



The (Copernicus) European monitoring and forecasting services

Thursday 5th June



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How to monitor the Ocean?



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How to monitor the Ocean?



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Mercator Ocean International





PROGRAMME OF THE
EUROPEAN UNION



Earth observation program

Funded by the EU commission and implemented by



FREE REGULAR SYSTEMATIC
information
on the state of ocean



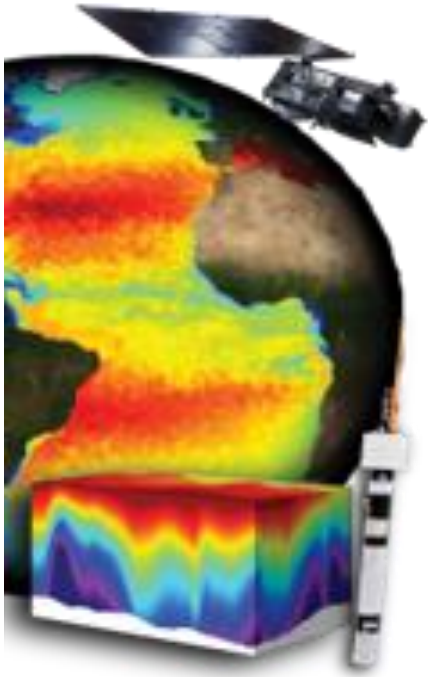
- Temperature
Salinity
- Currents
- Sea Level
- Mixed layer depth
- Waves



- Nekton
- Plankton
- Organic carbon
- Nutrients
- Oxygen
- Carbonate System
- Optics



- Sea Ice Concentration
- Sea Ice Extent
- Sea Ice Thickness
- Sea Ice Type
- Sea Ice Velocity
- Snow thickness
- Sea Ice Albedo
- Sea Ice Age



<https://marine.copernicus.eu>

<https://www.copernicus.eu/>

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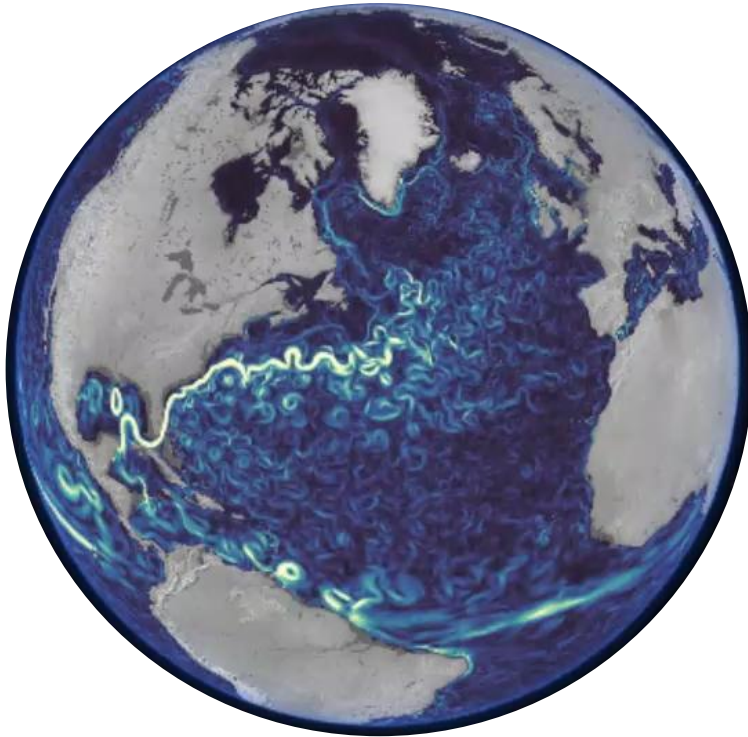


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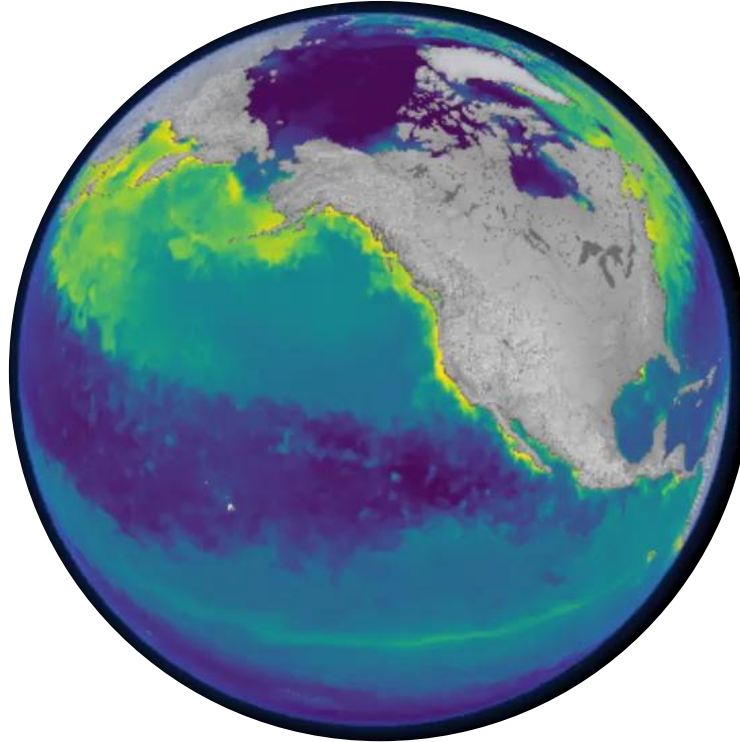


Currents



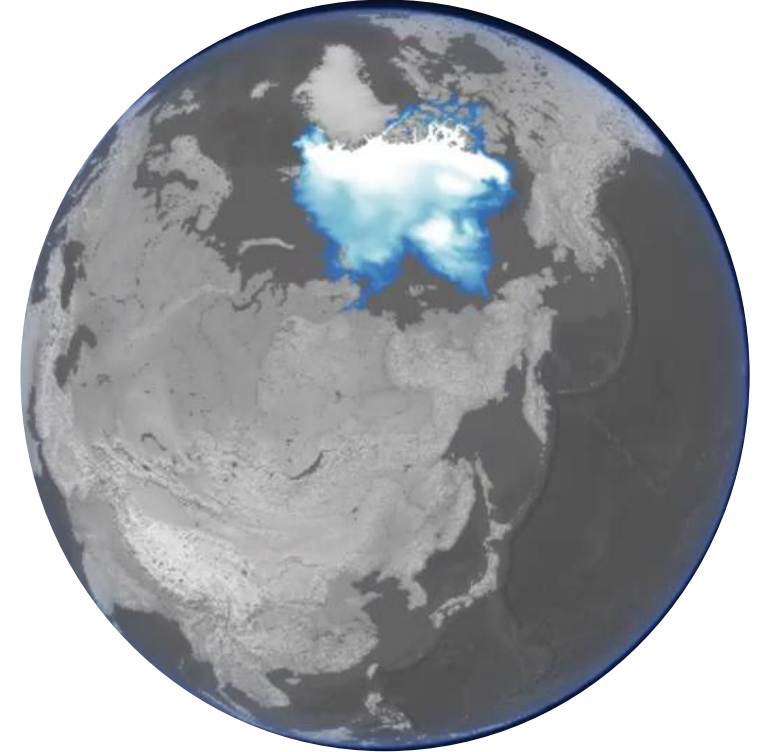
BLUE OCEAN
physical

Chlorophyll



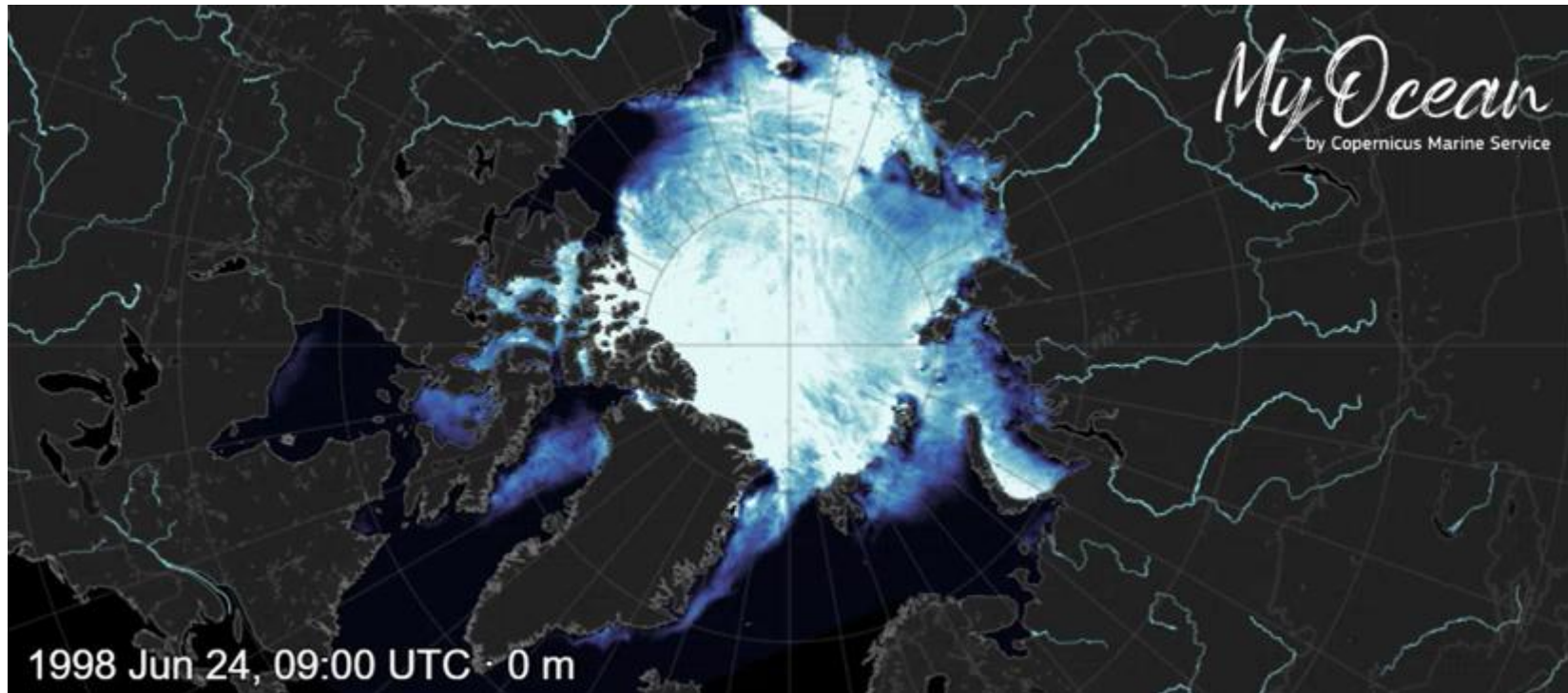
GREEN OCEAN
biogeochemical

Ice



WHITE OCEAN
Sea Ice

Arctic Ocean: a surface warming occurring at twice the
global average



Sea Ice thickness from Ice Reanalysis



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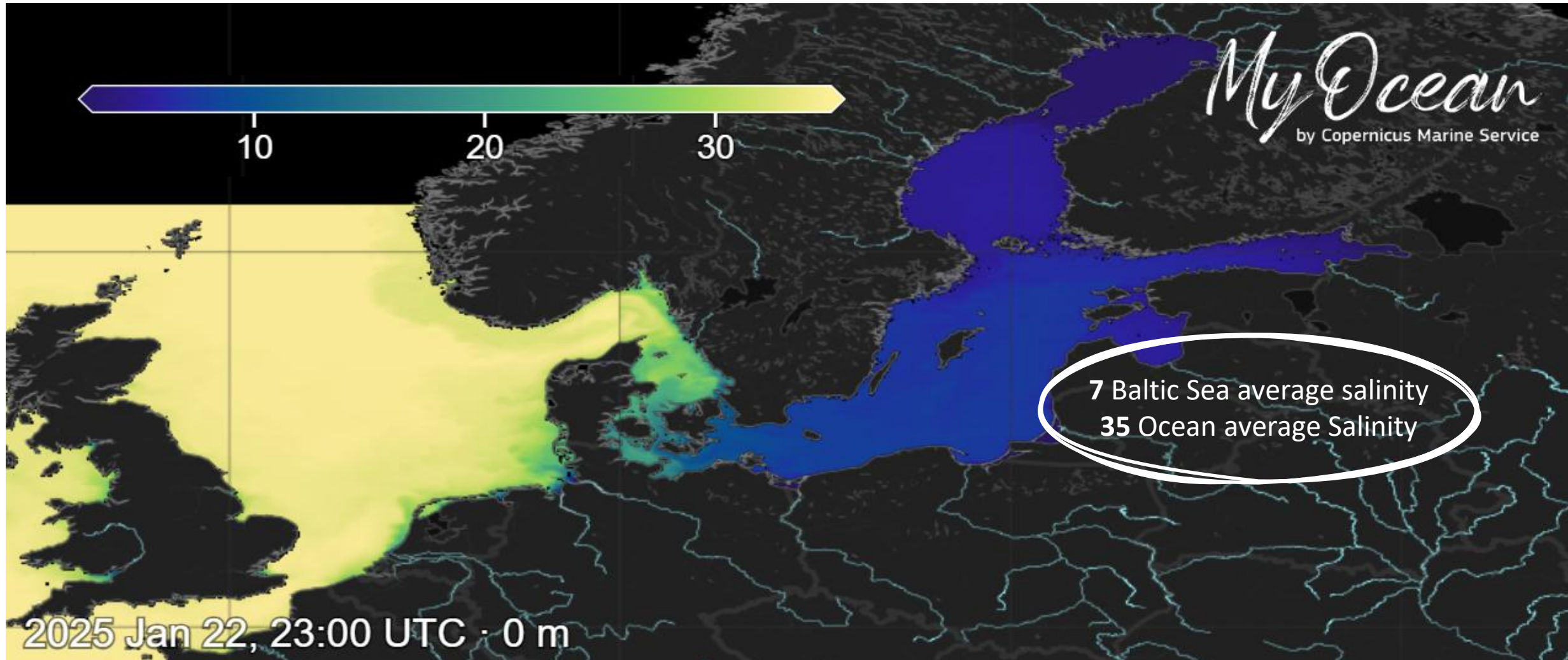


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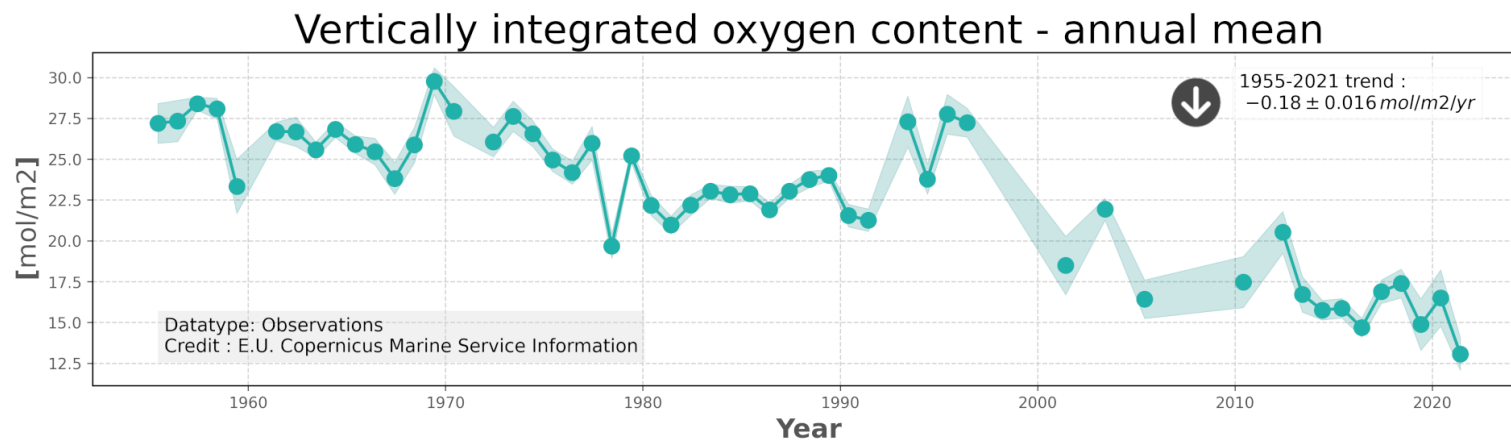


Baltic Sea: semi –enclosed brackish water

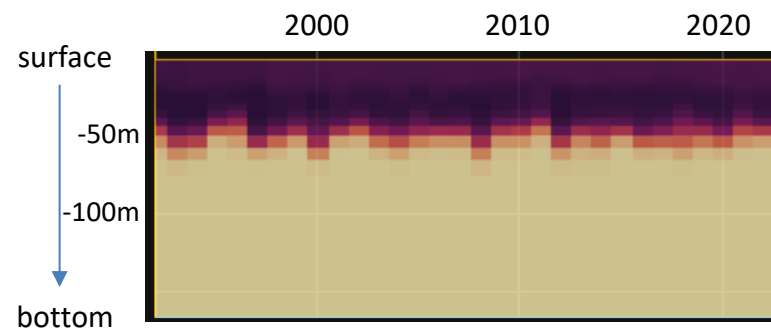
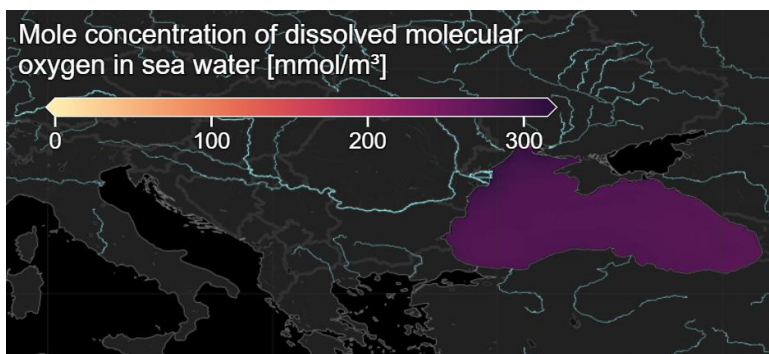




Black Sea the largest euxinic basin in the world



"The Black Sea is entirely anoxic, except for a thin ($\sim 100 \text{ m}$) ventilated surface layer. Since 1955, the oxygen content of this upper layer has decreased by 44 %." Capet et al. 2020





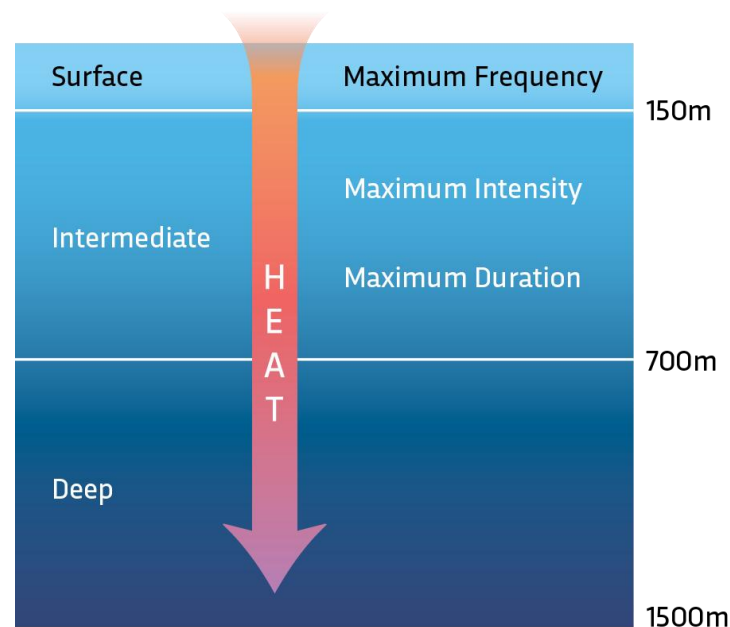
Mediterranean Sea hotspot for climate change



Deep Marine Heatwaves

A marine heatwave in the Mediterranean Sea reached up to 1,500 m below the surface. While heatwaves were more frequent at the surface, temperatures rose further and for longer beyond 150 m.

Copernicus Marine Ocean State Report



Heatwave reached 1500m depth!

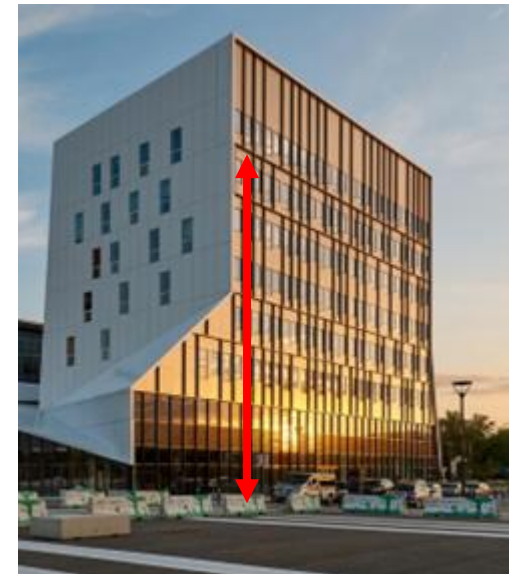
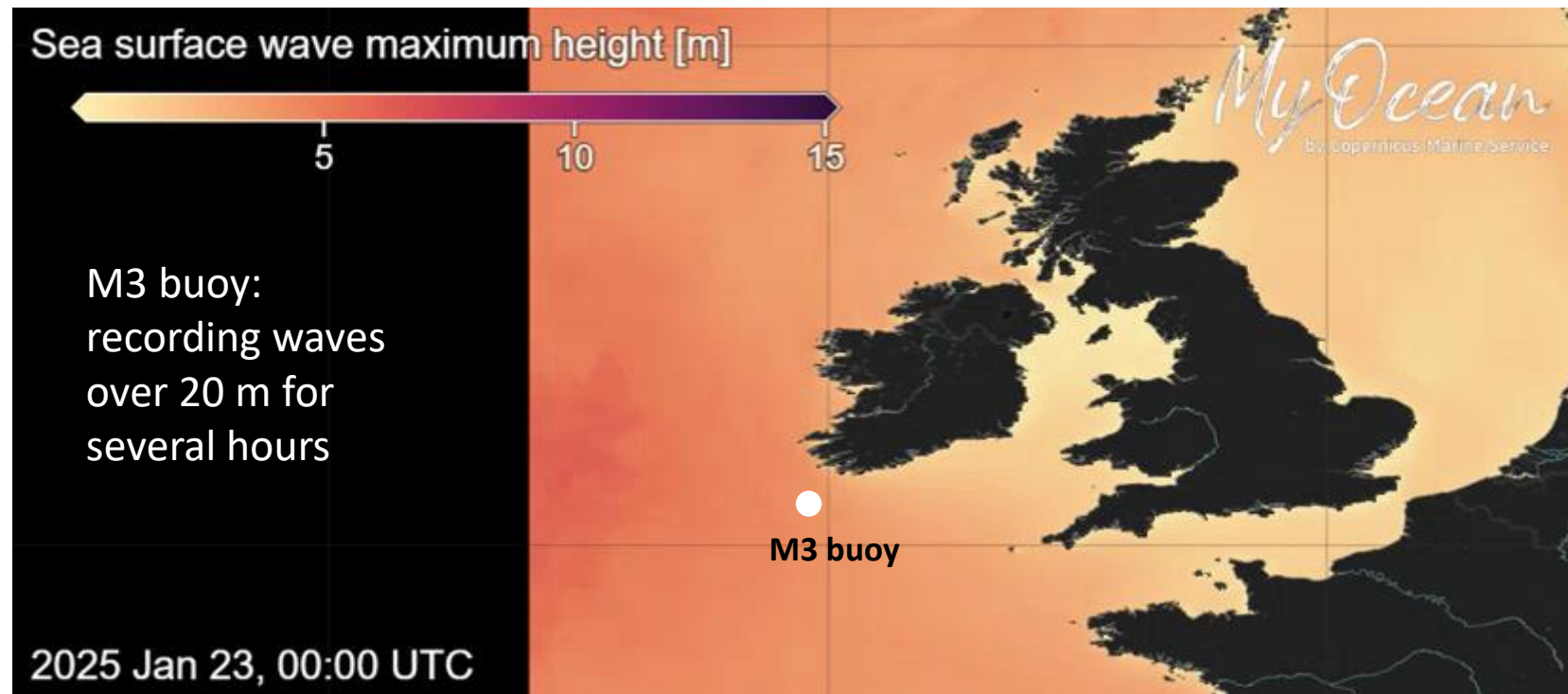


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North West-European Shelf strong storms

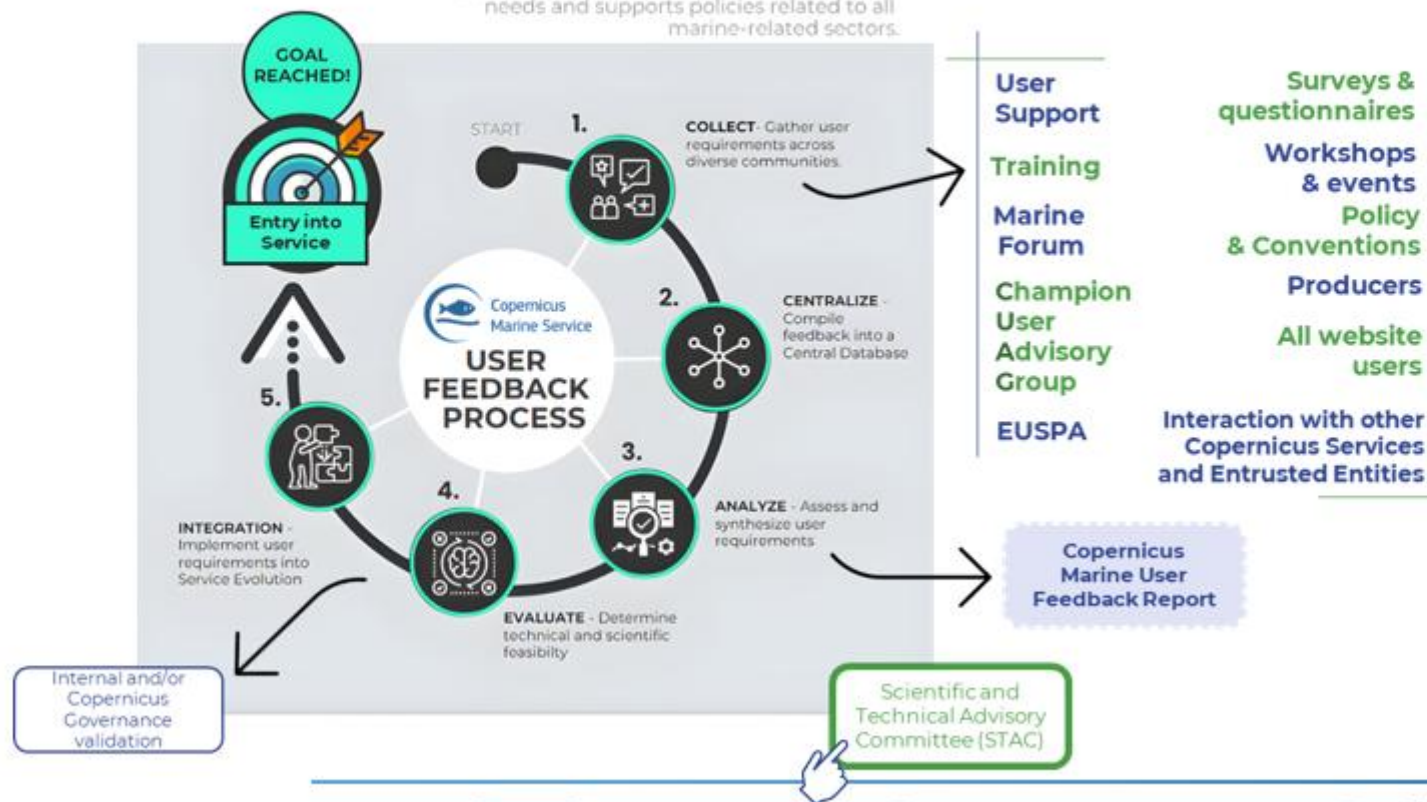


Éowyn strongest storm in 10 years, says Met Office

USER FEEDBACK PROCESS

A USER-DRIVEN SERVICE

The service responds to public and private user needs and supports policies related to all marine-related sectors.



→ **CUAG**: 3 meetings a year (2 workshops + 1 meeting at General Assembly)

→ **National Stakeholder Marine Forum**

→ **Annual survey**: sent to all users of the past year

→ **Systematic Survey**: after each event (trainings and workshop)

→ Dedicated interface **with major accounts** (e.g. Regional conventions)

→ Collection of feedback through **user support**

→ Interface **with other Copernicus Entrusted Entities** (C3S, EUSPA)



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EU Digital Twin Ocean will improve the Copernicus Marine offer



Responding more quickly to user and policy needs

Increasing flexibility of the offer

Facilitating the coastal extension of the service

The EU DTO is revolutionizing science by bringing together previously separate research fields.