



# Using Copernicus Marine Service spatial data into EwE Modelling approach

7 June 2024, 9-17 CEST

Select, visualize and download datasets through the MyOcean online Copernicus tool

Gianpiero Cossarini



## Summary:

- Marine Copernicus Catalogue and selection of products
- Spatial-temporal scales of products
- MyOcean online visualization
- How to access data and download

# How to access and visualize the products: the Marine Data Store

Implemented by Mercator Ocean International as part of the Copernicus Programme

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## Copernicus Marine Service

Providing free and open marine data and services to enable marine policy implementation, support Blue growth and scientific innovation.

Access Data >

DATA

### OCEAN PRODUCTS

A robust ocean data catalogue, to download or visualise data including hindcasts, nowcasts and forecasts.

EXPERTISE

### OCEAN STATE REPORT

Extensive annual analysis on the state of the ocean over nearly 20 years and severe/notable annual events.

TRENDS

### OCEAN MONITORING INDICATORS

Essential variables monitoring the health of the ocean over the past quarter of a century.

EXPLORATION

### OCEAN VISUALISATION

Dive into our 4D digital oceans through our 3 visualisation tools for beginner, intermediate and advanced users

# How to access and visualize the products: the Marine Data Store

Implemented by Mercator Ocean International as part of the Copernicus Program

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### Access Data >

**DATA**

**OCEAN PRODUCTS**

A robust ocean data catalogue, to download or visualise data including hindcasts, nowcasts and forecasts.

**EXPERTISE**

Extensive annual analysis of the ocean over nearly 20 years, covering severe/notable events.

**MAIN VARIABLES**

- Carbonate system 19
- Mixed layer thickness 17
- Nekton 1
- Nutrients 16
- Optics 41
- Organic carbon 2
- Oxygen 26
- Plankton 75
- Salinity 38
- Sea ice 37
- Sea surface height 50
- Surface density 2
- Temperature 90
- Velocity 54
- Wave 38
- Wind 6

**AREA**

- Global Ocean 102
- Antarctic Ocean 4
- Arctic Ocean 50
- Atlantic: Iberia-Biscay-Ireland 42
- Atlantic: NW European Shelf 34
- Atlantic: North 60
- Baltic Sea 57
- Black Sea 41
- Europe 4
- Mediterranean Sea 46

**INDICATORS & TRENDS**

**FEATURE TYPE**

## Copernicus Marine Data Store

Home > Marine Data Store

**Filters**

FREE-TEXT SEARCH

FAVOURITES 0

TIME RANGE

WITH DEPTH 37

DEPTH RANGE

UNIVERSE

- Blue Ocean 191
- White Ocean 40
- Green Ocean 78

**Products 277**

**MOST POPULAR**

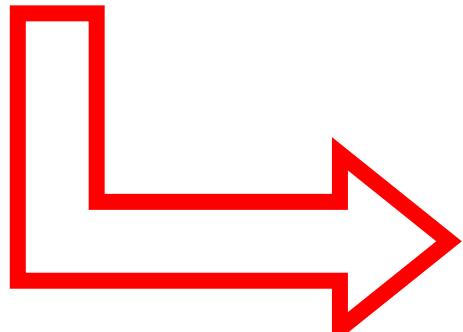
- Global Ocean Physics Analysis and Forecast
- Global Ocean Biogeochemistry Analysis and Forecast
- Global Ocean Physics Reanalysis
- Global Ocean and Forecast

**RECENTLY VIEWED**

- Mediterranean Sea, Bio-Geo-Chemical, L3, daily observation
- Global Ocean Physics Reanalysis
- Baltic Sea Physics Reanalysis
- Mediterranean Analysis

**NEW IN COPERNICUS MARINE**

- GlobCurrent
- Wind
- Wind
- MEDSEA\_A



# How to access and visualize the products: the Marine Data Store

 Copernicus  
Europe's eyes on Earth

## Copernicus Marine Service

Providing free and open marine data and services to enable implementation, support Blue growth and scientific in

### Access Data >

**DATA**

**OCEAN PRODUCTS**  
A robust ocean data catalogue, to download or visualise data including hindcasts, nowcasts and forecasts.

**EXPERTISE**  
Extensive annual analysis of the ocean over near-severe/notable

**MAIN VARIABLES**  
Carbonate system 19  
Mixed layer thickness 17  
Nekton 1  
Nutrients 16  
Optics 41  
Organic carbon 2  
Oxygen 26  
Plankton 75  
Salinity 38  
Sea ice 37  
Sea surface height 50  
Surface density 2  
Temperature 90  
Velocity 54  
Wave 38  
Wind 6

**AREA**  
Global Ocean 102  
Antarctic Ocean 4  
Arctic Ocean 50  
Atlantic: Iberia-Biscay-Ireland 42  
Atlantic: NW European Shelf 34  
Atlantic: North 60  
Baltic Sea 57  
Black Sea 41  
Europe 4  
Mediterranean Sea 46

**INDICATORS & TRENDS**

**FEATURE TYPE**

 Copernicus  
Europe's eyes on Earth

Services Opportunities Access Data Use Cases User Corner About

## Copernicus Marine Data Store

Home > Marine Data Store

**Filters**

FREE-TEXT SEARCH  
Free text

FAVOURITES ★ 0

TIME RANGE gg/mm/aaaa - gg/mm/aaaa  
Covering full interval

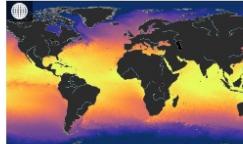
WITH DEPTH 37

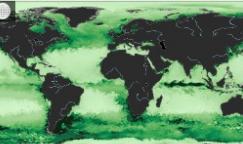
DEPTH RANGE

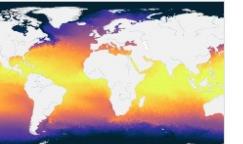
UNIVERSE ▾  
Blue Ocean 191  
White Ocean 40  
Green Ocean 78

**Products 277**

**MOST POPULAR**

  
Global Ocean Physics Analysis and Forecast  
GLOBAL\_ANALYSISFORECAST\_P... 001\_024 Models  
Global, 0.083° × 0.083° × 50 levels  
1 Nov 2020 to 6 Jun 2024, hourly, daily,..  
Temperature, salinity, sea surface height, velocity, mixed layer thickness, wave, sea ice...

  
Global Ocean Biogeochemistry Analysis and Forecast  
GLOBAL\_ANALYSISFORECAST\_B... 001\_028 Models  
Global, 0.25° × 0.25° × 100 levels  
1 Oct 2021 to 30 Sep 2024, daily,..  
Plankton, nutrients, primary production, optical system, optics...

  
Global Ocean Physics Reanalysis  
GLOBAL\_MULTIYEAR\_PHY\_001\_030 Models  
Global, 0.083° × 0.083° × 50 levels  
1 Jan 1950 to 31 Dec 2020, daily,..  
Temperature, salinity, sea surface height, velocity, mixed layer thickness, wave, sea ice...

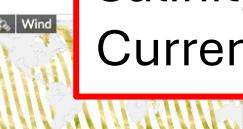
  
Global Ocean and Forecast  
GLOBAL\_AI\_001 Models

**RECENTLY VIEWED**

  
Mediterranean Sea, Bio-Geo-Chemical, L3, daily observation  
OCEANCLOUD\_MED\_BGC\_HR\_... 009\_205 Satellite (L3)  
Med Sea, 0.1 × 0.1 km  
1 Jan 2020 to 26 May 2024, daily  
Plankton, optics

  
Global Ocean  
GLOBAL\_MULTIYEAR\_PHY\_001\_030 Models  
Global, 0.083° × 0.083° × 50 levels  
1 Jan 1950 to 31 Dec 2020, daily,..  
Temperature, salinity, sea surface height, velocity, mixed layer thickness, wave, sea ice...

**NEW IN COPERNICUS MARINE**

  
GlobCurrent  
  
Wind

Input variables for EwE:

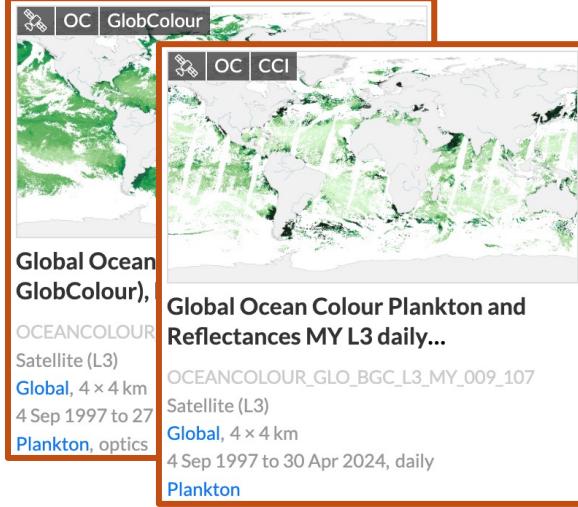
Chlorophyll  
Carbon biomass of phytoplankton  
Primary Production  
Carbon biomass of zooplankton  
Oxygen  
Temperature  
Salinity  
Currents

how many products for chlorophyll for a particular region (e.g. Mediterranean Sea)?

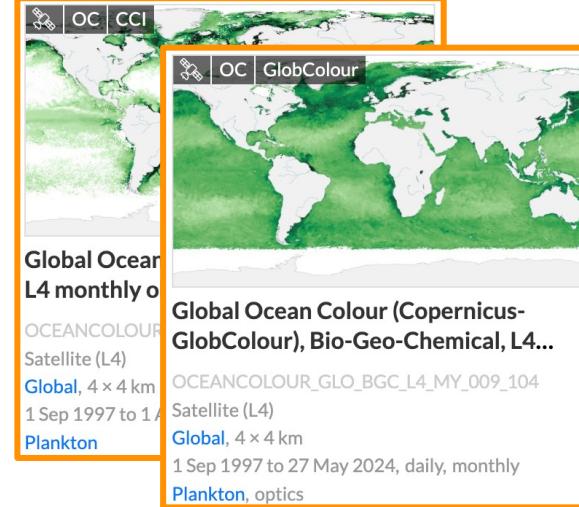
### models



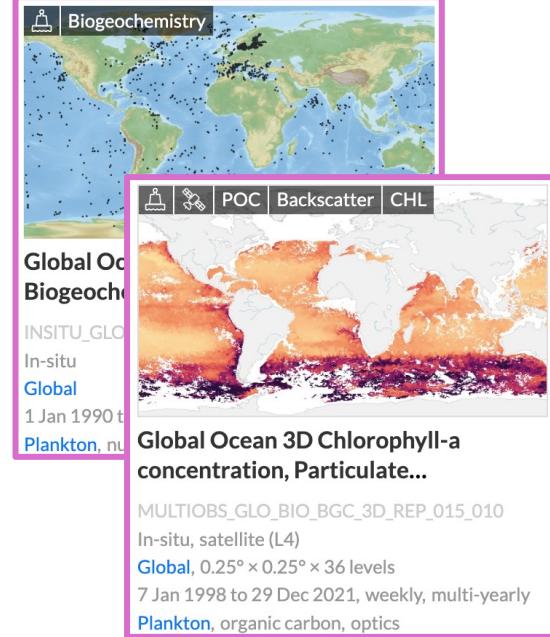
### satellite L3



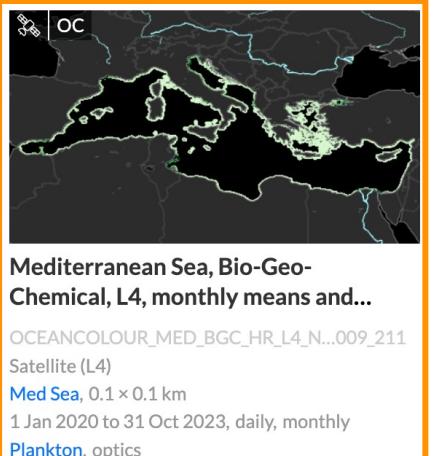
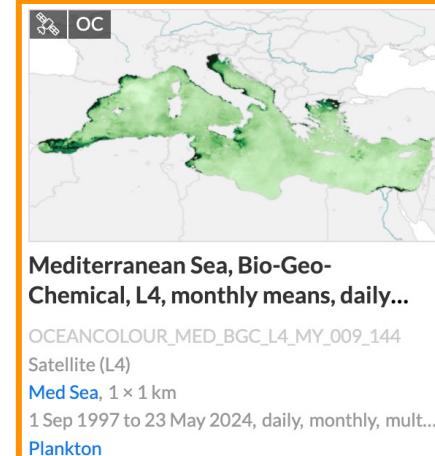
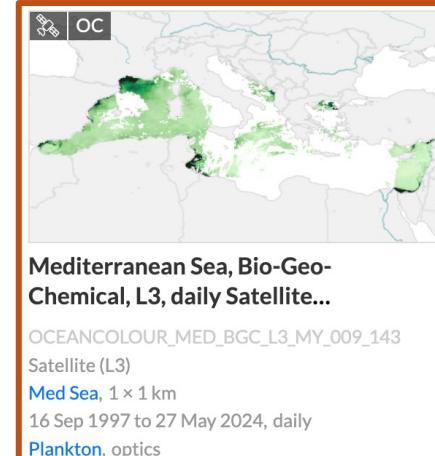
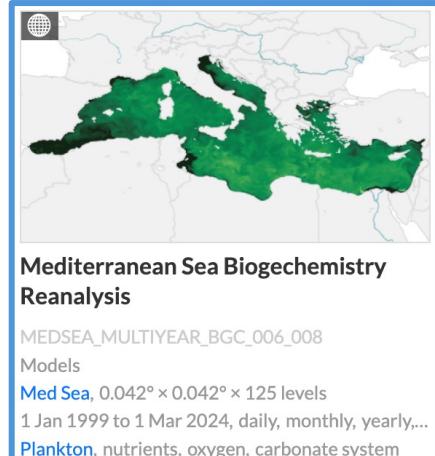
### satellite L4



### insitu and data driven models



### regional products



*In landscape ecology scale is defined as “resolution (grain) and extent” of phenomena, observations/sampling and analysis*

*Dungan et al., 2002*

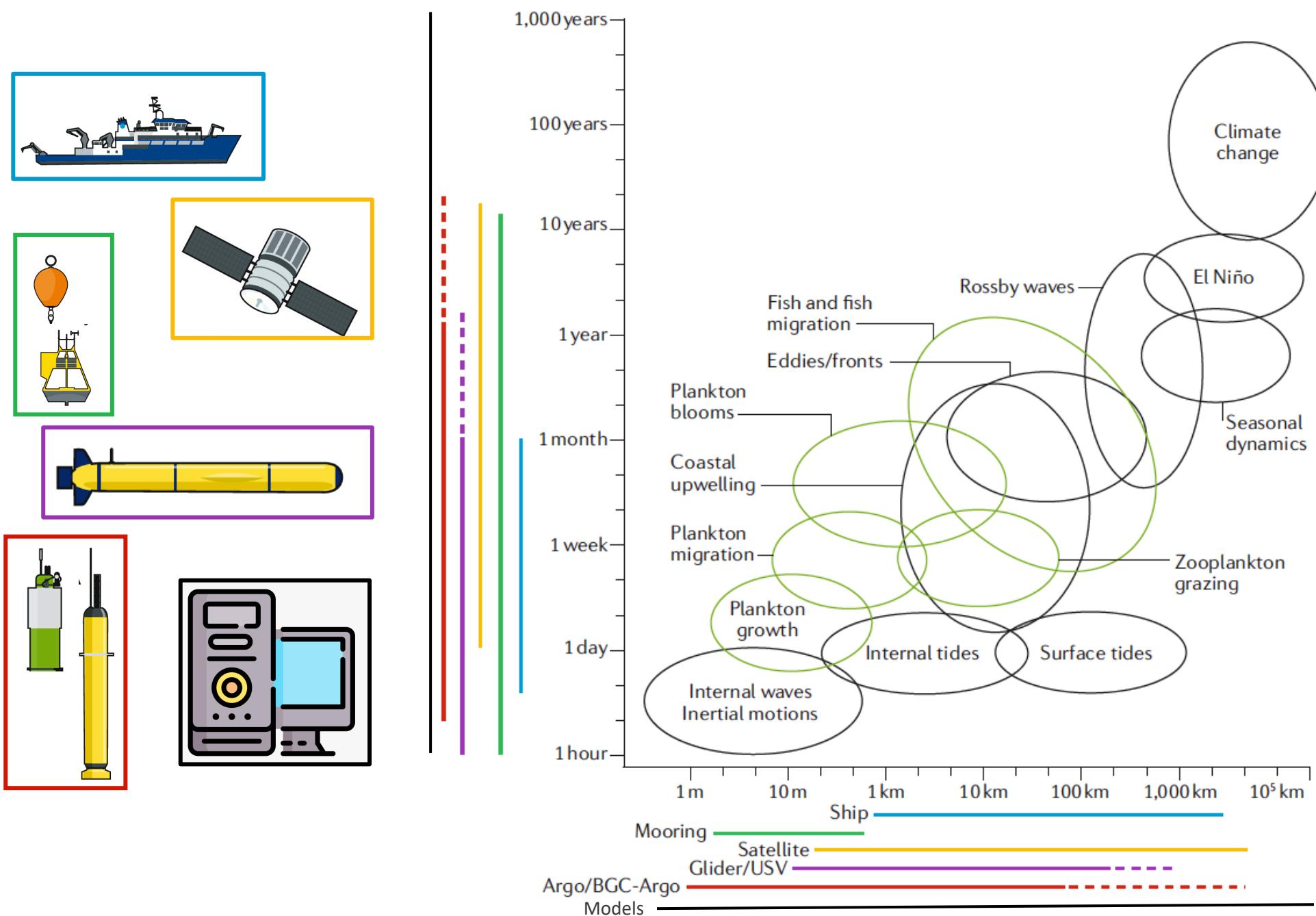
**resolution** refers to the size of the smallest possible feature (sampling unit or grain size) that can be detected

*remote sensing images and model are composed of a matrix of picture elements (pixels), which are the smallest units of an image. Image pixels are normally square and represent a certain area on an image*

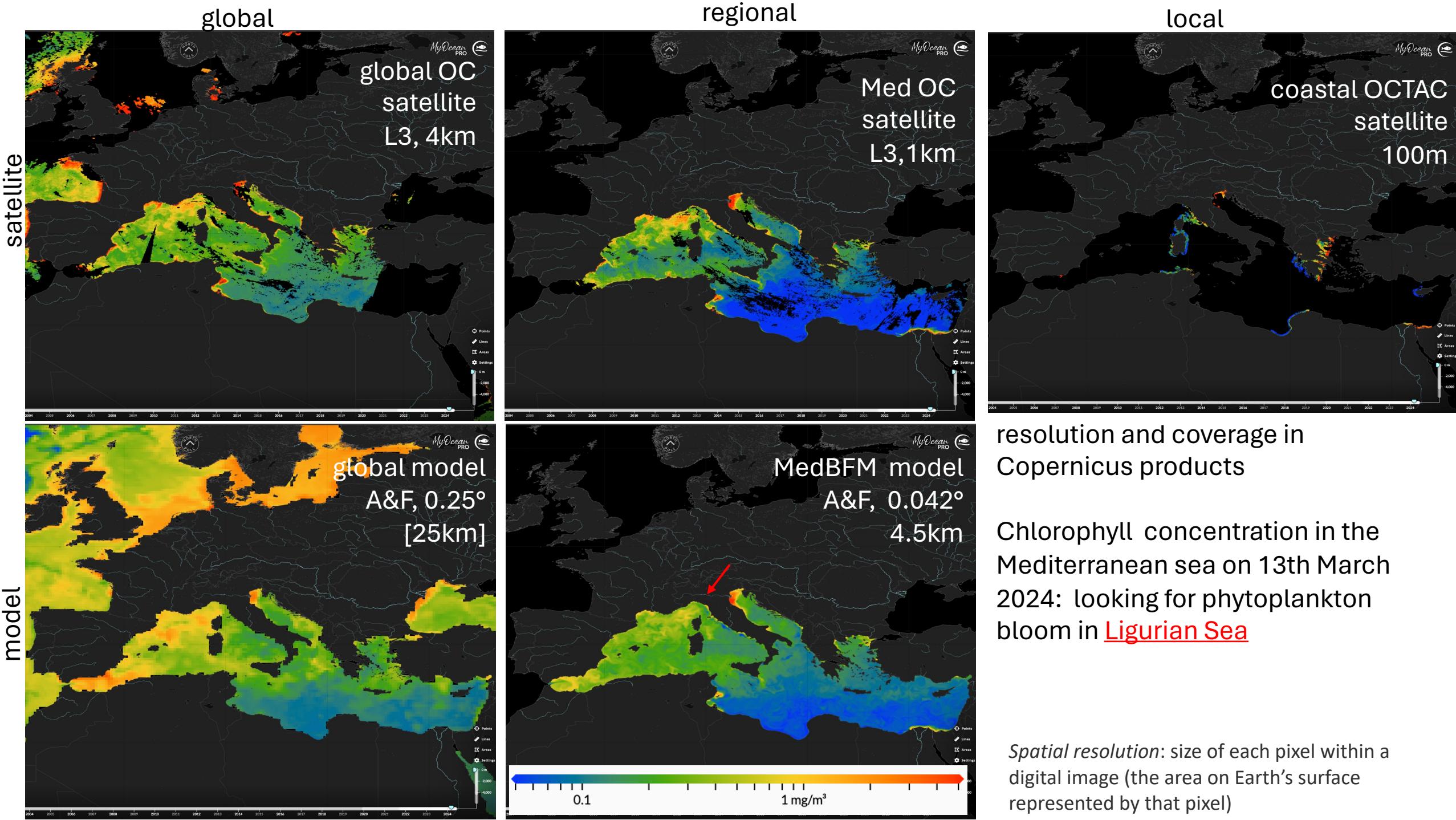
**extent** refers to the area/volume/period of time included in the phenomena or observed/analysed by sensors/dataset/model

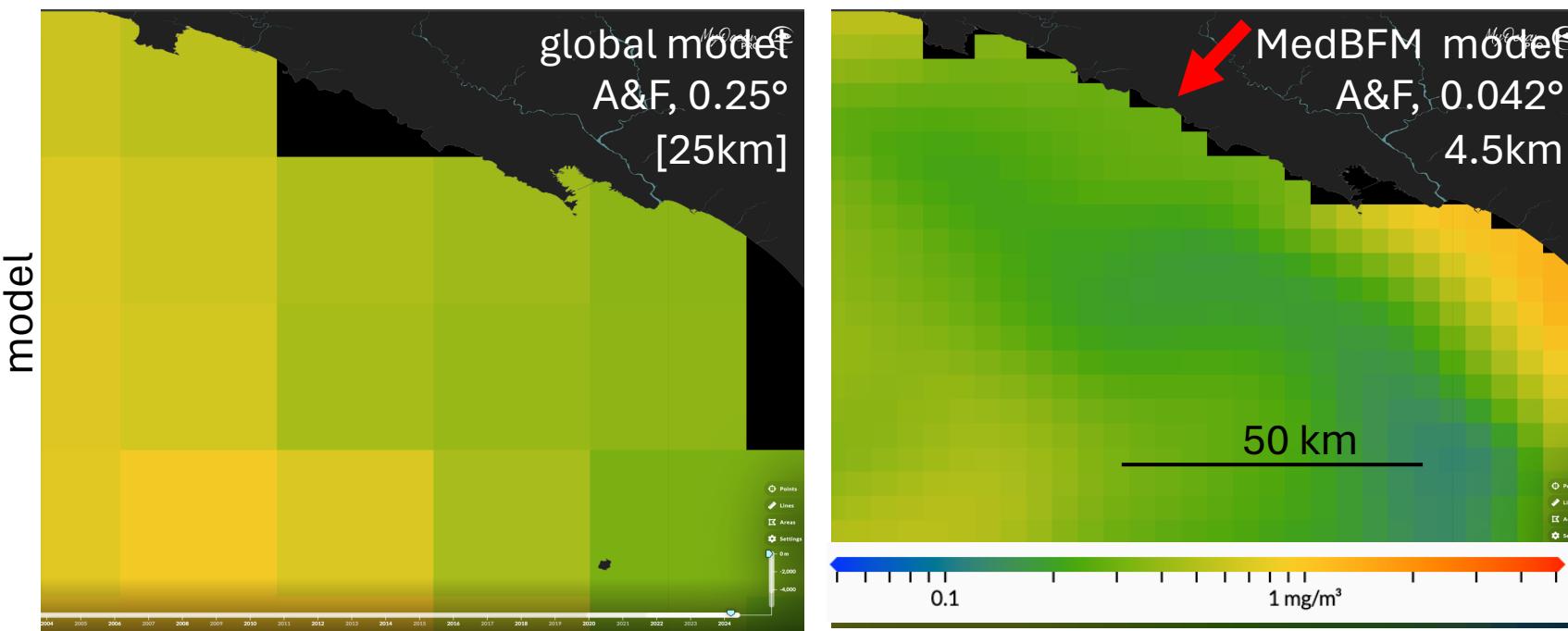
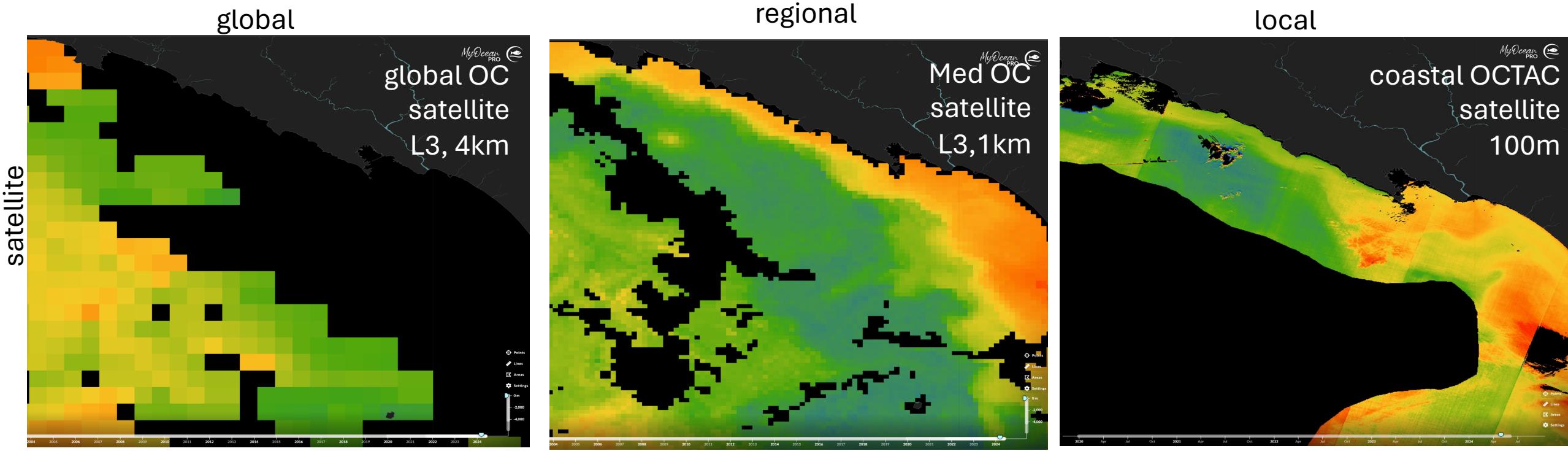
*area or period of time encompassing a phenomena  
model domain  
composite of satellite images*

# spatial and temporal scales of ocean processes and coverage of the different platforms



physical processes  
biological processes





resolution and coverage in Copernicus products

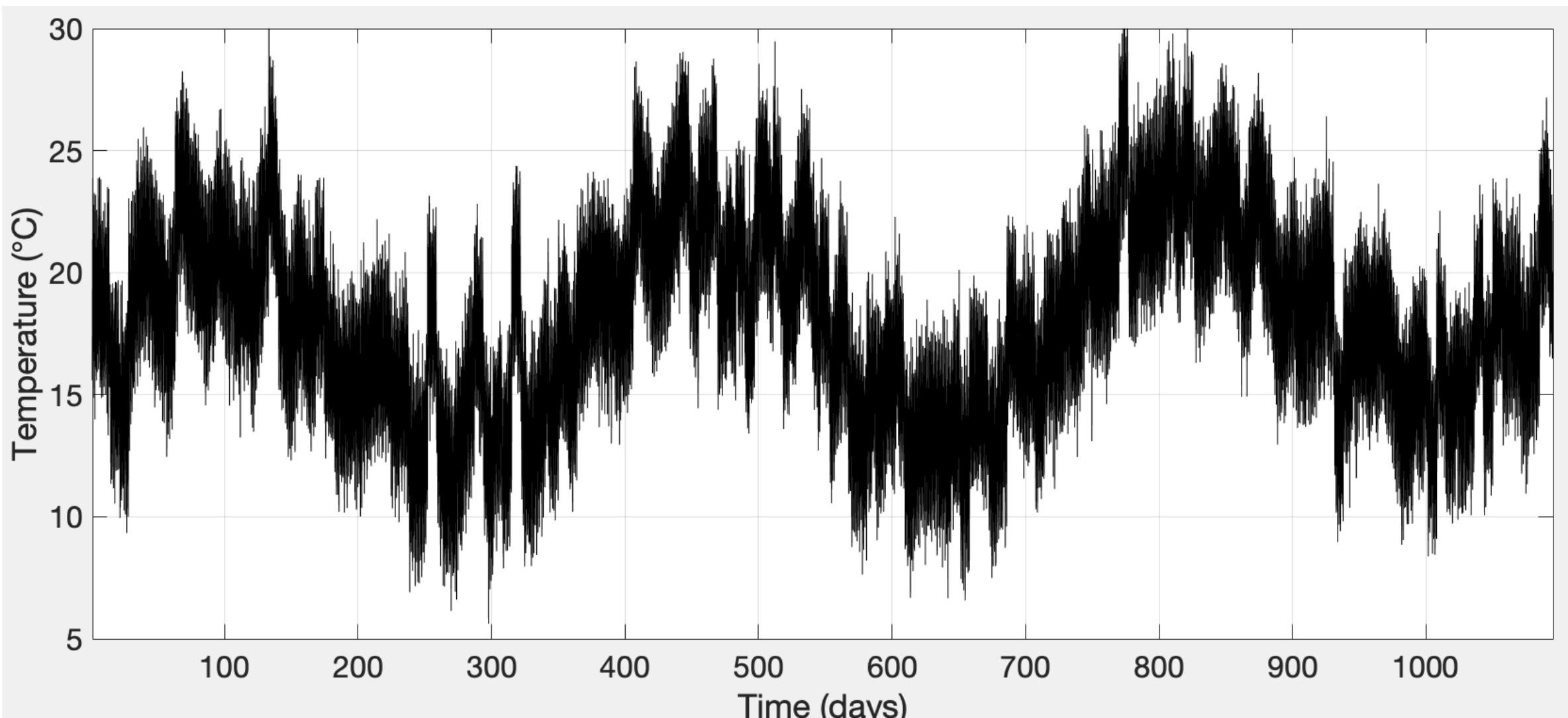
Chlorophyll concentration in the Mediterranean sea on 13th March 2024: looking for phytoplankton bloom in [Ligurian Sea](#)

*Spatial resolution:* size of each pixel within a digital image (the area on Earth's surface represented by that pixel)

*Temporal resolution* is time two subsequent data for the exact same location

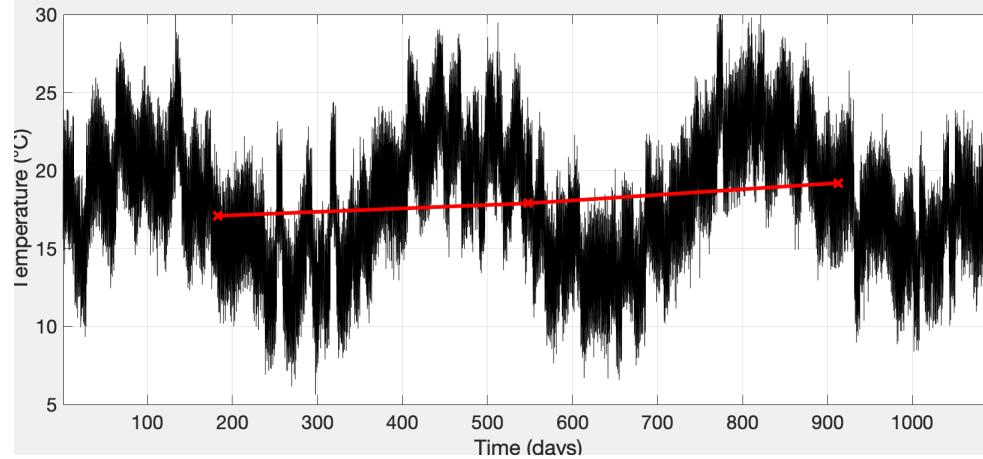
time series data represent a mixture of variation at different time scales

Example of hourly temperature with multiannual trend, seasonal cycle, monthly/weekly signals, daily cycle and random noise

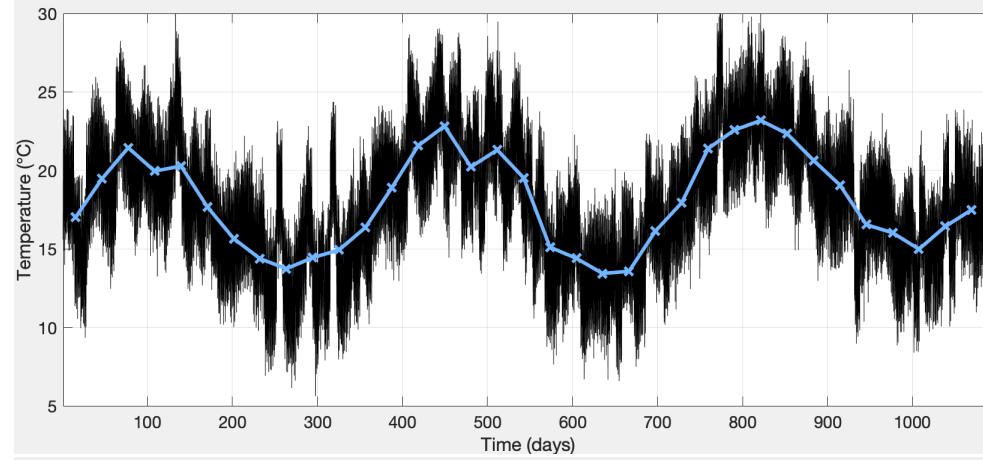


# Temporal resolution: averaging and instantaneously sampling at different frequencies

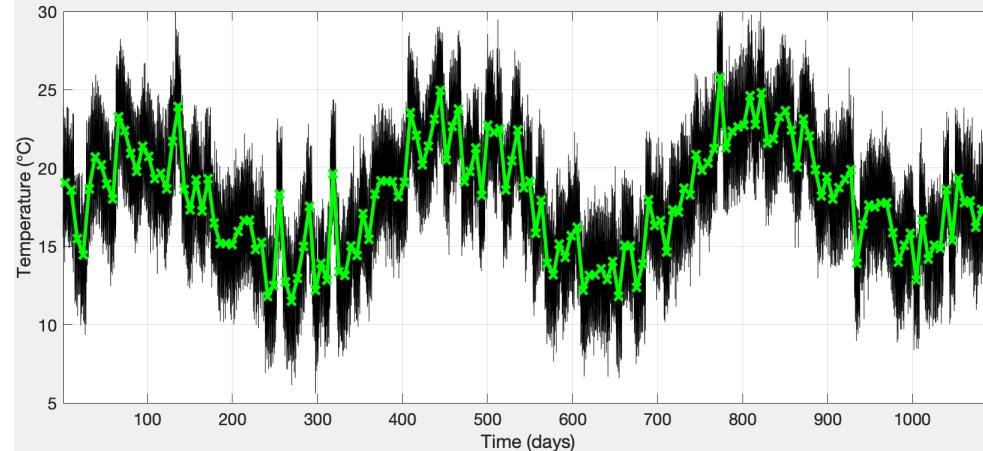
annual means



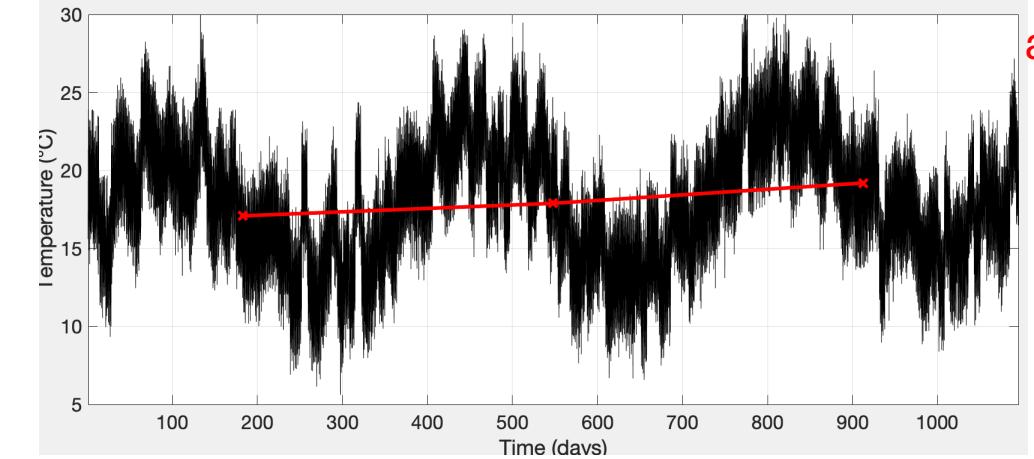
monthly means



weekly means

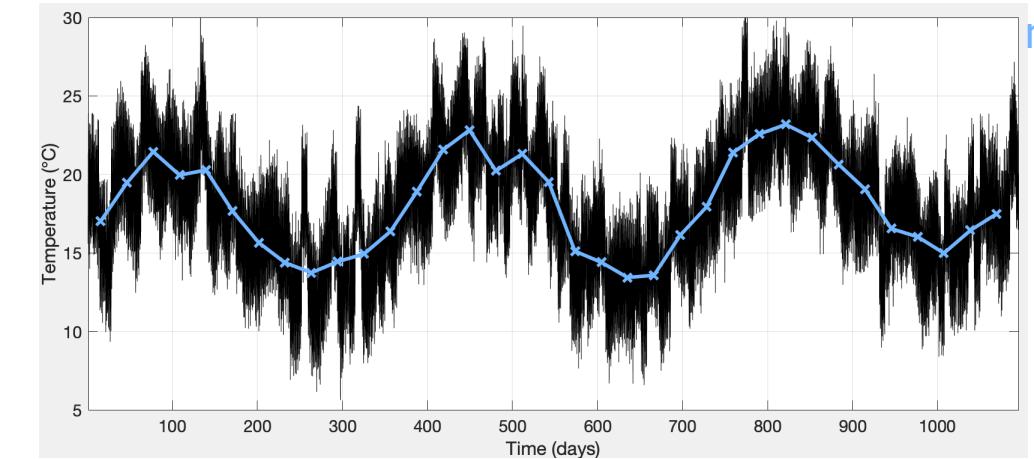


# Temporal resolution: averaging and instantaneously sampling at different frequencies



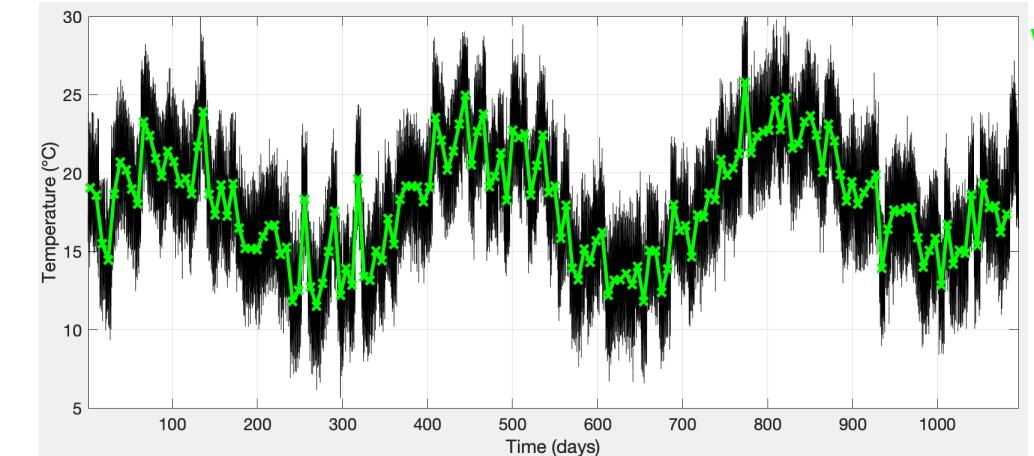
annual means

annual sampling



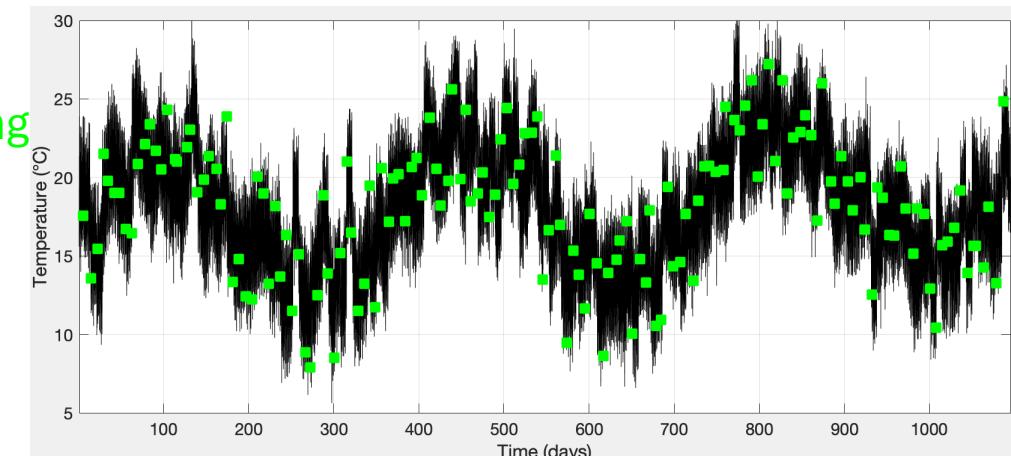
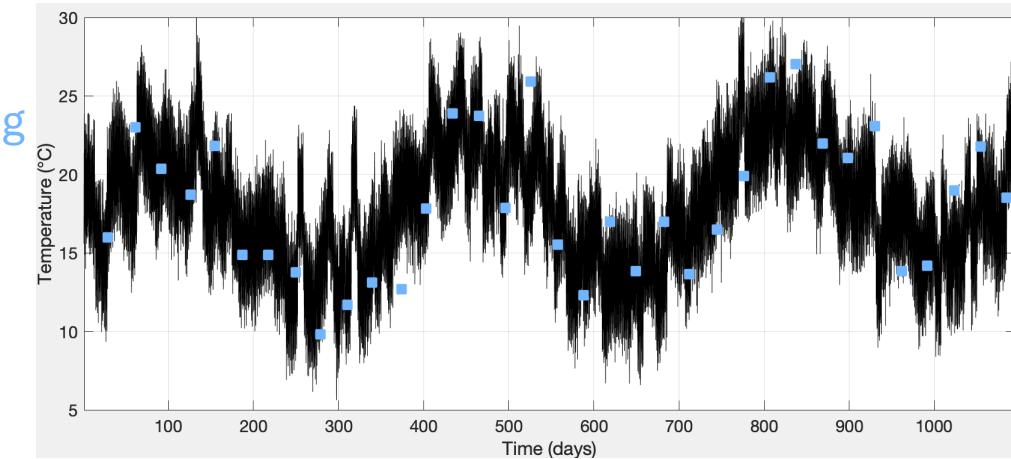
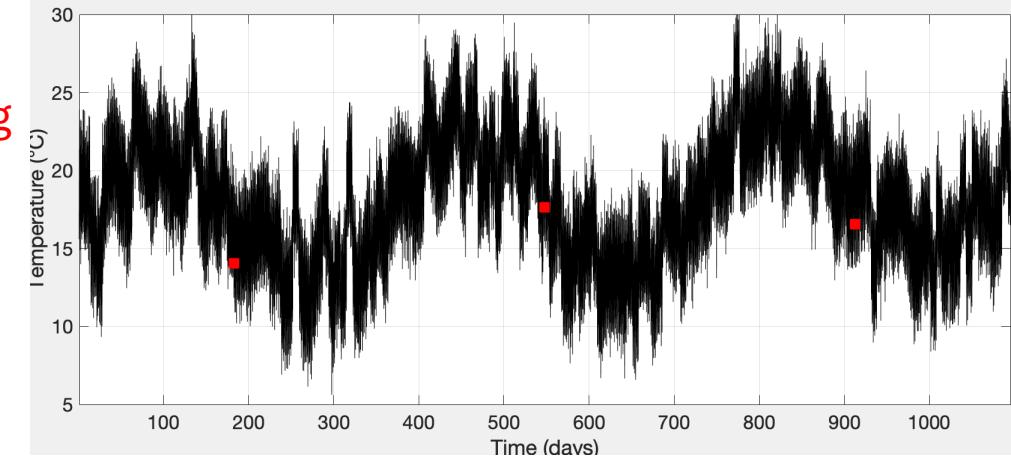
monthly means

monthly sampling



weekly means

weekly sampling



# How to access and dive into products and variables: Myocean viewer

The screenshot shows the Copernicus Marine Service website. At the top, there's a navigation bar with links for Resources, News, Events, Contact, a Register button, a search icon, and a language selection for English. Below the navigation is the Copernicus Marine Service logo and a banner for the MyOcean service.

**MyOcean Viewer Interface:** On the left, a map of the Mediterranean Sea displays chlorophyll concentration (chl) and sea water potential temperature (thetao) data. Three specific locations are highlighted with callouts: 36.081N, 10.165E; 37.477N, 17.990E; and 39.398N, 14.717E. Each location has its own detailed plot window showing time series data for chl and thetao over a period of about a year (2020-2021).

**Ocean Visualisation Box:** A red-bordered box on the right contains the following text:

**OCEAN VISUALISATION**  
Dive into our 4D digital oceans through our 3 visualisation tools for beginner, intermediate and advanced users

**MyOcean Viewer: 3 tools of online visualization**  
**What will we see?** how to select a product and a dataset; how to plot a variable; how to customize a plot; how to subset a region and download data  
**What do you need?**  
A connection to the web and nothing more ... maybe curiosity

**Credits:** <https://vimeo.com/891402984>

## Step by step

### 1. data search and select product

Chlorophyll (1) in the Mediterranean Sea (2) in the filter menu'

### 2. select the product (e.g., reanalysis of the Mediterranean Sea (3) )

data.marine.copernicus.eu/products?facets=colors~Green+Ocean--mainVariables~Plankton--areas~Mediterranean+Sea

 Copernicus Europe's eyes on Earth  Copernicus Marine Service

Services Opportunities Access Data Use Cases User Corner About

# Copernicus Marine Data Store

Home > Marine Data Store

**Filters** 

FREE-TEXT SEARCH  
Free text

FAVOURITES  0

TIME RANGE  dd/mm/yyyy  dd/mm/yyyy  
Covering full interval

WITH DEPTH 2

DEPTH RANGE  

UNIVERSE  Blue Ocean 1  Green Ocean 12

MAIN VARIABLES  Carbonate system 2  
Nutrients 2  
Optics 6  
Oxygen 3  
Plankton 12  
Salinity 1  
Sea surface height 1  
Temperature 1  
Velocity 1  
Wave 1

AREA  Atlantic: Iberia-Biscay-Ireland 1  
Atlantic: North 1  
Baltic Sea 1  
 Mediterranean Sea 12

INDICATORS & TRENDS

FEATURE TYPE

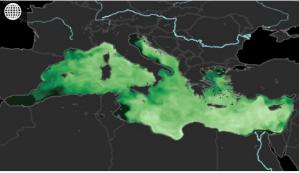
TEMPORAL RESOLUTION  Instantaneous 1  
Daily 8  
Monthly 5  
Yearly 1  
Multi-yearly 2

SOURCE  Numerical models 2  
In-situ observations 1  
Satellite observations 9

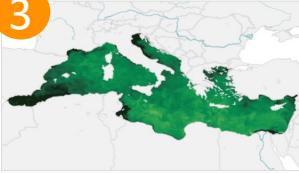
PROCESSING LEVEL

EU DIRECTIVE

**Products 12**

  Mediterranean Sea Biogeochemistry Analysis and Forecast

MEDSEA\_ANALYSISFORECAST\_BGC\_006\_014  
Models  
Med Sea, 0.042° × 0.042° × 125 levels  
1 Jan 2020 to 18 May 2024, daily, monthly  
Carbonate system, nutrients, optics, oxygen, plankton

 Mediterranean Sea Biogeochemistry Reanalysis

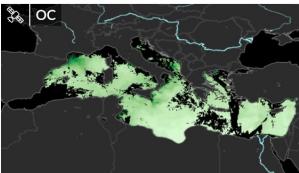
MEDSEA\_MULTIYEAR\_BGC\_006\_008  
Models  
Med Sea, 0.042° × 0.042° × 125 levels  
1 Jan 1999 to 1 Mar 2024, daily, monthly, yearly,...  
Carbonate system, nutrients, oxygen, plankton

 Mediterranean Sea, Bio-Geo-Chemical, L3, daily observation

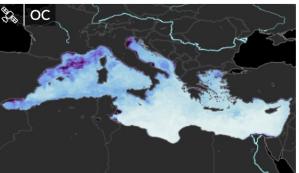
OCEANCLOUD\_MED\_BGC\_HR\_L3\_N...009\_205  
Satellite (L3)  
Med Sea, 0.1 × 0.1 km  
1 Jan 2020 to 8 May 2024, daily  
Optics, plankton

 Mediterranean Sea, Bio-Geo-Chemical, L4, monthly means and...

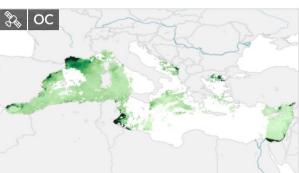
OCEANCLOUD\_MED\_BGC\_HR\_L4\_N...009\_211  
Satellite (L4)  
Med Sea, 0.1 × 0.1 km  
1 Jan 2020 to 31 Oct 2023, daily, monthly  
Optics, plankton

 Mediterranean Sea, Bio-Geo-Chemical, L3, daily Satellite...

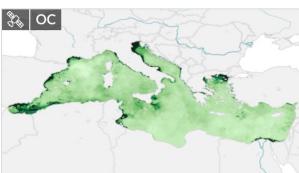
OCEANCLOUD\_MED\_BGC\_L3\_NRT\_009\_141  
Satellite (L3)  
Med Sea, 1 × 1 km  
29 Apr 2023 to 9 May 2024, daily  
Optics, plankton

 Mediterranean Sea, Bio-Geo-Chemical, L4, monthly means, daily...

OCEANCLOUD\_MED\_BGC\_L4\_NRT\_009\_142  
Satellite (L4)  
Med Sea, 1 × 1 km  
1 Jan 2022 to 9 May 2024, daily, monthly  
Optics, plankton

 Mediterranean Sea, Bio-Geo-Chemical, L3, daily Satellite...

OCEANCLOUD\_MED\_BGC\_L3\_MY\_009\_143  
Satellite (L3)  
Med Sea, 1 × 1 km

 Mediterranean Sea, Bio-Geo-Chemical, L4, monthly means, daily...

OCEANCLOUD\_MED\_BGC\_L4\_MY\_009\_144  
Satellite (L4)  
Med Sea, 1 × 1 km

 Mediterranean Sea- In-Situ Near Real Time Observations

INSITU\_MED\_PHYBGCWAV\_DISCRET...013\_035  
In-situ  
Med Sea

### 3. access to the product information

Analysis and Forecast biogeochemical model product

(1) documentations: User Manual, Quality Information Documents, Synthesis Quality Overview ...  
DOI

In the **Notifications** tab (2), you have access to all the maintenances, incidents and news about the product.

The **Data access** tab (3) displays all the datasets of the product and the different data access mechanisms available (**Subset, Files and Maps**)

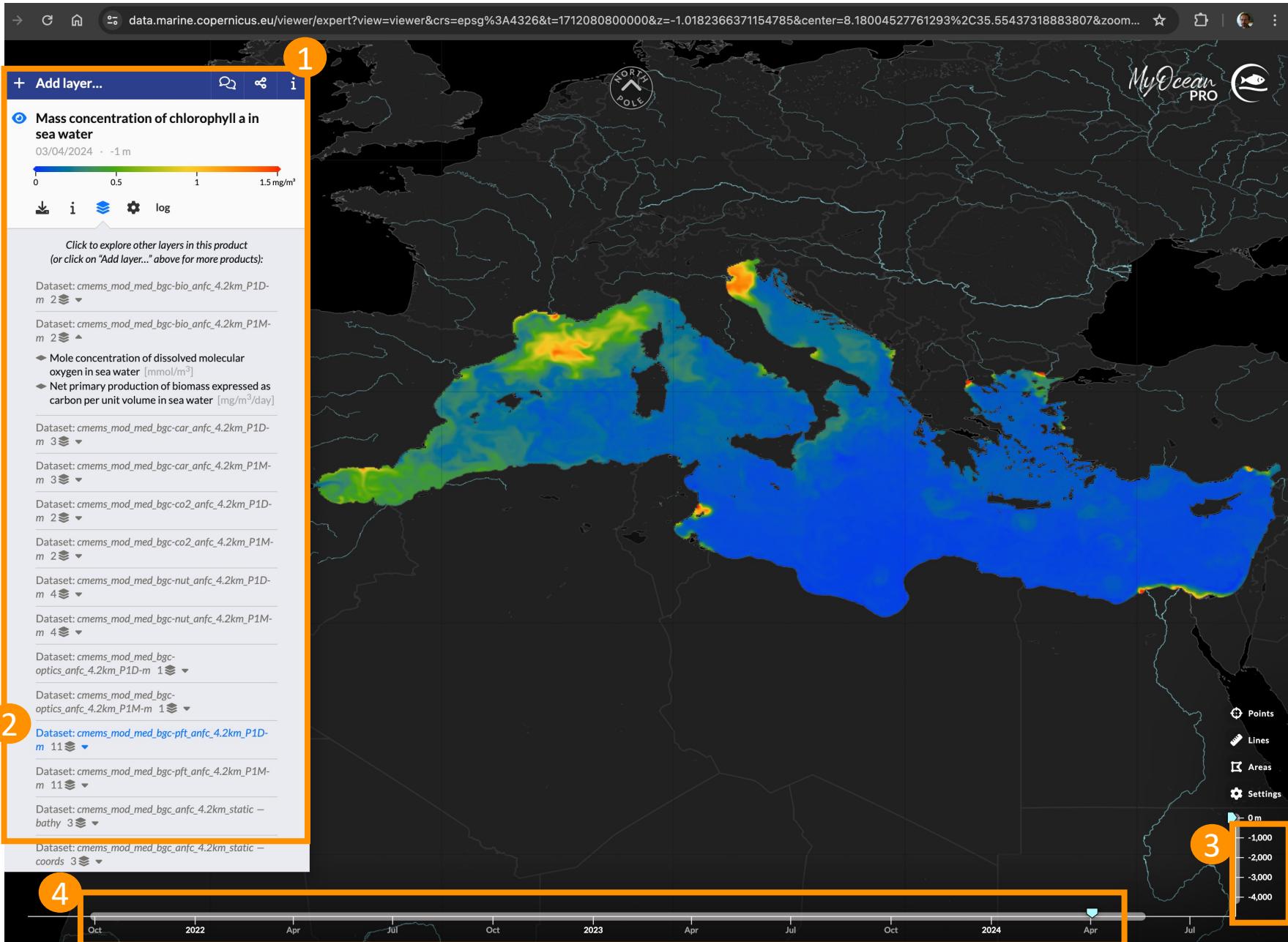
use **MyOcean viewer** (4) to plot variables

The screenshot shows the product page for the "Mediterranean Sea Biogeochemistry Analysis and Forecast". The top navigation bar includes links for Resources, News, Events, Contact, Log out (gcossarini1), a search bar, and a user menu. The main content area features the title "Mediterranean Sea Biogeochemistry Analysis and Forecast" with social sharing icons. Below the title is a breadcrumb navigation: Home > Marine Data Store > Product. On the left, a sidebar menu lists: Description (1), Notifications (2), Data access (3, updated), Contact, DOCUMENTATION (User Manual, Quality Information Document, Synthesis Quality Overview, Licence, How to cite), and DOI (10.25423/cmcc/medsea\_analysisforecast\_bgc\_006\_014\_medbfm 4). The main content area has an "Overview" section describing the model's components and assimilation scheme, followed by a citation. To the right is a map of the Mediterranean Sea showing chlorophyll concentration, with depth contours and a color scale from 0 m to 4,000 m. A legend indicates "Settings" and a timeline from 2020 to 2024. At the bottom, a call-to-action button says "Explore in MyOcean Pro" with a number 4.

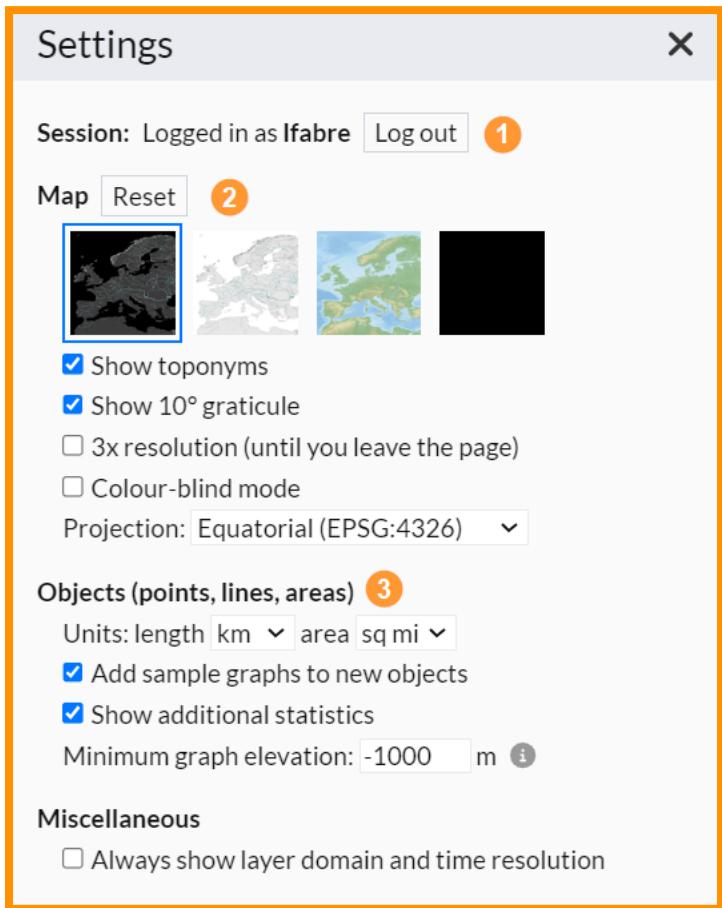
4. access to the list of all the datasets and variables you want to add on the map from the **layer panel**

the **layer menu** allows to select data and modify the appearance (1):

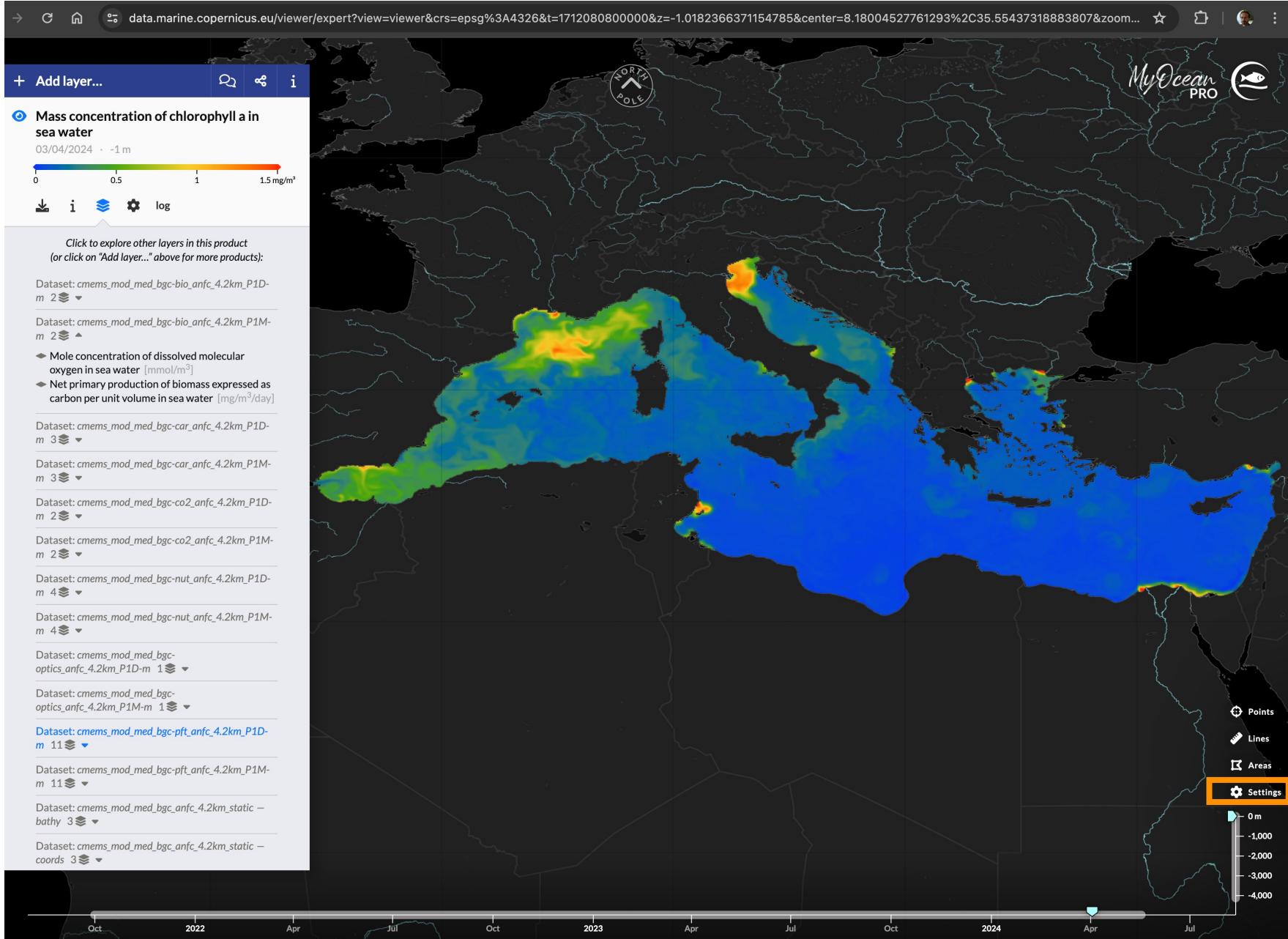
selecting **chlorophyll daily data** (2) and visualize the data according to a depth (3) and a date (4):



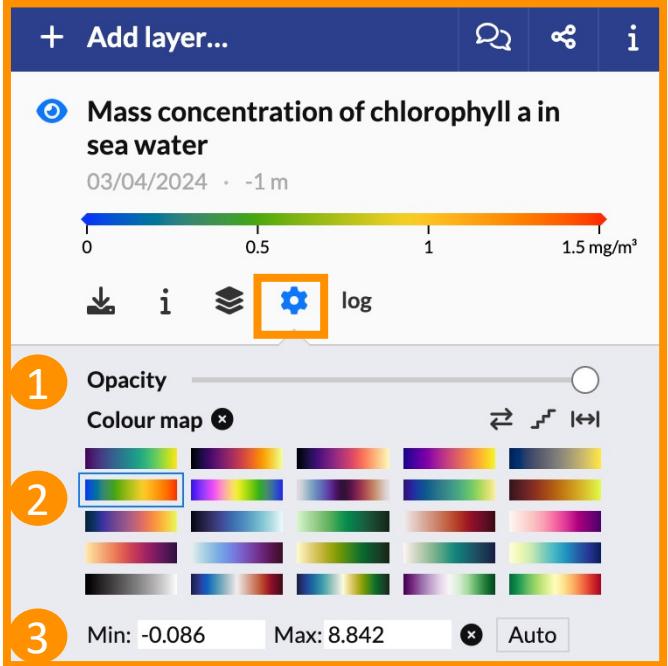
## 5. change setting of the map



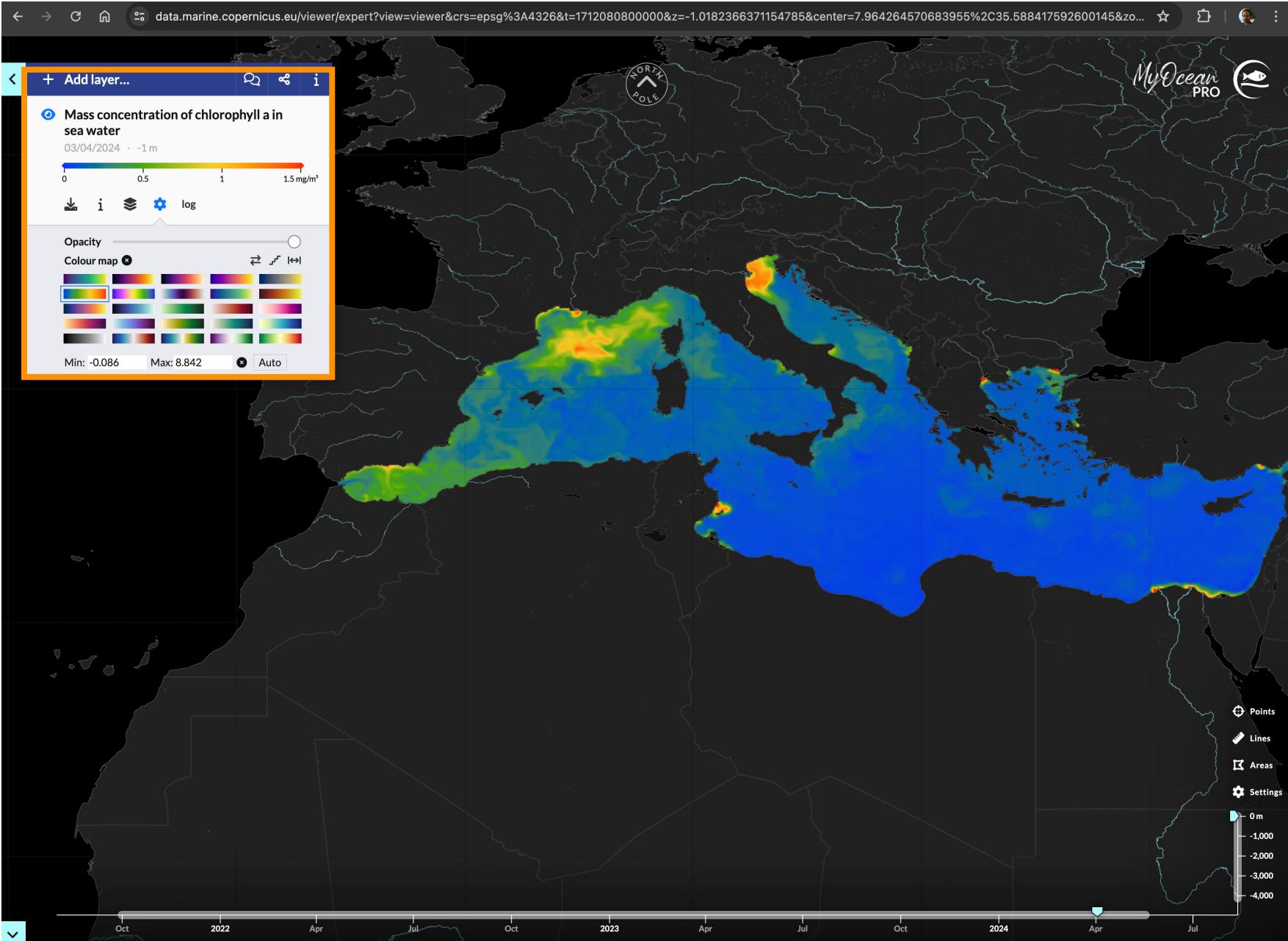
- login/logout to your Copernicus Marine account **(1)**
- change the map and projection settings **(2)**
- change object units **(3)**



6. in the layers panel, you can open the **layer configurations** by clicking on the gear icon



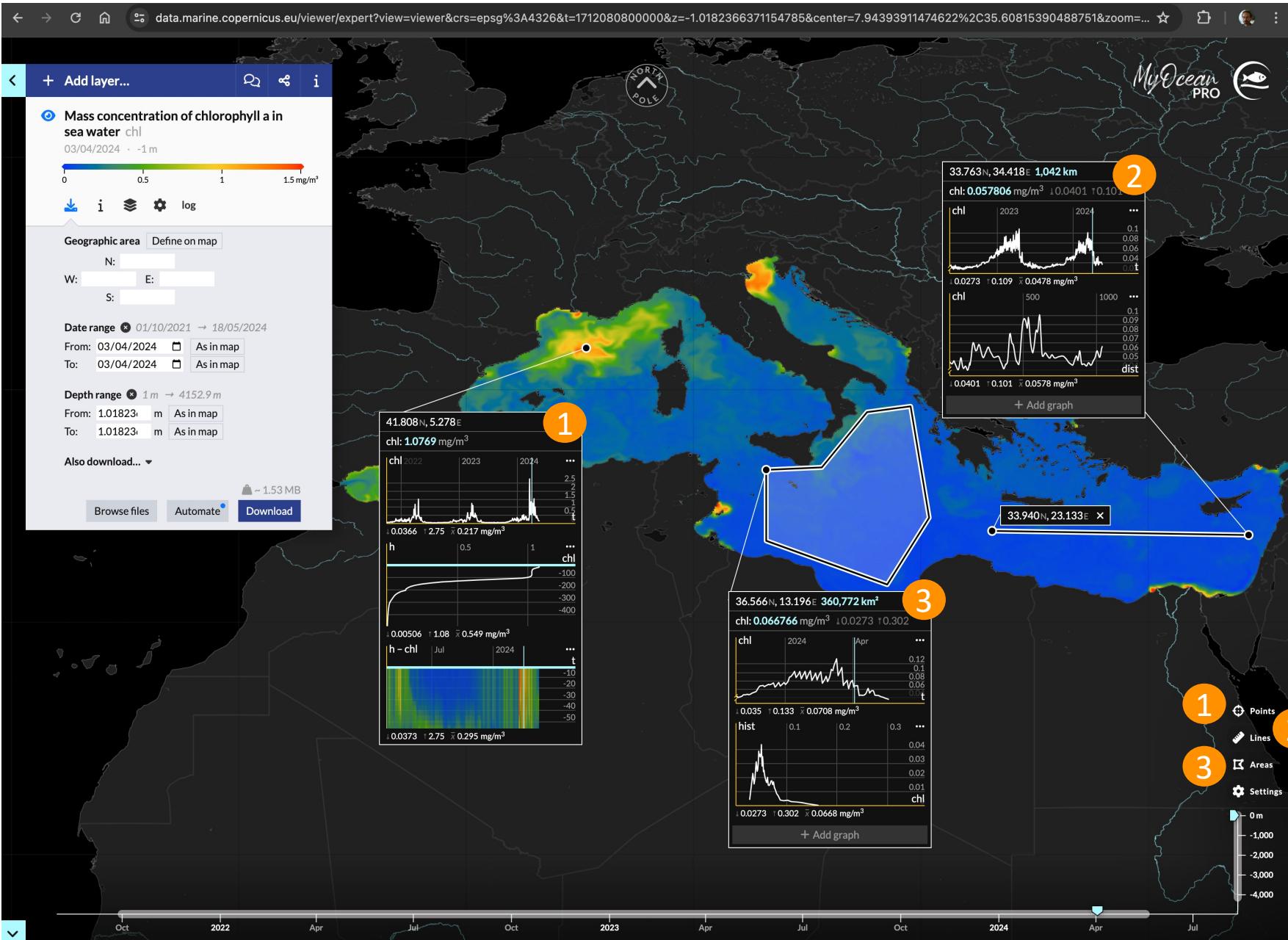
and change the **opacity (1)** of the layer, the **color map (2)** and the **minimum and maximum values** to consider (3)



## 7. Data exploration

add objects on the map:

- create time evolution, profile and ZT plots for a given **point (1)** in the map
- create time evolution and line plots for a transect using the **line object (2)**
- create a time evolution plot and a histogram of data frequency for a **geographic area of interest (3)**



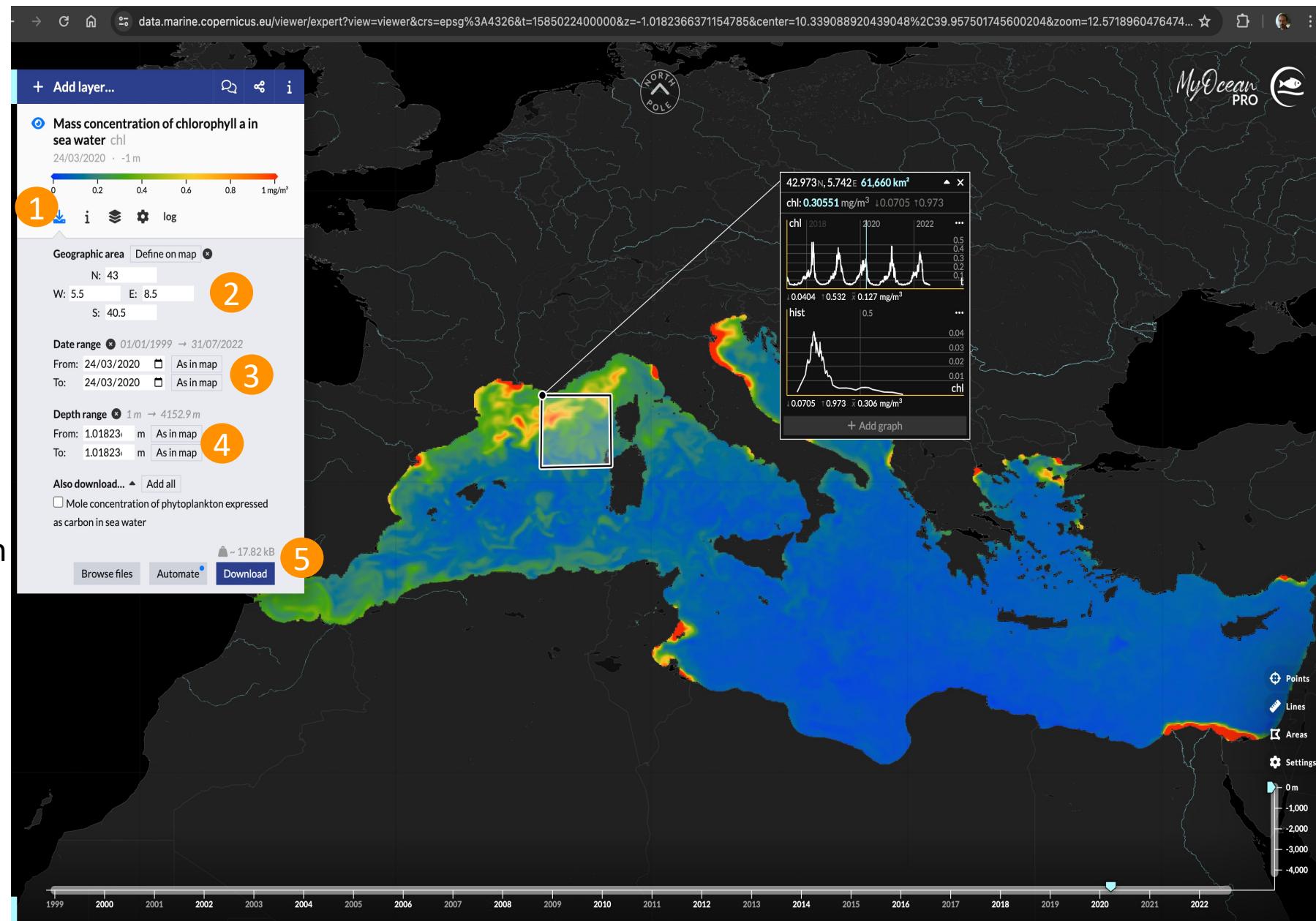
## 8. download data from the viewer

The **download icon (1)** allows you to define the request parameters in order to download a subset:

- geographic area **(2)**: it can be selected manually or through “define on map”
- temporal range **(3)**
- depth range **(4)**

Three download options:

- download the selected data **(5)** with indication of its size (limit 1Gb)



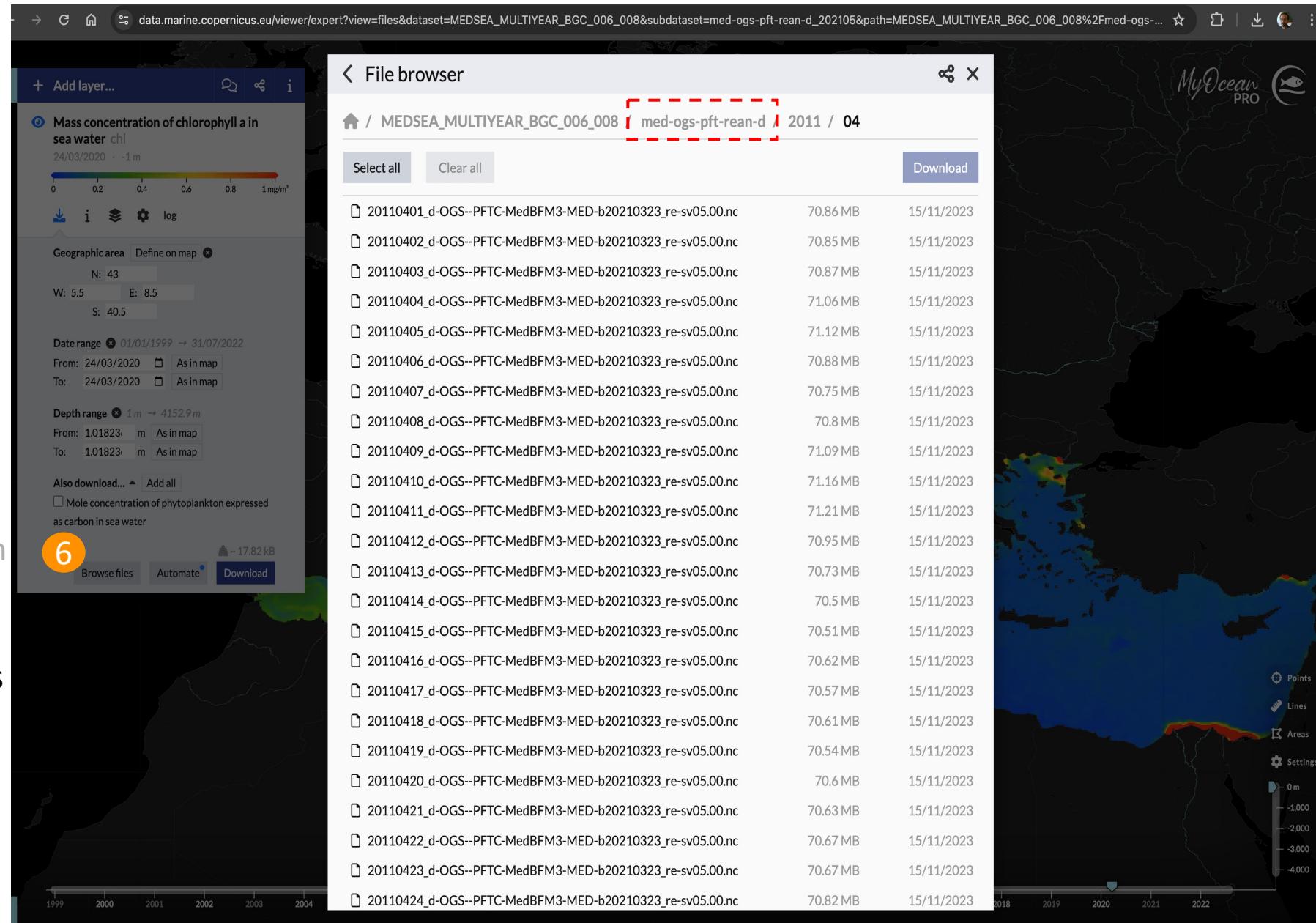
## 8. download data from the viewer

The download icon (1) allows you to define the request parameters in order to download a subset:

- geographic area (2): it can be selected manually or through “define on map”
- temporal range (3)
- depth range (4)

### Three download options:

- download the selected data (5) with indication of its size (limit 1Gb)
- download the full-size files of the dataset (6), browsing folders, names in User Manual



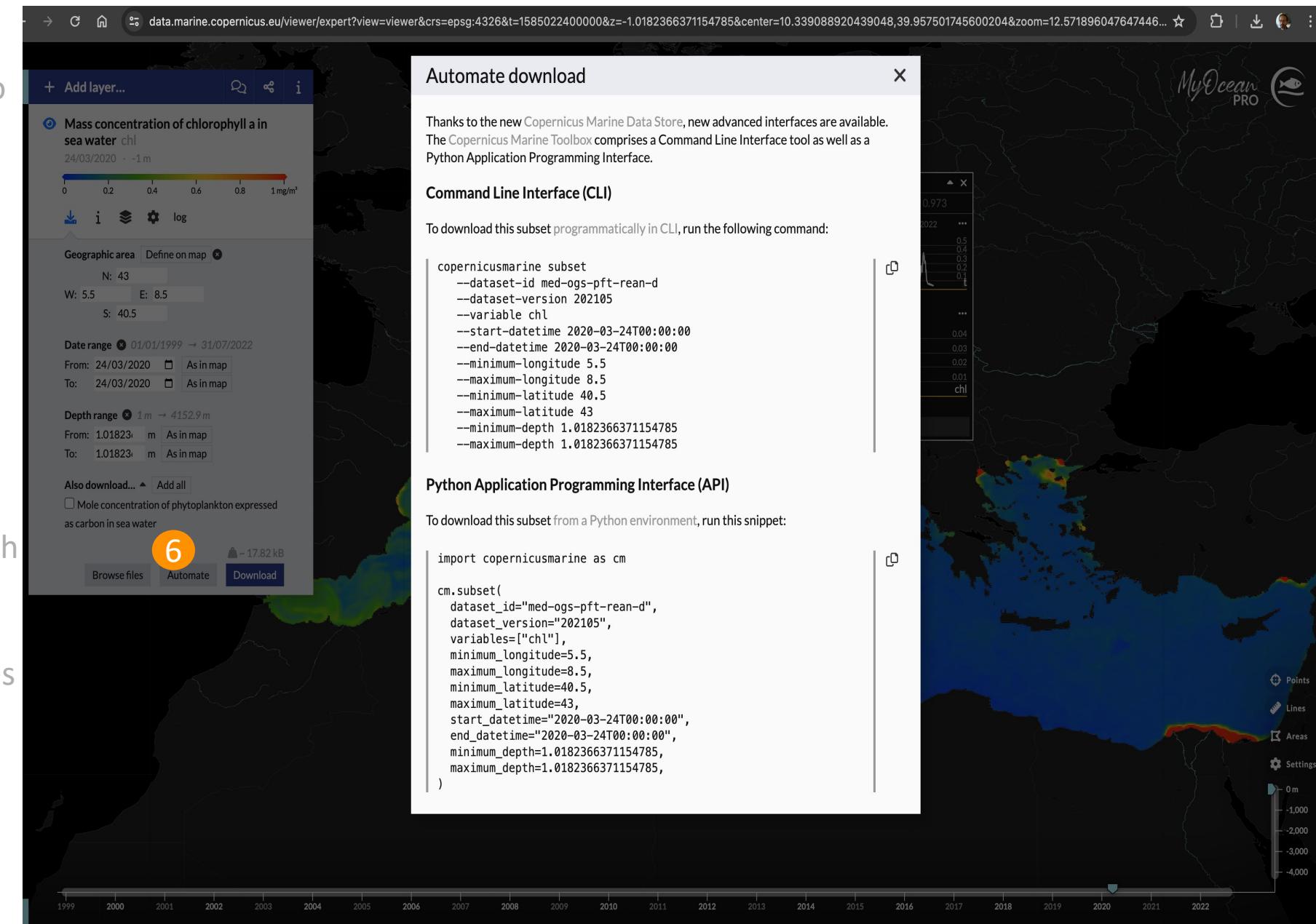
## 8. download data from the viewer

The download icon (1) allows you to define the request parameters in order to download a subset:

- geographic area (2): it can be selected manually or through “define on map”
- temporal range (3)
- depth range (4)

### Three download options:

- download the selected data (5) with indication of its size (limit 1Gb)
- download the full-size files of the dataset (6), browsing folders, names in User Manual
- by clicking on Automate (7), you can display the CLI and Python command lines of the Copernicus Marine Toolbox request [next lecture]





## Take home messages:

- many overlapping products in the Marine Copernicus catalogue
- fit-for-purpose of products
- myocean viewer as an exploratory tool to dive into products
- documentation in an essential part for an informed and effective use of free and open data

*thank you*

