



Vision for Digital Twins of the Ocean

MERCATOR OCEAN INTERNATIONAL
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Digital Twins of the Ocean in a nutshell

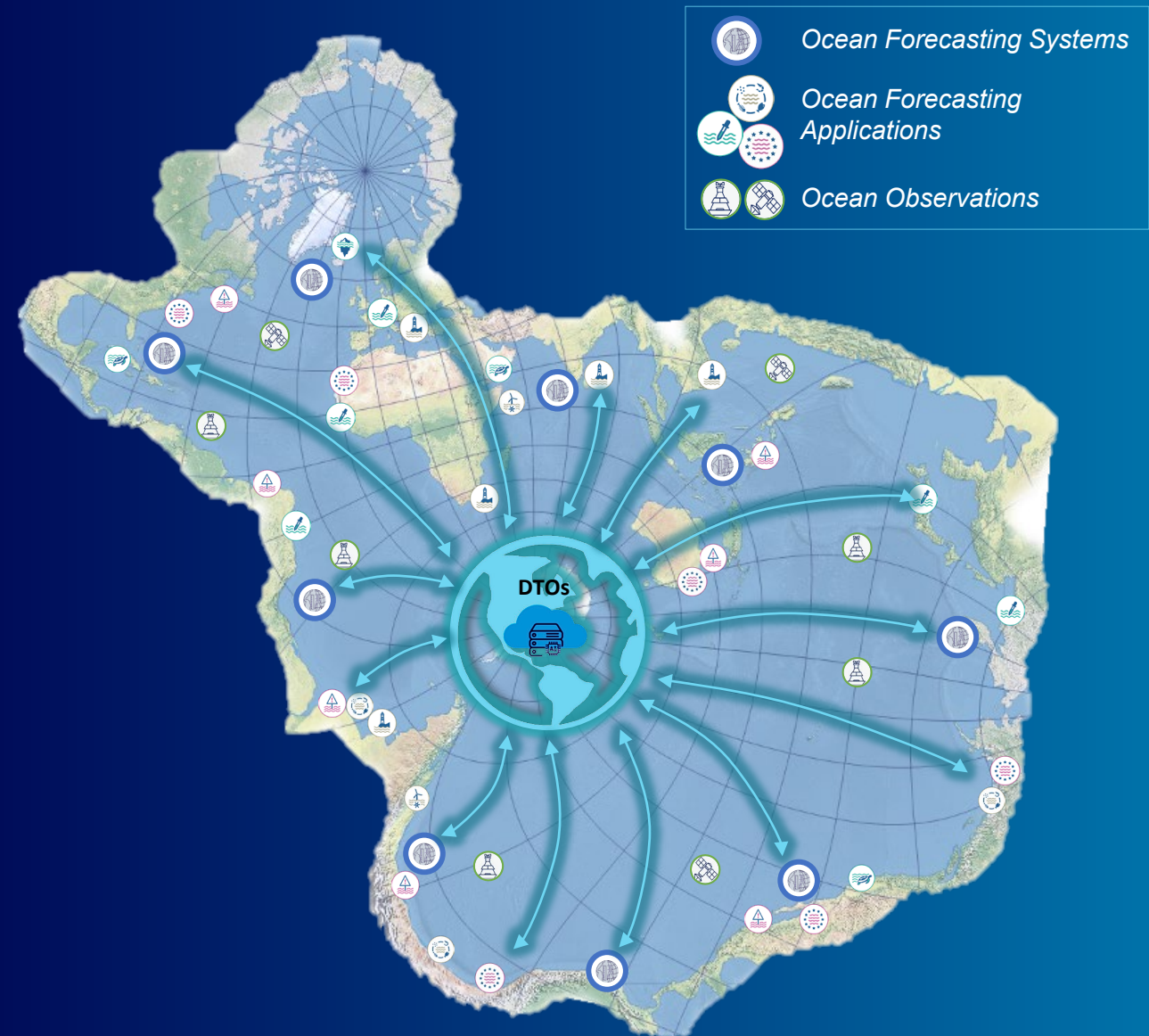


A Digital Twin Ocean offers a virtual depiction of the ocean: it aims at being a consistent, high-resolution, multi-dimensional and near real-time virtual representation of the ocean, combining ocean observations, artificial intelligence, advanced modelling, operating on high-performance computers and accessible to all, through interactive tools.

The European DTO: Setting the scene

Concept

A virtual representation of the ocean,
based on our common, shared
understanding of the ocean;
a knowledge pool intended to bring
together what we know, to enrich it, and
ultimately to question it to take informed
action.



Integrated into the EU flagship « Mission Ocean »



Cooperating at the global level



A UN Decade Collaborative Centre to connect the global community of digital oceanography, ocean modelling, science-to-service, in order to better deliver together.

A UN Decade Programme devoted to develop a common understanding of DTOs, and advance a digital framework to empower ocean professionals.



Designed by the European marine & digital community

The DIGITAL OCEAN FORUM



2022 – First edition of the Digital Ocean Forum (Paris). To respond to the EC President's call for a European DTO and gather marine & digital stakeholders, leading projects and initiatives in Europe.



2023 – Second edition of the Digital Ocean Forum (Brussels). To start designing a common vocabulary, architecture, infrastructure, offers and services in a community plan.



Facing 3 major challenges



Infrastructure

Robust, efficient,
performant:

Technological challenge



Information

Reliable, relevant,
scalable:

Scientific challenge



Impact

Demand-led, inclusive,
sustainable:

Cooperation challenge

The EDITO Projects

EDITO Infra

DATA LAKE AND PROCESSING ENGINE



A 2-year project building the public infrastructure backbone for European DTO by integrating key data service components (among which Copernicus Marine Service and EMODnet), and by sharing cloud processing capabilities and software into a single digital framework.

EDITO ModelLab

VIRTUAL SIMULATION ENVIRONMENT AND ADVANCED MODELS



A 3-year project developing the next generation of ocean models, combining artificial intelligence and high-performance computing, to be integrated into the European DTO public infrastructure, providing access to focus applications and simulations of different what-if scenarios.

The European DTO: Infrastructure

EDITO provides an architectural basis for the interconnection of assets



EDITO sets up a federated data lake



... to enable first a seamless access to the whole
EMODnet and CMEMS data



In addition, EDITO offers a processing engine



.... allowing to launch models, Machine Learning,
and any applications



The European DTO



The European DTO: Phase 2, full integration



The European DTO: Offer & Examples

The European DTO Offer



Explore

Create

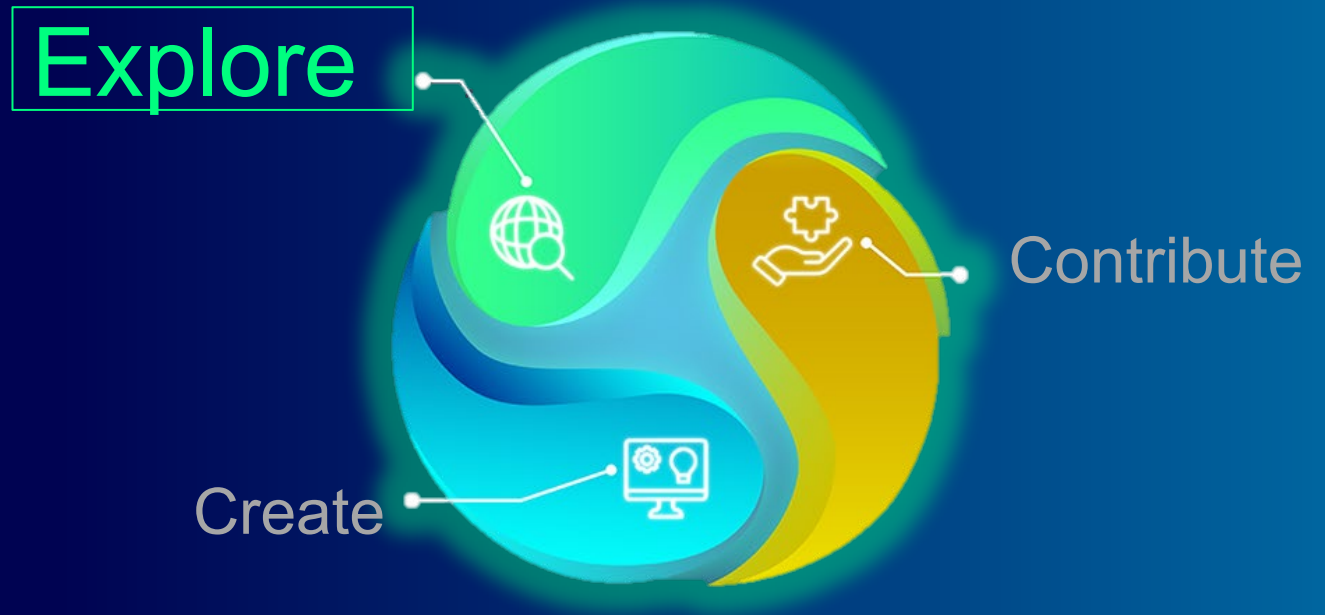


Contribute

Service offer: Explore

Use the DTO platform

- **Seamlessly browse and access ocean data** with adaptive resolution and downscaling
- **Extract data** from browsing data
- **Run predefined ocean processes and simulation scenarios** on different topics
- **Access ocean services** hosted on the platform, with a dedicated user experience

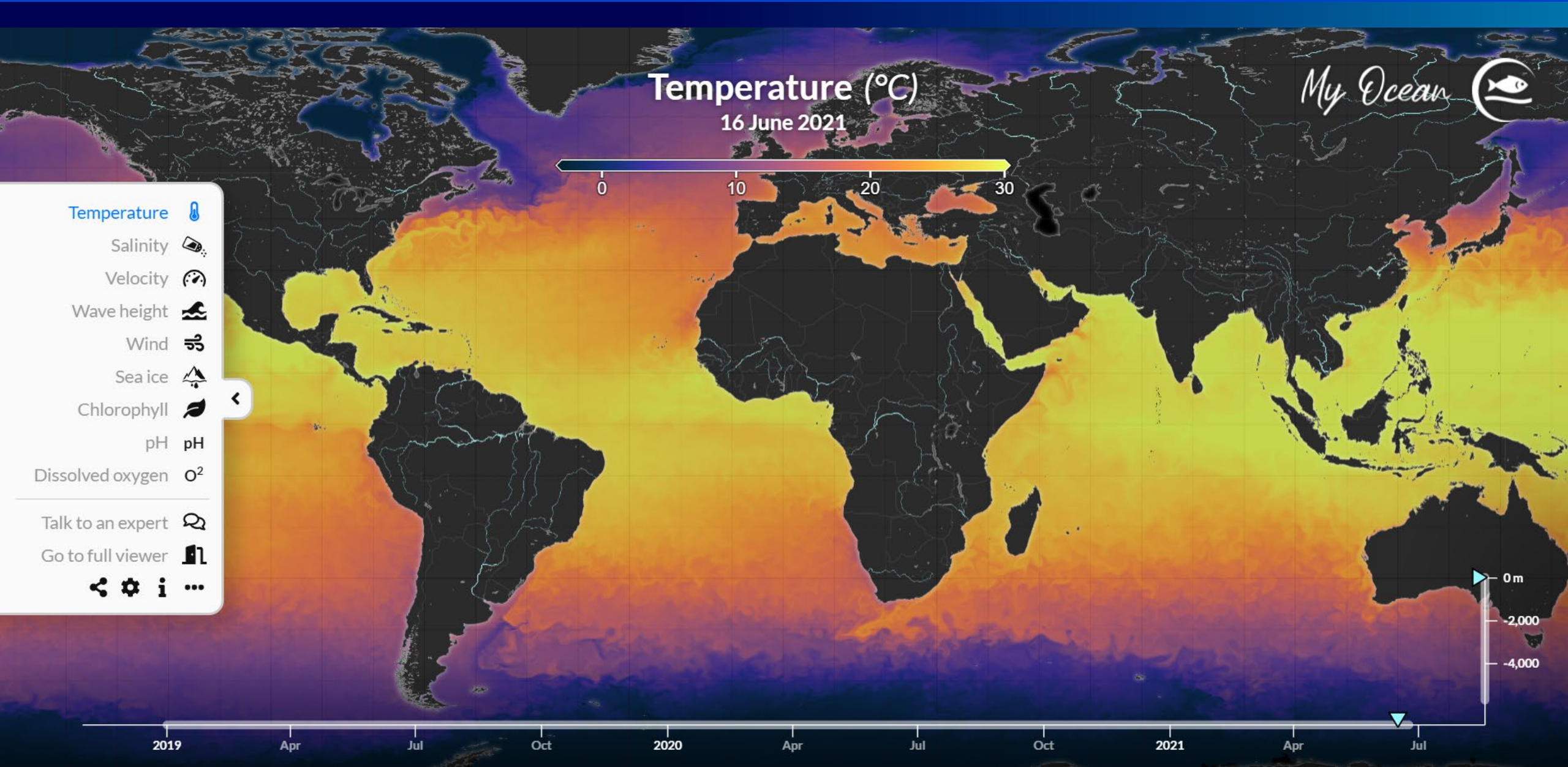


Explore: EMODnet data

The screenshot displays the EMODnet web application interface. The main map shows bathymetry data over Europe and the Mediterranean region, with a rainbow color scale representing depth. The interface includes several panels and controls:

- Layers Panel:** Located on the left, it shows 'Administrative units' and 'EMODnet Bathymetry' layers. A search bar for 'Search layer' is also present.
- Map settings Dialog:** A central dialog box titled 'Map settings' allows users to configure the map. It includes:
 - Coordinate format:** Set to 'Decimal 22.5°'.
 - Projection:** Set to 'EPSG:3035'.
 - Mean depth rainbow colour (no land):** A checked checkbox.
 - DTM Tiles:** A button to view details.
 - Buttons:** '+ Add external layers' and a close button 'x'.
- Search and Filter:** A 'Marine regions' search bar with the text 'Search for a region ...' and a 'Change basemap' dropdown set to 'EMODNET World Base Layer'.
- Map Controls:** A vertical toolbar on the right side includes icons for zooming (+, -), home, full screen, pan, 3D view, and sharing.
- Scale and Logo:** A '1000 km' scale bar is in the bottom left, and the EMODnet logo (European Marine Observation and Data Network) is in the bottom right.

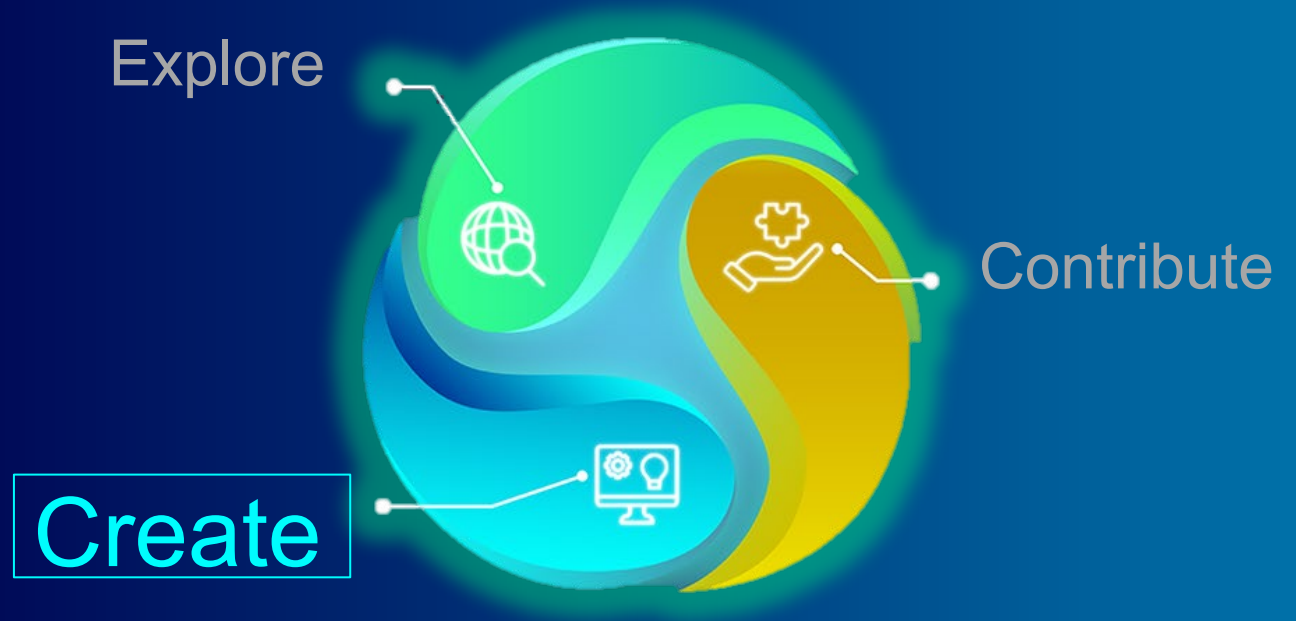
Explore: Copernicus Marine Service data



Service offer: Create

Create your own data & services

- Create your **data**
 - Benefit from the Virtual Ocean Model Lab to generate new data
 - Derive predefined processes on demand, what-if scenarios
- Create your **services** :
 - Create your own marketplace and place your service there
 - Use virtual environments (Jupyter, RStudio, IDE, Python, R, etc.) or other predefined services.
 - Access HPC computing, storage and streaming resources

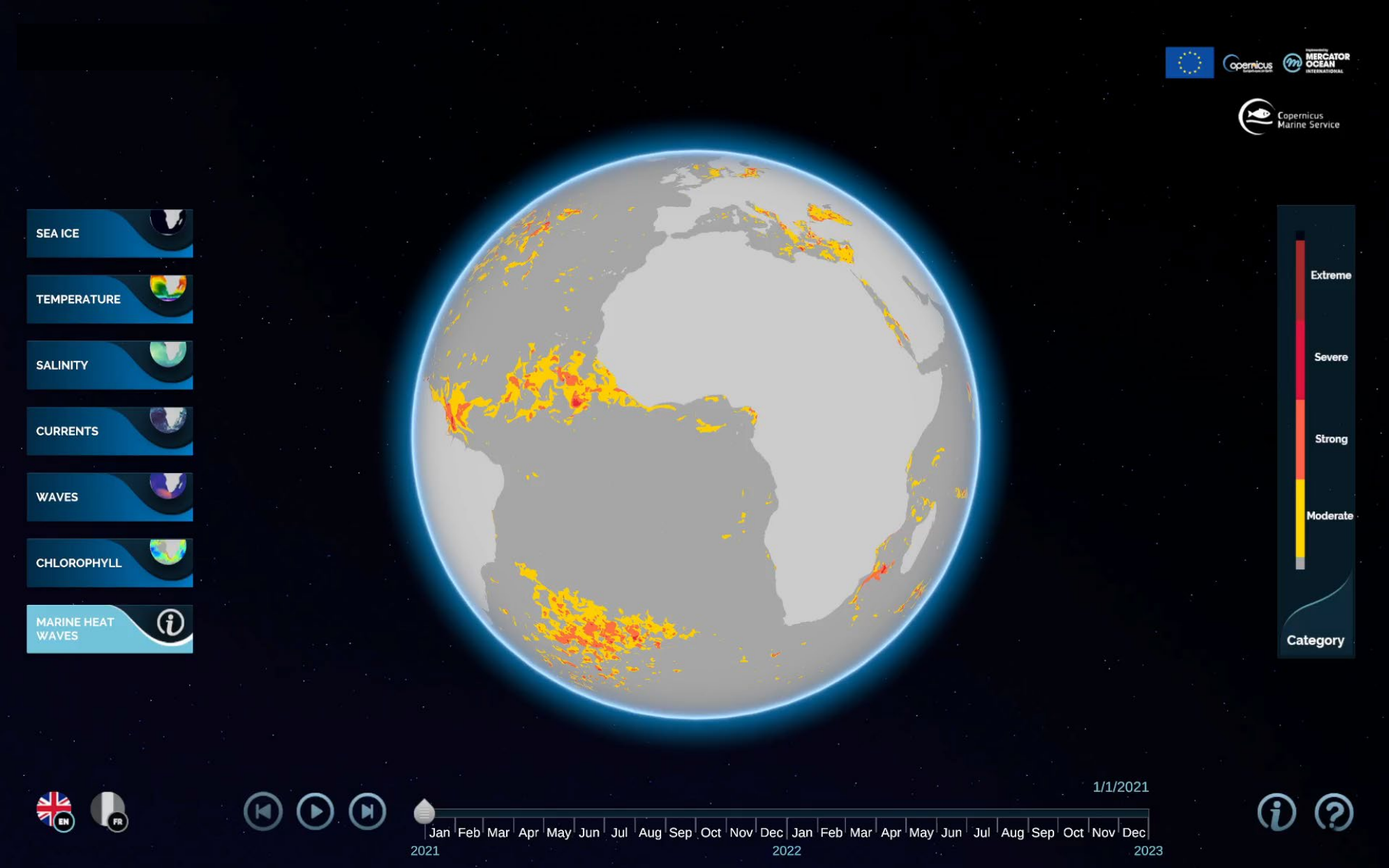


Create: Marine Heat Waves outreach services

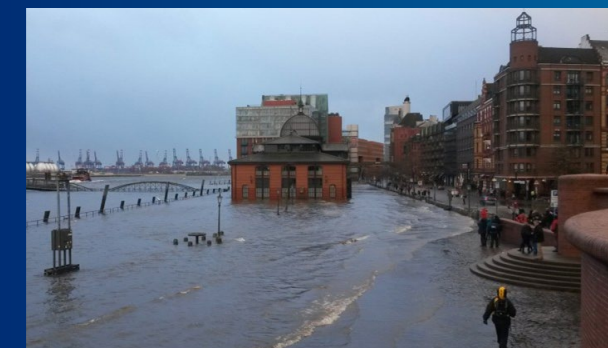
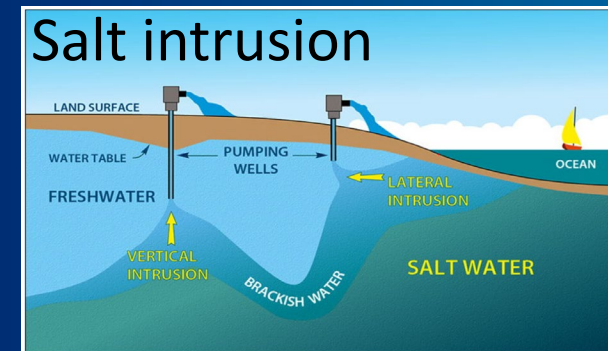
Visualisation of Marine Heatwaves days – summer 2022



Create: Thematic synthesis and visualization services



Create: Scenario - Seagrass beds to mitigate coastal erosion



Service offer: Contribute

Enrich the offer to benefit the community

- Open an access to your own data and tools to add them to the DTO catalogue
- Share your know-how, best practices, methods to feed the DTO
- Promote cooperation and the implementation of projects between DTO stakeholders



Contribute: What-if scenarios



Next: June 2024, milestone in the EU DTO construction

For 3 years, the Digital Ocean Forum has been gathering the Digital Ocean's European community.

The 3rd edition will unveil the prototype of the European DTO.



2022



2023



12-13 June 2024



Thank you!