



EU MISSION

'Restore our Ocean and Waters by 2030'

European Digital Twin of the Ocean (EU DTO)



TwinPolitics Ocean Seminar Series
25/03/2025

#MissionOcean #EUDTO #HorizonEU

EU DTO: the EC Vision



PROTECT AND RESTORE MARINE AND FRESHWATERS ECOSYSTEMS AND BIODIVERSITY

PREVENT AND ELIMINATE POLLUTION OF OUR OCEANS, SEAS AND WATERS

MAKE THE BLUE ECONOMY CARBON-NEUTRAL AND CIRCULAR

Cross-cutting enablers for the mission:

- Digital Ocean and Water knowledge system
- Public mobilisation and engagement



“Today, we know the ocean is vulnerable and is threatened by our misdeeds. Pollution, chemicals and the overexploitation of marine resources. The ocean is too large for any one of us, and yet so fragile that our individual actions matter. ...

*... Every problem is an opportunity for innovation. But we need a clear and ambitious objective. We need a mission, like the European Green Deal. **That is why we have launched the ‘Mission to restore our ocean and waters by 2030’** ...*

*... Finally, the ocean is still largely a great mystery for humankind. **That is why Europe is building a digital twin of the ocean.** We are connecting our assets – like the Copernicus satellites, marine infrastructure like icebreakers, buoys and underwater drones, and high-performance computing. We will gather the raw data and turn it into real-time knowledge and longer-term predictions.*

We are putting the power of the digital revolution at the service of our climate. ...”

EU DTO: the EC Vision



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Atlantic



Coastal zone management

Ocean Climate



Danube



Fishing

Pollution



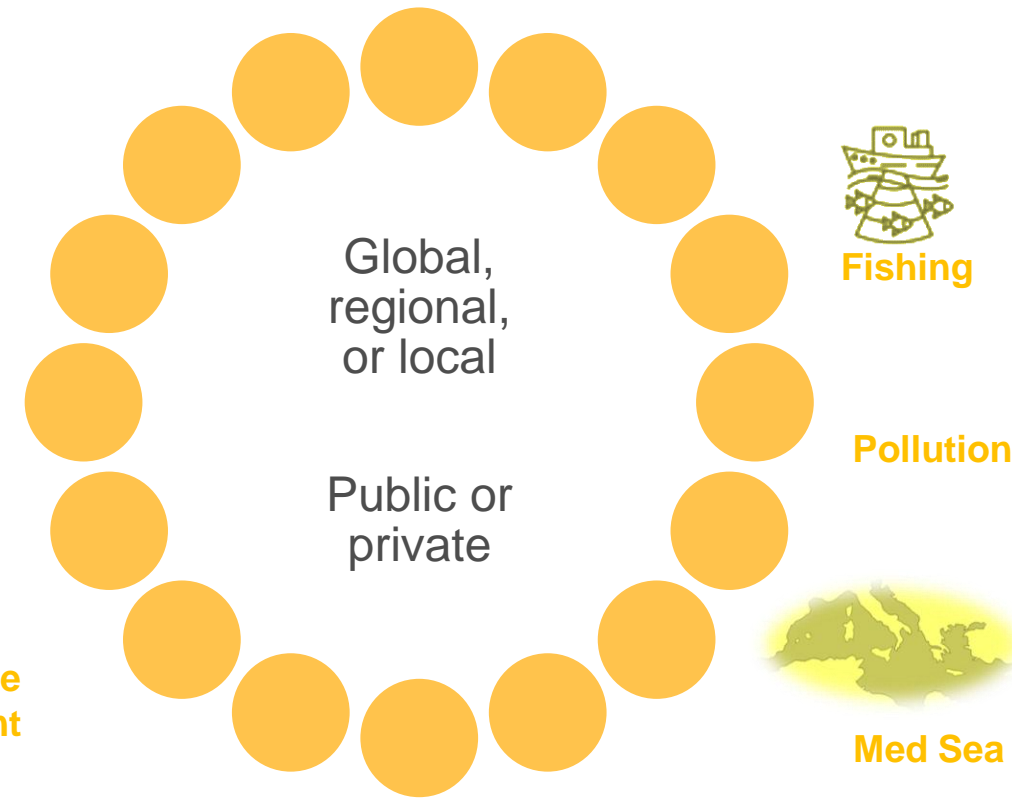
Med Sea



Baltic



Blue economy



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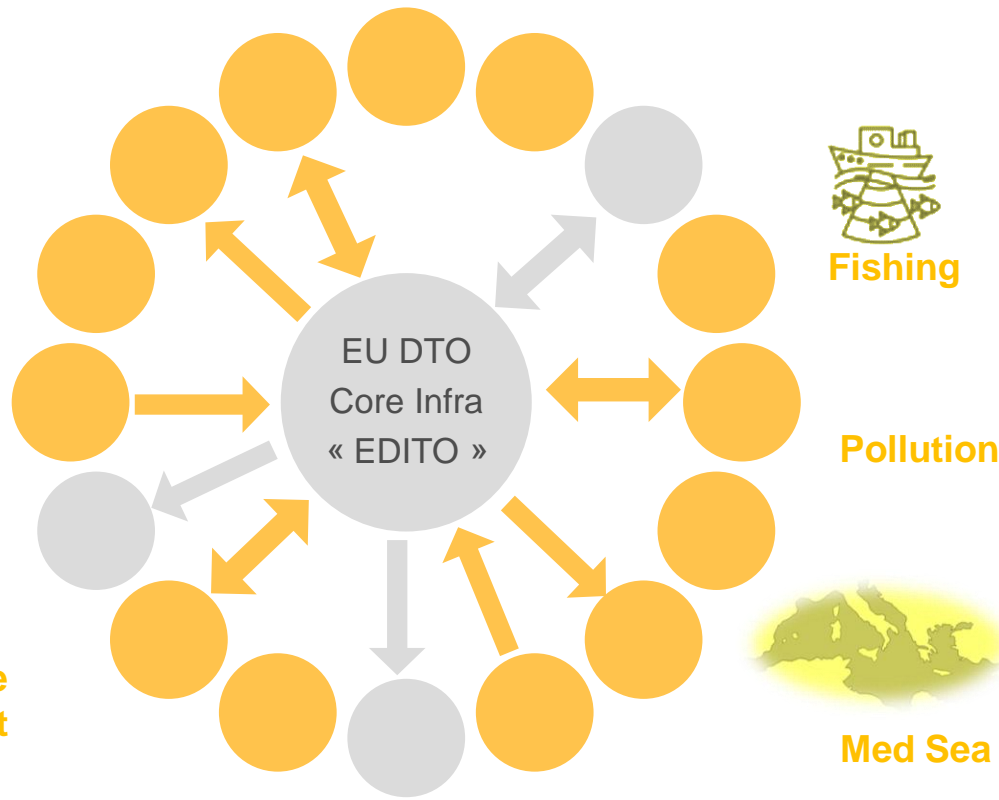
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4 Main challenges



Information

Reliable, relevant,
scalable:

Scientific challenge



Infrastructure

Robust, efficient,
performant:

Technological challenge



Impact

Demand-led, inclusive,
sustainable:

Cooperation challenge

Interdisciplinarity

EU Digital Twin Ocean as a consolidator of Marine Knowledge

A multi-DG flagship (RTD, MARE, DEFIS, JRC, ENV, CNECT)



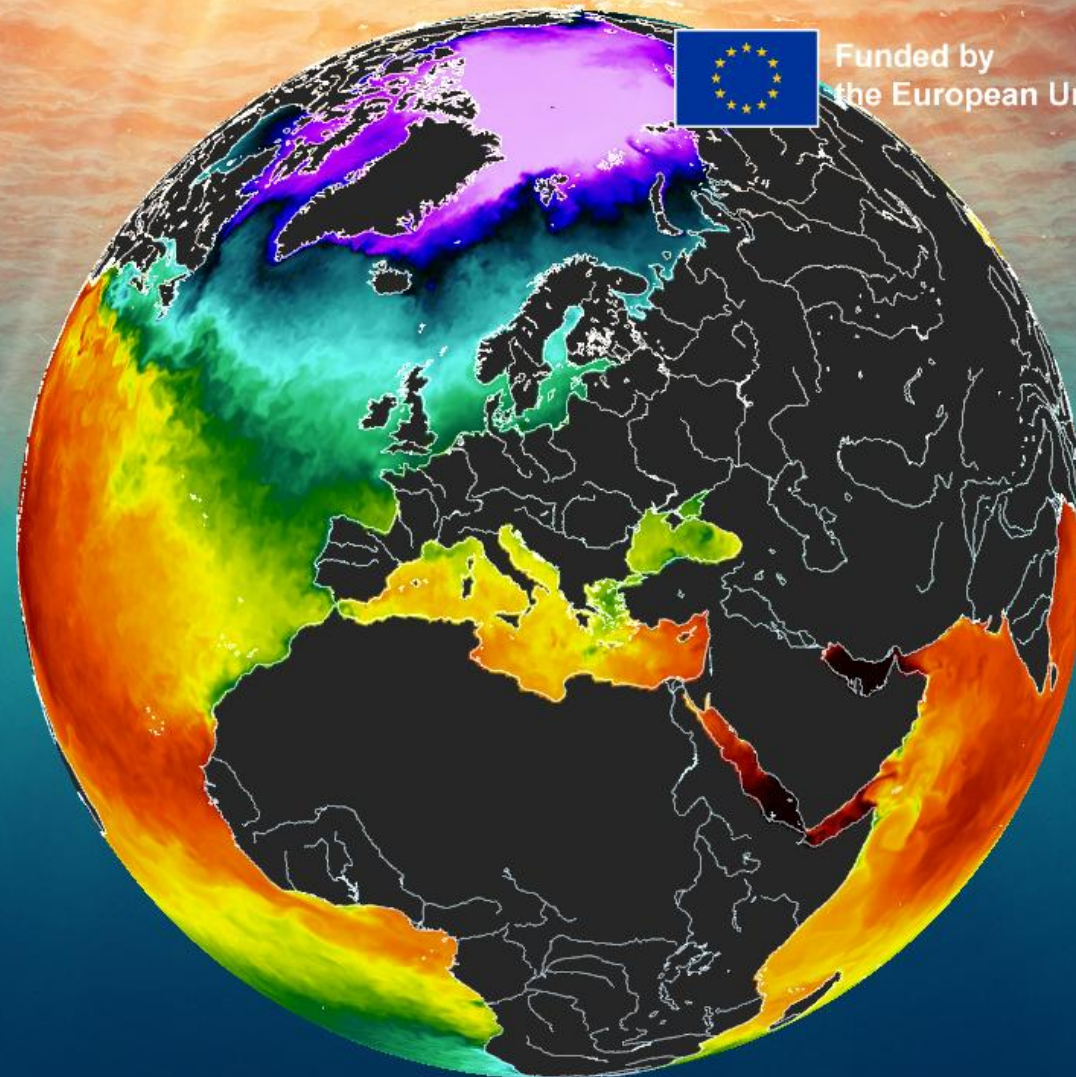
EDITO

European Digital
Twin Ocean

European Digital Twin Ocean

A leap in ocean knowledge and sustainable action empowering citizens to make informed decisions backed by science and data to restore marine and coastal environments, support a sustainable blue economy and mitigate and adapt to climate change.

DISCOVER ▶



Structuring & integrating the ocean knowledge value chain **FOR** ocean actors

TO:

- Support science-driven approaches to policies implementations by users: ecosystem-based management of marine habitats/green infrastructure, planning and management of marine areas, safeguard productivity and biodiversity of marine ecosystems, etc.
- Support industry to develop (new) sustainable business models, and green services (and opportunities in ocean data and related services)
- Increase citizen engagement & empowering citizens in innovative co-designed services and projects, enable the infusion of 'non-scientific data streams'

HOW:

- By Integrating and connecting wide range of data and models (from physics to socio-economics) with cloud infrastructures, HPC, AI
- by providing development kits, interfaces and visualization tools for "what-if" scenarios and decision support

« A core infrastructure, conceived as a public good »

EU DTO: the EC Vision



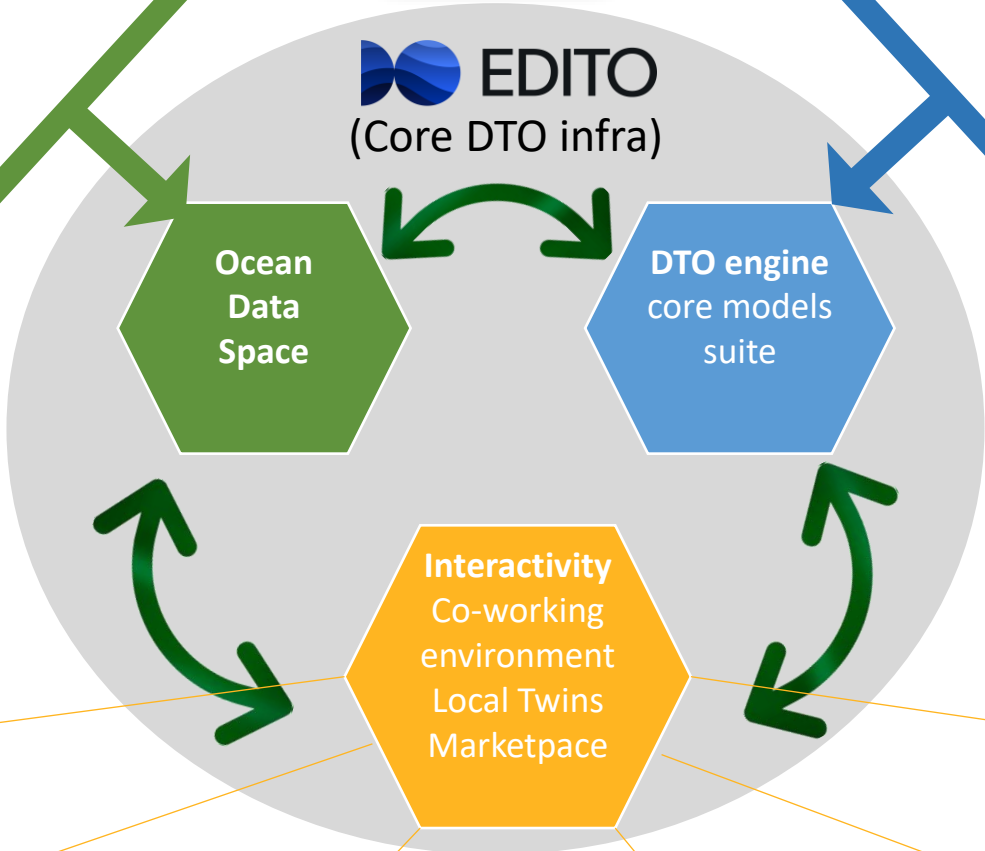
Ocean Observation
 The EU DTO needs to rely on a comprehensive and sustained OO system, coordinated and transparent

Harmonised data
 EMODnet Copernicus Marine Service Marine RIs

Other sources of data
 Research, citizen, private and other networks data

Models outputs

Models
 Physics, biogeochem, ecosystems & biodiversity, socio-ecological
 Research → to operations



EU DTO: 3 pillars of action

1. Science-base

(Horizon Europe, national programmes ...)

2. EU Core Infrastructure

(Mission Ocean WP)

3. EU DTO in the world



1. science-based: inclusive and open

 EDITO follows a co-design and co-development approach

The core EU DTO must:

- be co-developed in collaboration with willing projects and stakeholders
- foster the co-development of local or regional, application-specific, DTOs
- open to interoperability with other similar initiatives

European Digital Ocean Forum

DOF 1 – Paris, April 20-21 2022

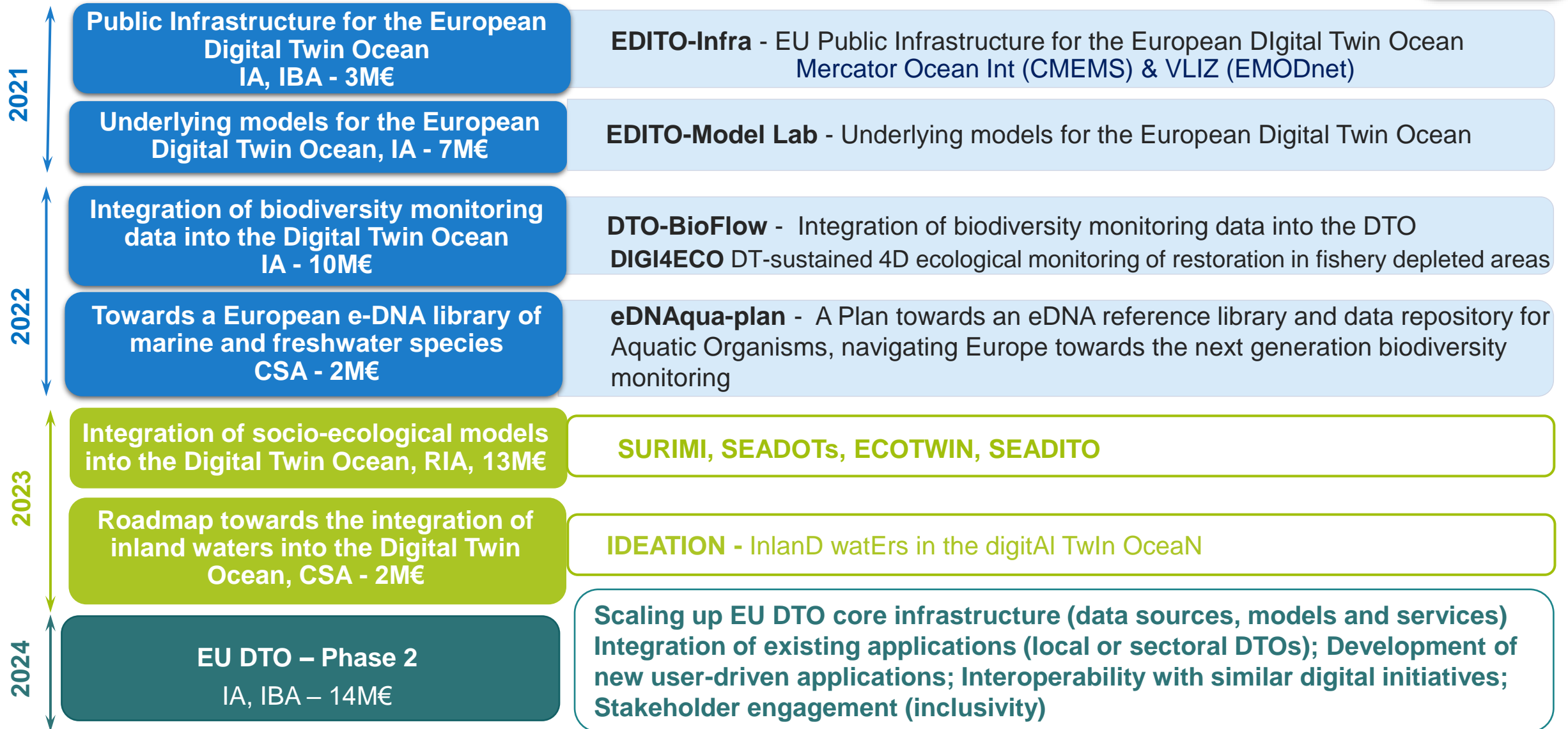
DOF 2 – Brussels, 14-15 June 2023

DOF 3 – Brussels, 12-13 June 2024

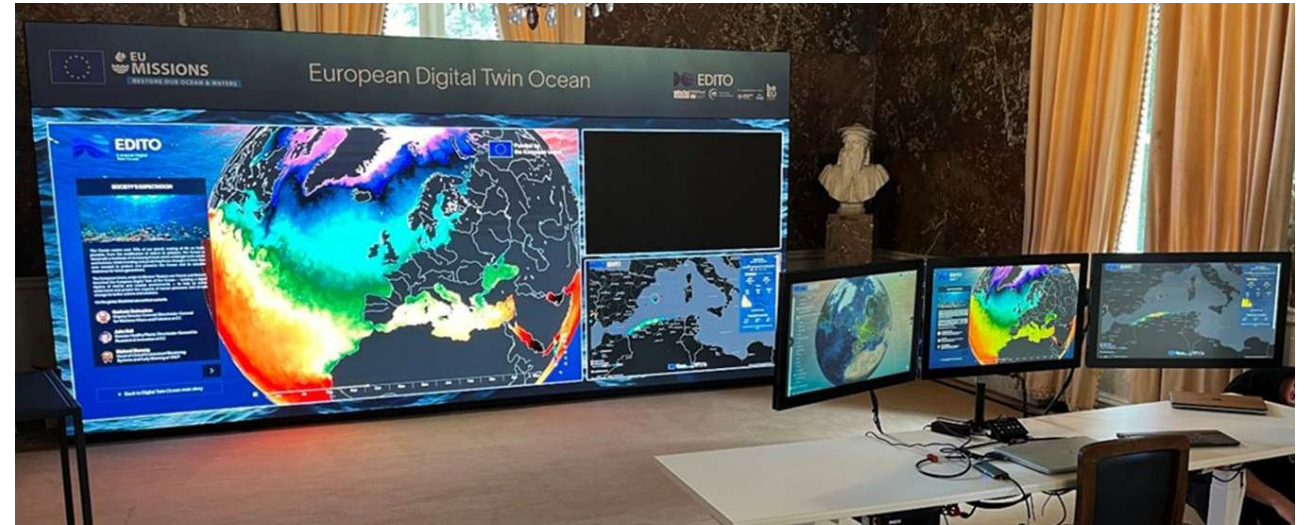


2. EU DTO Core Infrastructure (EDITO)

Mission Restore our Ocean and Waters



2. EU DTO Core Infrastructure: EDITO



- First prototype delivered at the DOF 2024 –platform publicly available <https://dive.edito.eu/>
- Second phase - Q1 2025, 14M scaling up infra & services

Digital Twin Ocean Applications


The grid displays 12 application cards, each with a play button icon and a brief description:

- EU DTO application: To combat marine plastic pollution and safeguard marine environments**
Monitoring marine plastic, providing its movements to support informed decisions and address local cleanup plans.
- EU DTO application: To support nature-based solutions against coastal hazards**
Evaluating the land-use to sea-level-rise (LULU-SLR) risk to coastal areas to support nature-based solutions.
- EU DTO - SOCE application: Early warning system for extreme events**
Providing real-time information to the sector's stakeholders for managing the risk associated with emerging events.
- EU DTO - UICOMAT application: Assessing weather-related and socioeconomic impacts in coastal areas in present and future climates**
Large-scale coastal and ocean assessment to quantify coastal hazard exposure and vulnerability of assets in coastal zones.
- EU DTO - UICOMAT application: Digital twin for sustainable fisheries management**
Digital twin for computing high quality data from fishing vessels to plan marine fisheries, assess and evaluate their performance.
- EU DTO - UICOMAT application: Improving ship navigability in the Arctic and Baltic Ocean**
Digital twin for monitoring sea ice and assessing the risk for maritime transport in the Arctic.
- EU DTO - Blue Cloud 3D application: An application to support marine biodiversity conservation**
Monitoring marine biodiversity and supporting marine biodiversity restoration.
- EU DTO - BIODIVER COAST application: Monitoring water quality to support aquaculture and biodiversity restoration**
Monitoring water quality to support aquaculture and biodiversity restoration.
- EU DTO - COAST application: Supporting sustainable multi-use of marine environment**
Supporting sustainable multi-use of marine environment.
- EU DTO - LUM application: An innovative ocean for marine resource management**
An innovative ocean for marine resource management.
- EU DTO - PIRINEO application: Improving coastal monitoring and forecasting**
Improving the data and forecasts for the Portuguese coastal users to support the sector and EU policy and decisions.
- EU DTO - VIRTUALITY application: Using virtual reality to raise awareness on marine plastic**
Virtual reality application to support marine plastic awareness on the public audience.

A wide range of applications showcased, some of them already integrated into the EU DTO



3. EU DTO in the world

- EU 27 – linking with national initiatives & 
- UN Decade of Ocean Science for Sustainable Development



-  Priority topic (JPN & EU lead)
FSOI agreed that the Ocean Decade DITTO programme is the appropriate platform for international collaboration – further discussion at annual meeting, October, Rome

- All-Atlantic Ocean Research & Innovation Alliance



EDITO: co-creation framework for the EU DTO

The European DTO Offer



Explore

Create



Contribute



Each Project
brings its:
Data
Tools
Front-Office

Socioecology
Marine Species ecosystems
Biogeochemistry
Physics



Coastal
Services

Coastal Project







Opportunity for the creation of a mosaic of innovative actions



EU DTO application
to combat marine plastic pollution and safeguard marine environments

Monitoring marine plastic, predicting its movement to support informed decisions and actions to curb marine plastic.

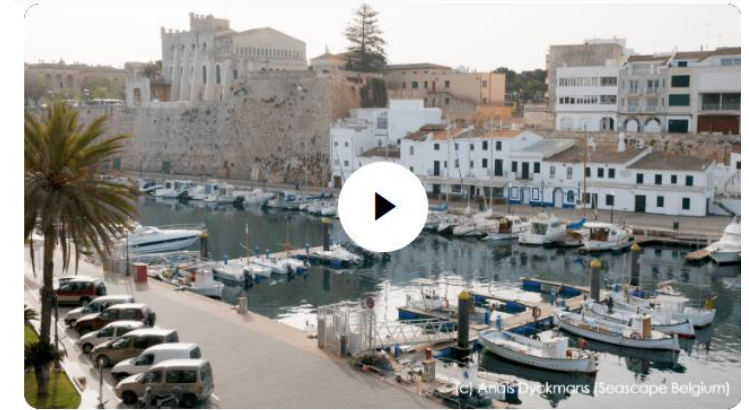
<https://youtu.be/BnvXpqNJliU>



EU DTO application
to support nature-based solutions against coastal hazards

Exploring the best way to use coastal vegetation such as seagrass to reduce coastal risks.

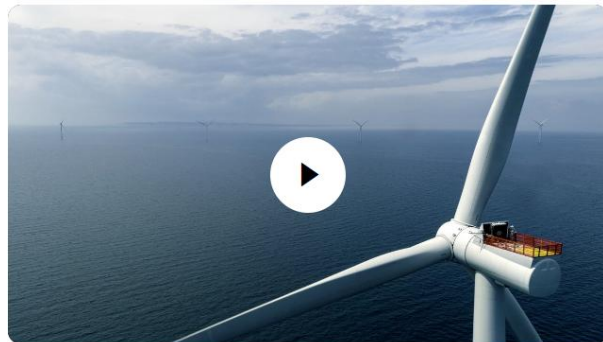
<https://youtu.be/PXt44Wj-SWw>



EU DTO - SOCIB application
Early warning system for extreme events

Predicting meteo-tsunamis in the western Mediterranean for managing risk and adaptation to a changing climate.

<https://youtu.be/yZL5SEOWB6o>



EU DTO - OLAMUR application
Supporting sustainable multi-use of marine environment

Unveiling the potential of multi-Use offshore wind energy and low trophic level aquaculture in the Baltic Sea.

<https://youtu.be/EAur0zZGDoQ>

A wide range of applications showcased, some of them already integrated into the EU DTO

<https://events.edito.eu/2024-digital-ocean-forum/content/use-cases>

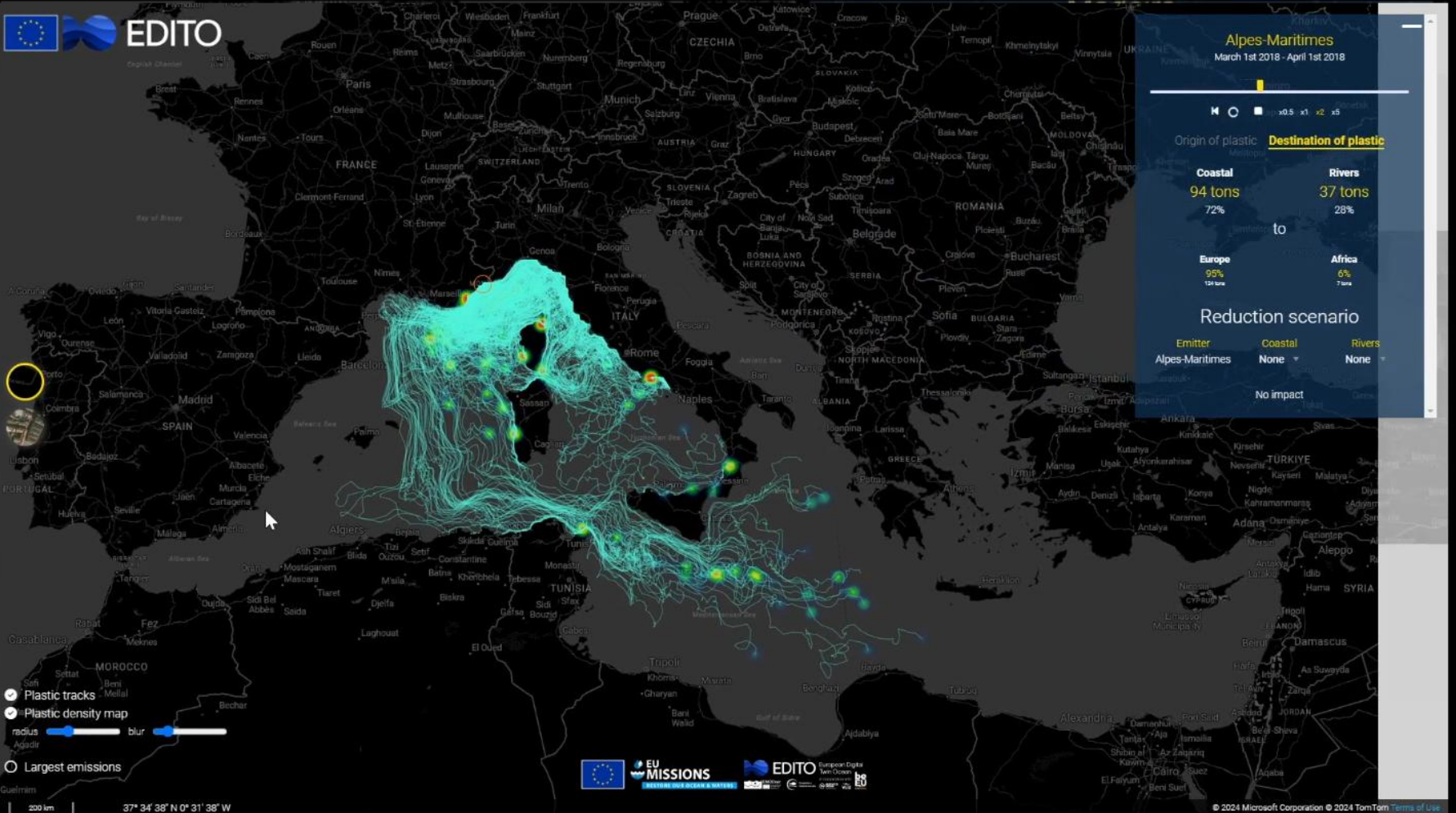


EU DTO - NOCOS DT application
Improving ship navigability in the Arctic and Baltic Ocean

Digital twin tools for monitoring sea ice and assessing the risk for maritime transport.

<https://youtu.be/Kz3acp2Ntww>





Alpes-Maritimes
March 1st 2018 - April 1st 2018

Origin of plastic Destination of plastic

Coastal 94 tons 72% Rivers 37 tons 28%

Europe 95% 101 tons Africa 6% 7 tons

Reduction scenario

Emitter: Alpes-Maritimes
Coastal: None
Rivers: None
No impact

- Plastic tracks
- Plastic density map
- radius
- blur
- Largest emissions

200 km 37° 34' 38" N 0° 31' 38" W

GLONET Global AI-Forecasting System

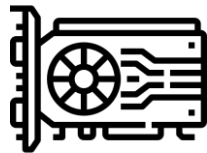
At Mercator

Physics Models

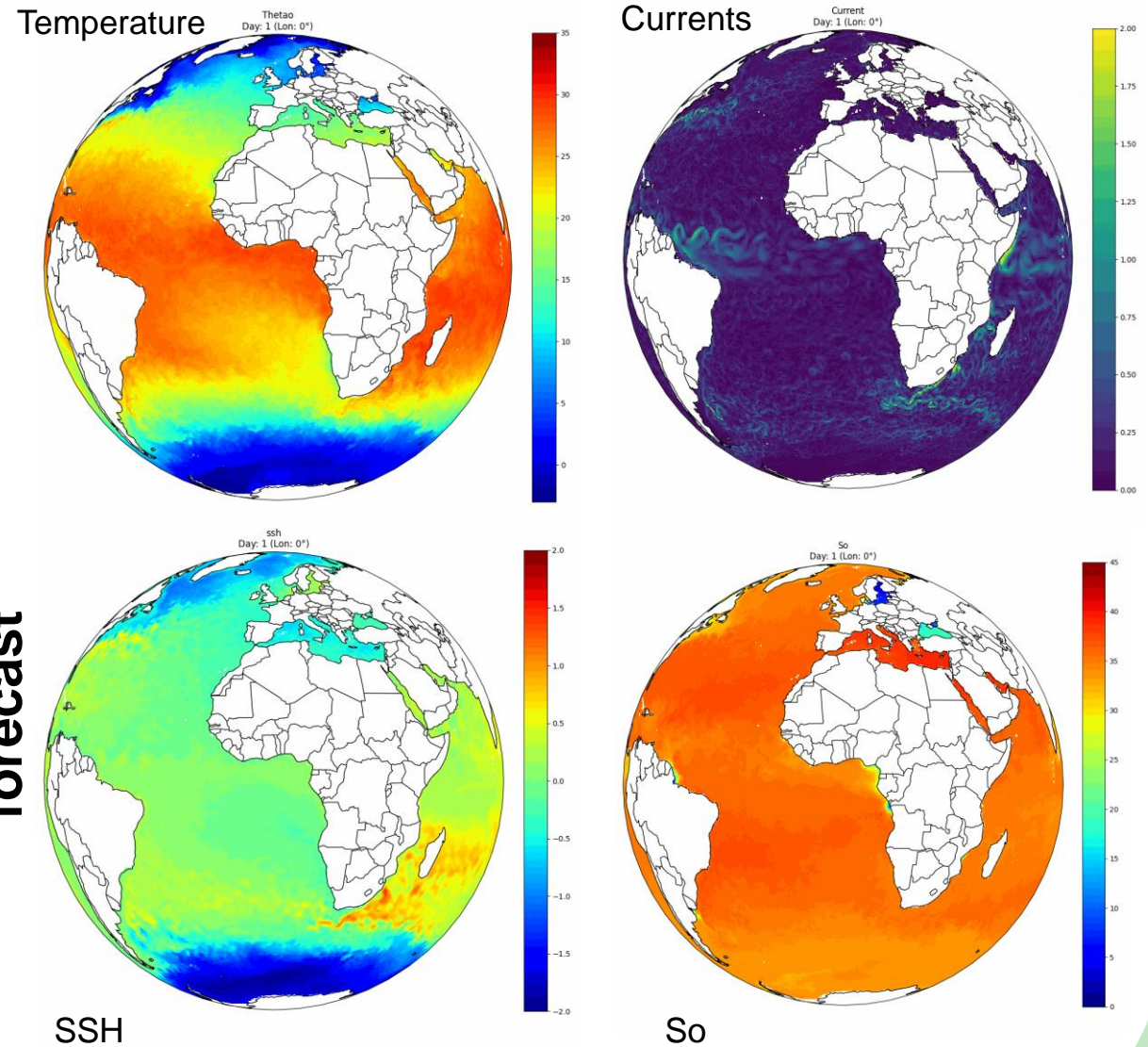
Forecast(daily):
Hours, days

AI Models

Forecast(daily):
Seconds
Suitable for what if
scenarios:
(easy to run forecast with
different initial conditions)



Glonet new
forecast



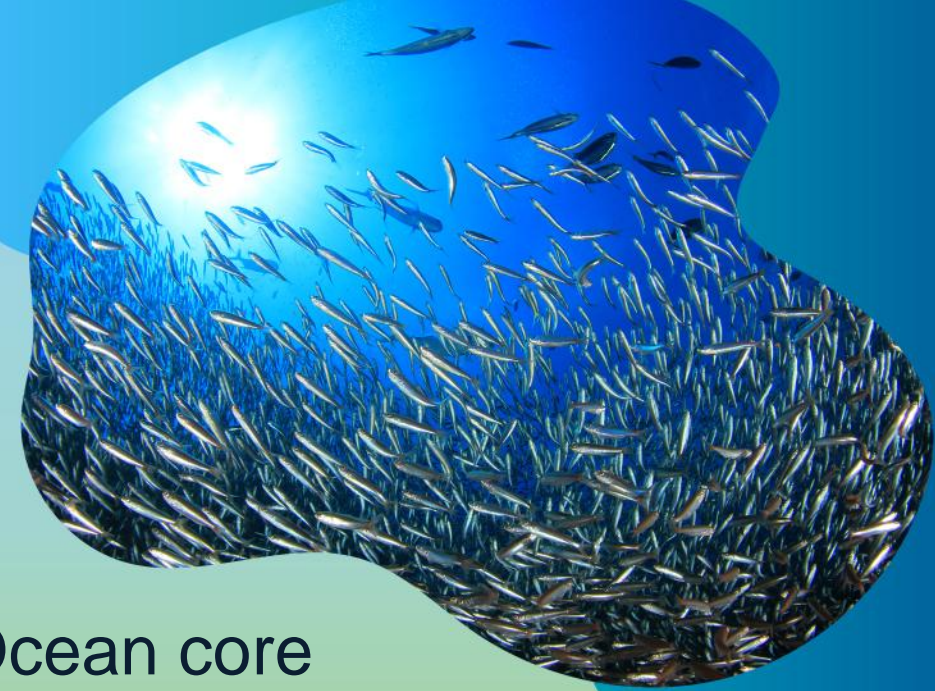


EUROPEAN UNION



EU
MISSIONS

RESTORE OUR OCEAN AND WATERS



Thank you!

Learn more for the EU Digital Twin Ocean core infrastructure [here!](#)

