



Copernicus
Marine Service



**MERCATOR
OCEAN**
INTERNATIONAL

Planes de desarrollo del programa Copernicus, Oportunidades para iniciativas Regionales integradas en Europa

Enrique Alvarez Fanjul

Transitioning to an intergovernmental organization

A pathway from 2022 to 2025:



2022, Portugal



2025, France



11 Feb 2022, Brest, France

The 6 governments from France, Italy, Norway, Portugal, Spain and United Kingdom, with the European Commission and IOC-UNESCO as observers,

- decided to transform the Mercator Ocean International organisation into an intergovernmental organisation (IGO) devoted to ocean prediction,
- called on other States to join,
- adopted a 3-year roadmap with the **2025 UN Ocean conference as a milestone.**

The purpose of the IGO shall be based on research, to design, develop and operate world-class Digital Ocean Systems encompassing marine physics, biogeochemistry and ecosystems and to provide authoritative Digital Ocean Information Services of general interest to Member States and international ocean governance, including operational ocean forecast services.



A governance change:



IGO Delegates, Lisbon, June 2022



IGO Delegates, Bergen, September 2023



IGO Delegates, Paris, February 2024

1. To **develop** further and **facilitate** the opening of Mercator Ocean governance to be **representative of ocean prediction** in Europe and beyond

2. To better **support** the **European Commission** and the UNESCO-IOC in the implementation of their programs, with a competent intergovernmental organisation fully **devoted to ocean digital ocean systems** knowledge and operations

3. To **foster** inter-governmental and **international agreements** required for a further **development** of ocean prediction worldwide through **national capacities**, e.g. on data sharing standards and interoperability protocols.

Drivers – Copernicus Marine

Increasing needs of ocean monitoring and prediction capabilities

- To understand, predict and adapt to climate change
- For a sustainable management of the ocean
- To protect marine ecosystems and biodiversity



The Ocean higher than ever in the political agenda

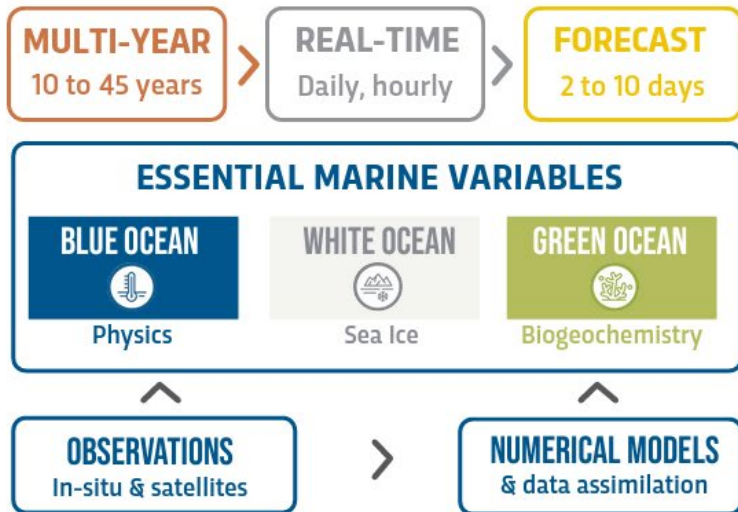
- Europe : Green Deal, Digital Strategy, Mission Ocean
- International: UN Ocean Conference, UN Decade, COP

Observe, model, predict to inform and act

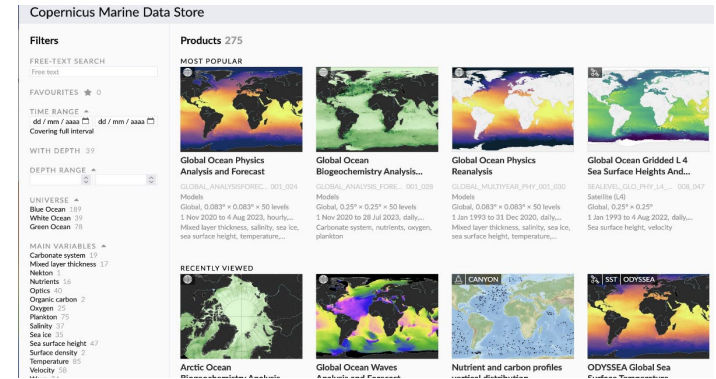
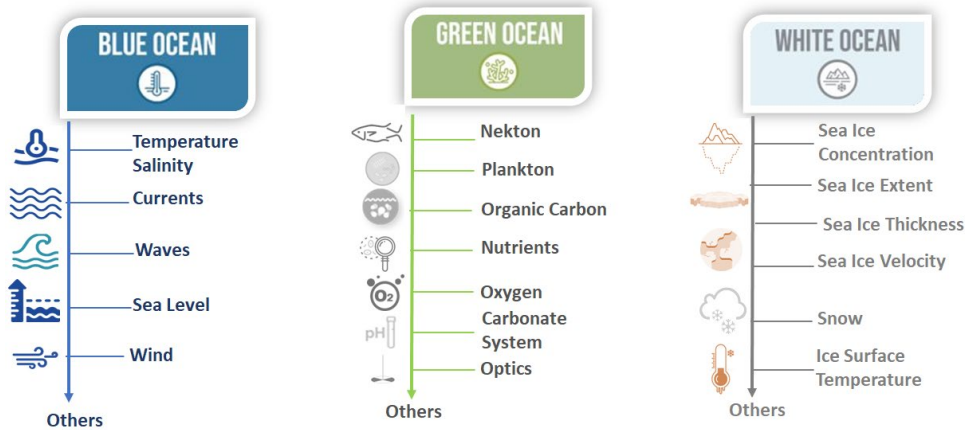
Global and Regional Ocean Monitoring and Forecasting

COPERNICUS MARINE REGIONAL OCEAN PRODUCT DIVISIONS

- 1 Global Ocean
- 2 Arctic Ocean
- 3 Baltic Sea
- 4 European North West Shelf Seas
- 5 Iberian Biscay Ireland Seas
- 6 Mediterranean Sea
- 7 Black Sea



Copernicus Marine Offer : Observation and Model products



- ❑ Observation products and model products
- ❑ Access to products: a cloud-based infrastructure – The Copernicus Marine Data Store.
- ❑ Description of each product - information on quality
- ❑ Service desk / expert advice

● Copernicus Marine 2021 - 2028

An ambition plan aligned with the EU Green Deal and Digital Strategies

Remain a marine reference worldwide. Foster User Uptake

Staged implementation driven by user&policy needs and science&technology advances

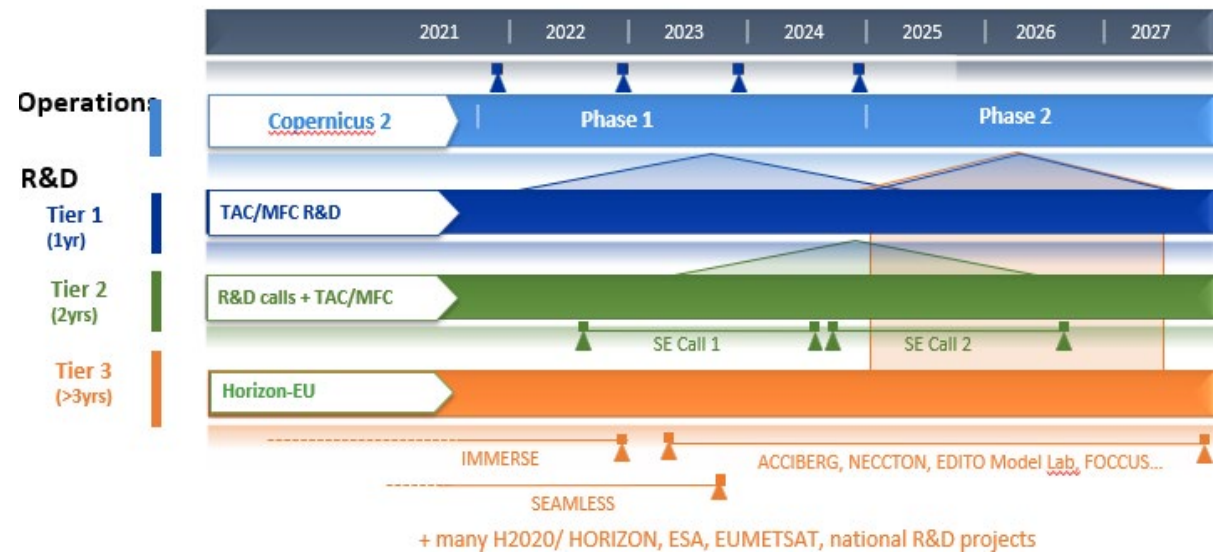
- ❑ **Continuity of service** with incremental evolution.
- ❑ Embrace the **new capabilities of digital services**. Synergy with Digital Twin Ocean.
- ❑ **International cooperation & impact (UN Decade)**

Service Evolution activities : R&D Streams

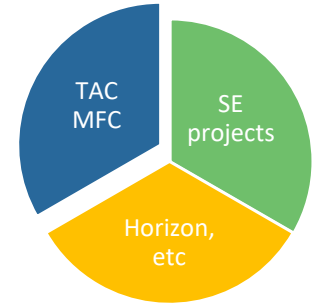
Document prepared by the Copernicus Marine Scientific and Technical Advisory Committee (STAC)



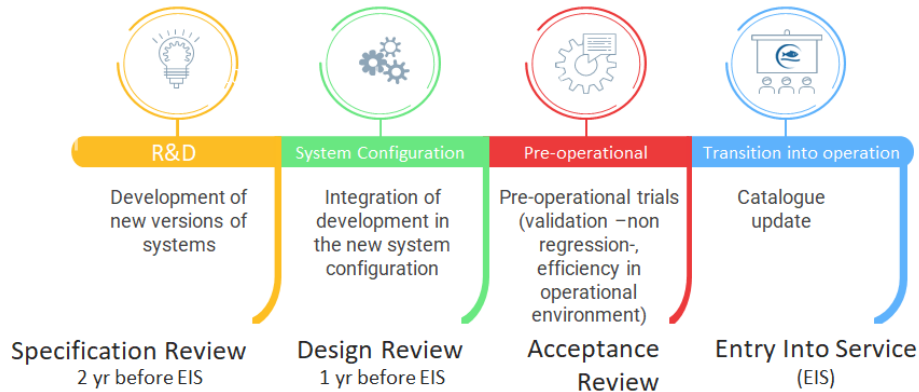
3 Streams defined with different time horizons, players and objectives

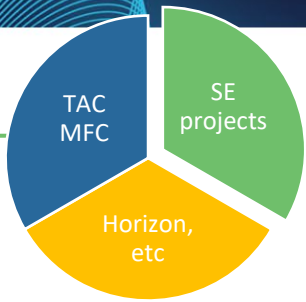


Tier 1 – Short term evolutions : 1 yr



- Addressed within Copernicus Marine through **production centres (TACs, MFCs)** activities resulting in regular updates of the catalogue
- **Research-to-operation process** → System/product evolutions managed with a series of formal reviews





Tier 2 - Mid-term evolutions : 2-3 yrs



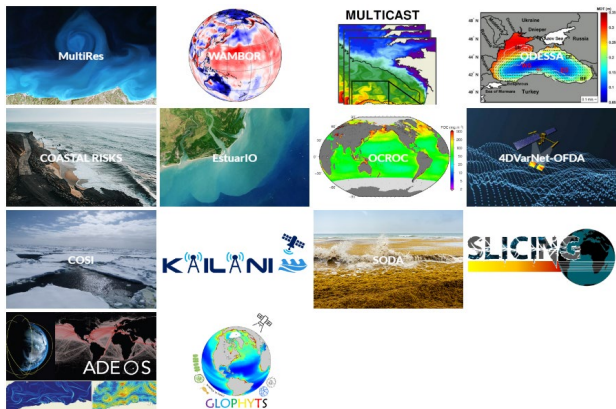
- Addressed within Copernicus Marine both through production centres (TACs, MFCs) activities and **open R&D Service Evolution calls**
- Covering topics defined in the **Copernicus Marine Service Evolution Strategy: R&D priorities** document
- R&D Service Evolution projects : **significant results in less than 2 years**; potential of **concretely improving the operational service in ~3 years**
- **Strong coordination** needed between R&D Service Evolution projects and production centres (TACs, MFCs)

Tier 2 – 1st call in Copernicus 2

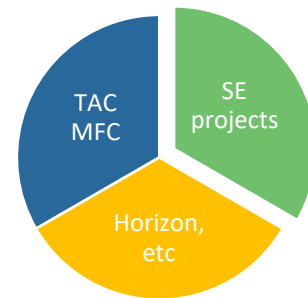
→ 14 R&D projects selected

July 2022 -> August 2024

Uptake in Copernicus Marine in following years



<https://marine.copernicus.eu/about/research-development-projects>



• New/Improved products:

- HR/multiresolution coastal OC products (S2&S3) (**MultiRes**)
- POC/DOC surface products for coastal/global ocean (**OCROC**)
- Long timeseries of Phytoplankton Functional Types (**GLOPHYTS**)
- Detection of Sargassum algae (**SODA**)
- Ocean mass from GRACE (+Alti/Argo); Freshwater fluxes (**WAMBOR**)
- Next generation of sea level products (incl. SWOT) (**SLICING**, **4DVarNet**)
- Ocean surface currents from AIS data (**ADEOS**)

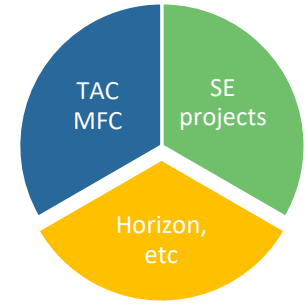
• Upgrading/Preparing the next generation of operational systems:

- Advanced data assimilation methodologies (incl. ensemble based, multi-grid) (**ODESSA**, **MULTICAST**)
- Calibration of sea-ice forecasts (**COSI**)
- Coastal zone monitoring (incl. river-ocean interface, wave modelling, risks assessment) (**EstuariO**, **KAILANI**, **Coastal-risks**)

A second call has been issued in January 2024 and is under evaluation

Tier 3 - Long-term evolutions : > 3 yrs

- Required to prepare major evolutions. Addressed externally, with strong links with e.g. H2020/HORIZON Europe/dedicated **HORIZON Copernicus Marine Evolution calls** (expression of needs provided by MOi), ESA, EUMETSAT, national projects.
- Require high-level coordination to prepare and ensure an efficient uptake.



Digital Twins of the Ocean in a nutshell



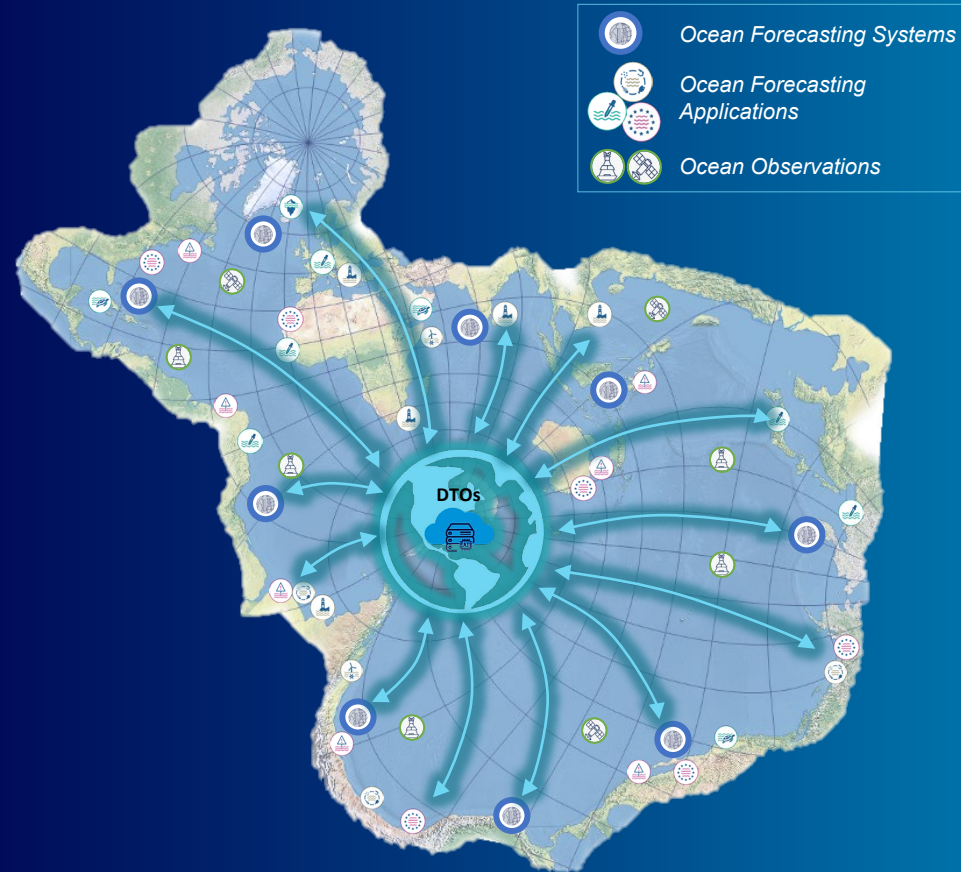
A Digital Twin Ocean offers a virtual depiction of the ocean: it aims at being a consistent, high-resolution, multi-dimensional and near real-time virtual representation of the ocean, combining ocean observations, artificial intelligence, advanced modelling, operating on high-performance computers and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

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 provides an architectural basis for the interconnection of assets



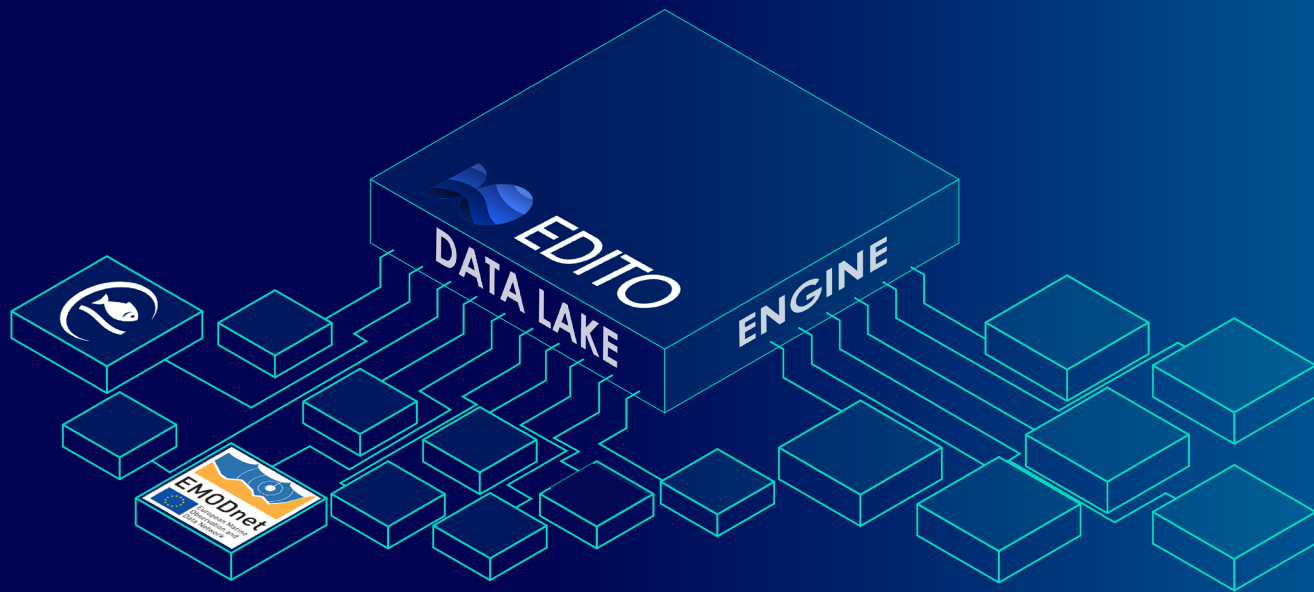
EDITO sets up a federated data lake



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



In addition, EDITO offers a processing engine



EU Digital Twin of the Ocean

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



EU Digital Twin of the Ocean



EU Digital Twin of the Ocean



The European DTO Offer



Explore

Create



Contribute

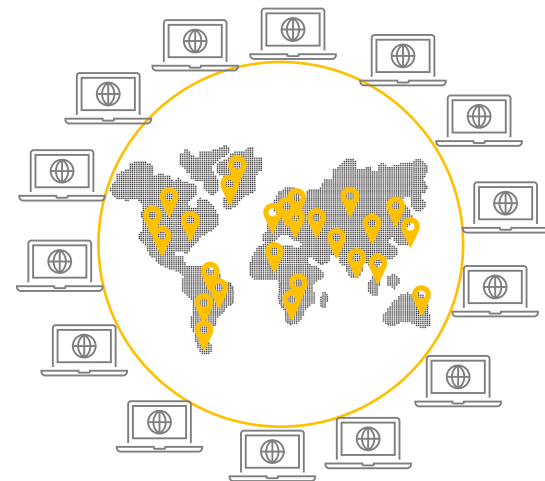
2020: THE OCEAN FORECAST WE HAVE



- Useful but partially disconnected services
- Poor presence in developing countries

OceanPrediction DCC VESSEL

Captain: UN Ocean Decade
Chief engineer: Decade actions and DTO
Crew: OceanPrediction DCC community
Navigator: OceanPrediction DCC



- Connected community and services
- Many robust systems worldwide



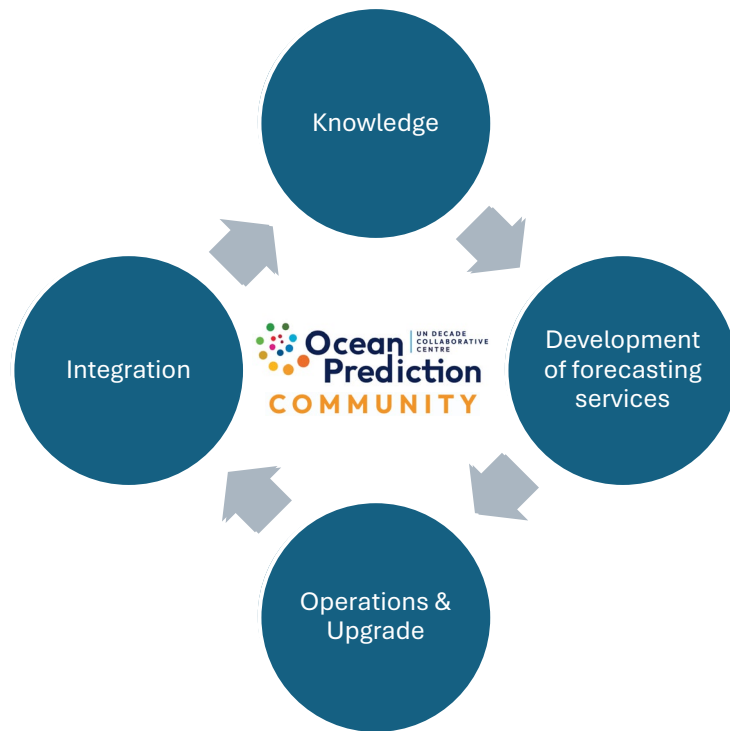
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 2030 United Nations Decade
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The ocean forecasting we need

- OceanPrediction DCC is promoting collaboration towards the ocean forecasting we need.
- A virtuous loop implemented by our community
- OceanPrediction DCC is building the assets to make it possible



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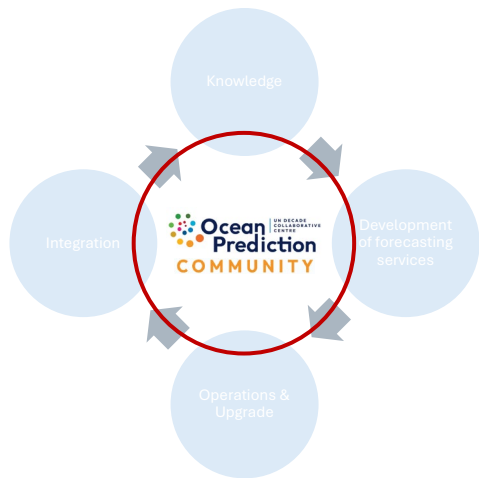
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Connecting the world around Ocean Prediction: *A vision for the Decade and Beyond*

Building a community with our Regional Teams



<https://www.unoceanprediction.org/e>



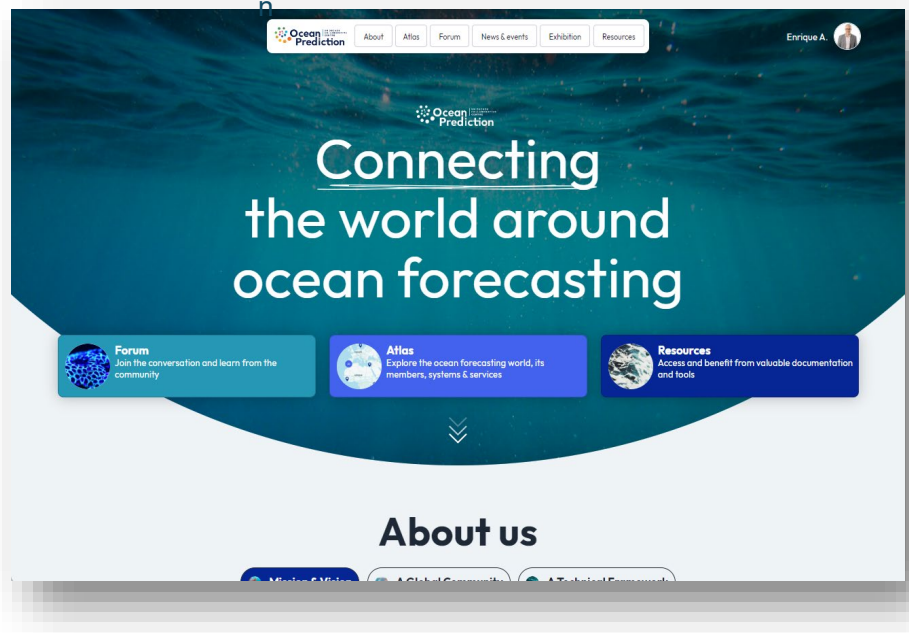
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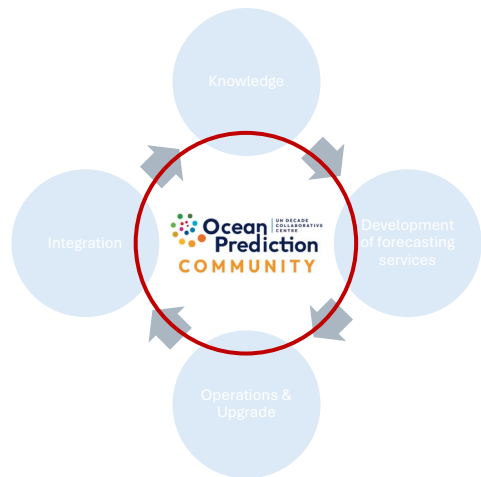


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Building a community with our Regional Teams



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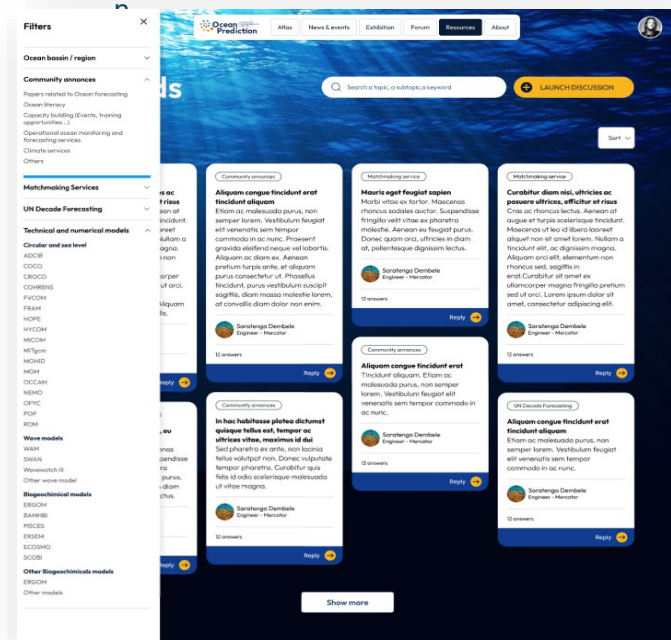
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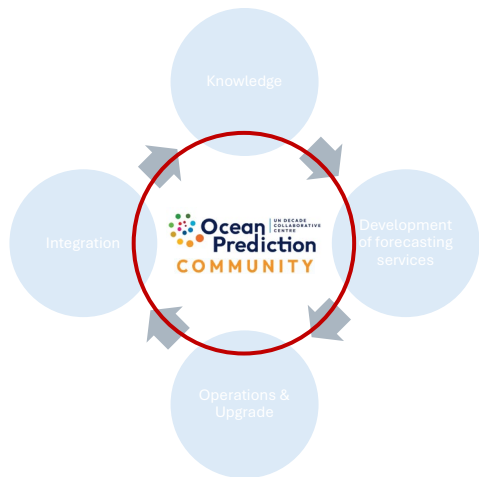
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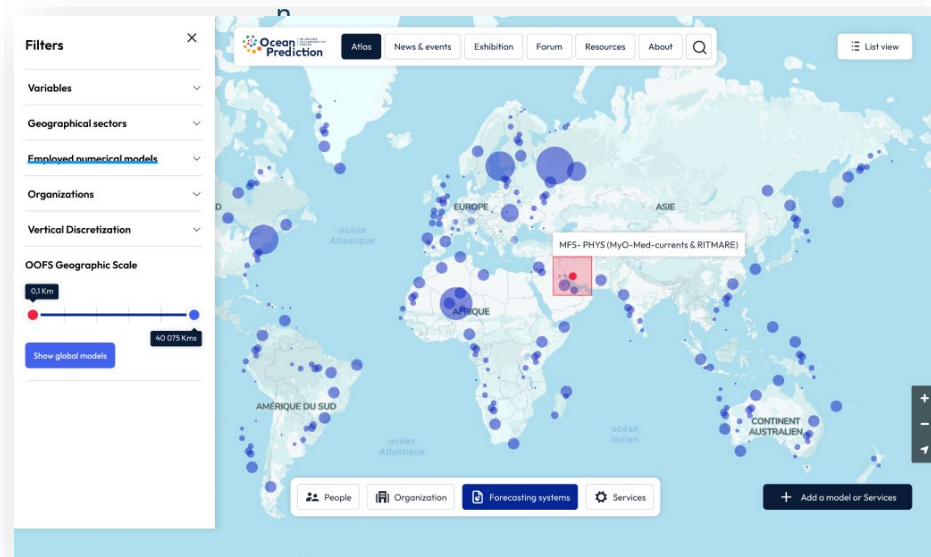
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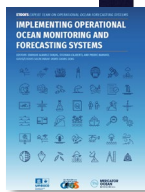
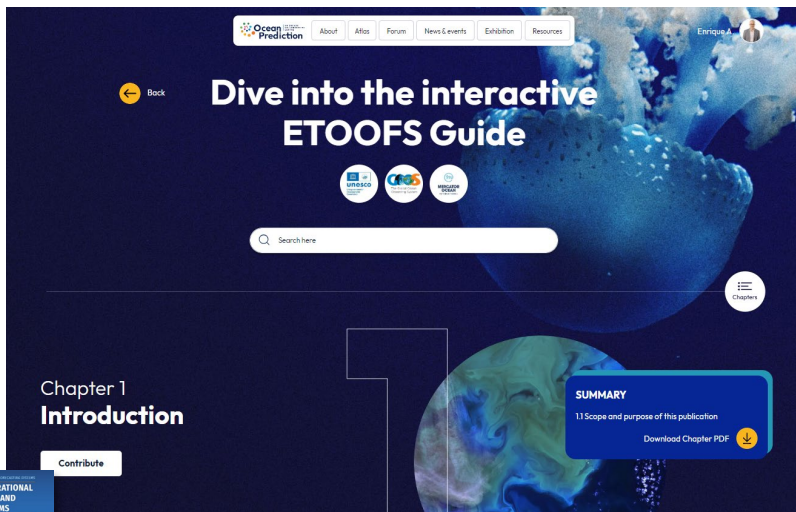
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Building our shared knowledge



<https://www.unoceanprediction.org/en/resources/etoofs-guide>



- A community compilation of our shared knowledge
- Now available on wiki format



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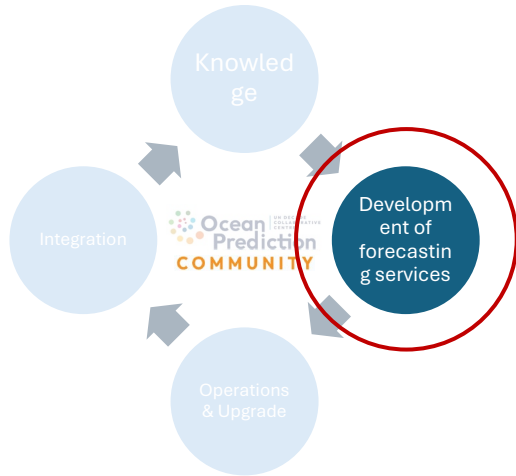
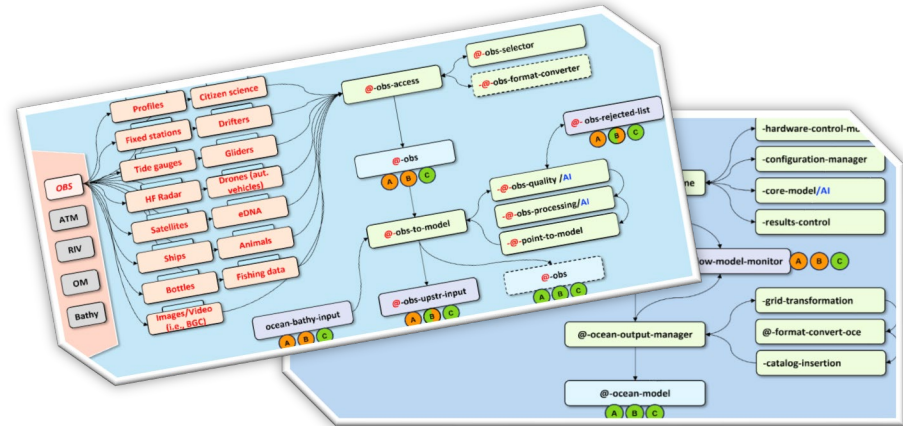


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Building robust Ocean forecasting services



<https://www.unoceanprediction.org/en/resources/architecture>



- A community product to be delivered soon by OceanPrediction DCC
- A practical Guide on how to “wire” a Forecasting System
- A definition of the tools and data standards to be developed during the Decade



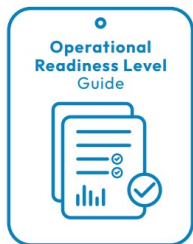
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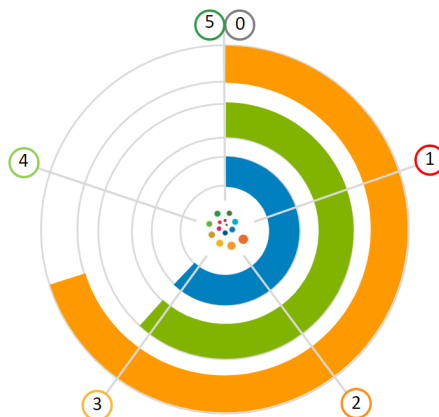


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Operating and improving Ocean forecasting services



<https://www.unoceanprediction.org/en/resources/orl>



#1: Production

The first digit - #1 - reflects the reliability of the service, focusing on operational aspects rather than product quality.

#2: System Validation

The second digit - #2 - monitors the level of validation for the service.

#3: Product Dissemination

The third digit - #3 - assesses the various degrees of product dissemination achievable by the system.

- A mechanism to introduce best practices
- A way to promote the evolution of the ocean forecasting
- A mechanism to endorse services to join common frameworks



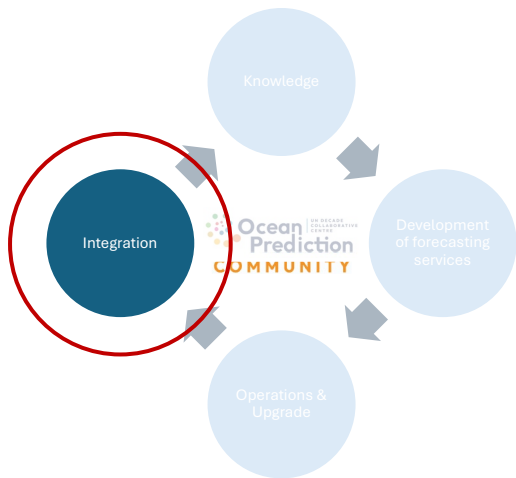
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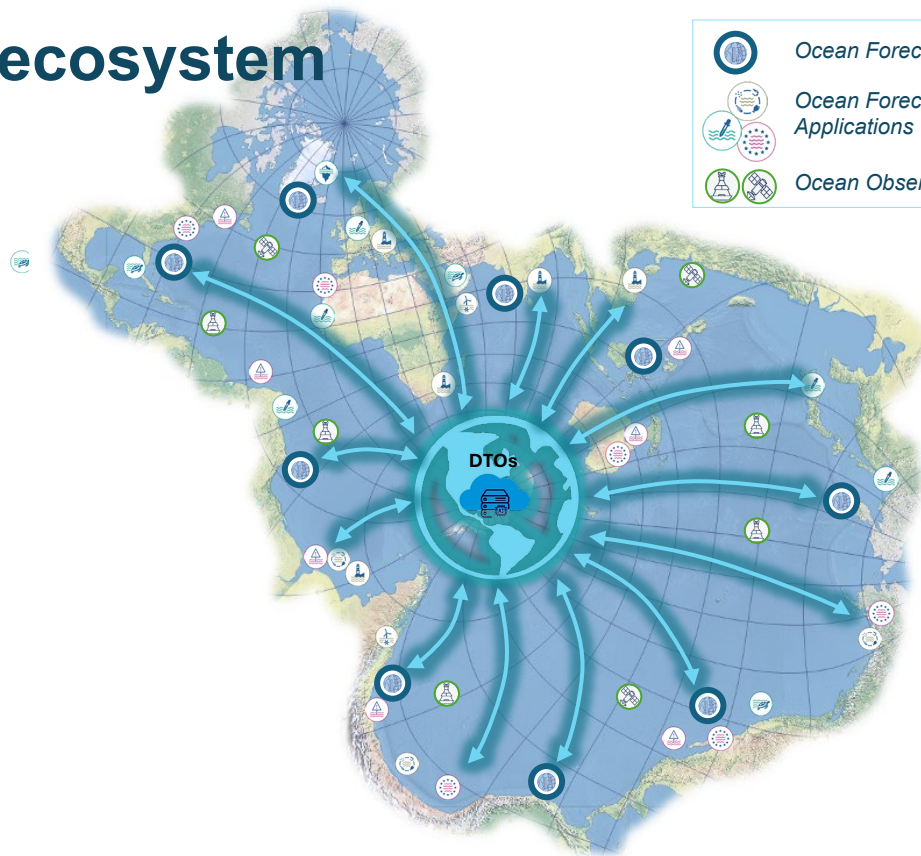
One ocean, one digital ecosystem



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Connecting the world around Ocean Prediction: *A vision for the Decade and Beyond*

Conclusions

- Mercator Ocean International will soon be converted into an IGO
- Copernicus Marine, with the participation of CESGA, is a world-class service
- The evolution is granted via Tier 1 to 3 activities
- European Digital Twin will be at the core of data exploitation
- The connection with the rest of the world is being carried out via the OceanPrediction DCC



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