DATAVIZ
WEBINAR SERIES

#2 EXPLAIN OCEAN DATA

Data Access and Beyond

Harnessing Tools for Marine Visualization

PROGRAMME OF THE EUROPEAN UNION

Copernicus
Europe's eyes on Earth

Copernicus Marine Service

implemented by MERCATOR OCEAN INTERNATIONAL

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User Support Officer

@Mercator Ocean International

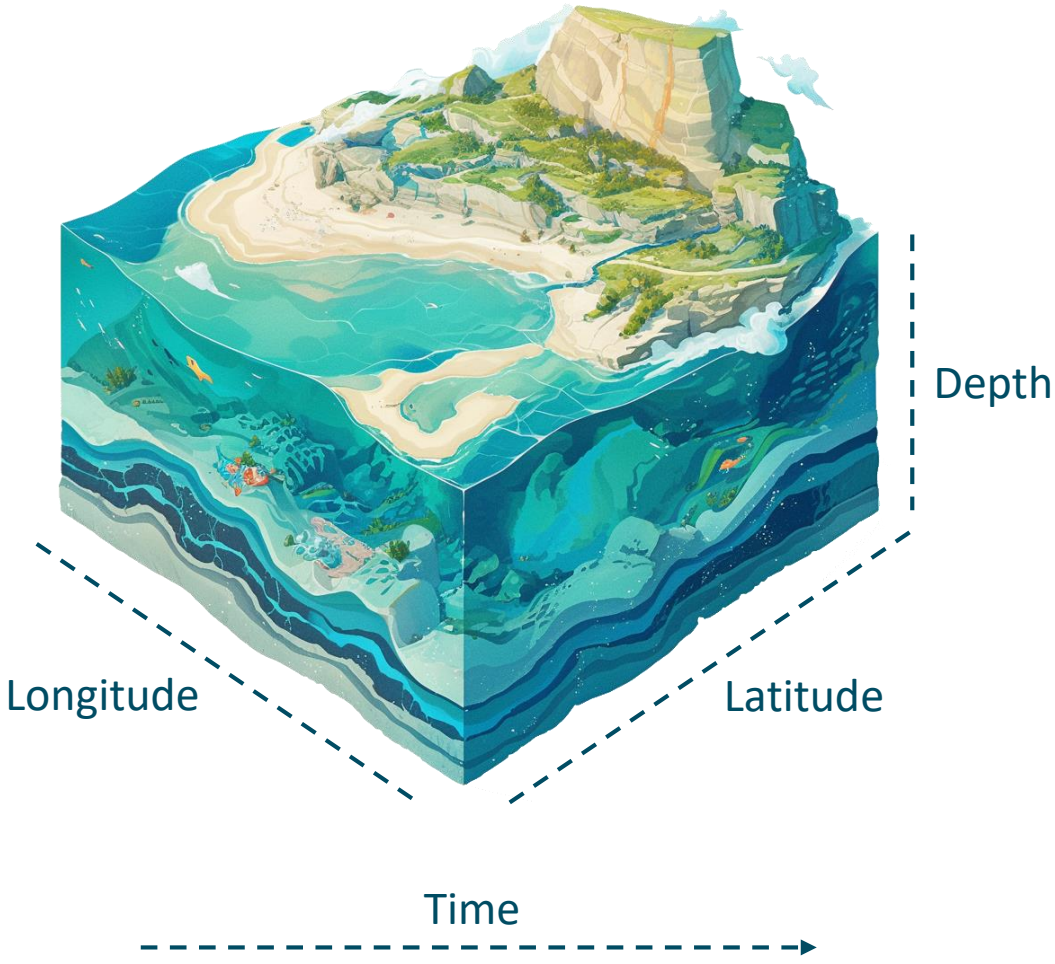
Summary

1. Data Formats
2. Explore & Access Data
3. Open & Visualize Data

Data Formats

Copernicus Marine Datasets

- Multiple variables
- Multi-dimensional
- Large volume
- Metadata
- Standardized



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Data Formats

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Default format

NetCDF

- Original files & subset
- Optimized for multi-dimensional
- Widely used in Earth science

Main advantages

- Open
- Self-describing
- Portable
- Scalable
- Appendable
- Shareable
- Archivable
- Standardized

Other formats

Zarr

- Recent format
- Optimized for multi-dimensional
- Parallel and distributed computing

Two-dimensional

- **CSV**
- GeoTIFF
- Shapefile

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Data Formats

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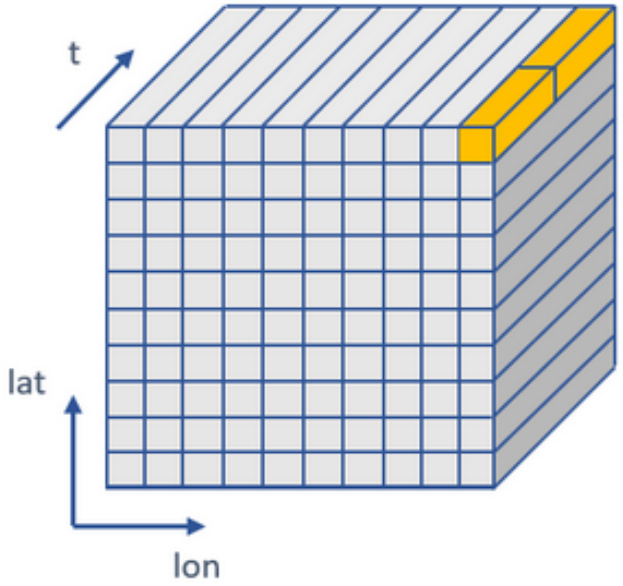
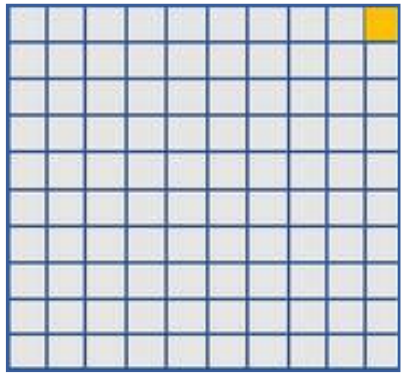
Multi-dimensional arrays



NetCDF/Zarr: *xarray.Dataset*

Data Science

Two-dimensional arrays



CSV/SQL: *pandas.Dataframe*

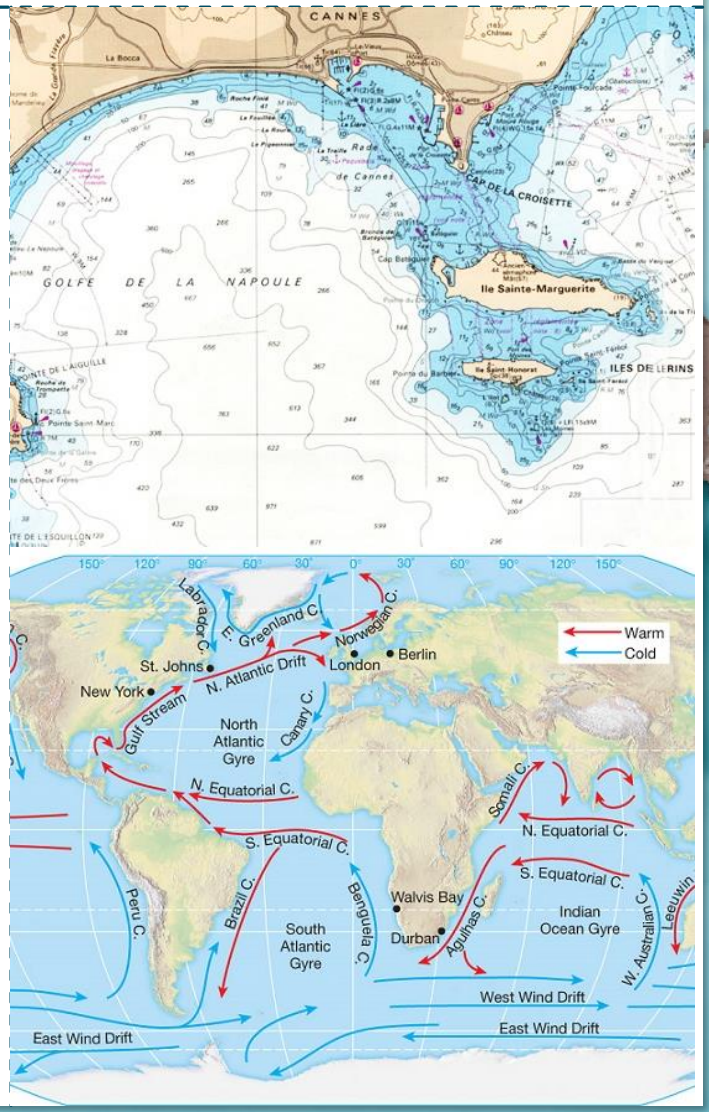
Explore & Access Data

Exploration

- Catalogue: Copernicus Marine Data Store
- Data visualization: MyOcean viewers

Access

- MyOcean Pro (GUI)
- Subsetter page (GUI)
- Copernicus Marine Toolbox (Programming)
- WMTS (Remote)



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Explore & Access Data

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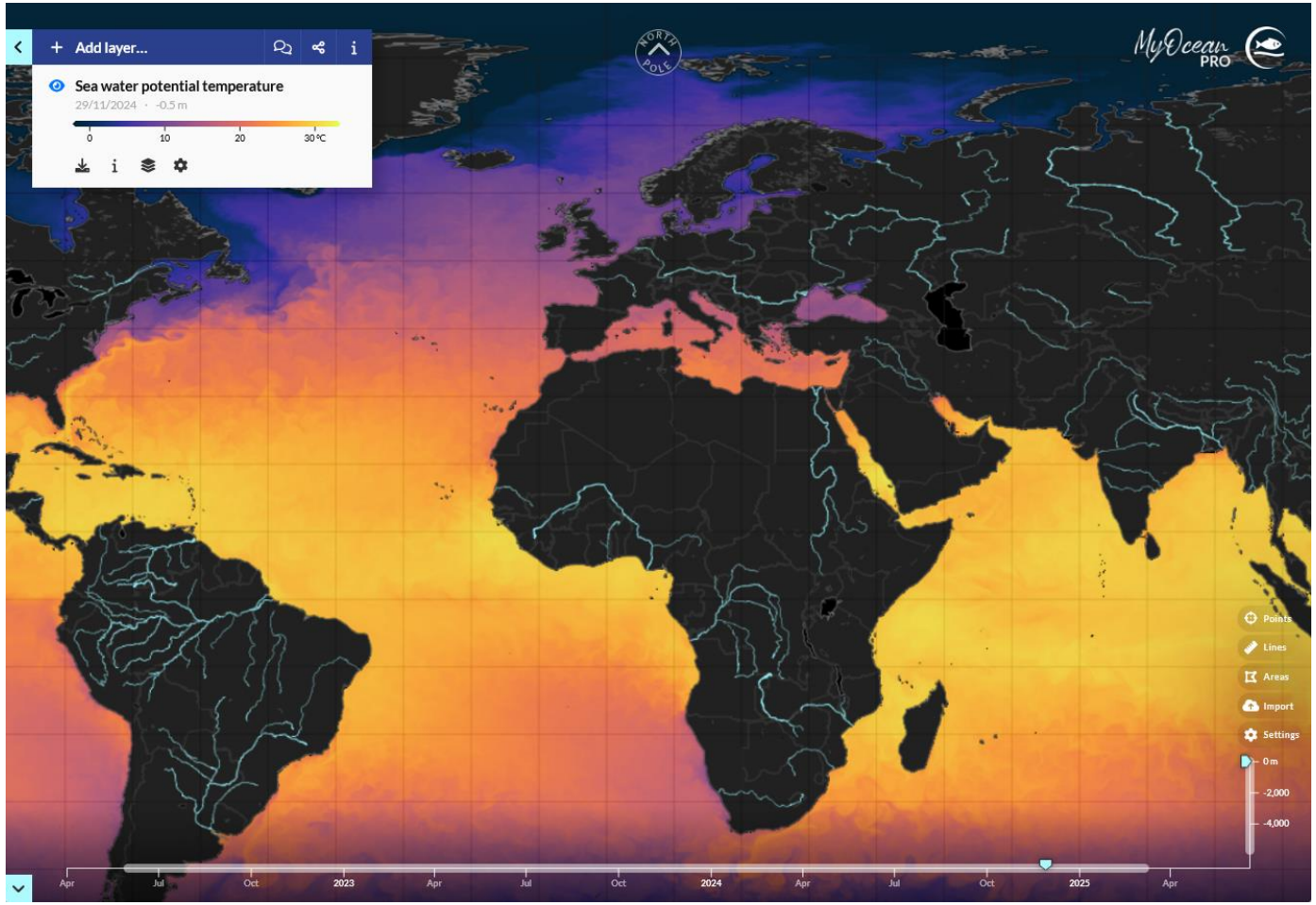
MyOcean Pro

- Access Catalogue
- Visualize data
- Download data
- Get query for Toolbox

Live demo



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Explore & Access Data

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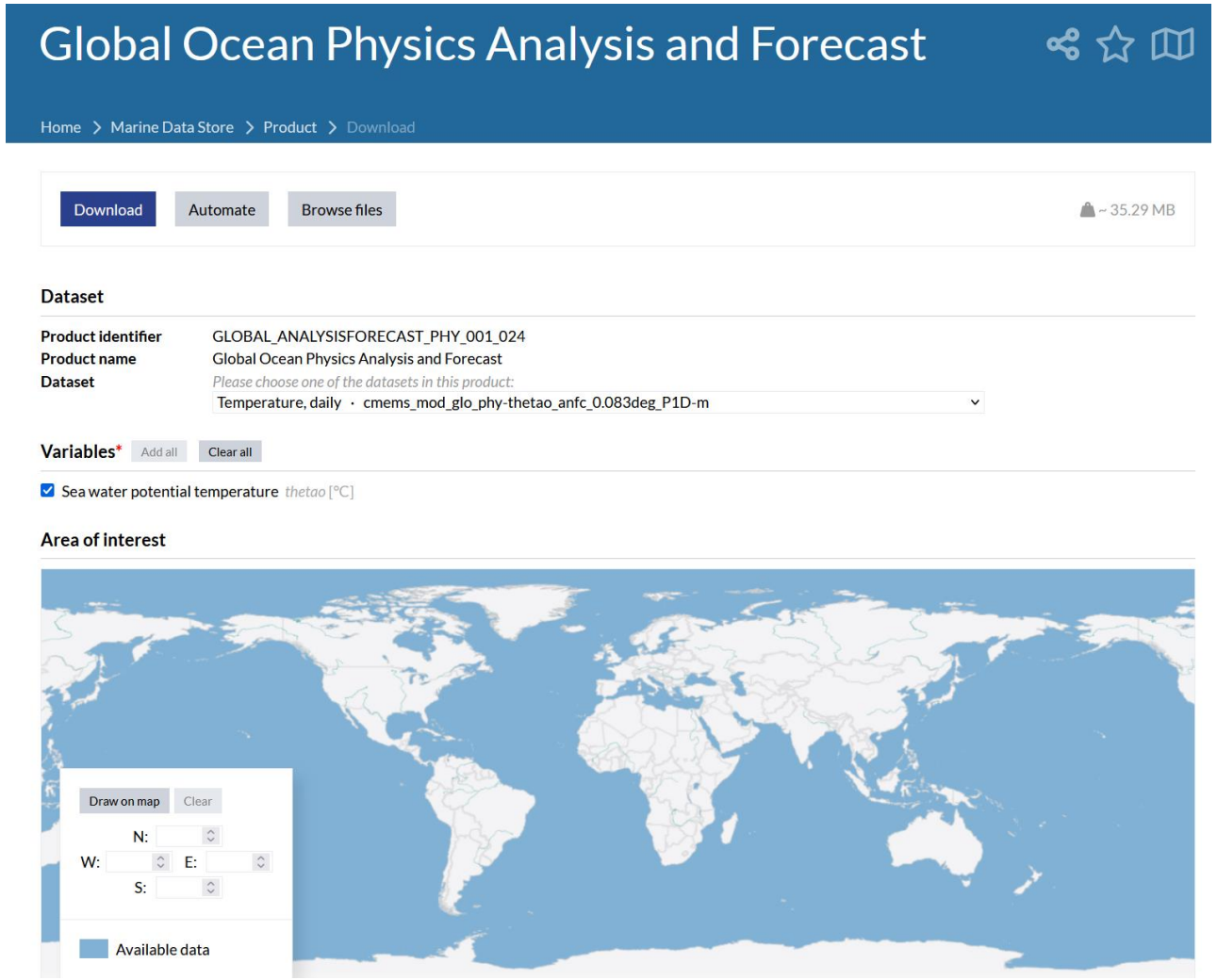
Subsetter Page

- Download subset of data
- Simplified interface

- From product's page
- Data Access > Form



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Copernicus Marine Toolbox

Features

- Access metadata
- Subset dataset
- Get original files
- Open data remotely
- No quota

Usage

- CLI
- Python
- R
- Julia
- Matlab

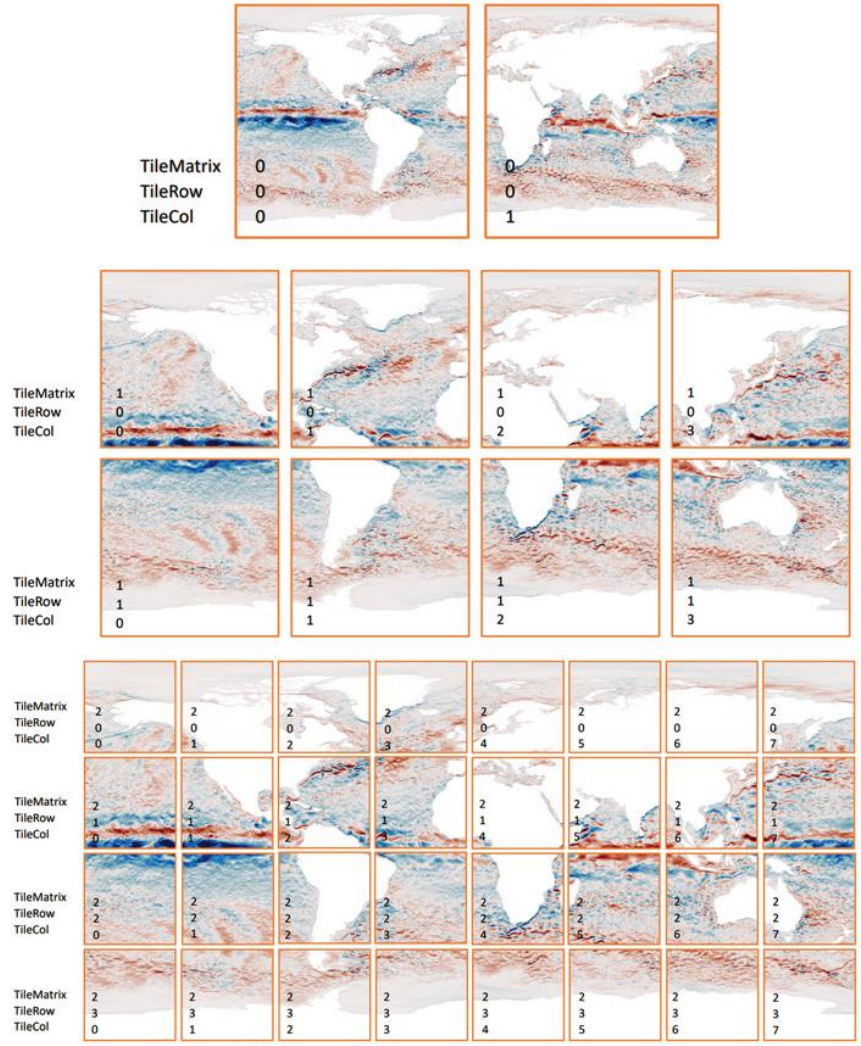
Cf. Toolbox demo

```
[1]: import copernicusmarine

[2]: copernicusmarine.open_dataset("cmems_mod_glo_phy-thetao_anfc_0.083deg_P1D-m")

INFO - 2025-02-26T16:19:36Z - Selected dataset version: "202406"
INFO - 2025-02-26T16:19:36Z - Selected dataset part: "default"

[2]: xarray.Dataset

► Dimensions:    (depth: 50, latitude: 2041, longitude: 4320, time: 1011)

▼ Coordinates:
  depth      (depth)      float32   0.494 1.541 ... 5.275e+03 5.7...
  latitude   (latitude)   float32   -80.0 -79.92 -79.83 ... 89.92 9...
  longitude  (longitude)  float32   -180.0 -179.9 ... 179.8 179.9
  time       (time)       datetime64[ns]  2022-06-01 ... 2025-03-07

▼ Data variables:
  thetao     (time, depth, latitude, longitude)  float32  dask.array<chunksize=(50, 1,...

► Indexes: (4)

▼ Attributes:
  contact :       https://marine.copernicus.eu/contact
  title :         daily mean fields from Global Ocean Physics Analysis and Forecast updated Daily
  references :    http://marine.copernicus.eu
  institution :   Mercator Ocean International
  Conventions :   CF-1.8
  credit :        E.U. Copernicus Marine Service Information (CMEMS)
  source :        MOI GLO12
  producer :      CMEMS - Global Monitoring and Forecasting Centre
```

Explore & Access Data

Web Map Tile Service (WMTS)

- OCG standard protocol
- Pre-rendered tiles stored in cache
- Custom URL: layer, style, zoom level, etc.
- Interoperability



Cf. QGIS demo

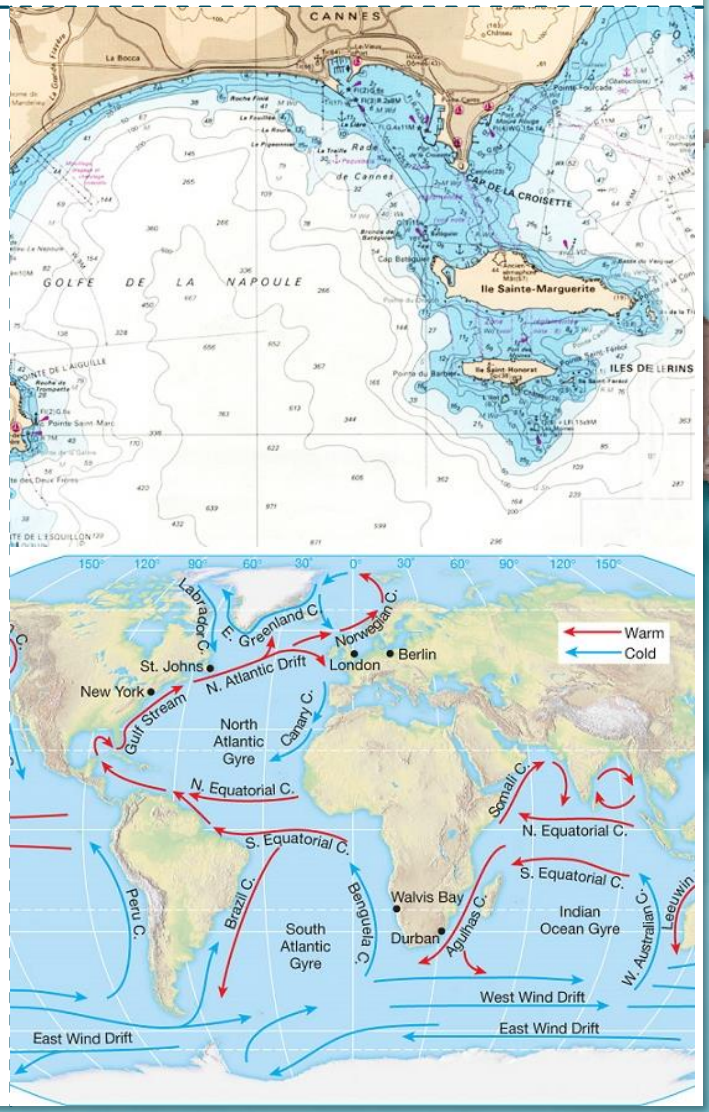
Open & Visualize Data

Software

- Graphical User Interface (GUI)
- No-code skills
- Free & powerful tools

Programming

- Copernicus Marine Toolbox
- Python: beginner-friendly
- Fine-tune plots and maps



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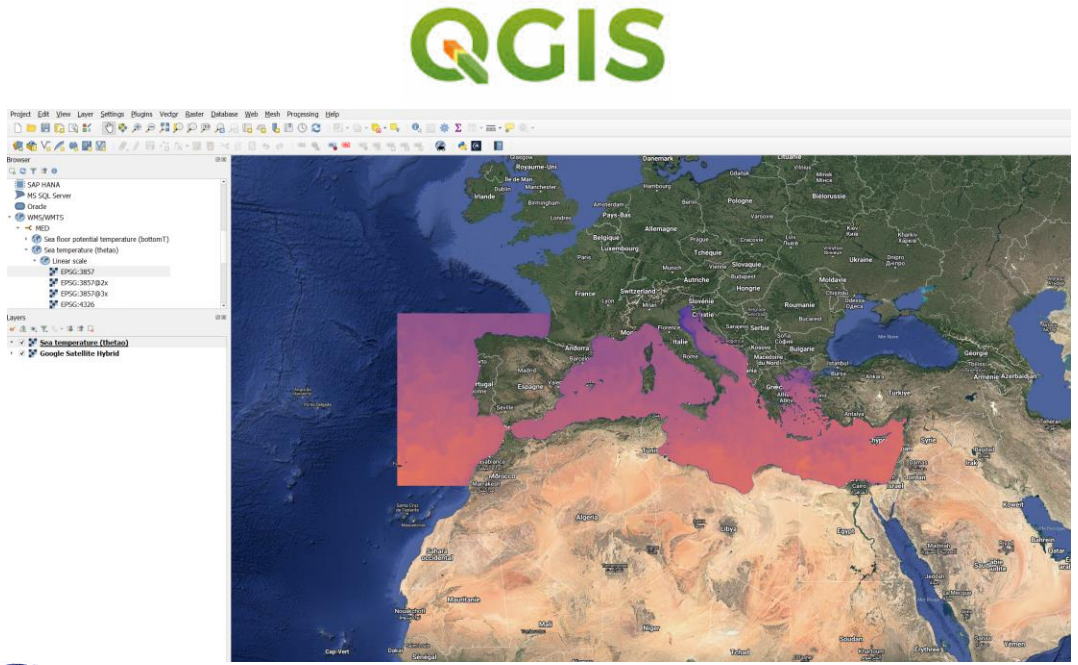
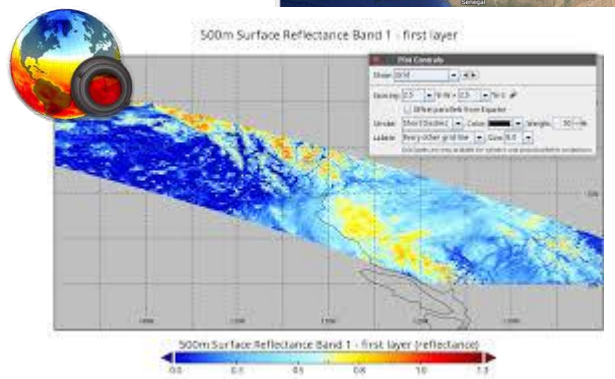
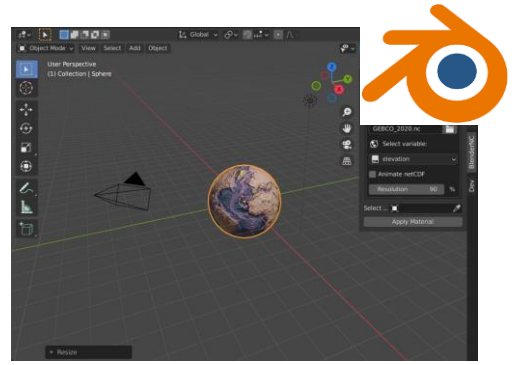
Software

- QGIS
- Panoply
- SNAP
- Google Earth Engine
- Blender plugins: BlenderNC, SciBlend







Live demo

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Open & Visualize Data

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Programming

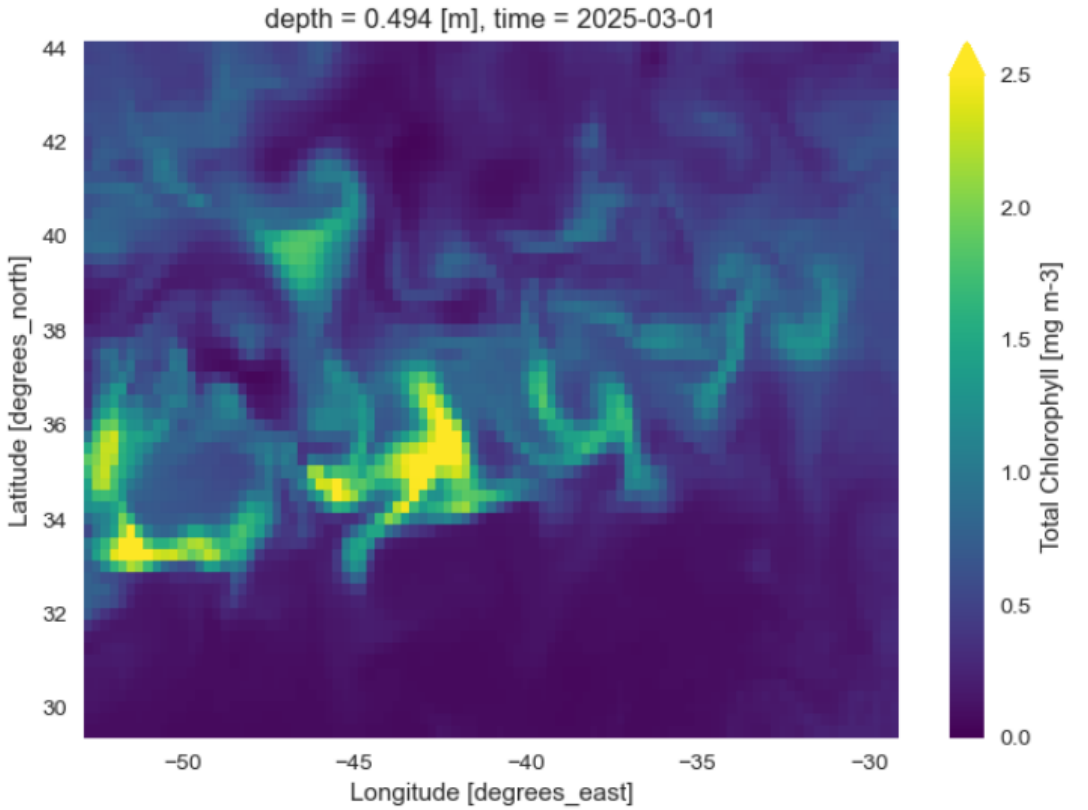
- Copernicus Marine Toolbox
- Languages: Python/R/Julia/Matlab
- Open NetCDF, CSV and more

Live demo

Plot CHL for one date (map)

```
dataset_remote.chl.sel(time="2025-03-01").plot(vmin=0, vmax=2.5)
```

```
<matplotlib.collections.QuadMesh at 0x22200ead4f0>
```



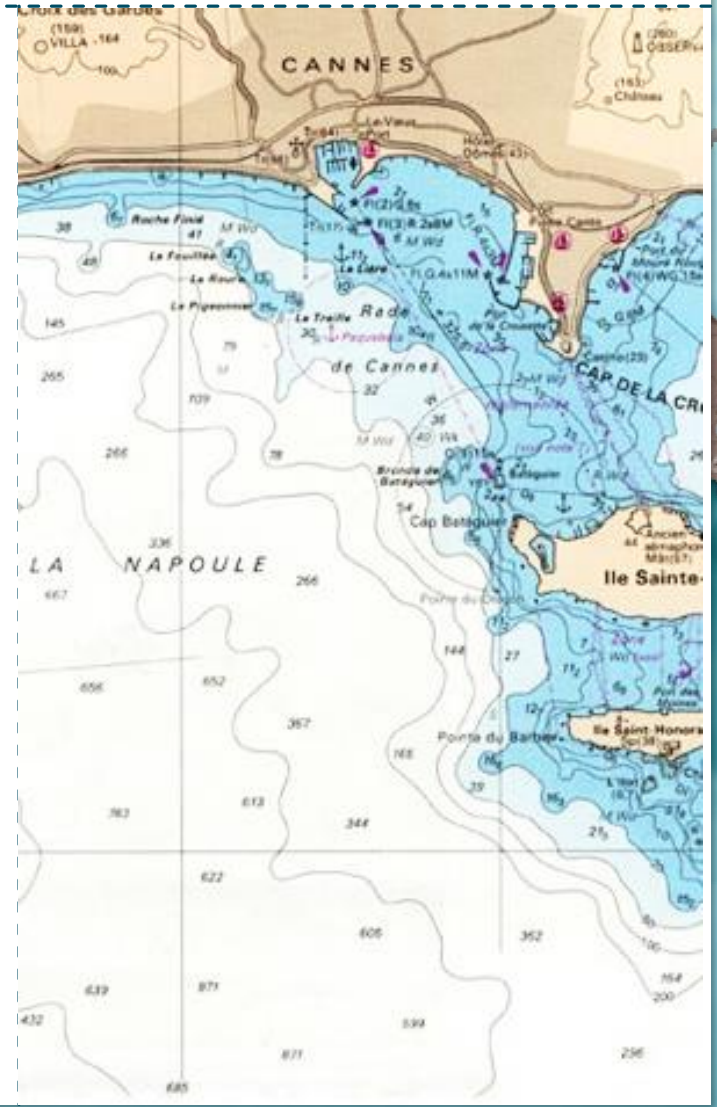
To go further

Resources

- Help Center
- E-learning materials
- Charts: Ocean Monitoring Indicators (OMIs)
- Events replays

User Support

- Widget chat
- AI agent (Blu)



Additional resources

NetCDF

Introduction to the NetCDF format

How to open and visualize NetCDF files?

How to convert NetCDF to CSV?

Toolbox

Introduction

Installation

Credentials configuration

QGIS

How to open and visualize Copernicus Marine data in QGIS?

How to download and use the NetCDF2QGIS plugin on QGIS?

MyOcean

Introduction to MyOcean Learn

Introduction to MyOcean Pro

Thank you!