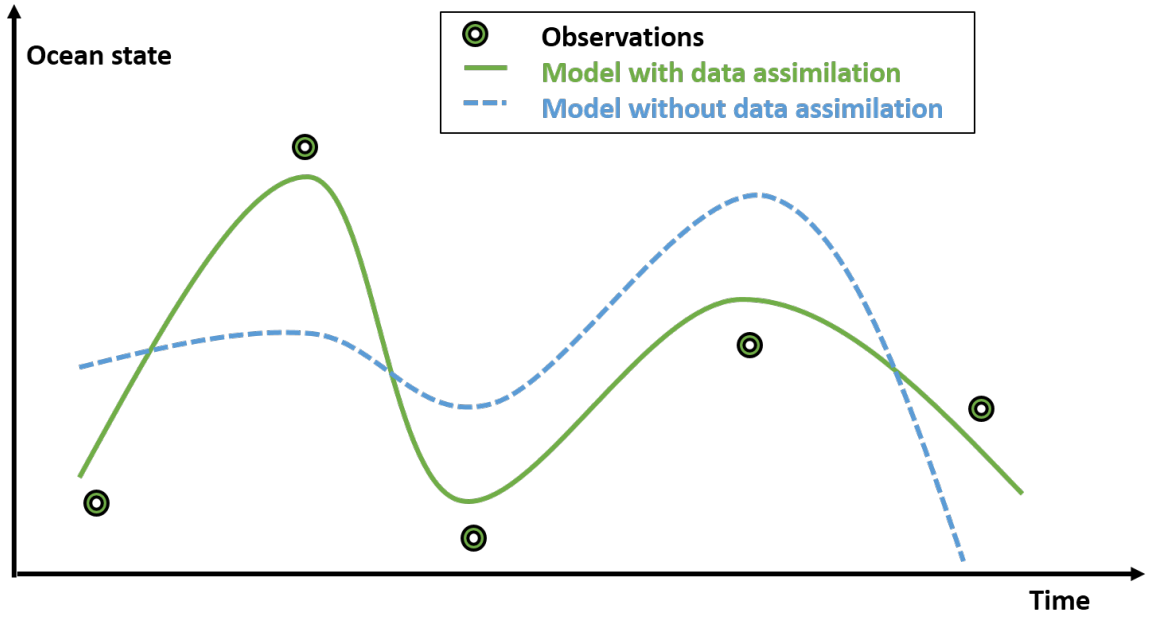
Copernicus [Spatial Resolution]

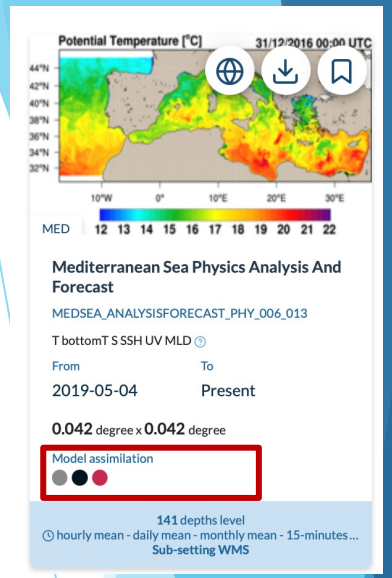


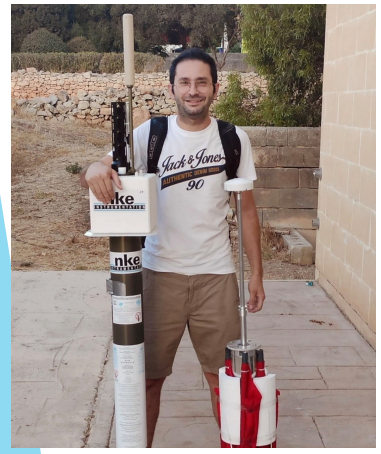


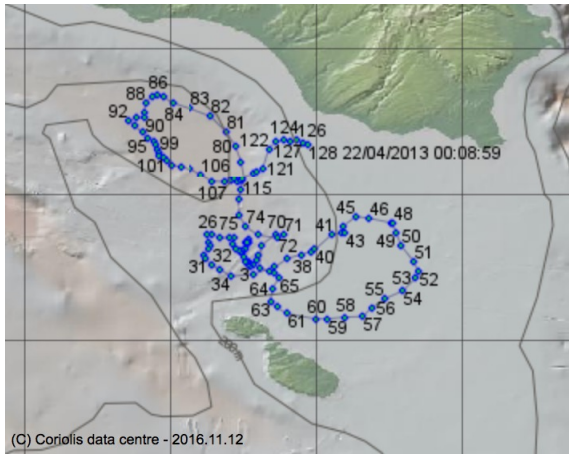
Copernicus [Data Assimilation]

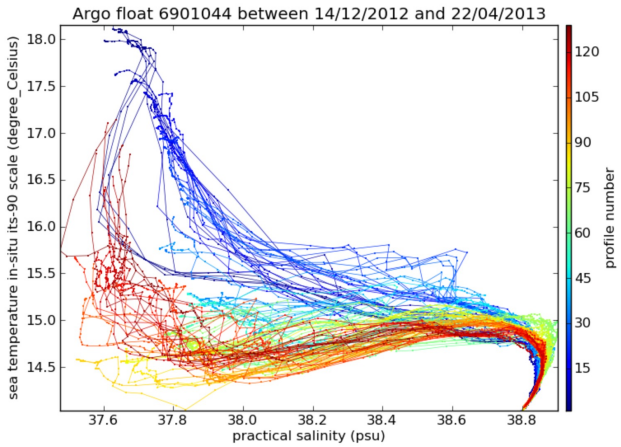




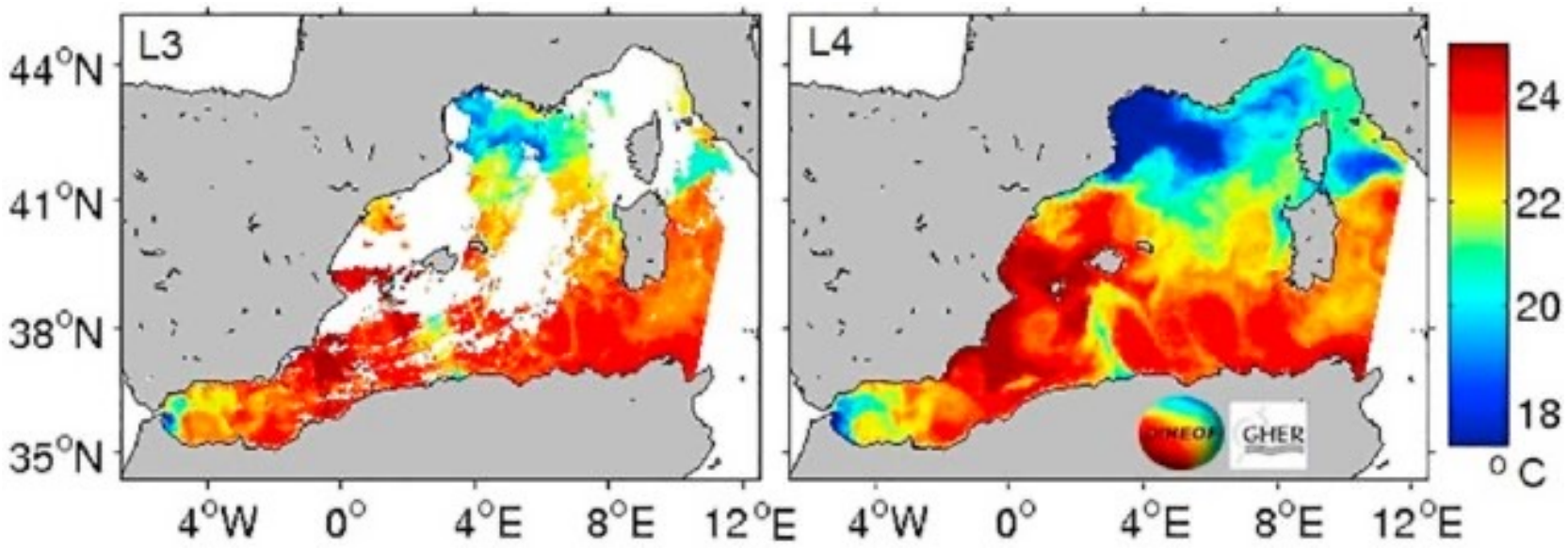




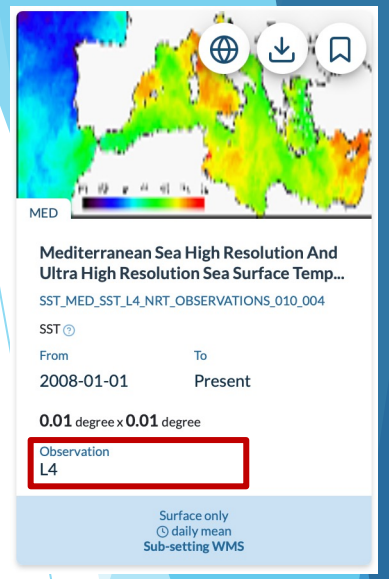




Copernicus [Satellite Data Levels]



Source: Minnett, P.J., et al., 2019. Half a century of satellite remote sensing of sea-surface temperature. *Remote Sensing of Environment*, *233*, p.111366.



Copernicus [Example]

- **Mediterranean Sea High Resolution and Ultra High Resolution Sea Surface Temperature Analysis**
  Product identifier: SST_MED_SST_L4_NRT_OBSERVATIONS_010_004
  Spatial resolution: 0.01.x 0.01
  Temporal resolution: daily mean

- **Mediterranean Sea Physics Analysis and Forecast**
  Product identifier: MEDSEA_ANALYSISFORECAST_PHY_006_013
  Spatial resolution: 0.042.x 0.042
  Temporal resolution: hourly mean

Copernicus [Example]

Data access

MEDSEA_ANALYSISFORECAST_PHY_006_013

Mediterranean Sea Physics Analysis and Forecast

Dataset selected: med-cmcc-tem-an-fc-h

Geographical area

N: 40

W: 10

E: 18

S: 33

Reset geographical selection

Time range

(Default = Last date available)

☐ Select all dates

Start date: 2021-10-20 00:30:00

End date: 2021-10-22 23:30:00

Depth

(Default = Surface depth)

☐ Select all depths

Start depth: 1.0182

End depth: 1005.1355

Variables

(Default = All variables)

☑	Name	Description	Standard name	Units
☑	bottomT	sea floor potential temperature	sea_water_potential_temperature_at_sea_floor	degrees_C
☑	thetao	potential temperature	sea_water_potential_temperature	degrees_C

Copernicus [Example]

Data access

SST_MED_SST_L4_NRT_OBSERVATIONS_010_004

Mediterranean Sea High Resolution and Ultra High Resolution Sea Surface Temperature Analysis

Dataset selected

SST_MED_SST_L4_NRT_OBSERVATIONS_010_004_c_V2

Geographical area

N 40

W 10

E 18

S 33

Reset geographical selection

Time range

(Default = Last date available)

☐ Select all dates

Start date 2021-10-20 00:00:00

End date 2021-10-22 00:00:00

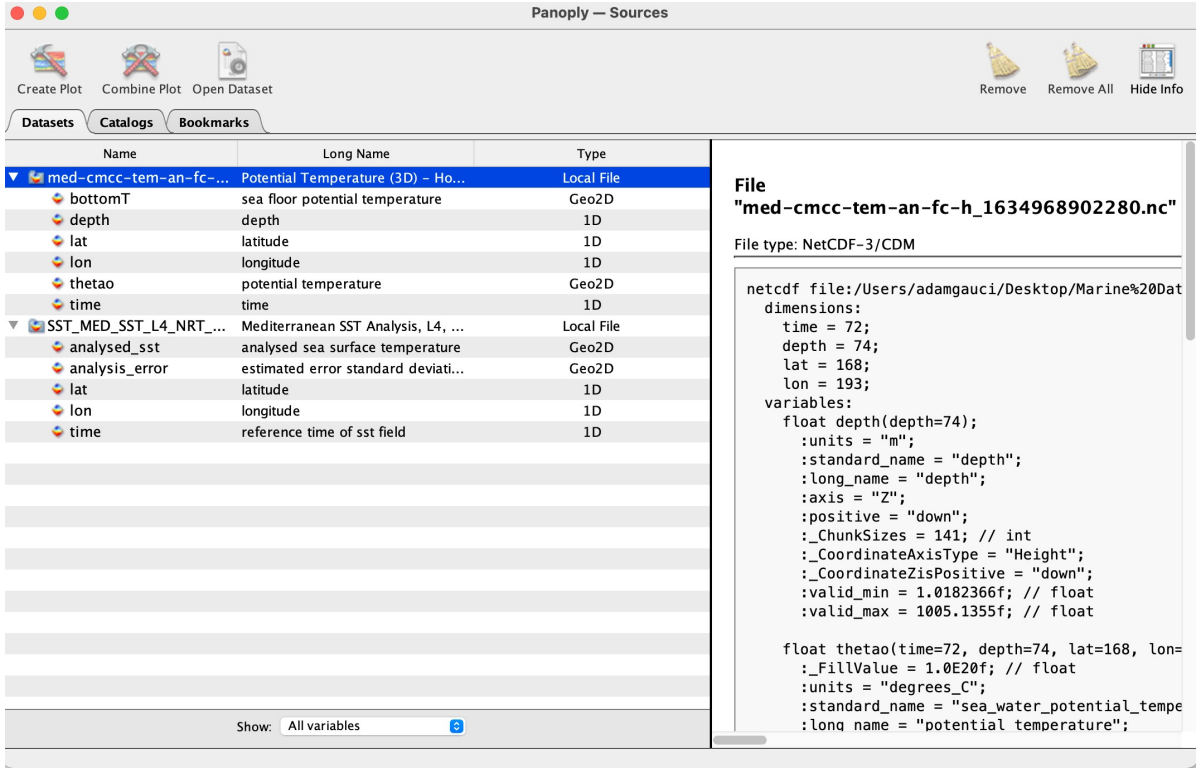
Variables

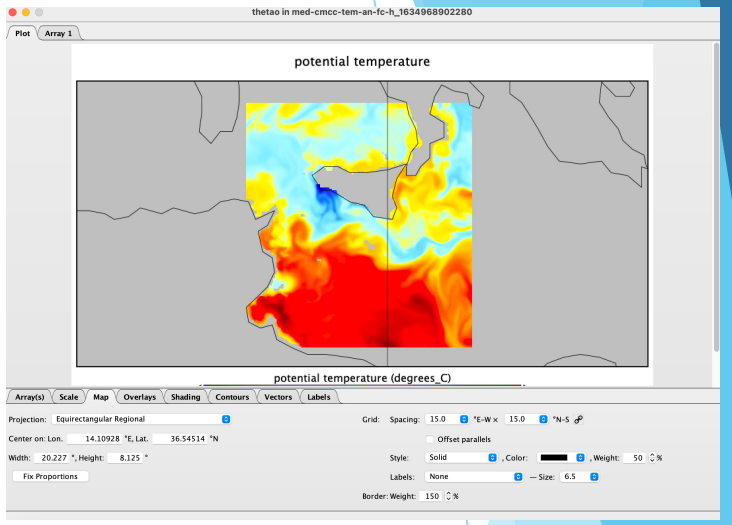
(Default = All variables)

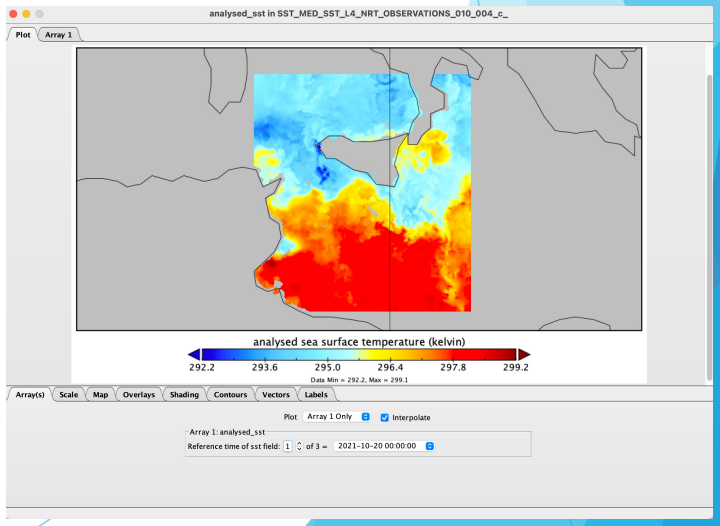
☑	Name	Description	Standard name	Units
☑	analysed_sst	analysed sea surface temperature	sea_surface_temperature	kelvin
☑	analysis_error	estimated error standard deviation of analysed_sst		kelvin

Panoply

https://www.giss.nasa.gov/tools/panoply/download/







Matlab

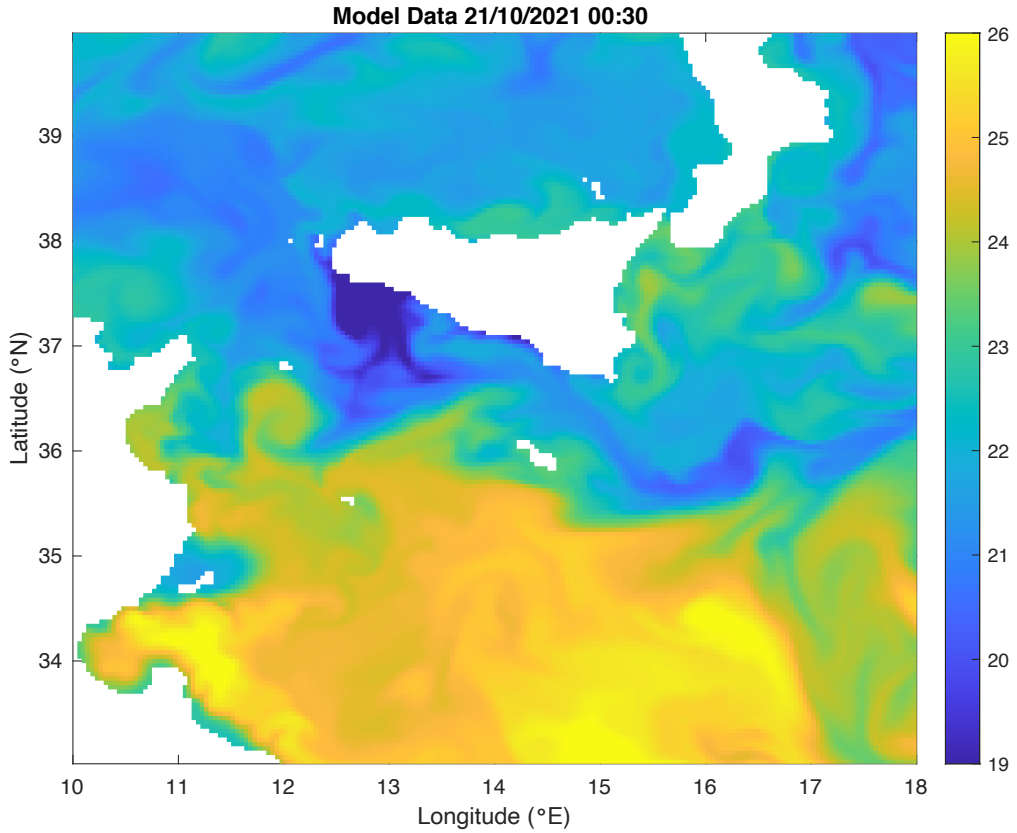
```
%reading model data
model_filename = 'med-cmcc-tem-an-fc-h_1634968902280.nc';
model_lon = ncread(model_filename, 'lon');
model_lat = ncread(model_filename, 'lat');
model_depth = ncread(model_filename, 'depth');
model_time= ncread(model_filename, 'time');
model_data = ncread(model_filename, 'thetao');

%extracting the first depth level
%for all frames
figure
for h = 1:1:size(model_data, 4)
    model_data_temp = model_data(:,:,1, h);
    pcolor(model_lon, model_lat, model_data_temp');
    box on;
    shading flat;
    title(['Hour = ', num2str(h)]);
    xlabel('Longitude (\circE)');
    ylabel('Latitude (\circN)');
    caxis([19 26]);
    colorbar;
    pause (0.1);
    drawnow;
end
```

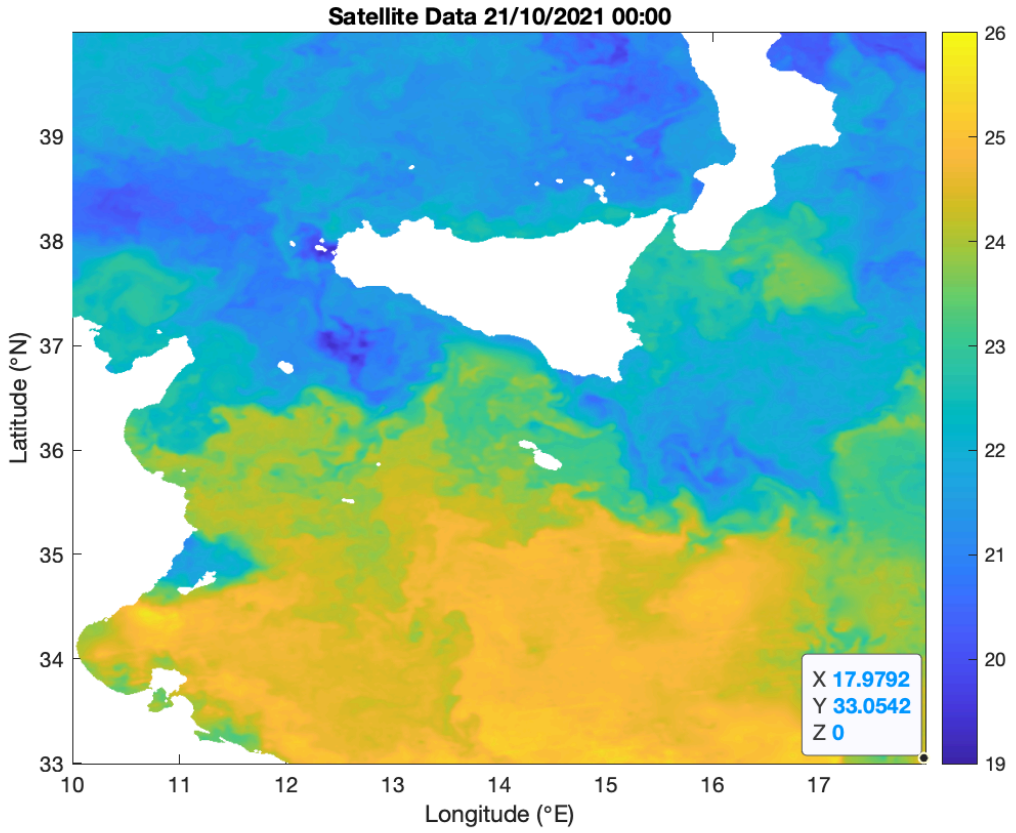
```
%extracting all depth levels
%for the first time frame
figure
for d = 1:1:size(model_data, 3)
    model_data_temp = model_data(:,:, d, 1);
    pcolor(model_lon, model_lat, model_data_temp');
    box on;
    shading flat;
    title(['Depth = ', num2str(model_depth(d)), 'm']);
    xlabel('Longitude (\circE)');
    ylabel('Latitude (\circN)');
    colorbar;
    pause (0.1);
    drawnow;
end

%------------

%extracting surface corresponidng to 21/10/2021 at 00:30
model_data_temp = model_data(:, :, 1, 25);
figure;
pcolor(model_lon, model_lat, model_data_temp');
box on;
shading flat;
title(['Model Data 21/10/2021 00:30']);
xlabel('Longitude (\circE)');
ylabel('Latitude (\circN)');
caxis([19 26]);
colorbar;
```

Matlab

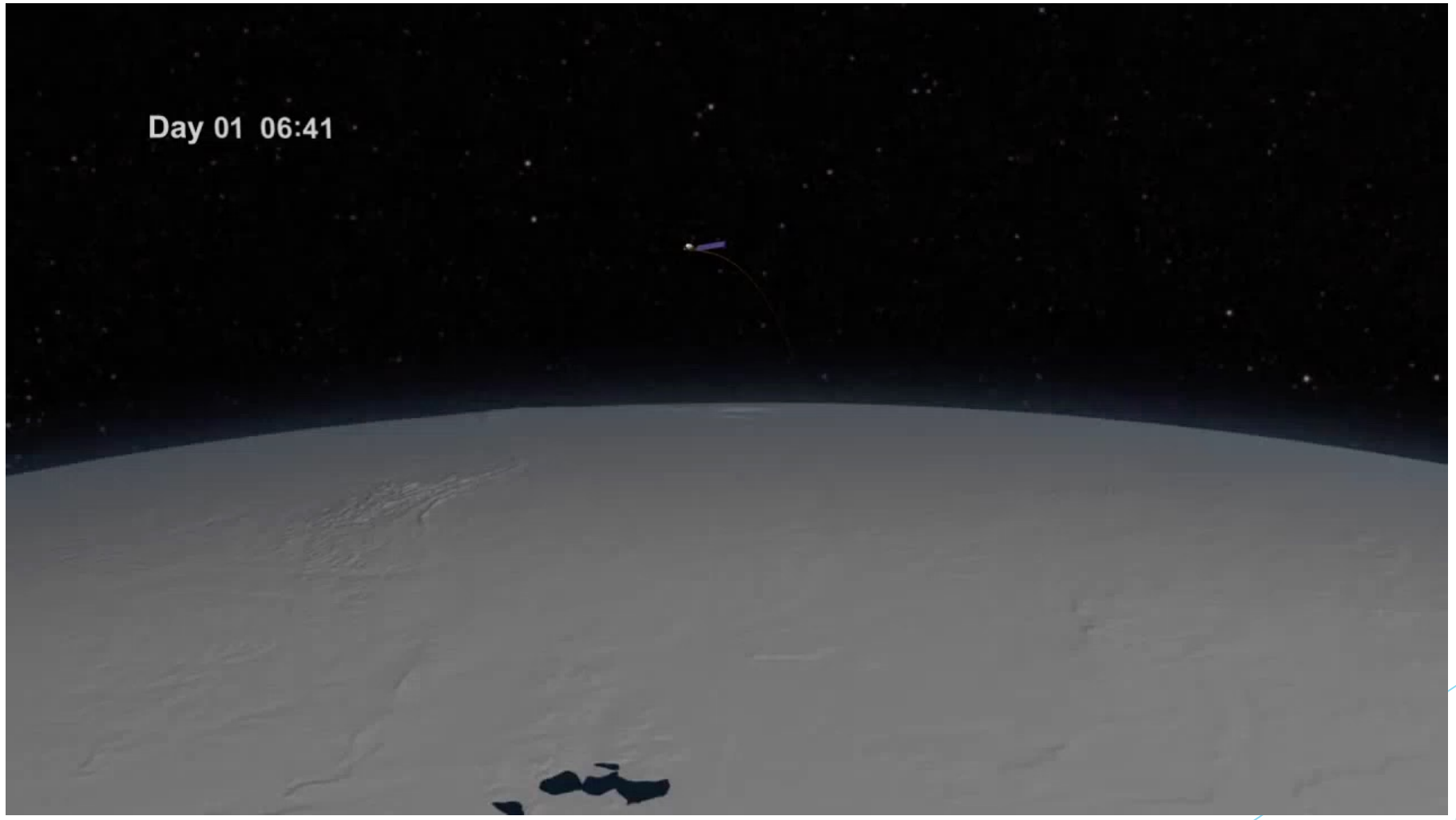
```
reading satellite file
sat_filename = 'SST_MED_SST_L4_NRT_OBSERVATIONS_010_004_c_V2_1634969733519.nc';
sat_lon = ncread(sat_filename, 'lon');
sat_lat = ncread(sat_filename, 'lat');
sat_time = ncread(sat_filename, 'time');
sat_data = ncread(sat_filename, 'analysed_sst');
sat_data = sat_data(:,:,2) - 273.15;
figure;
pcolor(sat_lon, sat_lat, sat_data');
box on;
shading flat;
title(['Satellite Data 21/10/2021 00:00']);
xlabel('Longitude (\circE)');
ylabel('Latitude (\circN)');
caxis([19 26]);
colorbar;

%------------

%mapping satellite data onto grid model
sat_data_interp = CommonGrid(model_lon, model_lat, model_data_temp, sat_lon,
sat_lat, sat_data);
plot(model_data_temp(:), sat_data_interp(:), '.');
axis equal;
axis tight;
xlabel('Model Data');
ylabel('Satellite Data');
axis([20 26 20 26]);
```

Matlab


Model Data 21/10/2021 00:30
Latitude (°N)
Longitude (°E)
39
38
37
36
35
34
10
11
12
13
14
15
16
17
18
26
25
24
23
22
21
20
19

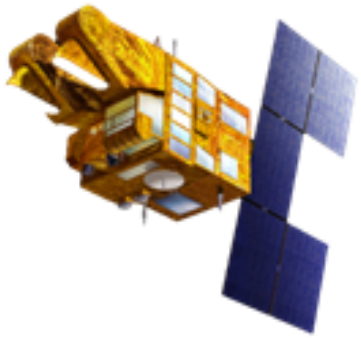

Satellite Data 21/10/2021 00:00
Latitude (°N)
Longitude (°E)
39
38
37
36
35
34
33
10
11
12
13
14
15
16
17
26
25
24
23
22
21
20
19
X 17.9792
Y 33.0542
Z 0

Sentinel Family



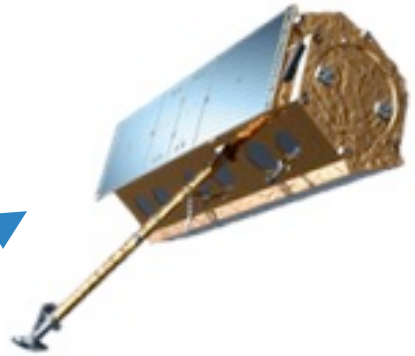
Sentinel Family

Sentinel Family



OPTICAL

RADAR



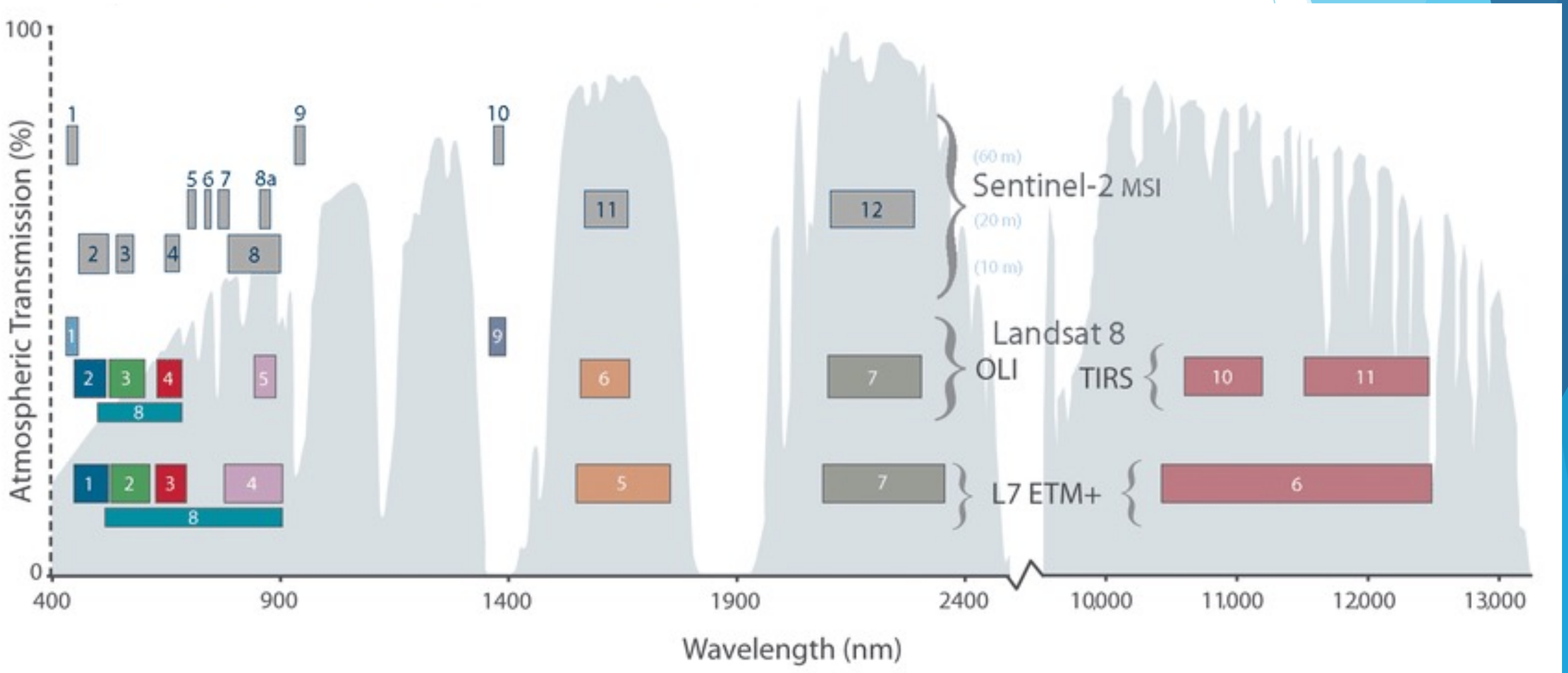
The optical satellite measures the visible part of the spectrum.

The energy scattered off the leaf is dependent on the greenness of the leaf as a function of the amount of chlorophyll, which absorbs the energy that is needed for photosynthesis

The radar satellite will measure the microwave part of the spectrum.

The energy scattered off the leaf is dependent on the size, shape, orientation and dielectric properties.

Sentinel Family [Optical]

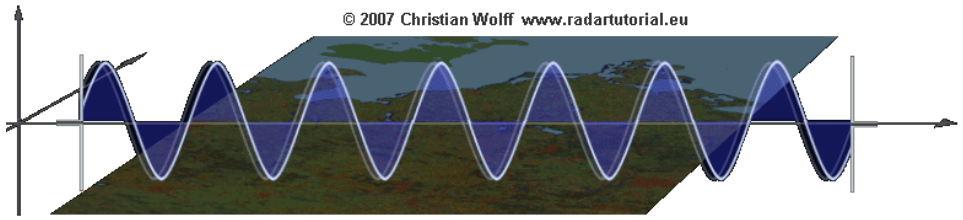


Sentinel Family [Optical]

- **SENTINEL-1 has a single C-band SAR instrument operating at a centre frequency of 5.405 GHz.**

Sentinel-2 Bands	Central Wavelength (µm)	Resolution (m)
Band 1 - Coastal aerosol	0.443	60
Band 2 - Blue	0.490	10
Band 3 - Green	0.560	10
Band 4 - Red	0.665	10
Band 5 - Vegetation Red Edge	0.705	20
Band 6 - Vegetation Red Edge	0.740	20
Band 7 - Vegetation Red Edge	0.783	20
Band 8 - NIR	0.842	10
Band 8A - Vegetation Red Edge	0.865	20
Band 9 - Water vapour	0.945	60
Band 10 - SWIR - Cirrus	1.375	60
Band 11 - SWIR	1.610	20
Band 12 - SWIR	2.190	20

Sentinel Family [SAR]

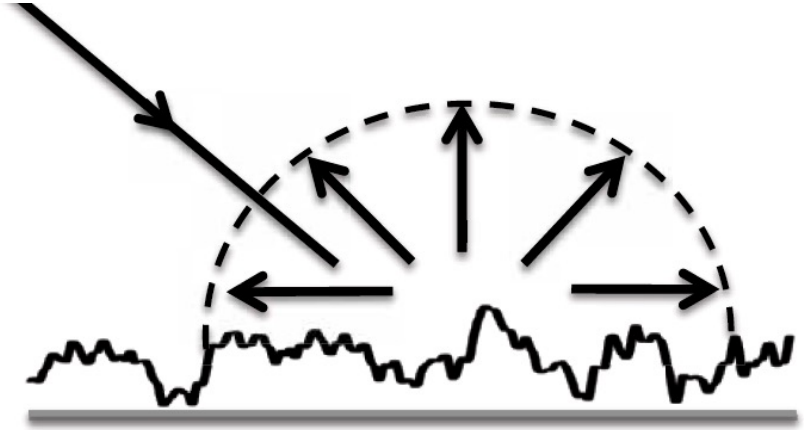


Single-polarimetric SAR mode	
VV	HH

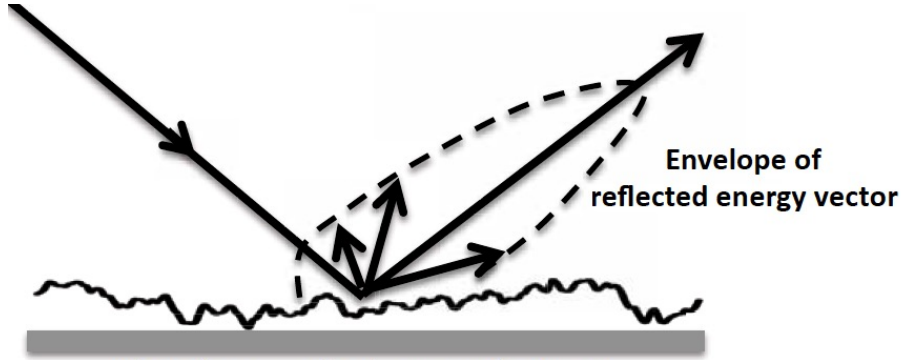
Dual-polarimetric coherent mode	
HH - HV	VV - VH

Full-polarimetric mode			
VV	VH	HV	HH

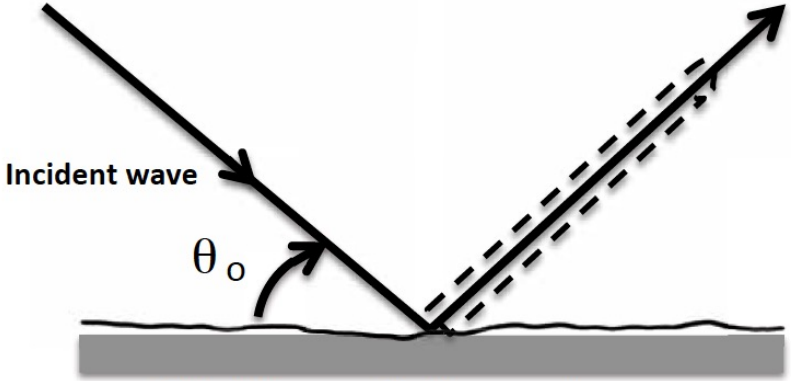
Sentinel Family [SAR]



Oil Sheen or no oil present

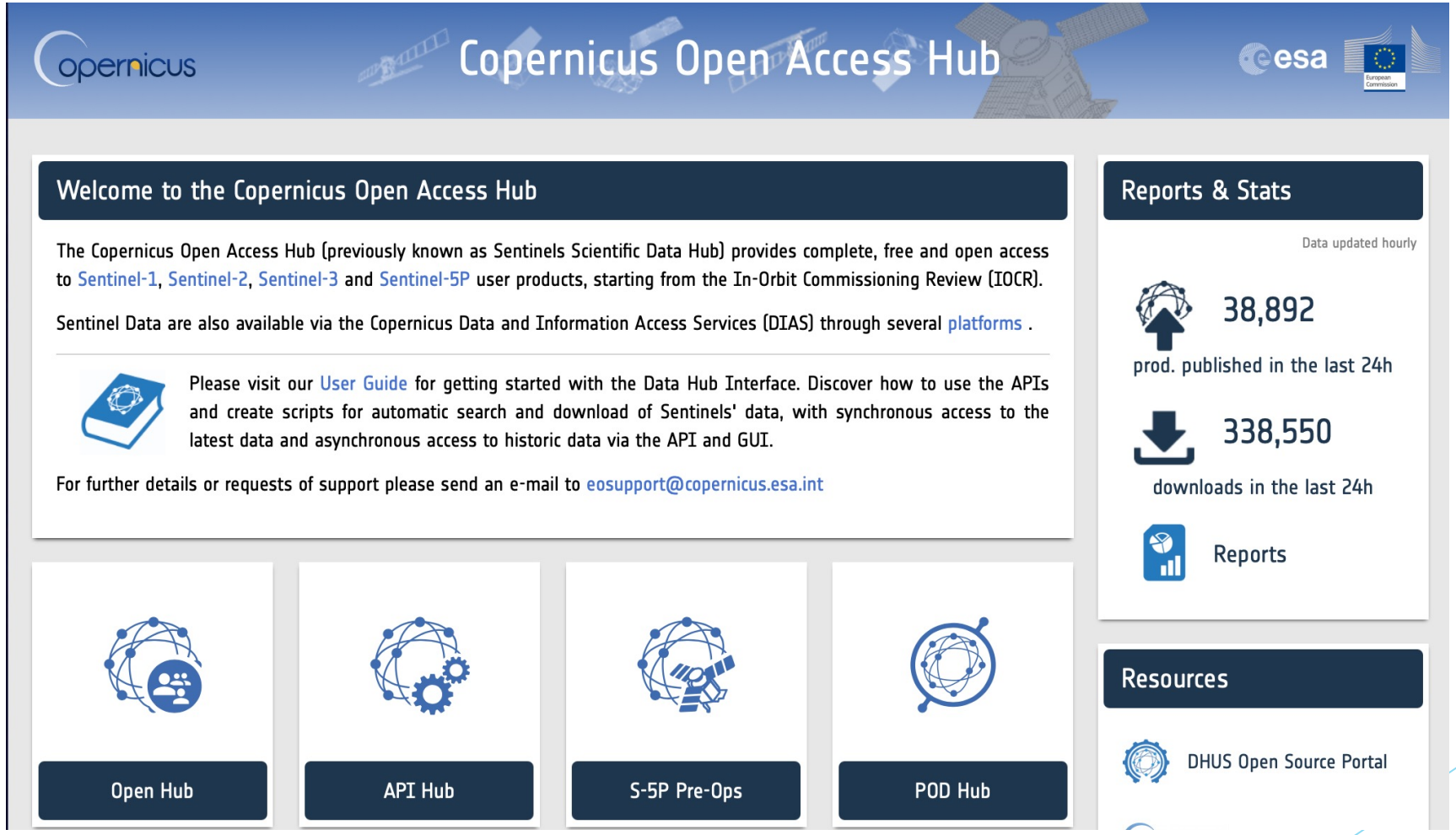


Thin layer of oil or surfactant



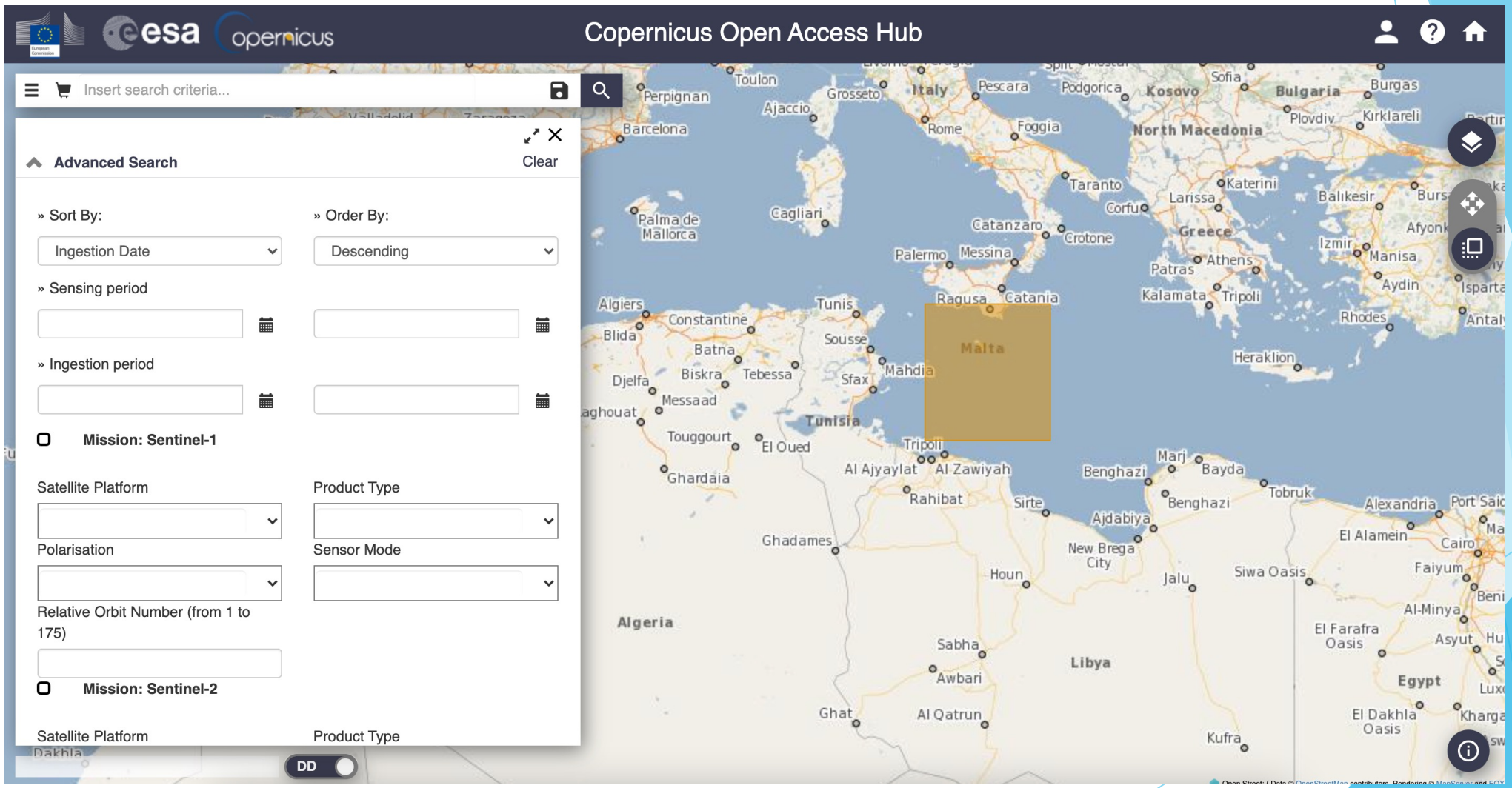
Thick layer of oil or surfactant

ESA Data Hub



https://scihub.copernicus.eu

ESA Data Hub



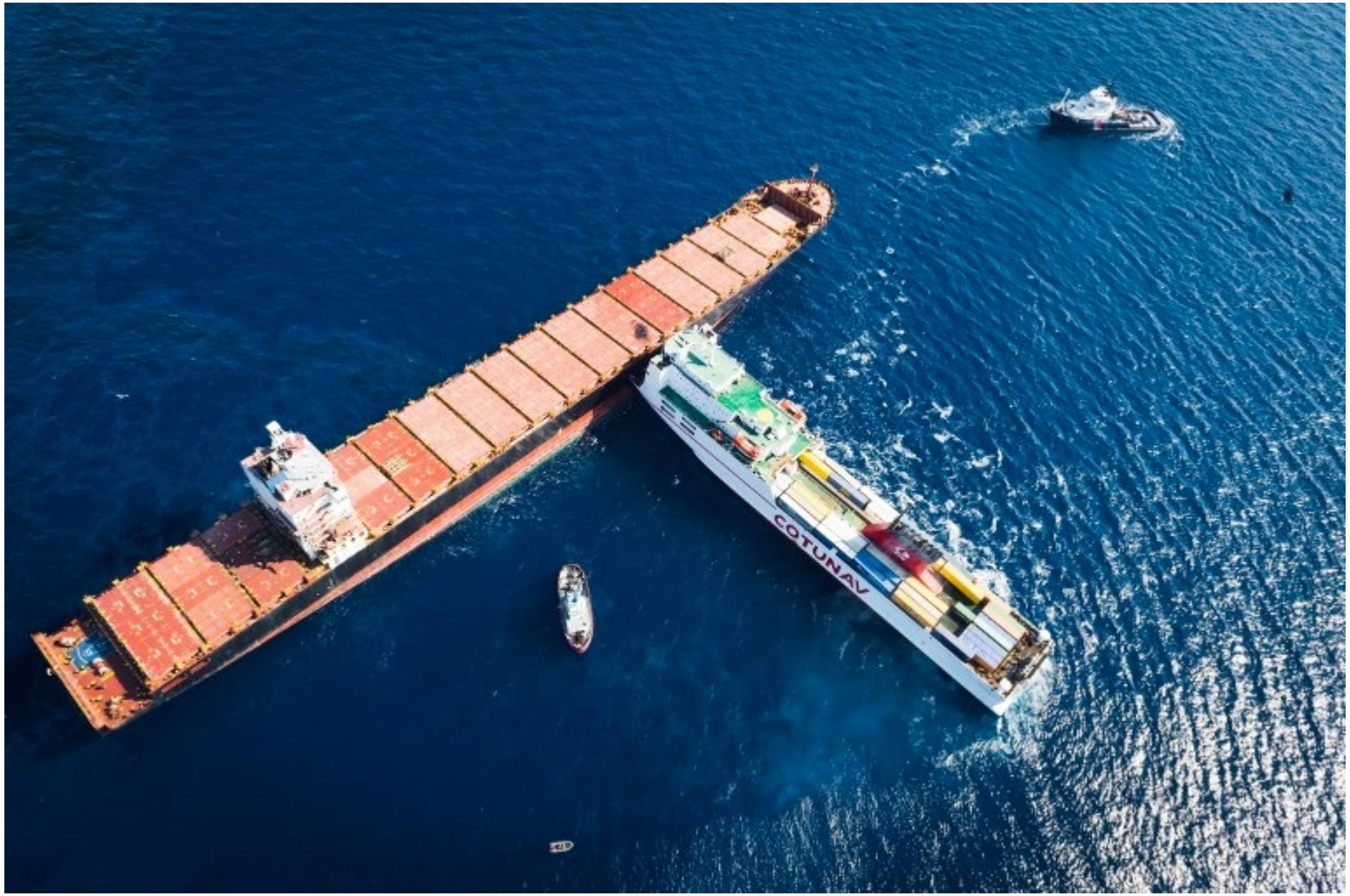
https://scihub.copernicus.eu

SNAP [Oil Spill Exercise]

- Tunisian tanker carrying trucks rammed into an anchored Cypriot container ship north of Corsica in the morning on Sunday 7th October 2018.
- Huge hole in the hull of one of the ships caused the fuel spill into the marine reserve created just two years ago.
- Spill created a trail of pollution 12 miles long and several hundred meters wide, heading away from Corsica towards the French and Italian mainland. The spill was pushed by the wind and started to break up.
- An estimated 40 to 200 cubic metres of oil leaked.
- Not clear why crash in clear conditions happened but most likely cause was human error. No-one was injured in the collision.
- Inflatable booms were deployed to stop the spread of a slick.

SNAP [Oil Spill Exercise]

SNAP [Oil Spill Exercise]



SNAP [Oil Spill Exercise]

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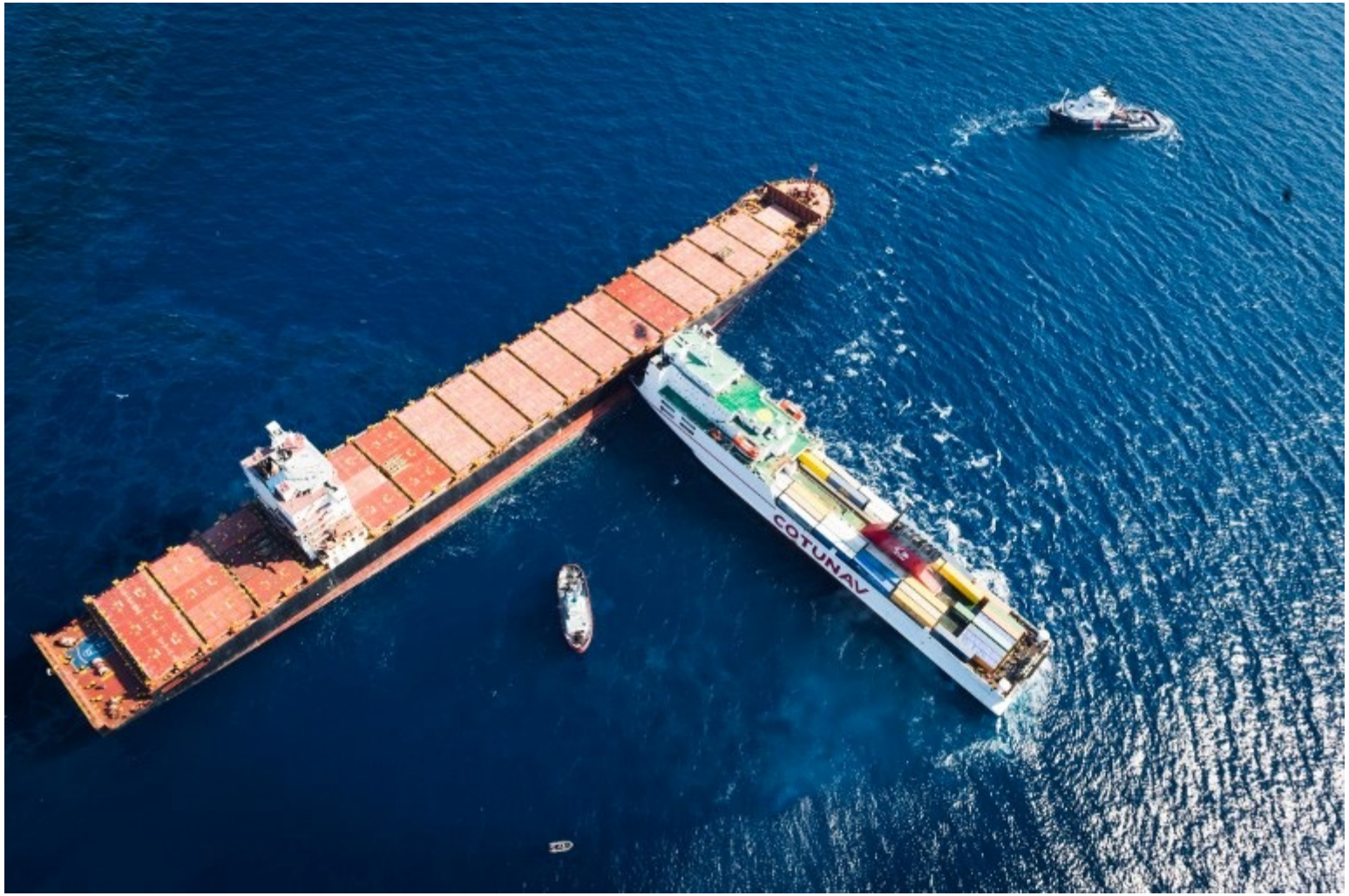
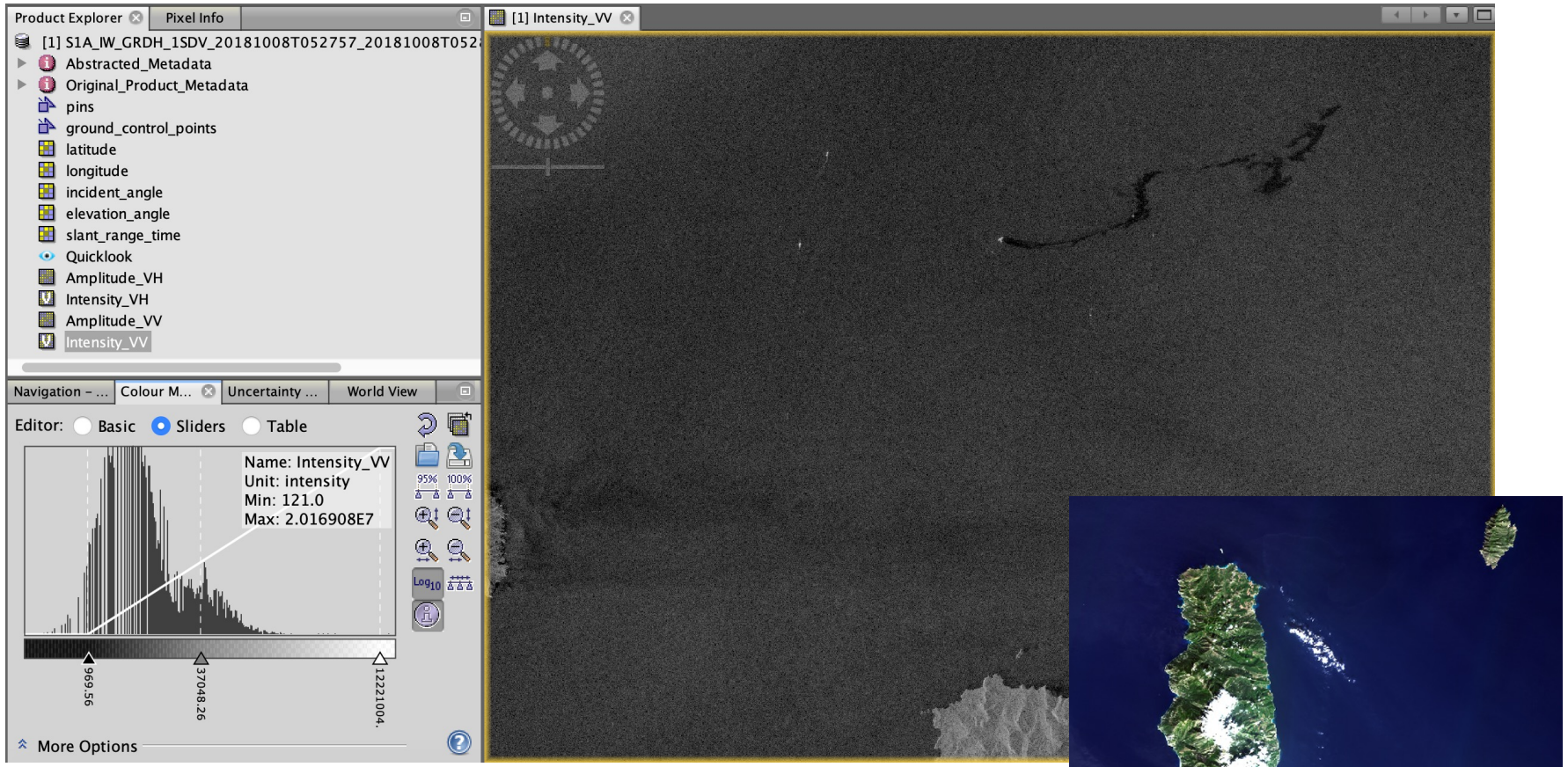


SNAP [Oil Spill Exercise]

SNAP [Oil Spill Exercise]



ESA Data Hub [CHL]

- Storm on 3rd October 2021
- Sentinel 2 data on 4th October 2021

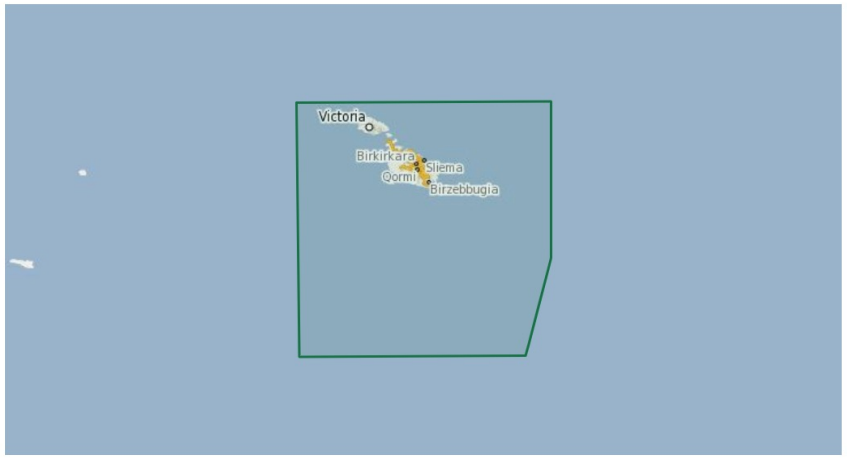
ESA Data Hub [CHL]

S2A_MSIL1C_20211004T095031_N0301_R079_T33SVV_20211004T105111

https://scihub.copernicus.eu/dhus/odata/v1/Products('18d5015e-97c0-427a-8c66-fc5f8de7f689')/$value

Download TCI

Footprint



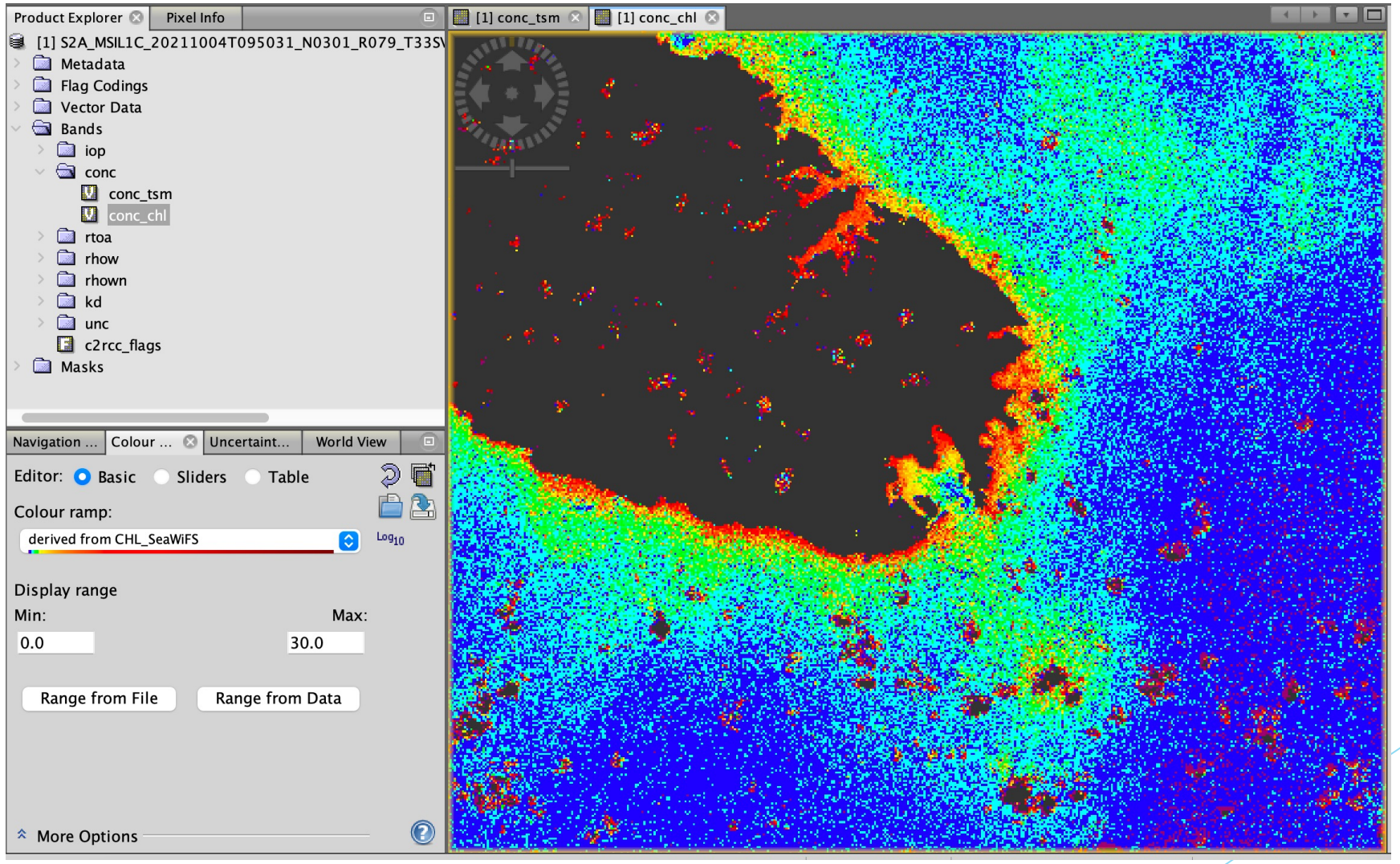
Quicklook

Attributes

Summary

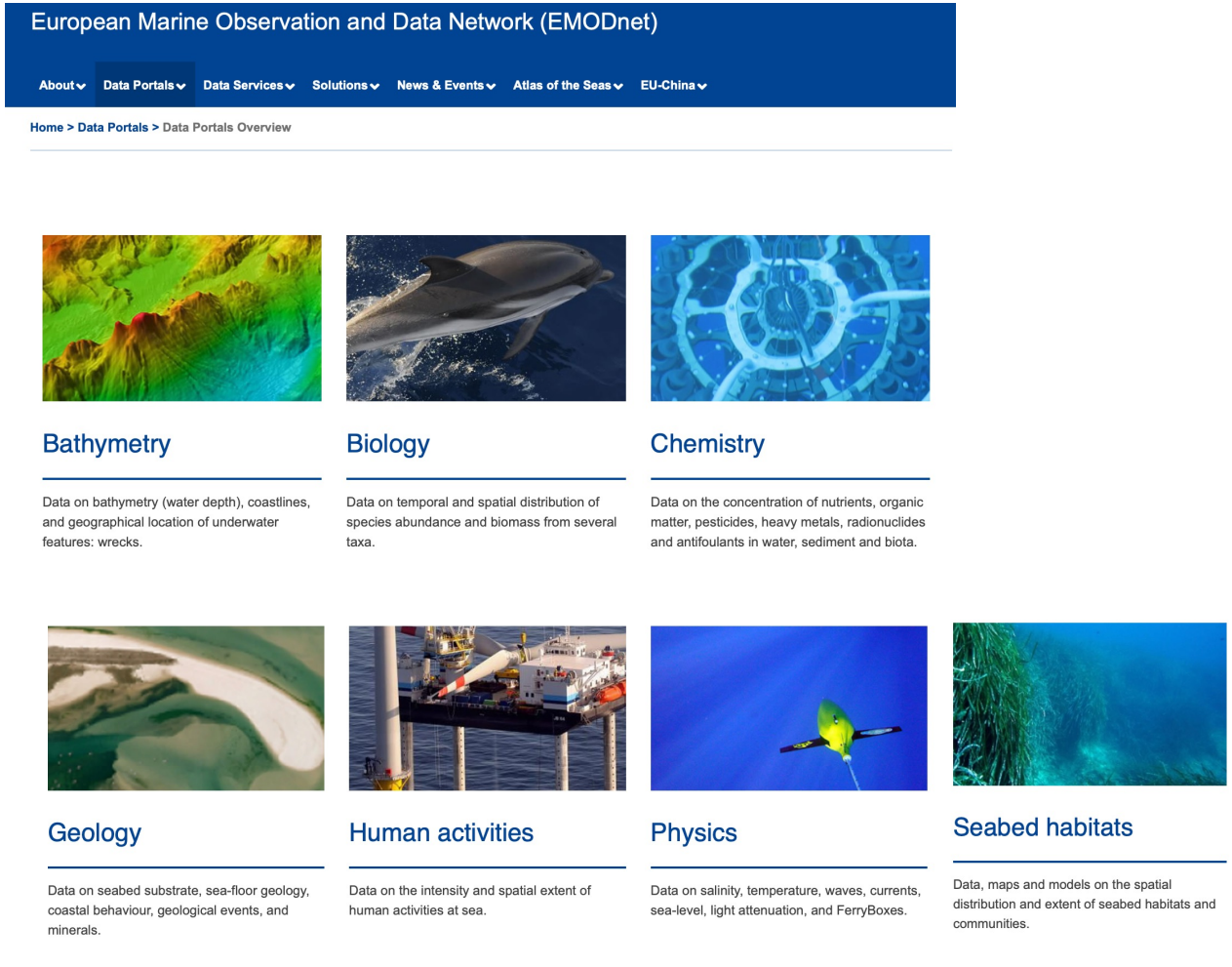
Inspector

ESA Data Hub [CHL]



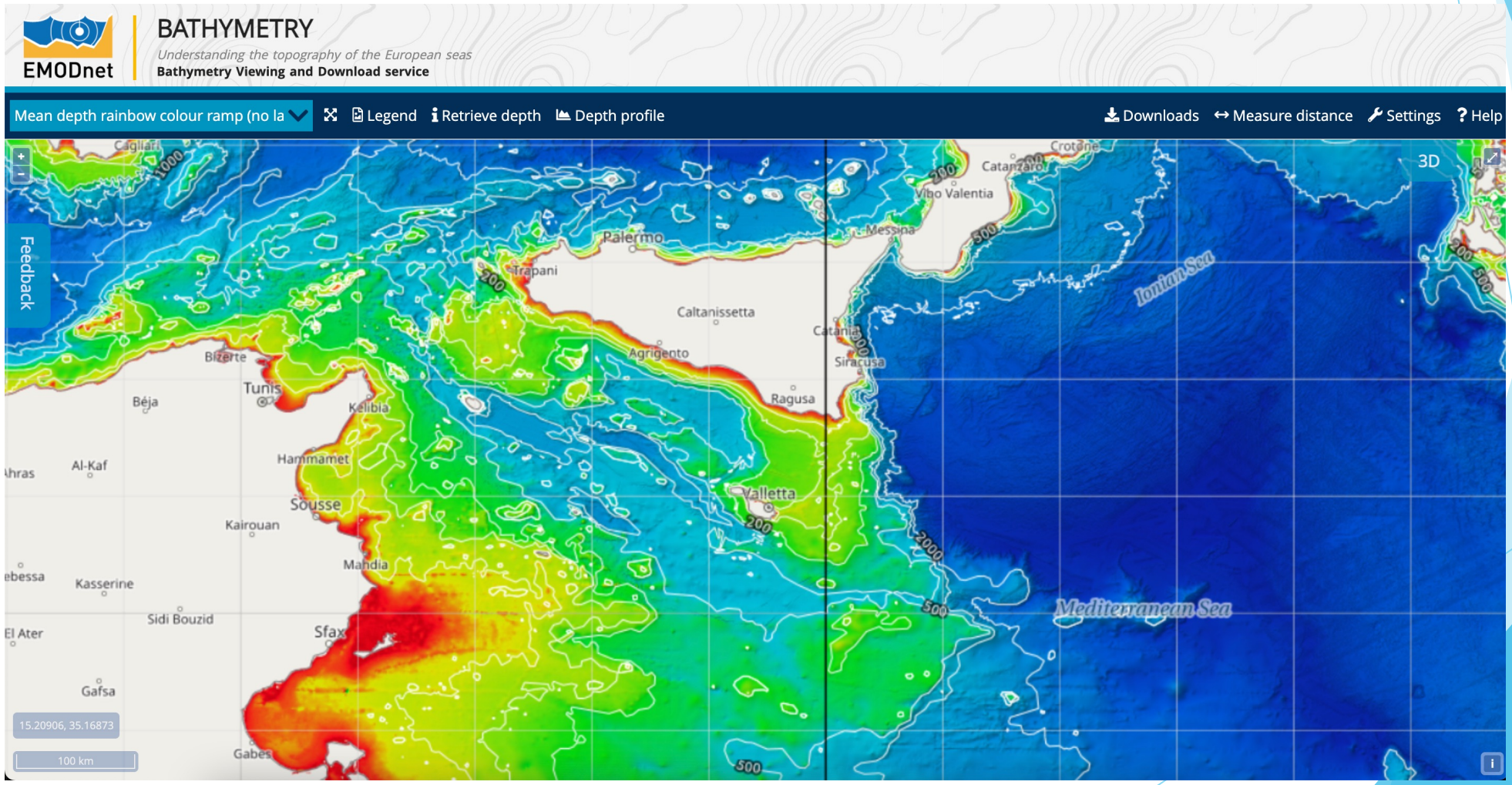
EMODnet

https://emodnet.ec.europa.eu/en/portals



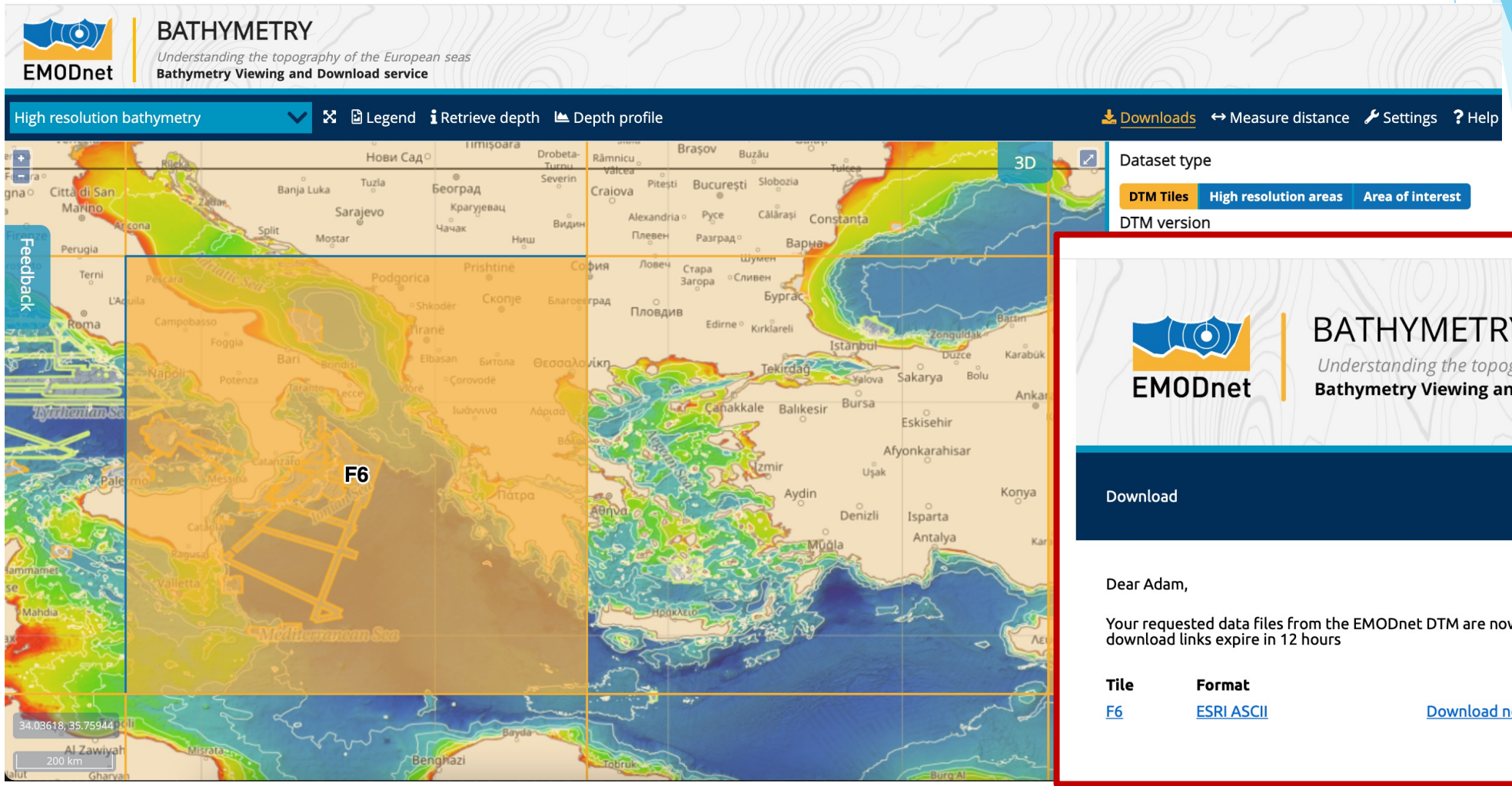
EMODnet [Bathymetry]

https://www.emodnet-bathymetry.eu/



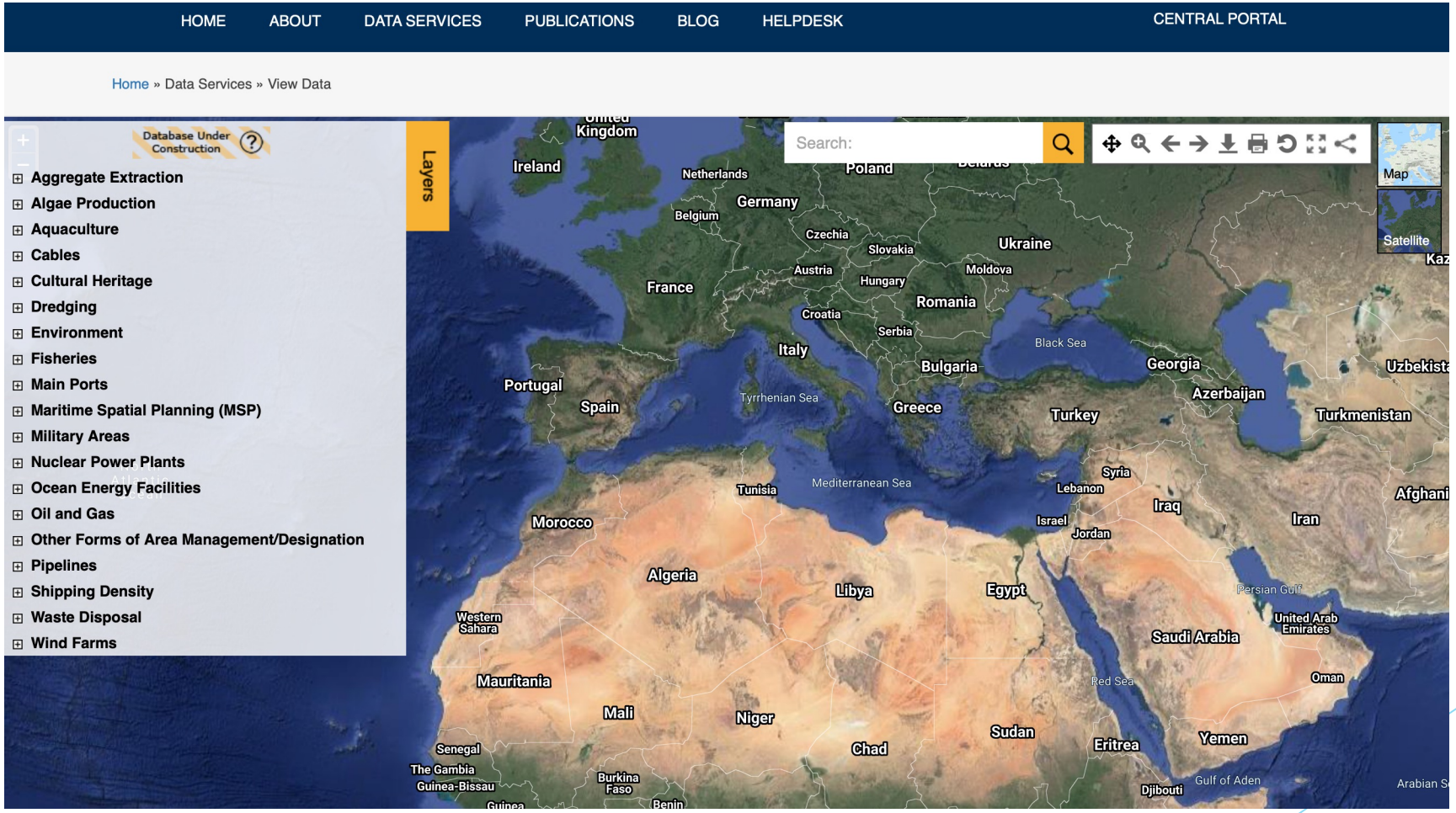
EMODnet [Bathymetry Download]

https://www.emodnet-bathymetry.eu/



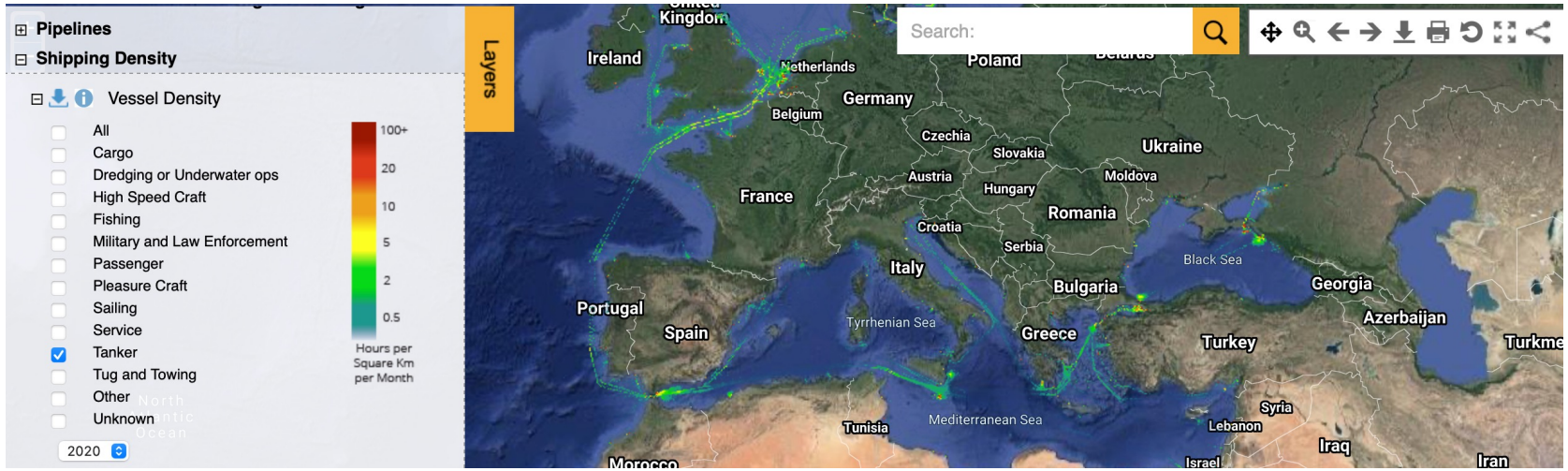
EMODnet [Human Activities]

https://www.emodnet-humanactivities.eu/



EMODnet [Human Activities – Vessel Density]

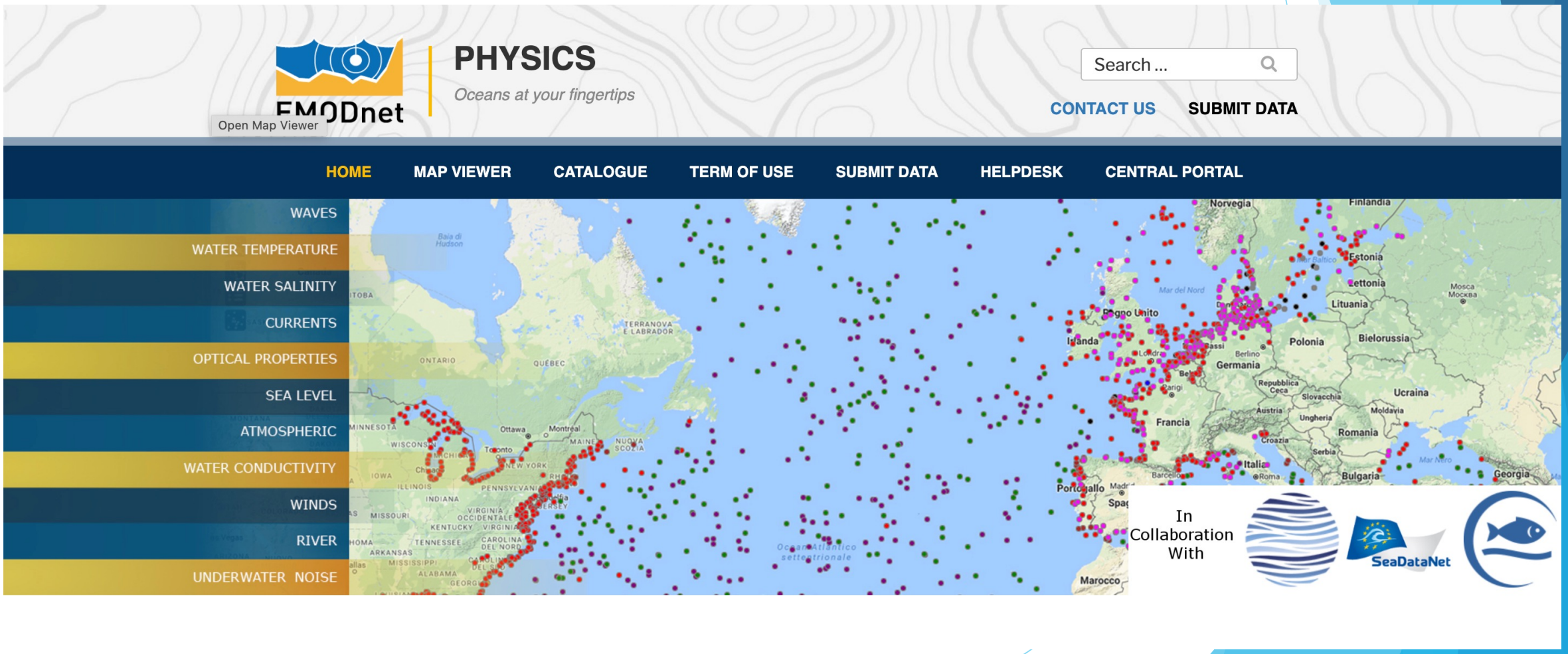
https://www.emodnet-humanactivities.eu/



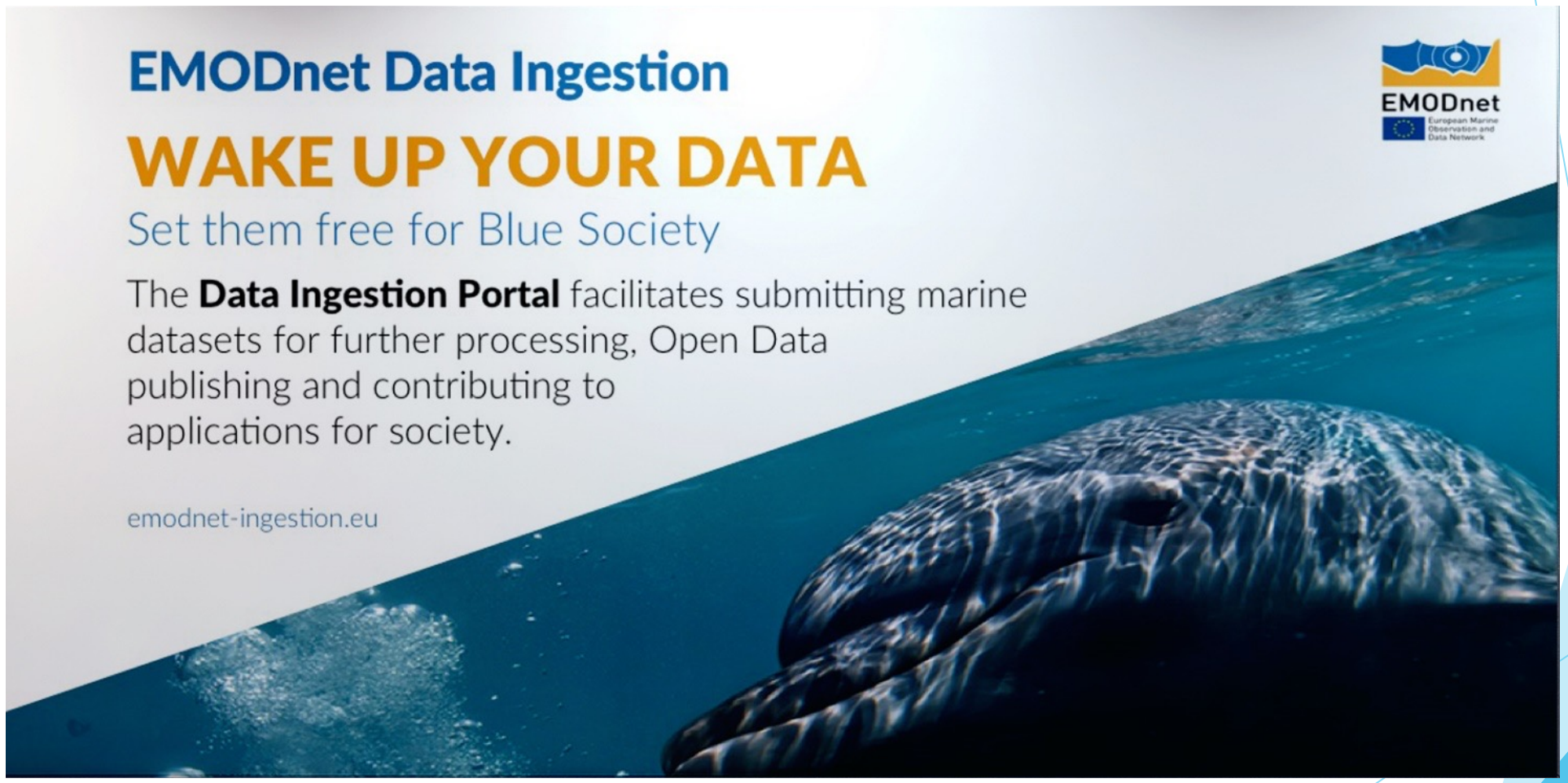
- All - All types
- 00 - Other
- 01 - Fishing
- 02 - Service
- 03 - Dredging or underwater ops
- 04 - Sailing
- 05 - Pleasure Craft
- 06 - High speed craft
- 07 - Tug and towing
- 08 - Passenger
- 09 - Cargo
- 10 - Tanker
- 11 - Military and Law Enforcement
- 12 - Unknown

EMODnet [Physics]

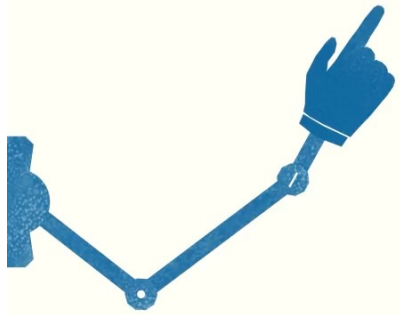
https://map.emodnet-physics.eu/



EMODnet [Ingestion]

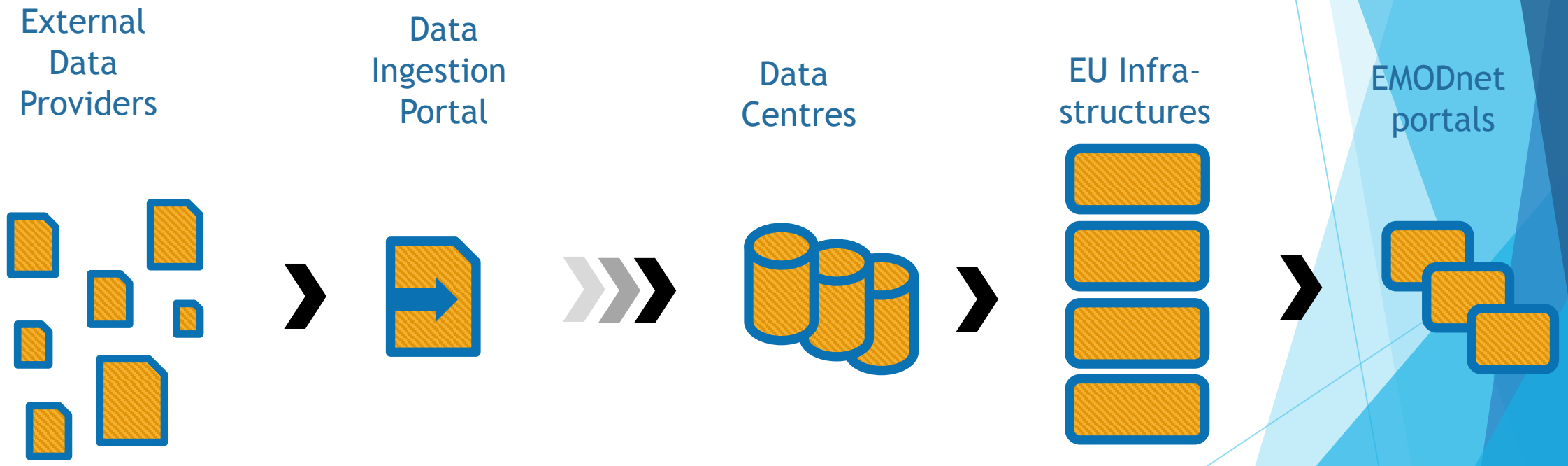


EMODnet [Ingestion]



EMODnet [Ingestion]

The EMODnet Ingestion services will serve all EMODnet thematic portals for streamlining incoming data sets

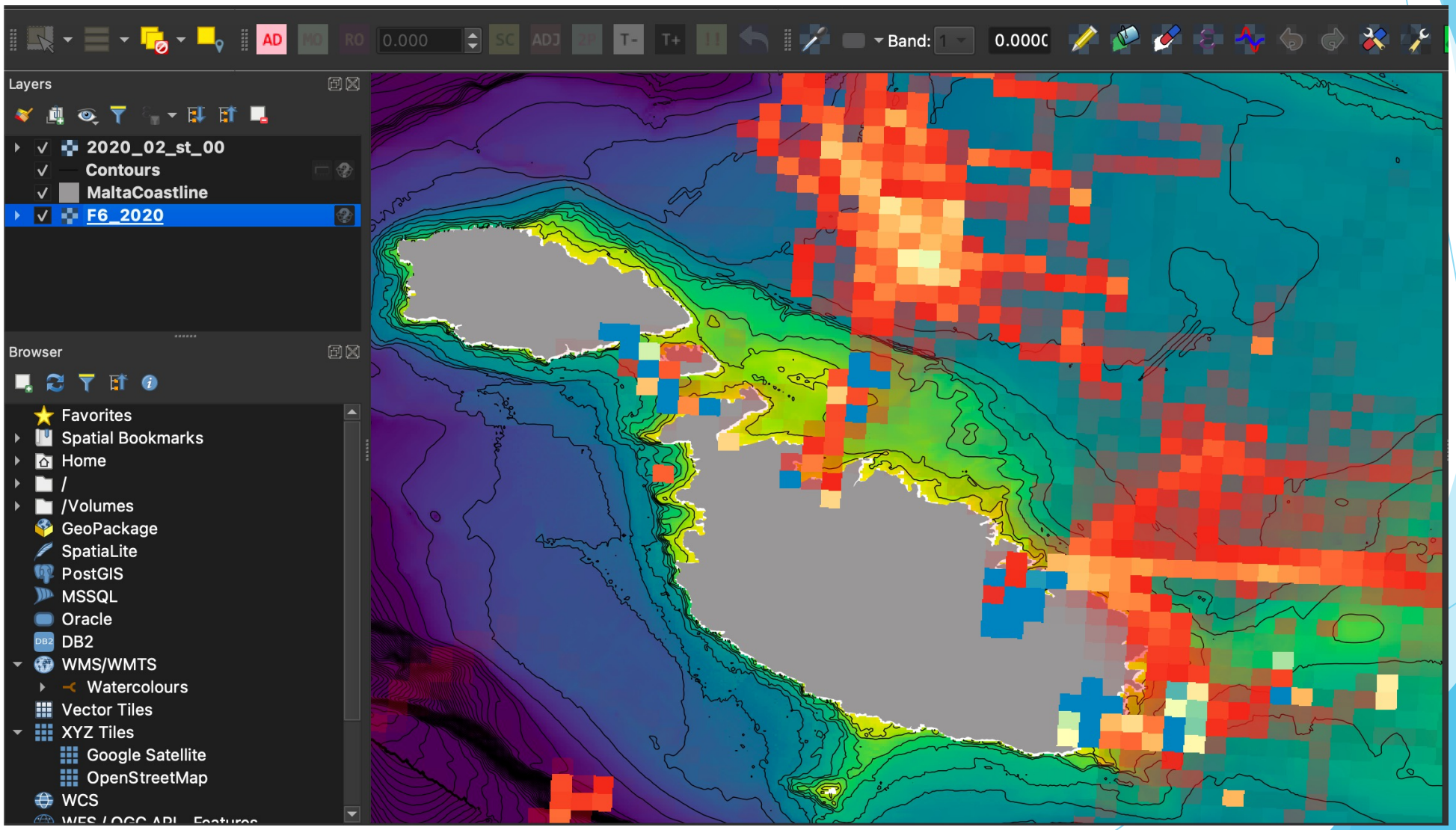


For more info, please visit www.emodnet-ingestion.eu

QGIS

https://qgis.org/en/site/

QGIS


Band:
Layers
2020_02_st_00
Contours
MaltaCoastline
F6_2020
Browser
Favorites
Spatial Bookmarks
Home
/
/Volumes
GeoPackage
SpatiaLite
PostGIS
MSSQL
Oracle
DB2
WMS/WMTS
Watercolours
Vector Tiles
XYZ Tiles
Google Satellite
OpenStreetMap
WCS

World Ocean Database

https://www.ncei.noaa.gov/products/world-ocean-database

WORLD OCEAN DATABASE SELECT AND SEARCH

Note: At this time, World Ocean Database 2018 (WOD18) contains prereleased data and flags for the WOA18.

The WOD18 is an NCEI product and an IODE (International Oceanographic Data and Information Exchange) project.

The WOD*select* retrieval system allows a user to search *World Ocean Database* and new (quartely updated/added) data using a user-specified search criteria. A distribution map and cast count of these search criteria will give the user the option to have the data extracted and placed on the NODC FTP site in the *WOD* native, 'csv', and netCDF data formats.

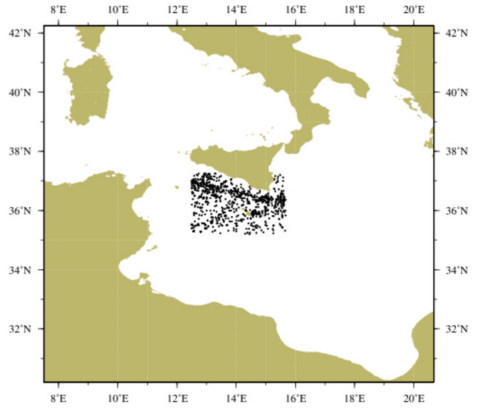
To build a user defined search query:

1. Place check mark in front of any number of criteria.
2. Press the "Build a query" button.

(If any criteria below are not checked, the default will apply).

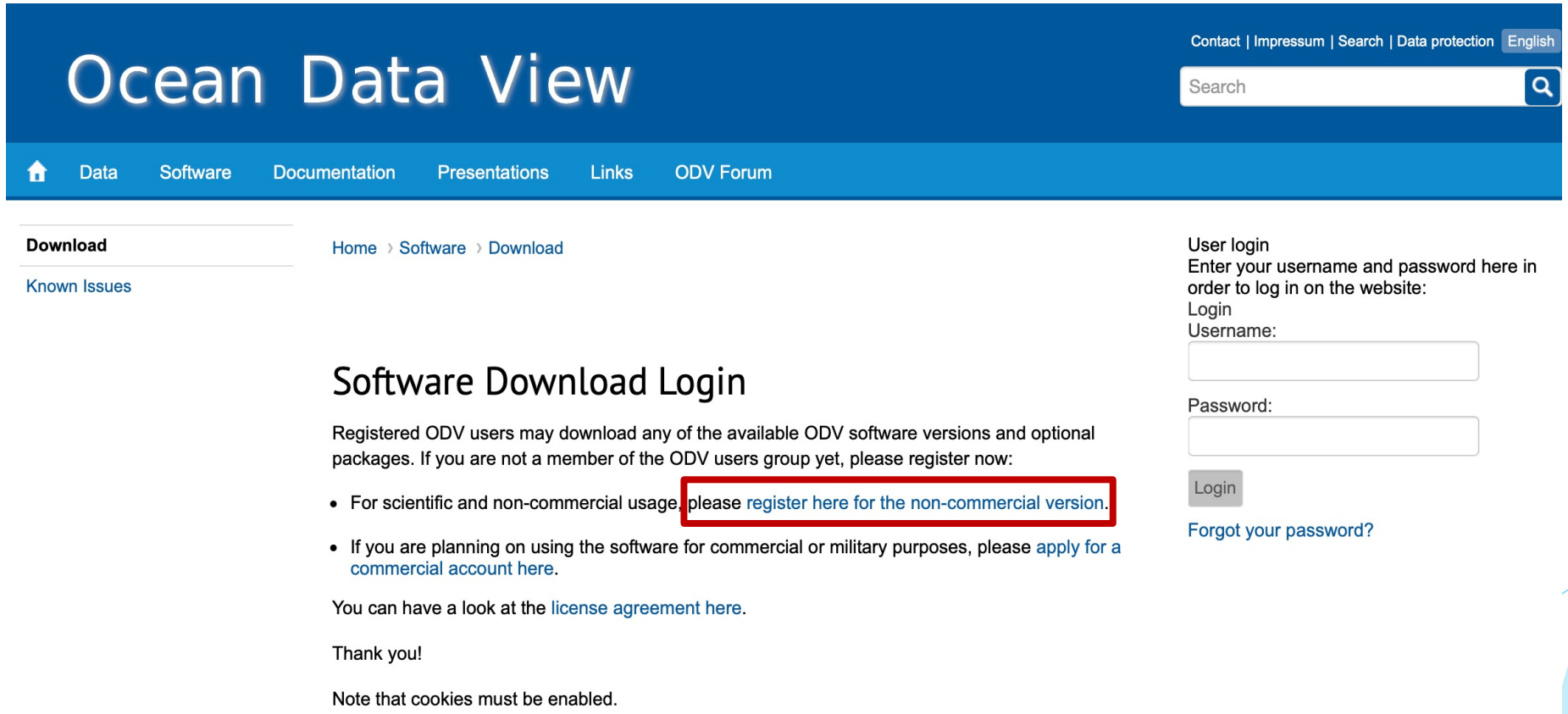
SEARCH CRITERIA: (definitions)	DEFAULT:
☑ Geographic Coordinates	- whole world
☐ Observation Dates - e.g., Year(s), Month(s), Day(s)	- all years/months/days
☑ Dataset - e.g., OSD, CTD, XBT	- all datasets
☐ Measured Variables - e.g., Temperature, Salinity, Nutrients	- all available variables
☐ Biology - e.g., Phytoplankton, Zooplankton	- all available plankton
☐ Deepest Measurement	- all depths
☐ Country	- all countries
☐ Ship/Platform	- all ships/platforms
☐ Cruise	- all cruises
☐ Accession #	- all accessions
☐ Project	- all projects
☐ Institute	- all institutes
☐ Data Exclusion Using WOD Quality Control Flags	- no exclusion
☐ Data Additions	- WOD18 released data

Northern Edge	37.25 °N
Southern Edge	35.20 °N
Western Edge	12.50 °E
Eastern Edge	15.60 °E



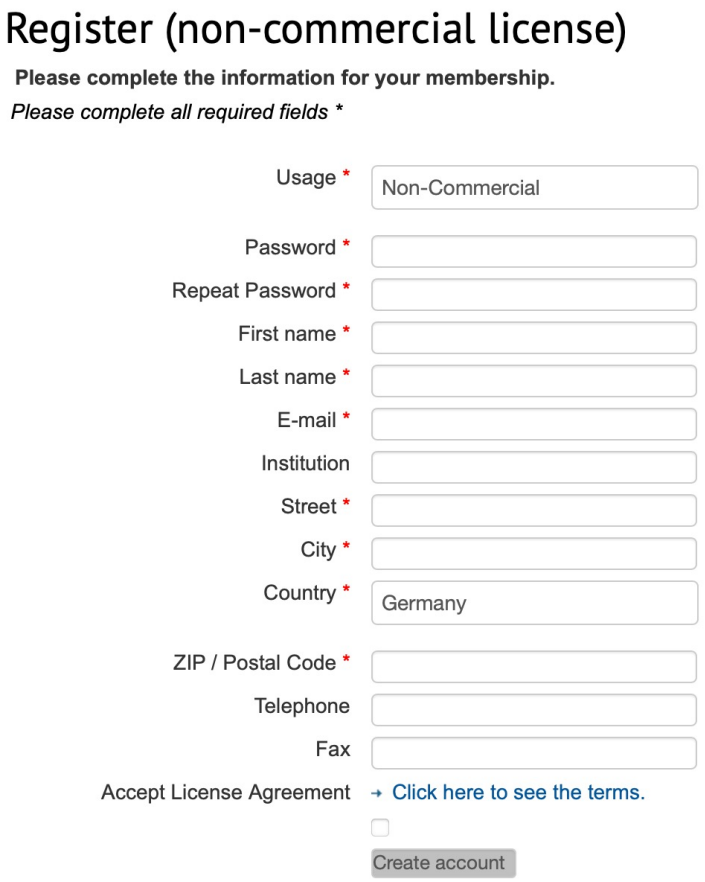
Ocean Data View

1. Go to: https://odv.awi.de/software/download/
   and click on **'register here for the non-commercial version'.**



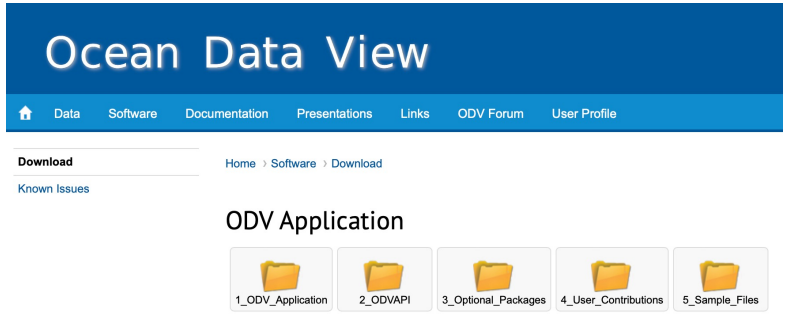
Ocean Data View

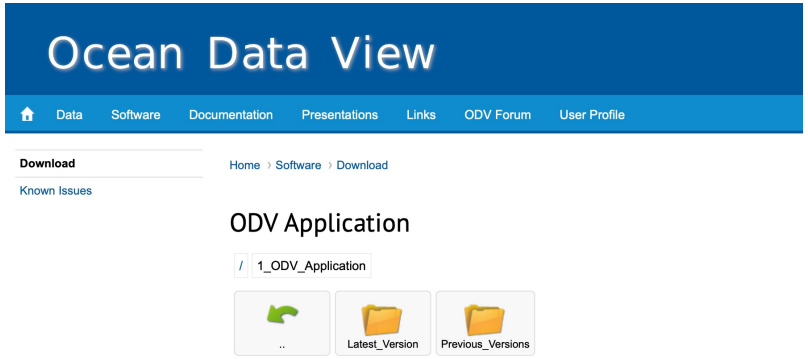
2. Fill in your details and **create an account.** If successful, you'll be directed to the **Software Download** page.



Ocean Data View

3. Click on **ODV_Application**. Click on **Latest_Version**.
   Select your **Operating System** (Linux, MacOS, or Windows).
   For Windows, download and install the **64-bit**, **odv_5.3.0_w64.exe** file.
   For MacOS, download and install the **64-bit**, **odv_5.3.0_macx_64bit.dmg** file.





Ocean Data View