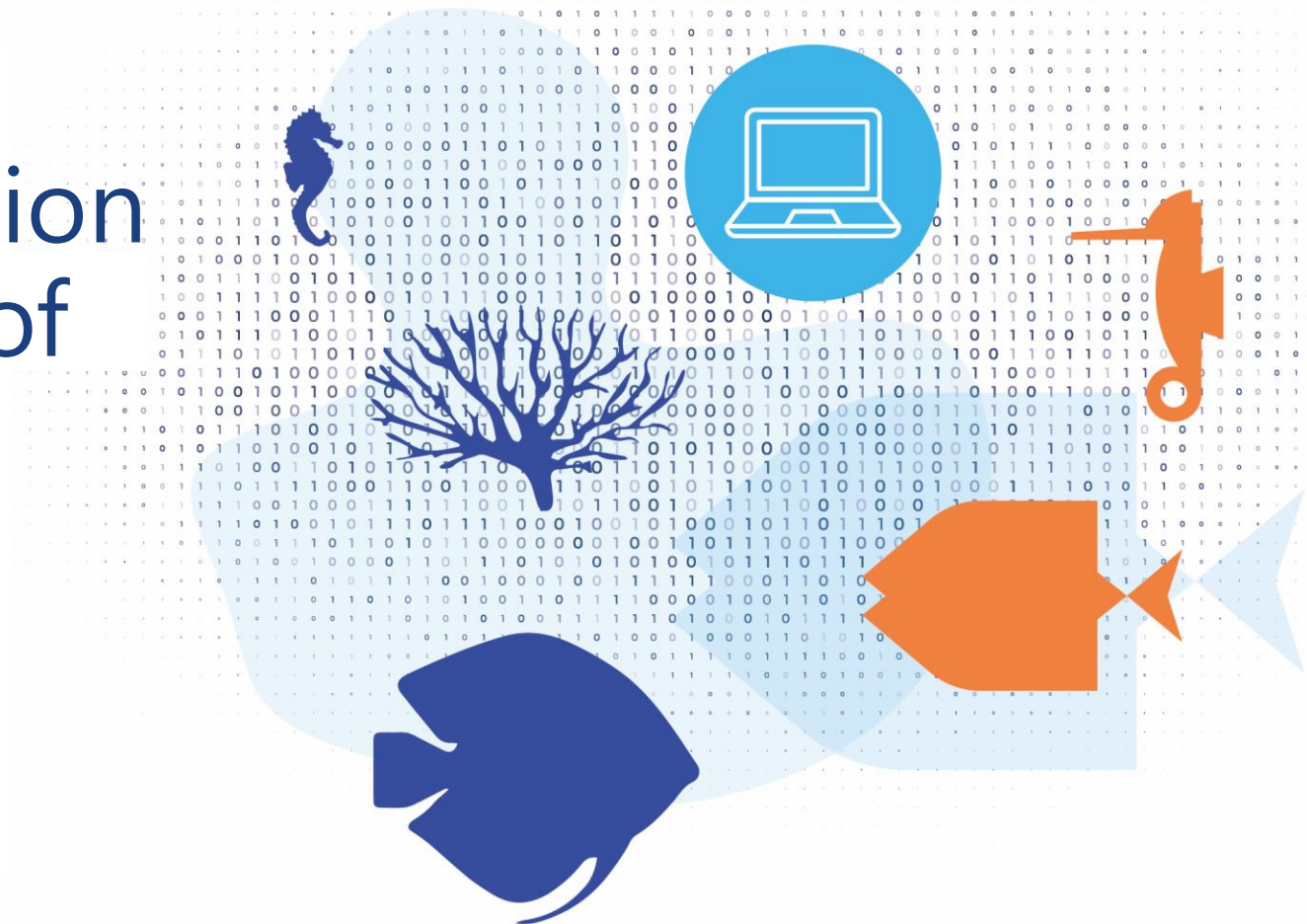


The ongoing construction of the EU Digital Twin of the Ocean

Alain ARNAUD
April 30th, 2025



#MissionOcean #DOF24 #EUDTO #edito_dto

Outline

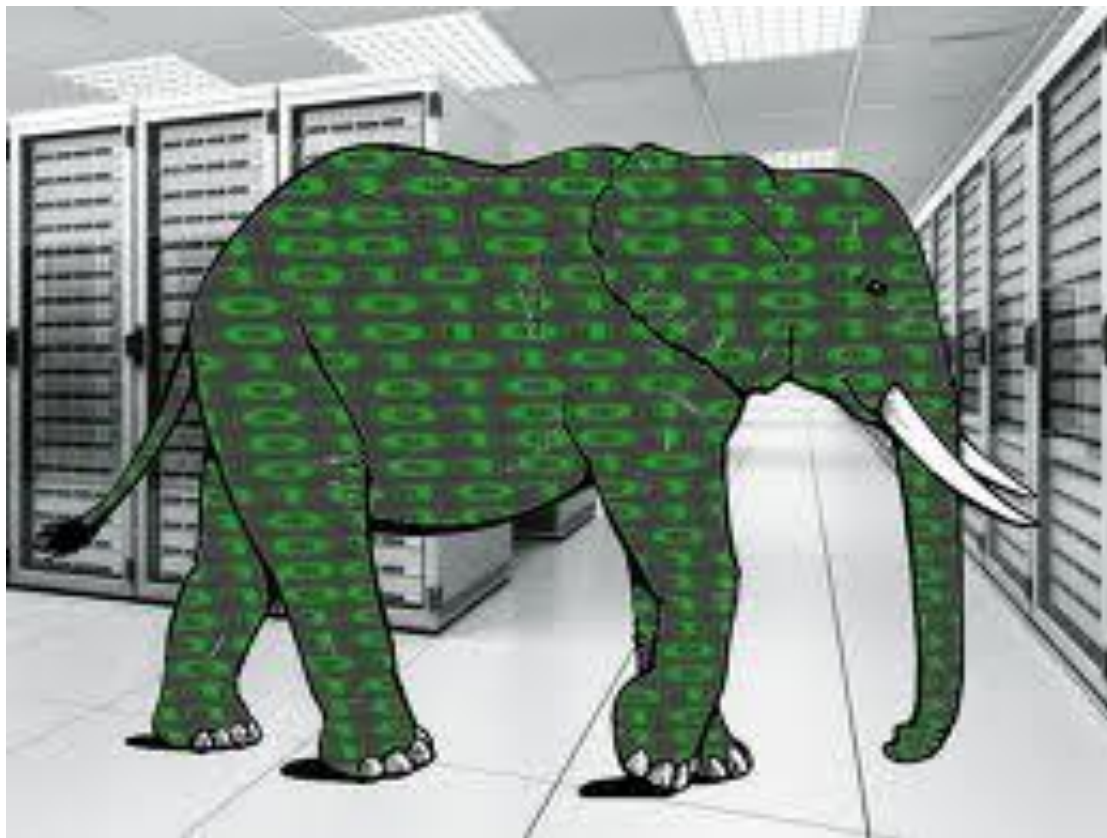
- EU DTO in a nutshell
- Conclusion

EU DTO in a nutshell



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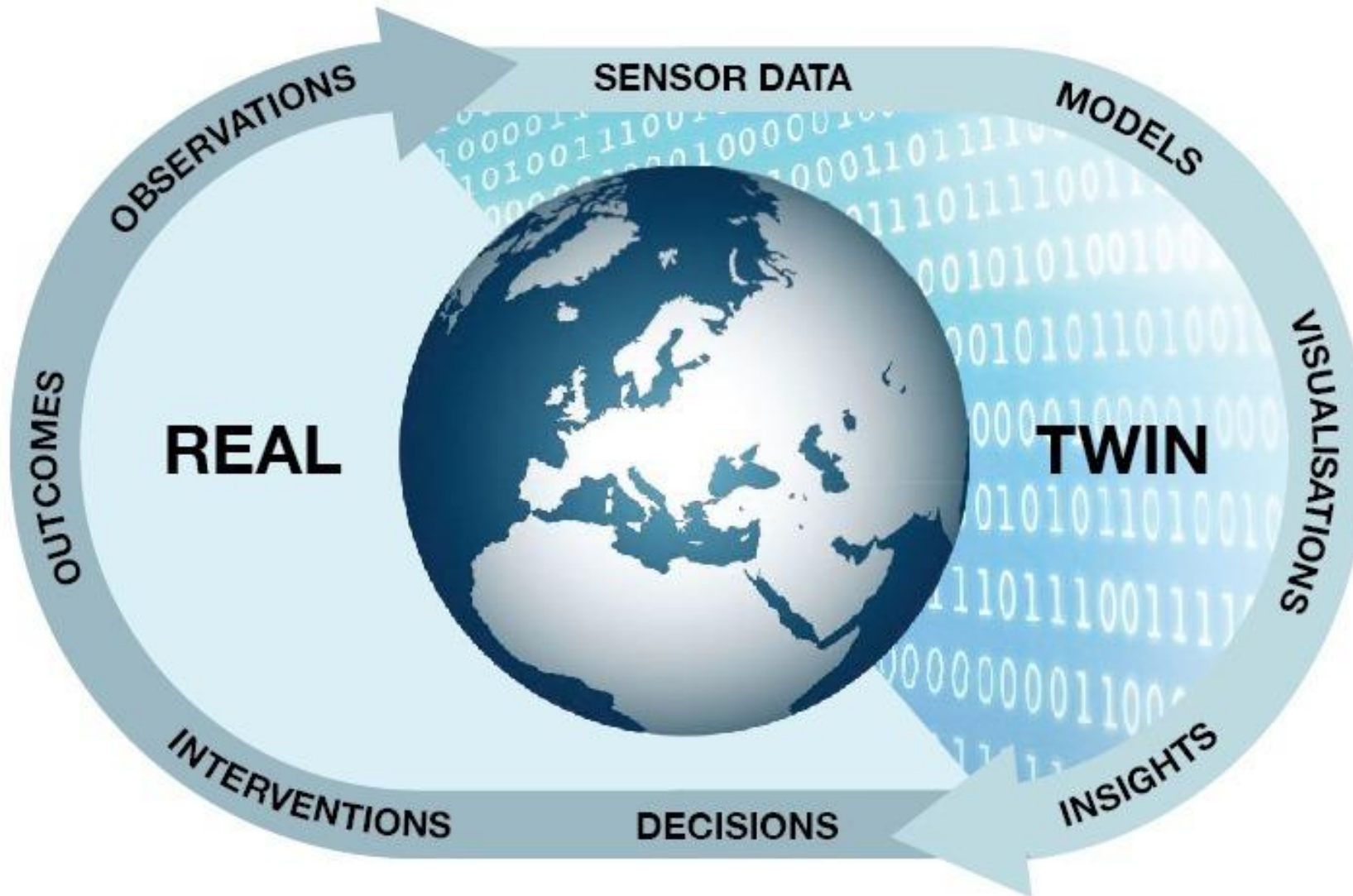
The elephant in the room?



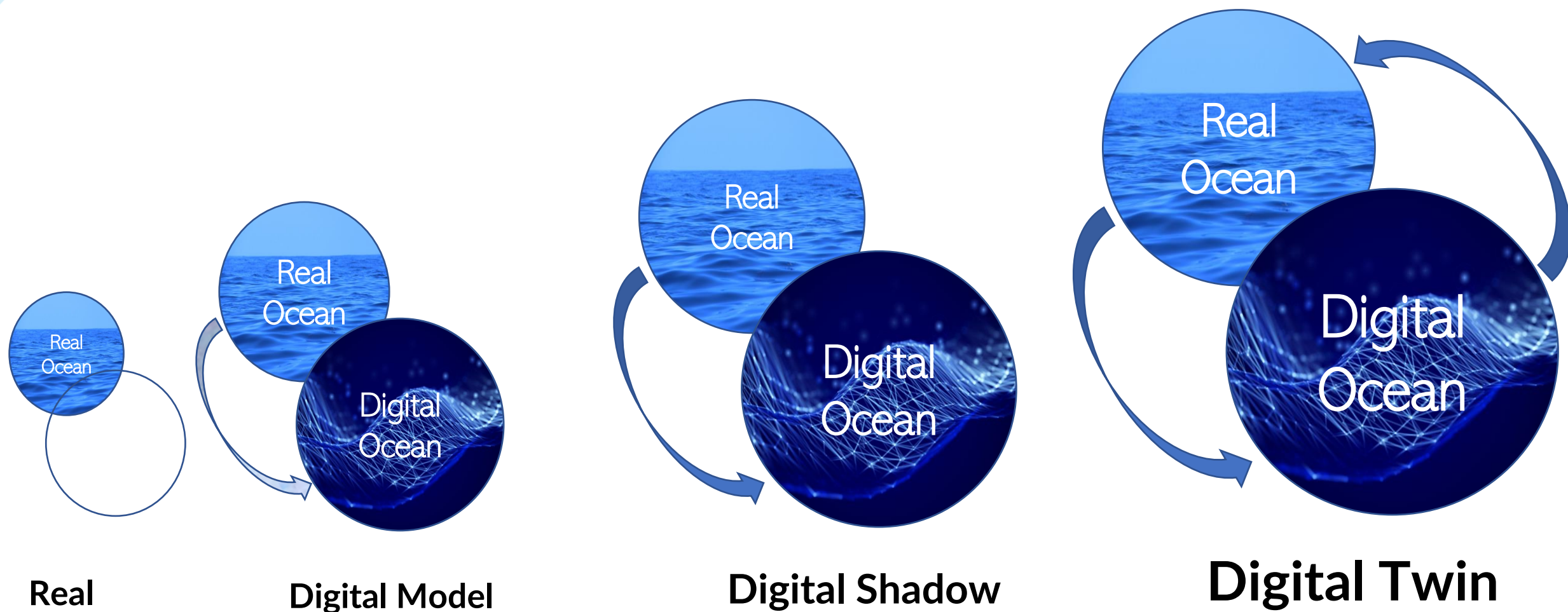
What is a
Digital Twin?
(of the Ocean)



What is a DIGITAL TWIN of the OCEAN



The Complexity of a true Digital Twin



DTO to support actions

Real word: Decision makers



Real word: Citizen



decision and impact



knowledge and science

Digital word: Science and Expertise



Marine and Innovation Experts,
Digital Ocean Forum, Paris, 21 avril 2022

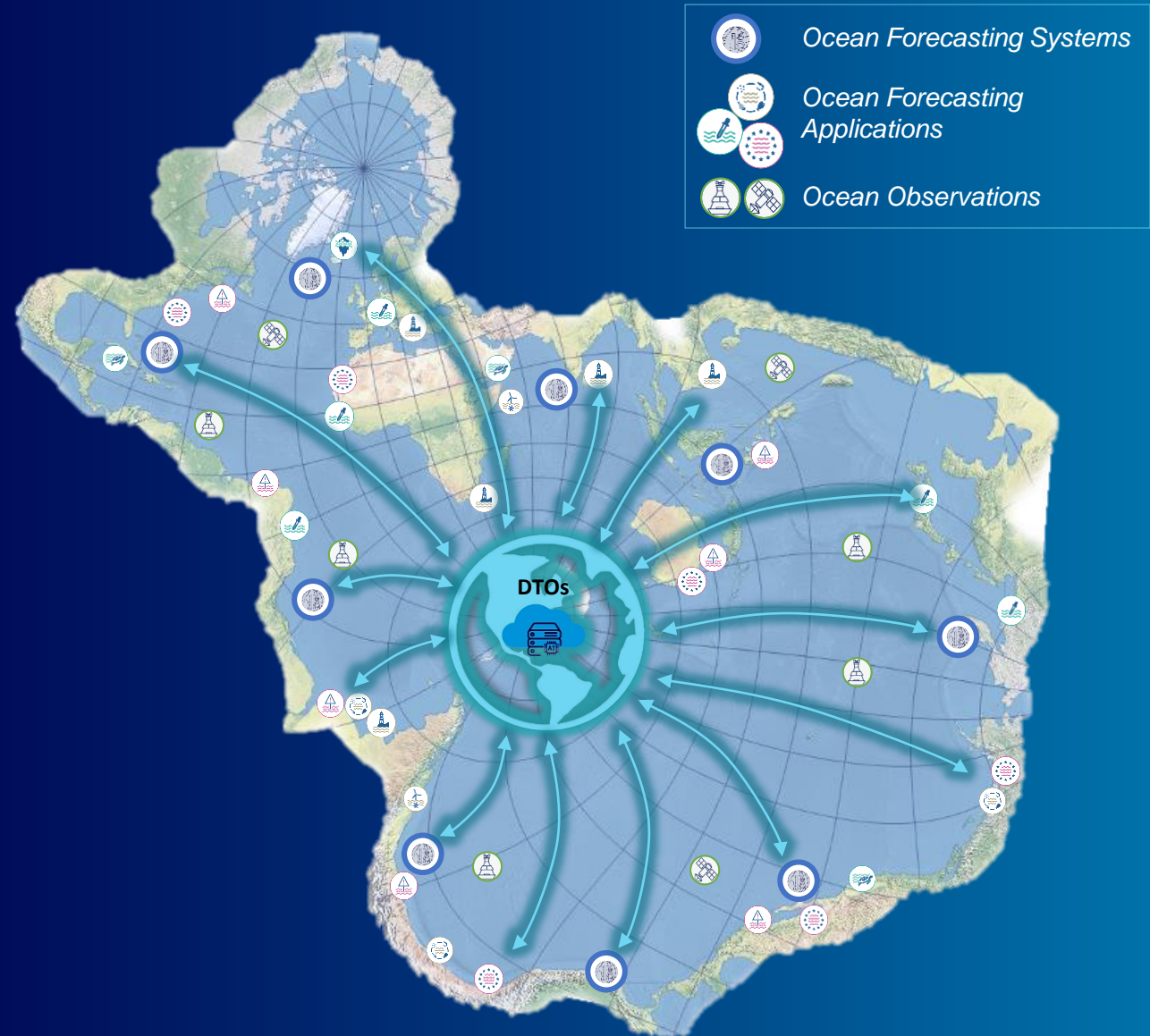
EU DTO: the construction



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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.

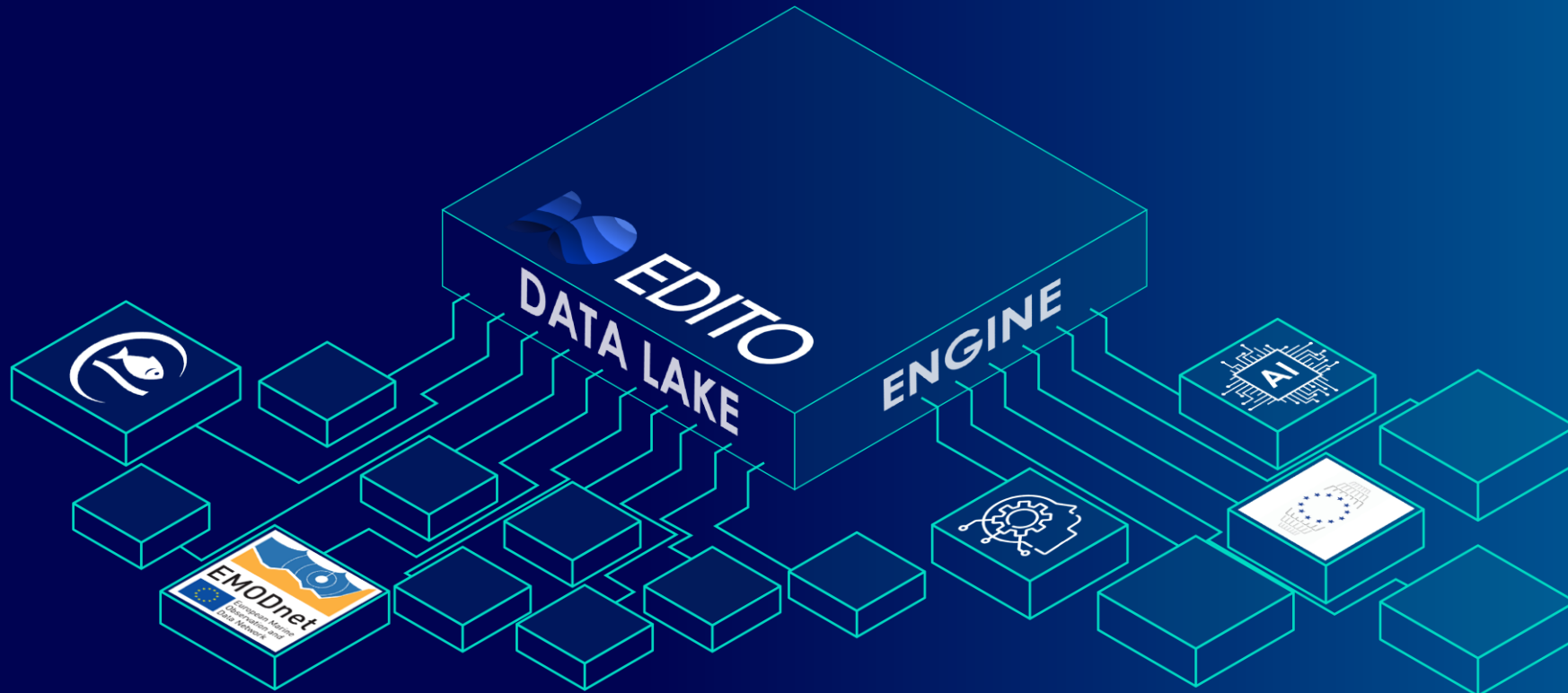


EDITO federated data lake

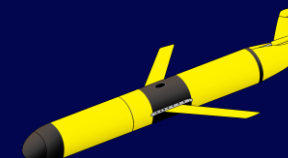
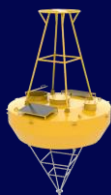
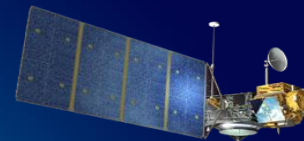


EDITO infra processing engine

for running models, AI Machine Learning, Hybrids models
and applications

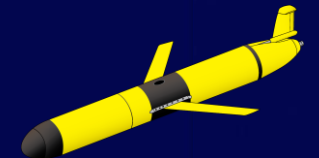
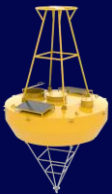
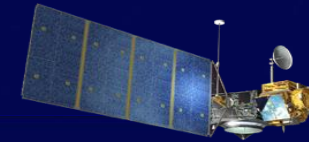






Each Project
brings its:
Data
Tools
Front-Office





EU DTO: the construction

Application to one project

Each Project
brings its:
Data
Tools
Front-Office







The European DTO Offer



Explore

Create



Contribute

The tools for the co-construction

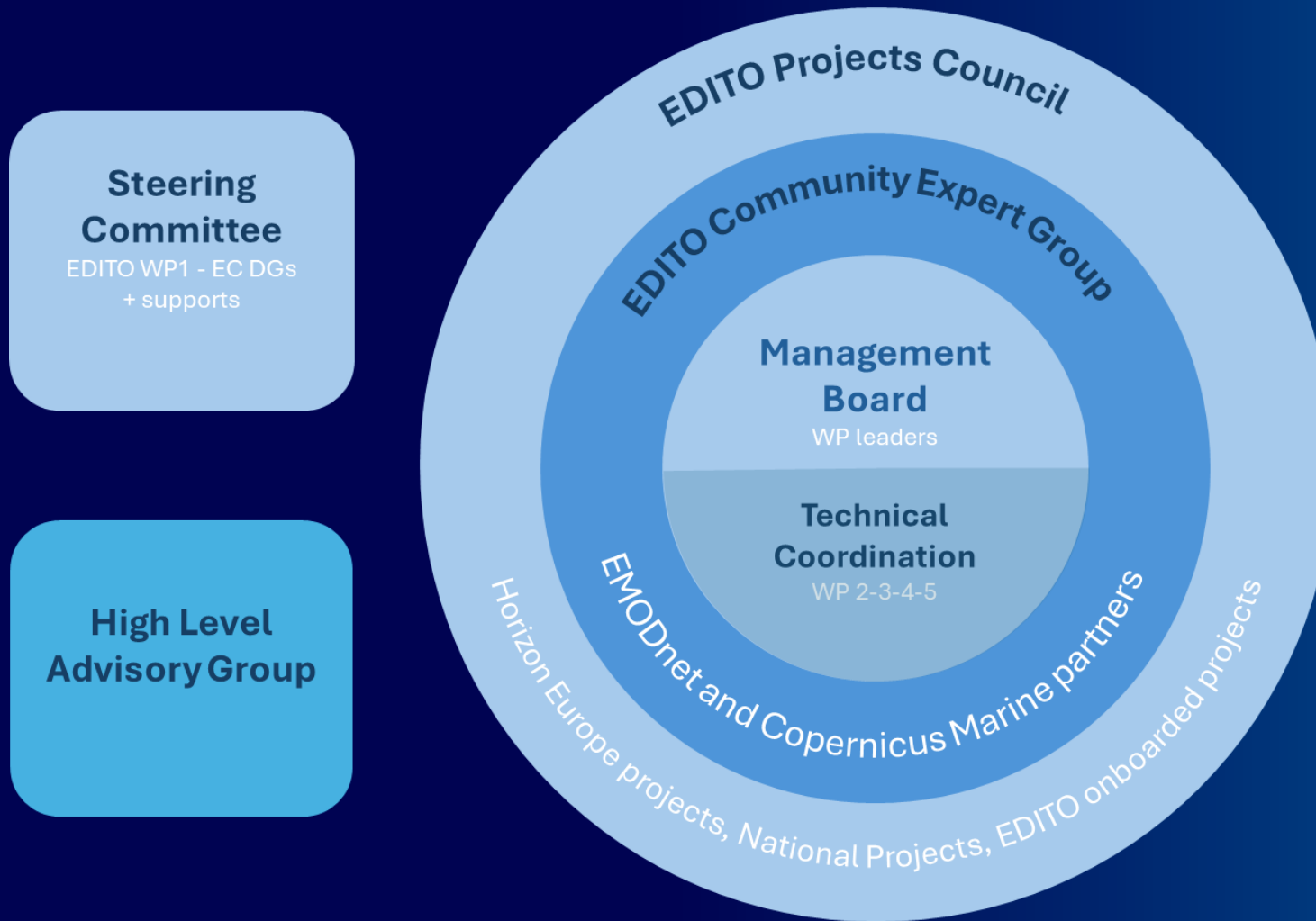


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The European DTO: The CO-Construction



The European DTO: The CO-Construction



For the third year in 2024, the Digital Ocean Forum has gathered the Digital Ocean's European community.

The 3rd edition has unveiled the prototype of the European DTO



2022

First edition in Paris. To gather marine & digital stakeholders, leading projects and initiatives in Europe.



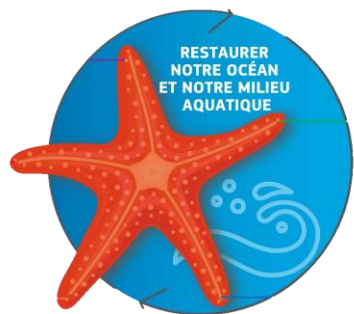
2023

Second edition in Brussels. To start designing a common vocabulary, architecture, infrastructure, offers and services in a community plan.



2024

Third edition in Brussels. To continue the codesign and showcase first demonstrator to High Level EU representatives



Digital Twin Ocean Applications



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.



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.



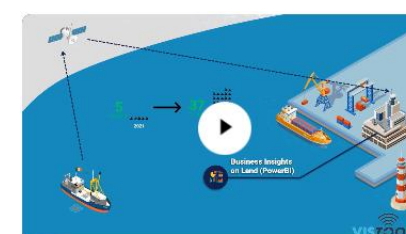
EU DTO - SOCIB application
Early warning system for extreme events

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



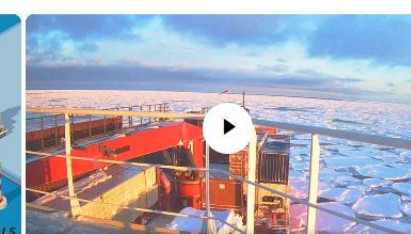
EU DTO - LISCOAST application
Assessing weather-related and socioeconomic impacts in coastal areas in present and future climates

Large-scale sea-level and coastal assessment tool to quantify coastal hazard, exposure and vulnerability and assess consequent risks.



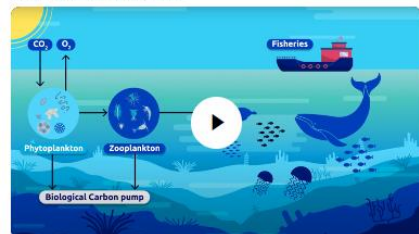
EU DTO - ILVO/ ILIAD application
Digital twinning for sustainable fisheries management

Digital twin tool combining high quality data from fishing vessels to allow real time fish stock, ecosystem evaluation and catch prediction.



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



EU DTO - Blue Cloud 2025 application
An application to support marine biodiversity conservation



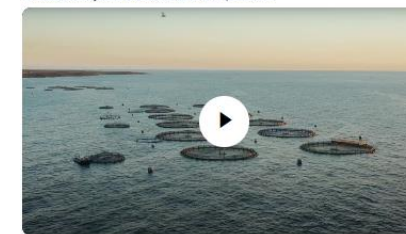
EU DTO - BIODIVER-COAST application
Monitoring water quality in support of aquaculture and biodiversity restoration



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



EU DTO - ILIAD application
An immersive ocean for marine resource management



EU DTO - PIPELINE DTO application
Improving coastal monitoring and forecasting

Improving marine data and forecasts for the Portuguese coastal waters in support of national and EU policy and directives.



SILICONHAGEN virtual reality application
Using virtual reality to raise awareness on marine plastic

Immersive virtual reality experience to support ocean literacy actions on marine plastic pollution.

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>

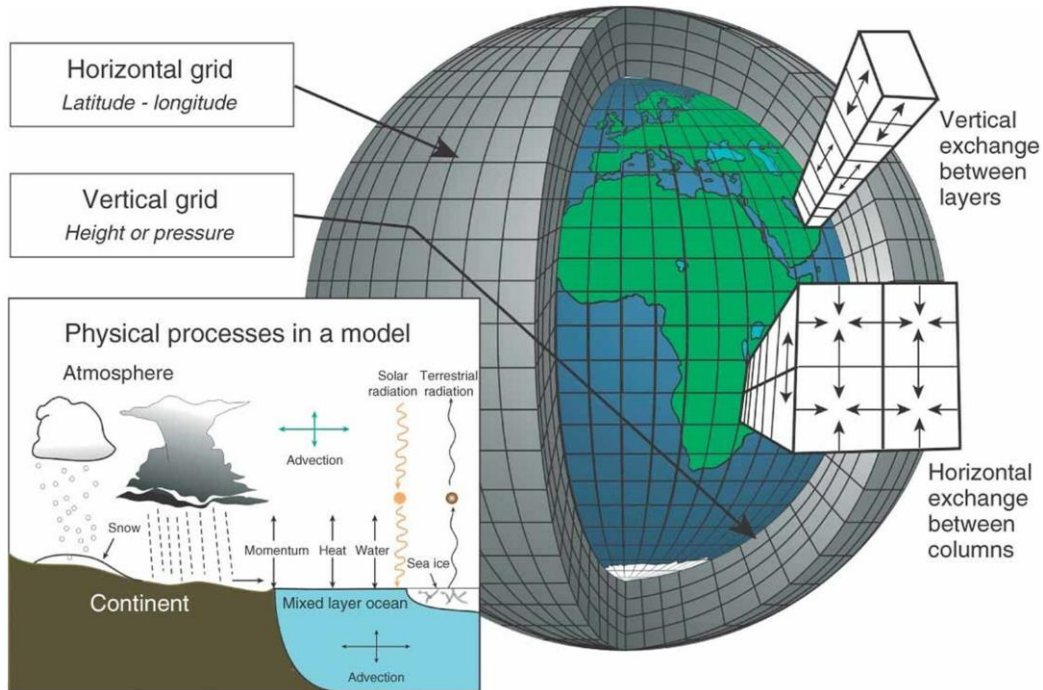
AI and DTO for Ocean Modelling



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GLONET Global AI-Forecasting System

Classical Global Ocean models Forecast

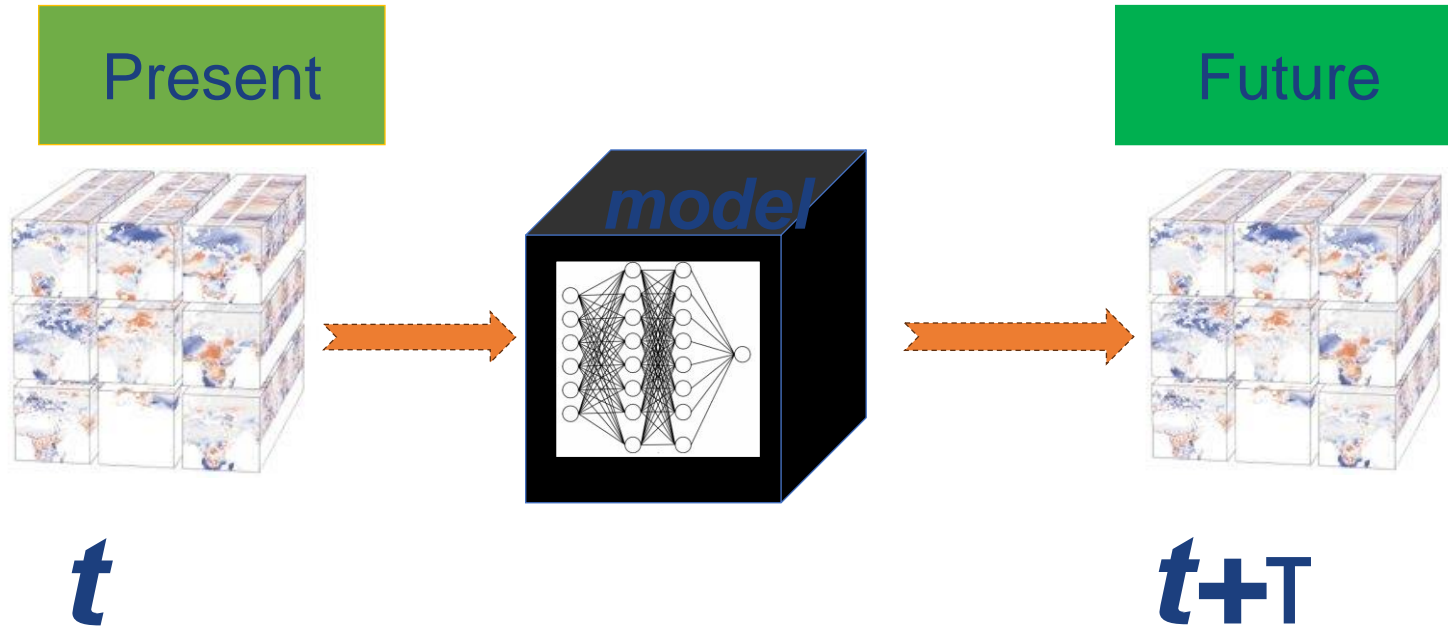


- Can be used for a wide range of tasks
- Trustworthy

- Computationally expensive
- Memory Intensive
- **Difficult to improve given more data**

GLONET Global AI-Forecasting System

AI-Forecasting model



- Competitive accuracies
- Fast prediction
- Performance improves given more data
- Learn more complex patterns not representable by equations

- Lack the versatility of numerical methods

GLONET Global AI-Forecasting System

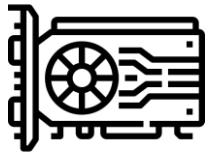
At Mercator

Physics Models

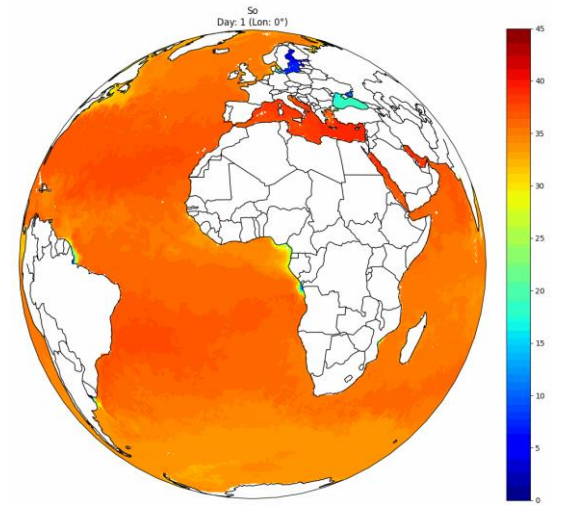
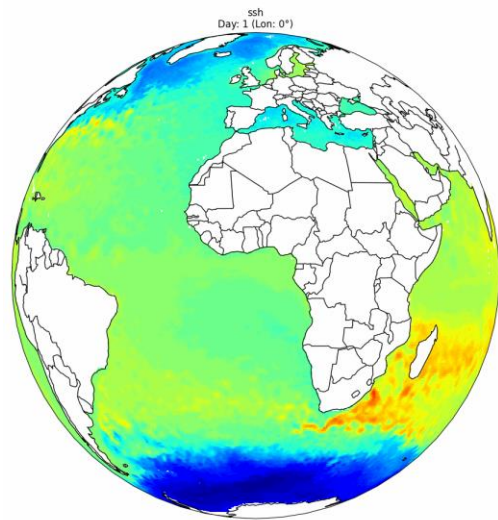
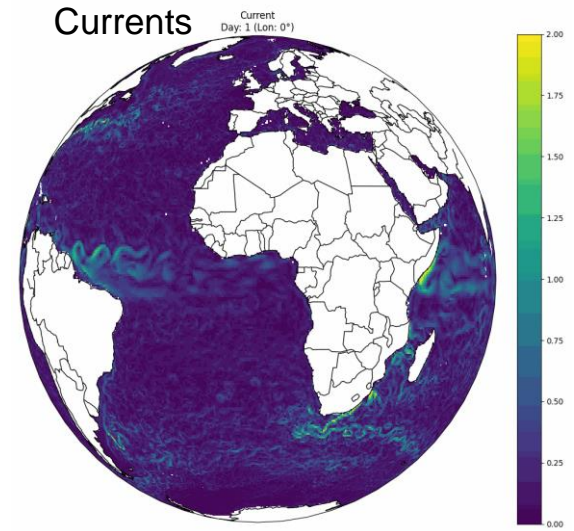
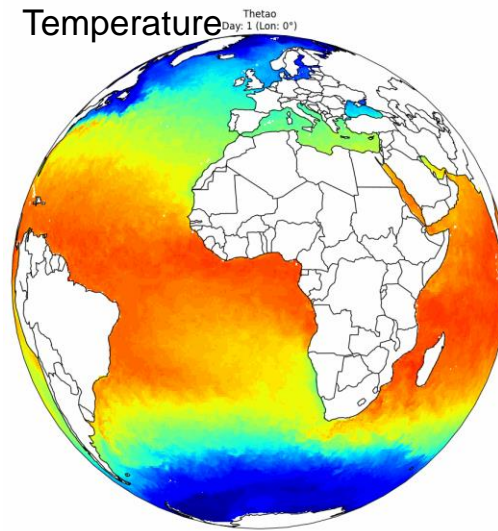
Forecast(daily):
Hours, days

AI Models

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



Glonet new
forecast



SSH

So



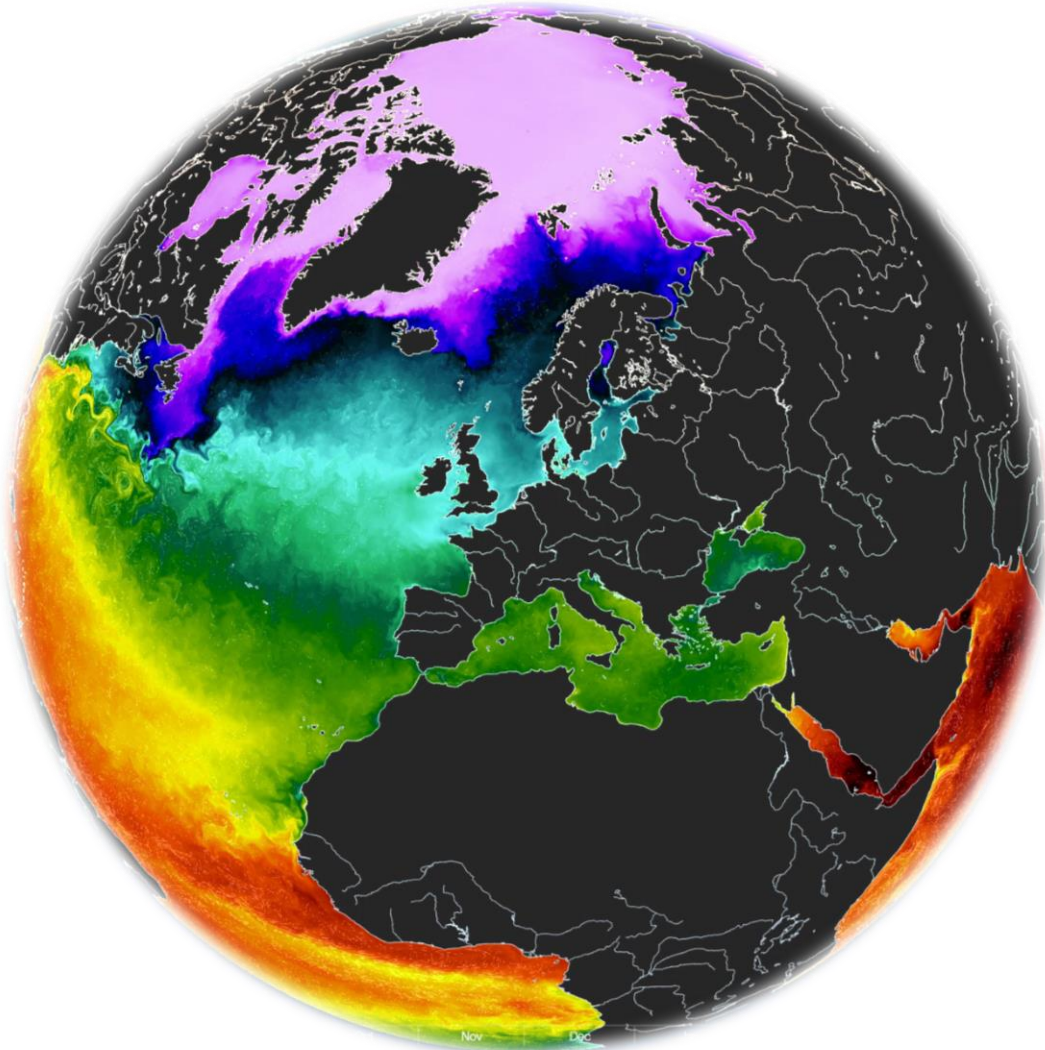
EUROPEAN UNION

What is the EUROPEAN DIGITAL TWIN OF THE OCEAN



EU
MISSIONS

RESTORE OUR OCEAN & WATERS



What NOW?

Real-time monitoring of ocean conditions using data from satellites, in-situ sensors and models.

What NEXT?

Forecasting of ocean dynamics using state of the art modeling based on current data trends

What IF?

Advanced simulations and scenario modeling to assess future impacts and adaptation strategies helping citizens and stakeholders enhance ocean sustainability and resilience.

Better decision-making

CONCLUSION



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Conclusion

- A real momentum in Europe for a DTO
- The European Commission is committed
- Mercator Ocean has contributed to federate the marine&digital community and will lead with VLIZ 3 projects, « **EDITO Infra** » developing the Infrastructure, « **EDITO Model Lab** » for model innovation, « **EDITO 2** » Scaling up the concept.
- The design of the European DTO is collaborative and distributed (from a core-twin to many twins of the ocean)
- The UN Decade (DITTO and OceanPrediction) is a natural framework for international cooperation

An **inclusive**
community of
European experts,
ready to commit



END

Thank you for your attention



#MissionOcean #DOF24 #EUDTO #edito_dto