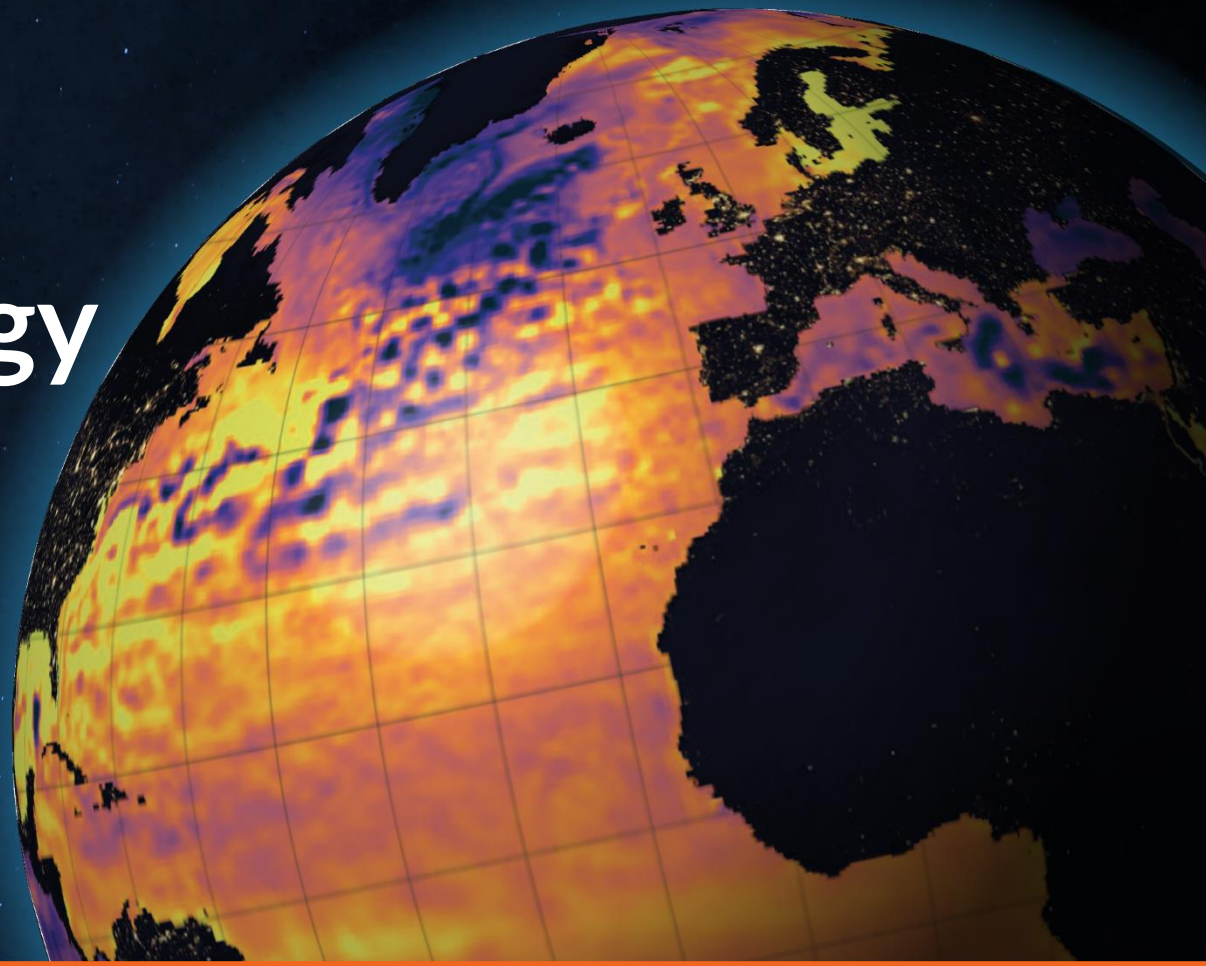
Ocean Predict

SYMPOSIUM OP'24

In partnership with unesco Intergovernmental Oceanographic Commission

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Copernicus Marine – Service Evolution Strategy



Stéphanie Guinehut, Angélique Melet and Pierre-Yves Le Traon

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PROGRAMME OF THE EUROPEAN UNION

Copernicus Europe's eyes on Earth

implemented by MERCATOR OCEAN INTERNATIONAL

Copernicus Marine Service

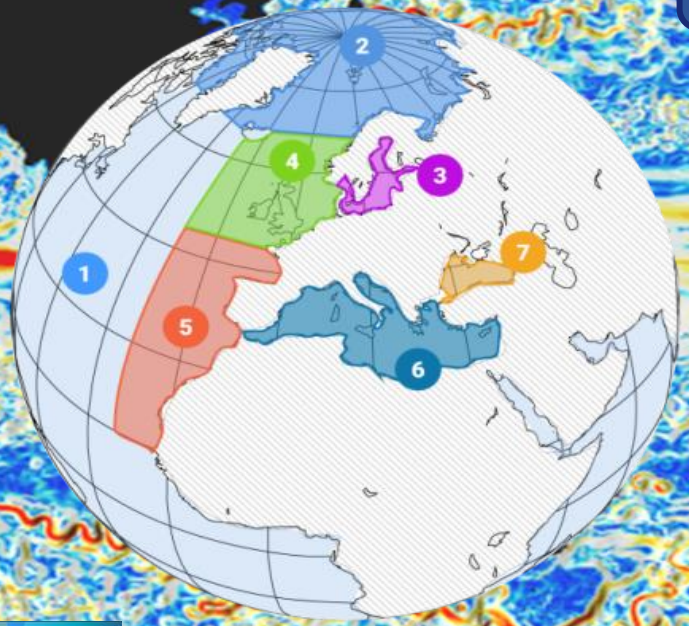
The EU Copernicus Marine Service

Global & Regional Ocean Monitoring and Forecasting

MULTI-YEAR
10 to 45 years

REAL-TIME
Daily, hourly

FORECAST
2 to 10 days

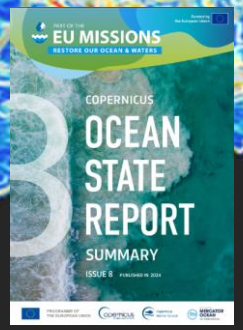


ESSENTIAL OCEAN VARIABLES

BLUE OCEAN	WHITE OCEAN	GREEN OCEAN
Physics	Sea Ice	Biogeochemistry

OBSERVATIONS
In situ **& Satellites**

NUMERICAL MODELS
& data assimilation



1 Global
2 Arctic
3 Baltic
4 NWS
5 IBI
6 Med Sea
7 Black Sea

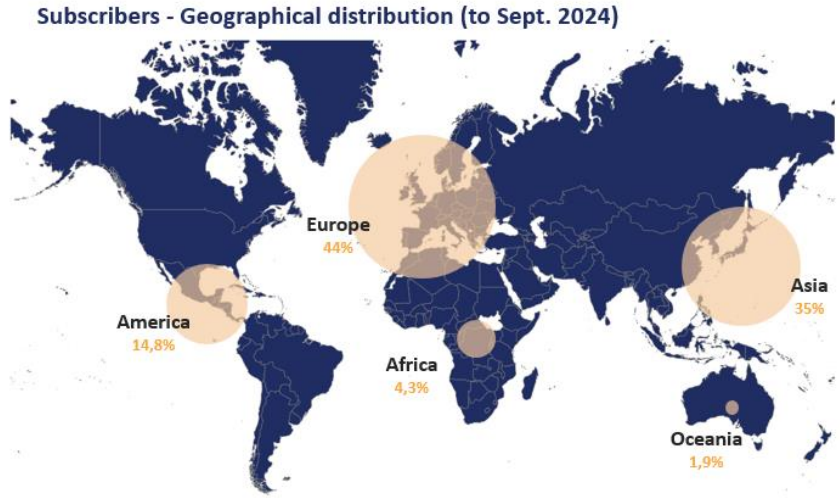
marine.copernicus.eu

Free and Open

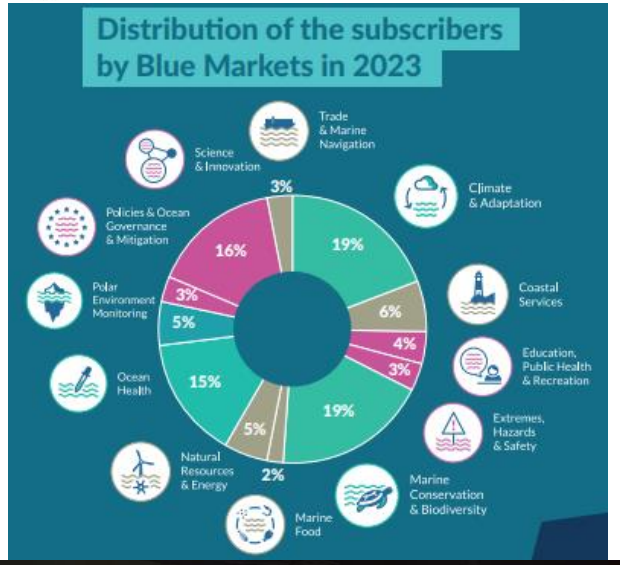
Users, Applications and User Uptake

85 000 registered users
~1,5 million visits on marine.copernicus.eu

A wide range of applications covering all sectors of the blue economy (environment, society, economy)
Support to EU policies (Green Deal)



1 POLAR ENVIRONMENT MONITORING
2 CLIMATE & ADAPTATION
3 OCEAN HEALTH
4 MARINE CONSERVATION & BIODIVERSITY
5 SCIENCE & INNOVATION
6 POLICIES & OCEAN GOVERNANCE & MITIGATION
7 EDUCATION, PUBLIC HEALTH & RECREATION
8 EXTREMES, HAZARDS & SAFETY
9 MARINE FOOD
10 COASTAL SERVICES
11 TRADE & MARINE NAVIGATION
12 NATURAL RESOURCES & ENERGY



https://marine.copernicus.eu/news/release-copernicus-marine-user-uptake-2023-kpi-report

Continuously evolving Service

BLUE OCEAN
Currents, temperature, waves, sea level, ...

WHITE OCEAN
Ice coverage, velocity, concentration, Icebergs ...

GREEN OCEAN
CO2, nutrients, oxygen, primary production, ...

Copernicus Marine Service in COPERNICUS 2 :

Regular incremental improvements to the current Offer
+ a series of major evolutions

Coastal
- Coastal Hub
- New products (bathy, HR winds, SL, OC,...)
- FOCCUS

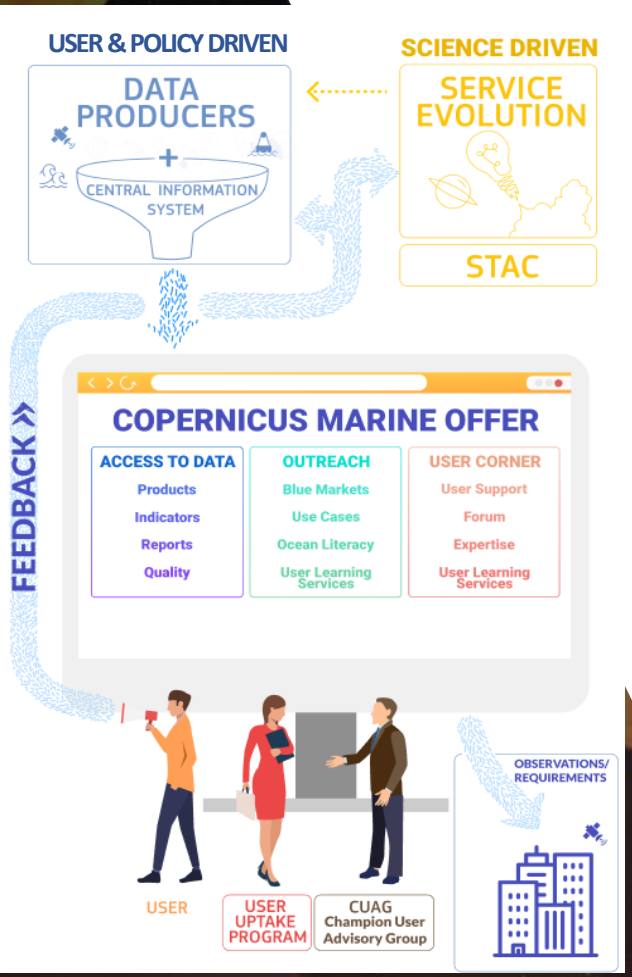
Arctic
- New HR products at pan-Arctic scale
- ACCIBERG

Marine Biology
- New products (POC, DOC, PFTs,...)
- NECCTON

Ocean Climate
- Long reanalyses
- SEACLIM

Digital services
- EDITO (ModelLab & Infra)

Service Evolution principles



A user, policy, science driven, continuously evolving service to remain state-of-the-art and a leading service for Copernicus

- The **continuous improvement approach is applicable to all Copernicus Marine Service elements**: production centers, marine data store, web & service
- **User & policy driven:** user feedbacks & policy needs are monitored and translated into service/products evolution objectives. **Guidance** from our **Champion User Advisory Group (CUAG)**

  *Co-design with users – Valentina, Thursday, Room II, 11:30
- **Science driven: Scientific** (observations, modelling, assimilation, AI) and **technological** (e.g. cloud and computing capabilities) **advances** are fully taken into account. **Guidance** from our international, independent experts from the **Scientific and Technical Advisory Committee (STAC)**

Copernicus Marine Service

Scientific and Technical Advisory Committee


N. Smith


P. Brasseur


K. Fennel


G. Smith


M. Grégoire


J. Holt


P. De Mey Frémaux


V. Kourafalou


E. Stanev


V. Nieves


A. Storto


A. Bracher

+ observers from other Copernicus Services, ESA, EUMETSAT, EuroGOOS

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Service Evolution strategy: R&D priorities

Document prepared by the STAC

➔ Priority topics covering 8 R&D areas:

- Next generation of integrated ocean forecasting systems
- HR monitoring and forecasting of the blue ocean
- Arctic Ocean: sea-ice analysis, modelling, forecasting
- AI, big data and advanced data products
- Ocean climate products, indicators, projections
- Observations, inputs and sensitivity studies
- Biogeochemistry and marine biology
- Marine coastal environment

https://marine.copernicus.eu/about/service-evolution-strategy

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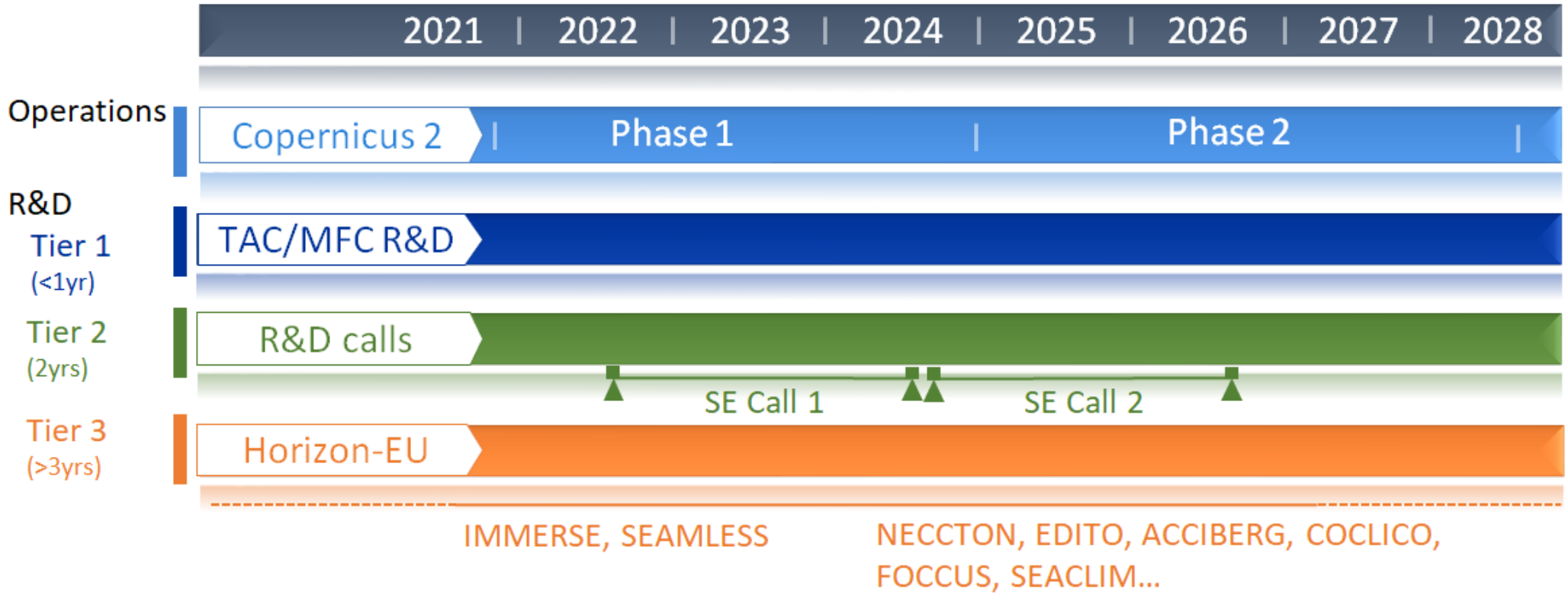
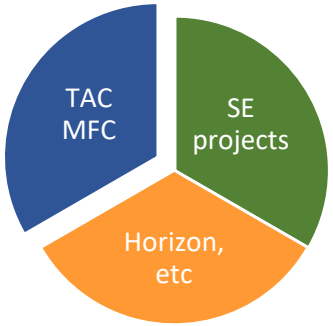
Service Evolution activities: R&D streams

- 3 Streams defined to support Copernicus Marine R&D activities, with different time horizons, players and objectives
- Overall objective: integrate the developments in the operational systems

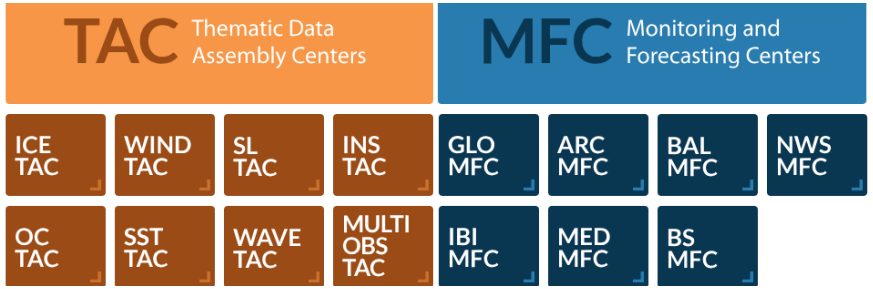


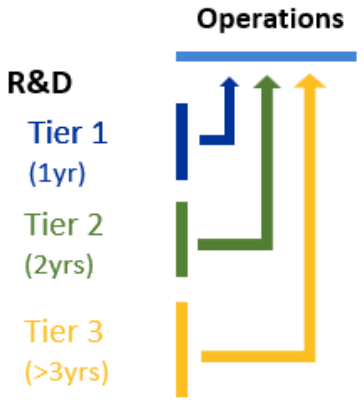


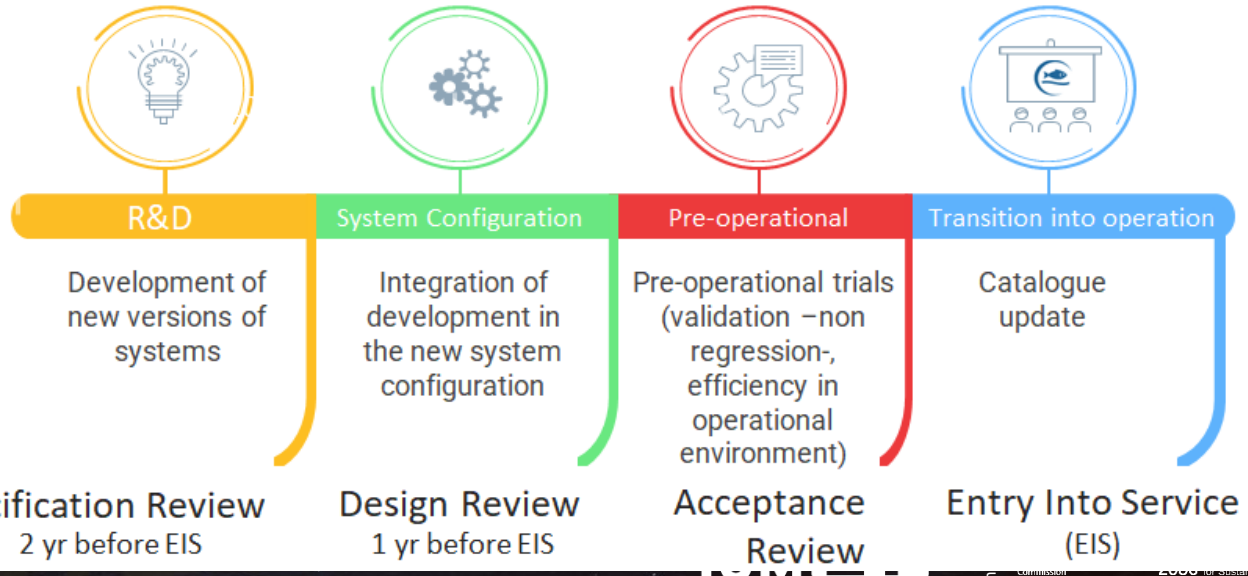
Tier 1 – Short term evolutions : 1 yr

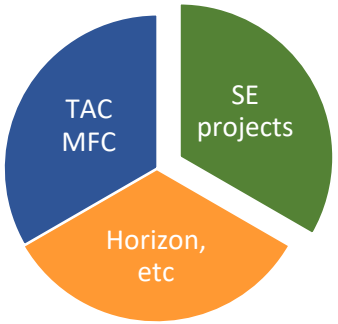
Copernicus Marine Service

- 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





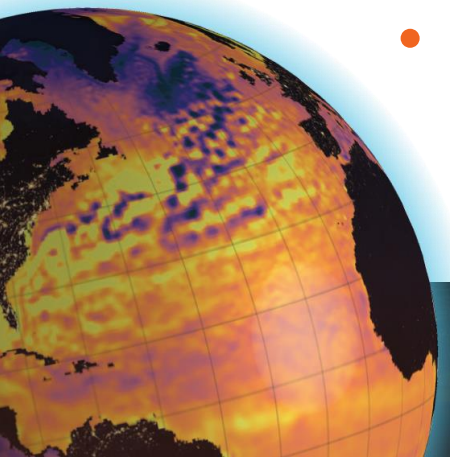


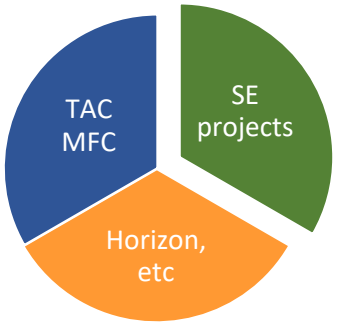


Tier 2 – Mid-term evolutions : 2-3 yrs

Copernicus Marine Service

- 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) to foster the uptake





Tier 2 – 1st call in Copernicus 2

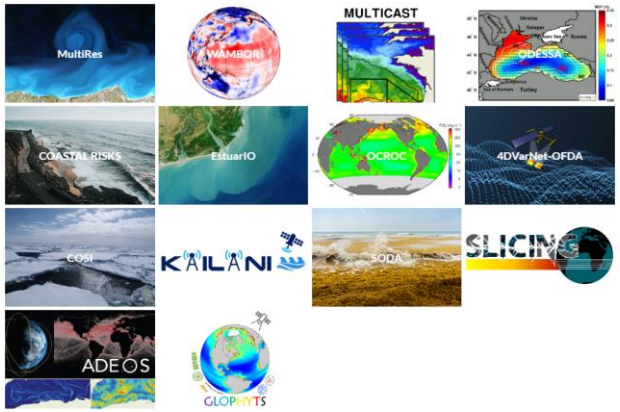
➔ 14 R&D projects selected

- **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)

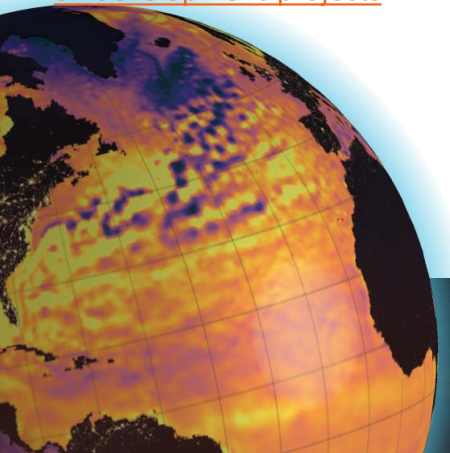
- **Upgrading/Preparing the next generation of operational systems:**
  - Advanced data assimilation methodologies (incl. ensemble based, multi-grid) (ODESSA, MULTICAST)
  - Calibration of sea-ice forecasts (COSI)
  - Coastal zone monitoring (incl. river-ocean interface, wave modelling, risks assessment) (EstuarIO, KAILANI, Coastal-risks)

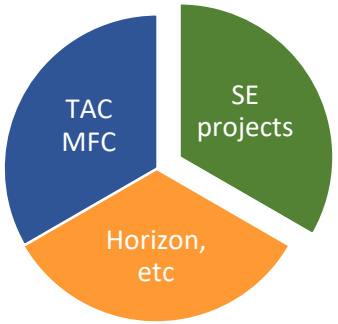
July 2022 -> August 2024

Uptake in Copernicus Marine in following years



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

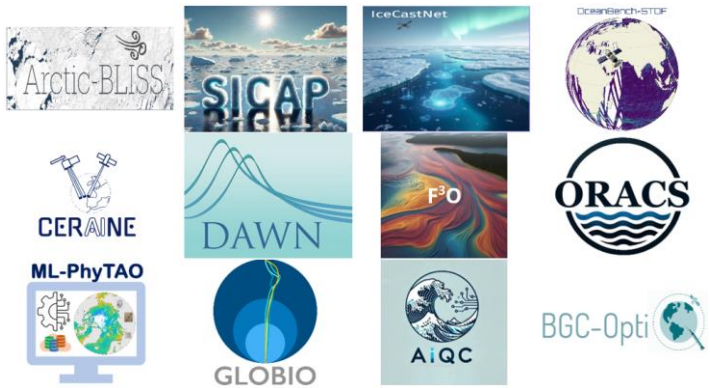




Tier 2 – 2nd call in Copernicus 2

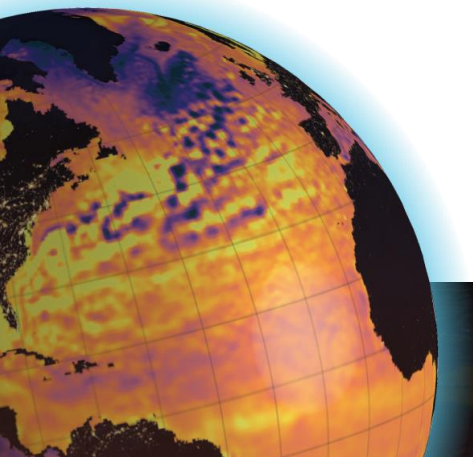
➔ 12 R&D projects selected

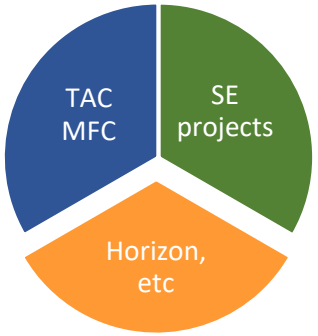
Sept 2024 -> Oct 2026



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

- **New/Improved products:**
  - AI-Enhanced real-time QC of *in-situ* observations (AIQC, BGC-OptiQ)
  - Improved BGC-Argo Chla products (BGC-OptiQ)
  - AI-based synthetic profiles of Chla, nutrients & carbon (GLOBIO)
  - Freshwater fluxes (*in-situ*, GRACE, GloFAS) (F3O)
  - Phytoplankton Functional Types in the Arctic (ML-PhyTAO)
- **Upgrading/Preparing the next generation of operational systems:**
  - Improved Arctic predictions (incl. calibration of sea-ice forecasts, AI-based forecasts, predictability&sensitivity study (SICAP, IceCastNet, Arctic-BLISS))
  - Improved wave modelling (DAWN, CERAINE)
  - AI-based forecasts (IceCastNet, OceanBench-STOF, DAWN)
  - Ocean reanalysis algorithms for climate studies (ORACS)

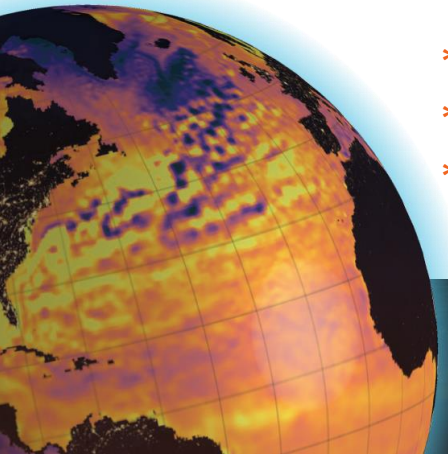




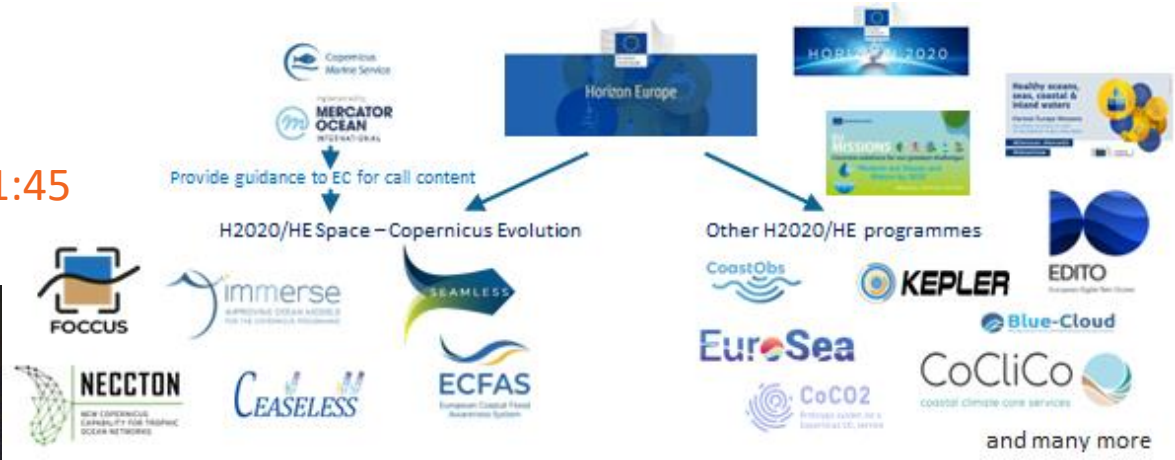
Tier 3 – Long-term evolutions : >3 yrs

Copernicus Marine Service

- 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.

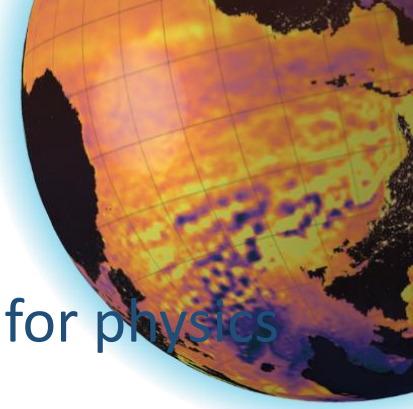


*NECCTON – Stefano, Tuesday, Room IV, 11:00
*FOCCUS – Kelli, poster Tuesday
*EDITO-Model Lab – Yann, Thursday, Room IV, 11:45



Copernicus Marine Service

A continuously evolving product offer



Copernicus Marine Service: An operational state-of-the-art EU marine service for physics (ocean circulation, waves), sea ice, biogeochemistry, low trophic level

Ambition: remain a marine reference worldwide by creating more “marine value” to foster further the service uptake

Staged implementation driven by user & policy needs, science & technological advances:

- **Continuity of service** with incremental evolution
- Embrace the **new capabilities of digital services** in synergy with Digital Twin Ocean development
- Prepare the implementation of the **next generation of ocean and sea ice monitoring and forecasting** systems and new services for **Coastal and Biology**

Supported by the different Tiers (1, 2 and 3) of R&D and the different actors who contribute to them

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Thank you!

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