# The Copernicus Marine Service
## Monitoring and forecasting the ocean

**Marine Monitoring**
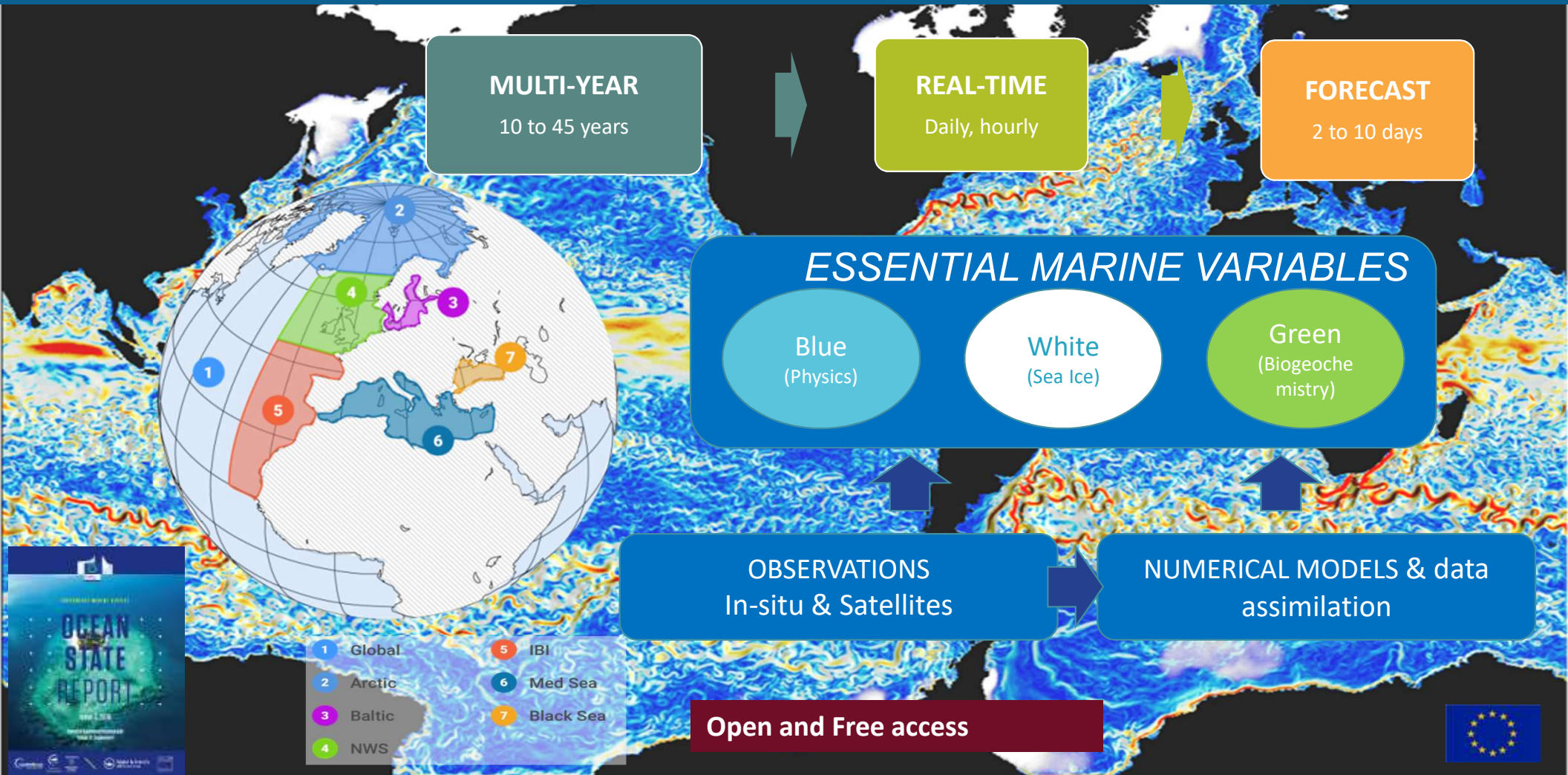
**In-situ observations** from CMEMS in-situ TAC (e.g. moorings, tide gauges, HF Radars) (links organized with EMODnet)

**Satellite observations**: ocean colour, altimetry, SST (at regional scales – products tailored for coastal applications), new Sentinel 2 high resolution turbidity/ocean colour products (end of 2020) (coastal).

**Modelling and data assimilation** (global and regional). All models include tides better address coastal user needs. Improved coupling with rivers.

**Interfaces/coupling with downstream coastal** systems developed as part of CMEMS Service Evolution and User uptake programmes.



**YOUR SEARCH**

Found 171 ocean products matching your criteria.

Export results

Search by keyword

GLOBAL_ANALYSIS_FORECAST_PHY_001_024

REGIONAL DOMAIN

GLOBAL OCEAN 1/12° PHYSICS ANALYSIS AND FORECAST UPDATED DAILY

All areas

MODEL

GLO

PARAMETERS

T bottomT S SSH 3DUV MLD SIC SIT SIUV

TEMPORAL COVERAGE

0.083 degree x 0.083 degree (50 depth levels)

From 1992-01-01 To 2020-06-25

From 2020-06-15 to Present

If checked, the search results will only show products containing the whole selected time range

hourly-mean,daily-mean,monthly-mean,6-hourly-instantaneous

MORE INFO    ADD TO CART    WMS    Sub-setting

**COPERNICUS MARINE SERVICE TO DELIVER HIGH-RESOLUTION OCEAN COLOUR PRODUCTS USING SENTINEL-2**

March 2020

Coastal monitoring services, operated by European Union Member States or private groups, form an important and strategic group of the Copernicus Marine Service users.



One way nesting

AMM15   1.5 km
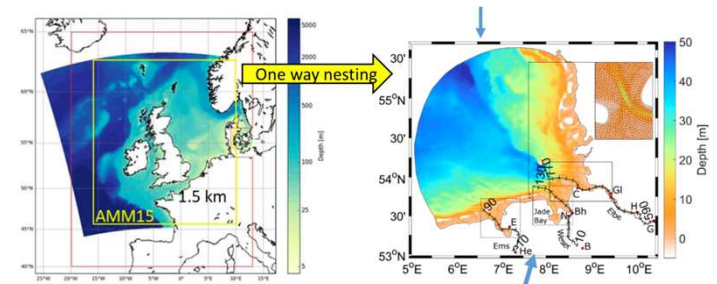
# CMEMS User Uptake Programme – 39 DEM

**Marine Monitoring**

**Services on Atlantic NWS:**
1 marine food
1 water quality
1 safety
2 marine policies
1 coastal monitoring

**Services on Arctic Ocean:**
4 Polar Environment Monitoring
1 marine navigation

**Services on Baltic Sea:**
1 Polar Environment Monitoring
1 safety
1 water quality
1 marine navigation

**Services on Atlantic IBI:**
1 coastal monitoring
2 water quality
2 safety
1 marine policies

**Services on Black Sea:**
1 water quality
1 marine food

**Services on Global ocean and ORs:**
4 energy
1 marine navigation
3 safety
1 marine policies
1 coastal monitoring

**Services on Mediterranean Sea:**
2 water quality
1 marine navigation
1 marine food
1 coastal monitoring
1 safety

39 demonstrations

7 CMEMS geographical areas

POLAR ENVIRONMENT MONITORING

SAFETY & DISASTER

NATURAL RESOURCES & ENERGY

MARINE NAVIGATION

COASTAL MONITORING
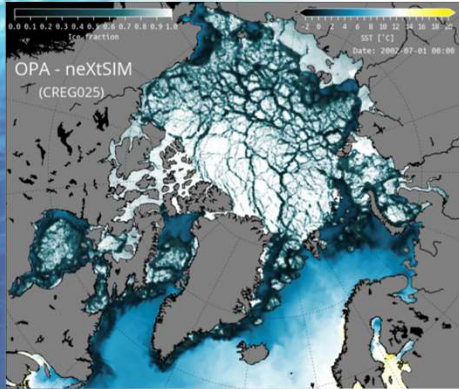
MARINE CONSERVATION & POLICIES

WATER QUALITY

MARINE FOOD

# Service Evolution 2nd Call: End of the 18 funded projects [2018-2020]

http://www.mercator-ocean.fr/mercator-ocean/copernicus/service-evolution/

**Marine Monitoring**

**Marine extremes**

$H_{max}$

OPA - neXtSIM
(CREG025)

**Arctic environment
next generation of sea-ice
forecasting system**

- Supporting **user needs, applications and policies**

- Expanding the CMEMS **scientific community**

- Enhancing CMEMS capabilities
  and maintaining CMEMS at the **state-of-the-art**

- Covering the **main CMEMS thematics**
  (blue, white, green ocean / models, observations)

- **Large uptake foreseen in CMEMS** (improved/new
  systems and products, quality assessment and data
  assimilation methodologies, …)

- Paving the way for main **future evolutions in
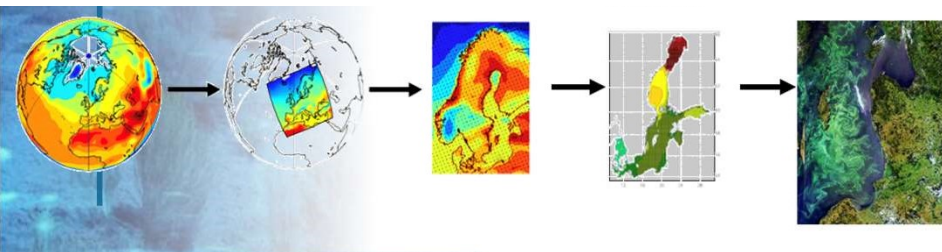  Copernicus 2: Coastal**, Biology, Arctic, Climate

**Coastal
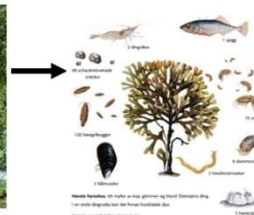ocean and
hydrology
(rivers)**

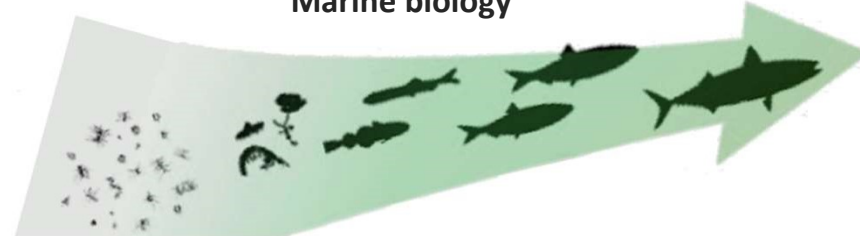**From global to regional past and future marine climates**

**Ecosystem changes**

**Marine biology**

Marine Monitoring

Copernicus Environment Monitoring Service

MERCATOR OCEAN INTERNATIONAL — Copernicus — European Environment Agency

**Roadmap for the evolution of Copernicus marine and land services to better serve coastal users**

*December 5th, 2018*

## Copernicus Services:
## Longer term perspective on Coastal Zones

**Coupling with coastal models.** Strengthen the interfaces between Copernicus Marine and Land Services and downstream coastal systems through **interaction and coproduction with Member States**.

**Hydrology/Rivers.** Monitoring/forecasting of major EU rivers and production of validated river discharges for freshwater input, nutrient loading, particulate and dissolved matter. (cooperation between marine, land, emergency and climate services).

**Long term evolution of the Land cover / Land use monitoring system** towards the EAGLE data model and enrichment with key ecosystem attribute information.

**Long term evolution of the coastal zones:** seasonal to long-term projections of the state of the coastal ocean (e.g. sea level) (marine in interaction with the climate service).

**DIAS:** Harmonized access to Sentinel and Copernicus service data and on line processing capabilities for coastal applications.

Marine Monitoring — Land Monitoring

### 2018-2021 → 2021-2024

**Characterization of coastal zones**
- Land cover / land use (LCLU): status mapping every 6 years, plus 6-year changes maps
  - Low spatial resolution
    - High resolution LCLU status and change mapping in Coastal Zones
- Topography / bathymetry
  - Static coastline position
    - Improved digital elevation models in the coastal zone
    - Improved bathymetry
    - Coast characterisation (e.g. beach type) and coastline dynamics (coastal erosion, accumulation, ...)
- Addition of coastal observations
  - High frequency radar data
- Improved algorithms / Increased resolution of EO for the coastal ocean
  - High-resolution Altimetry
    - Ocean colour data at full resolution
    - Enhanced ocean colour products for coastal waters
    - Improved wind observations in coastal zones

**Modelling and forecasting of coastal zones**
- **Continuous improvements in CMEMS models for coastal users needs**
  Inclusion of more processes relevant for coastal zones Improved wave modelling
  Higher-resolution, more coupled (ocean-wave-atmosphere-sea-ice-biogeochemistry) systems
  Modelling of higher trophic levels (from primary production to fishes)
- **Seamless interfaces with coastal models**
  High-frequency, high-resolution CMEMS model to force coastal models
  Operational high-frequency 3D interfaces between regional and coastal models
  Co-production with member state service

**River monitoring and forecasting**
- Improved hydrological products (topology rivers, lakes, coast, ...)
- Near real time observation and characterization of EU rivers based on in situ observations and on satellite observations
- Homogenized modelling and forecasting of river discharges
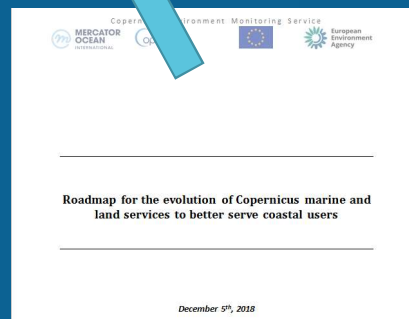
**Climate change and coastal vulnerability**
- Seasonal and decadal predictions, regional ocean projections for coastal zones and ecosystems

**Marine Monitoring**

*Users and markets*

*Partnership & Co production*

*Marine Service*

C) Developing **UPTAKE**

B) Producing core **DATA**

A) Valuing **INPUT** data

*Observations & Research*

*Copernicus Marine Environment Monitoring Service*

| ENVIRONMENT | | | | SOCIETY | | | | ECONOMY | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| POLAR ENVIRONMENT MONITORING | MARINE CONSERVATION & BIODIVERSITY | OCEAN HEALTH | CLIMATE & CLIMATE ADAPTATION | POLICIES & OCEAN GOVERNANCE & MITIGATION | EDUCATION, PUBLIC HEALTH & RECREATION | SCIENCE & INNOVATION | EXTREMES, HAZARDS & SAFETY | COASTAL SERVICES | MARINE FOOD | NATURAL RESOURCES & ENERGY | TRADE & MARINE NAVIGATION |
| Arctic policy, MSFD, MSP, WFD, Habitat Directive, Bird Directive, Natura 2000, the Convention on Biological Diversity, WMO/UNFCCC, IPCC, the Paris agreement / global stocktake, SDG 13, 14, 15 | | | | Arctic Policy, MSFD, MSP, WFD, IOG, The Sendai Framework for Disaster Risk Reduction, SDG 1, 2, 3, 4, 5, 6, 7, 9, 11 and 16, 17 | | | | Space policy, Flood Directive, Green Deal, Energy Policy, Air Quality Directives, SDG 8, 9, 10, and 12, 17 | | | |

1. The Ocean higher than ever on the **political agenda**
2. **Markets** responding well to our sectoral approach
3. **Coastal, Arctic, Marine Biology & Climate** calling for more

4. Users calling for a consistent **BLUE / WHITE / GREEN** ocean
5. **Better** accuracy, **higher** resolution, **longer** reanalysis period
6. Integration of WEkEO/**Cloud based** digital approaches

7. New space observations (Sentinel evolution, polar missions)
8. New in situ int. observation effort (BioGeoChemical Argo, …)

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# New or improved services: needs and responses

- **Marine Safety and maritime transport** : high resolution, ocean and sea ice, increased product accuracy, increased operational data access and user support. Uptake of future Sentinel missions.

- **Marine Resources**: reach for biology the level of excellence CMEMS has for physics: better support fisheries management, sustainable aquaculture and living resources protection. Harmful Algae Blooms. Higher trophic levels in BGC models.

- **Marine & coastal environment**: Coastal Zone Monitoring (satellite) and Coastal Zone Forecasting (co-design & co-production between MS services and a reenforced EU Marine Service) incl. coupling with land (rivers).

- **Climate** : Transform CMEMS expertise on the ocean into a strong assessment capacity on the ocean climate and $CO_2$ uptake, develop new capabilities for long term projection & scenarios for the coastal ocean and marine ecosystems.

- **Digital** : Take benefit of WEkEO DIAS platform to extend the product & service portfolio for Marine Users (access to all Level 1&2 Sentinel data, other marine products eg Emodnet, on line cloud processing capabilities).

Arctic

Biology

Coastal

Climate

Digital

Subject to approval

**3 levels for the CMEMS product/service portfolio**

**1/baseline**

**2/enhanced continuity (product and service improvements)**

**3/expansion (new products and services)**

2/ and 3/ will integrate R&D from H2020 and Horizon Europe (Space) projects and will be developed over time depending on budget constraints.

**Marine Monitoring**

**EXPANSION: COASTAL ZONE**

- **Monitoring (Sentinels) for a better characterization** : Satellite derived bathymetry, shoreline position, water quality, HR surface winds (SAR), spectral wave information, marine litter ?
- **Forecasting**: co-design/co-production of model-derived information between Member States services and CMEMS (coupling, harmonization, **river discharges**).
- **Regional climate projections** of the marine environement (downscaling of C3S global climate models)

*Subject to approval*



*Melet et al. 2020*

⇒ Activities **initiated** in CMEMS Service Evolution R&D projects and H2020 Copernicus Evolution projects. Preparatory phase (R&D) through Horizon Europe.

⇒ In line with the **Coastal Roadmap** delivered by MOi/CMEMS and EEA/CLMS to the EC

⇒ Coastal zones: a **sectoral approach (Knowledge Hub)**, coordinated across Copernicus services

⇒ Coordination with **EMODnet** required.

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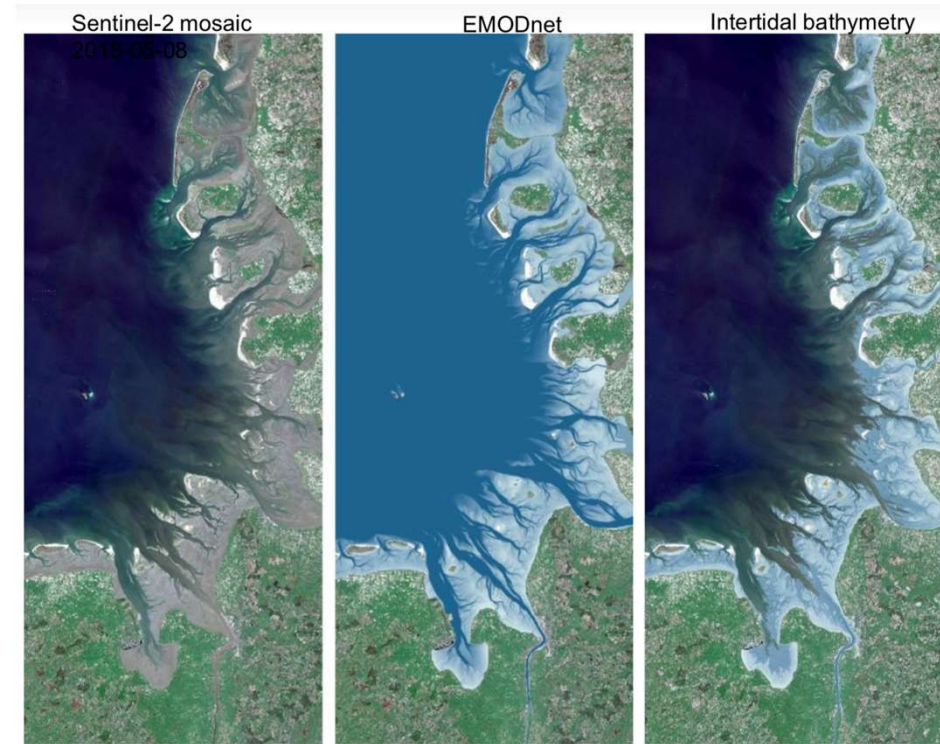


Satellite derived bathymetry using Sentinel-2: Here in German Bight/ Wadden Sea, with intertidal bathymetry. CMEMS Service Evolution funded project (DHI-Gras, UPC, HZG)
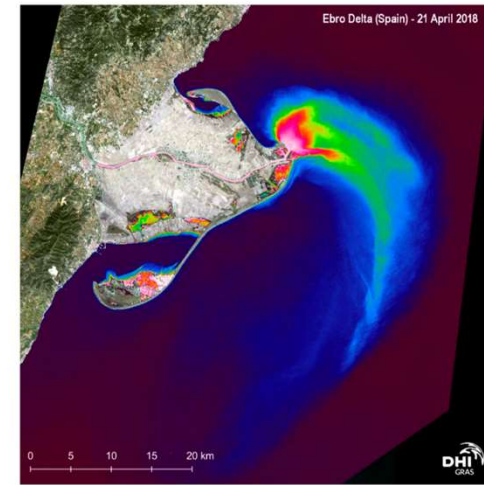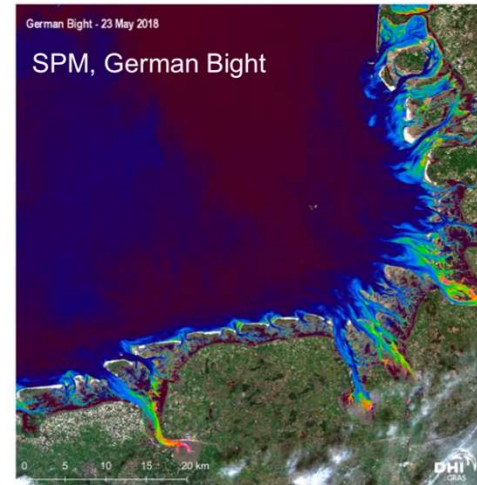
Marine
Monitoring

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German Bight - 23 May 2018
SPM, German Bight

Ebro Delta (Spain) - 21 April 2018

0  5  10  15  20 km

Legend
coastlines
20150825
20180819

Legend
coastlines
20150825
20180819

Accretion

Erosion

2015 S2

2018 S2

**Satellite derived suspended particulate matter and shoreline position change using Sentinel-2: CMEMS Service Evolution funded project (DHI-Gras, UPC, HZG)**
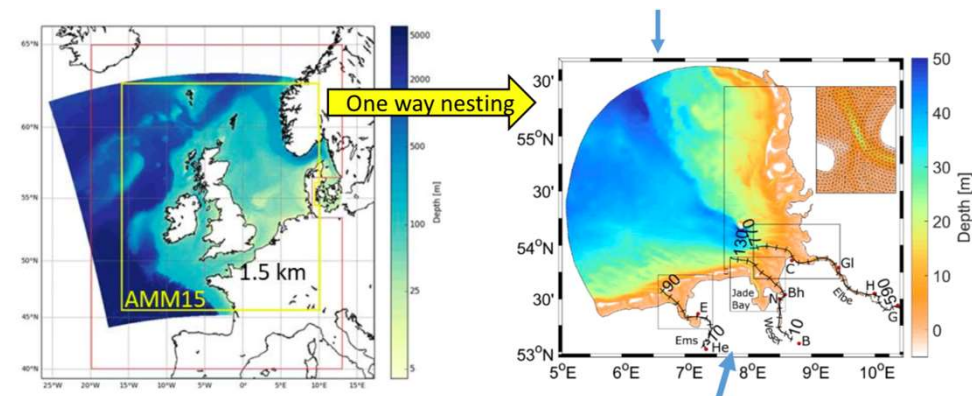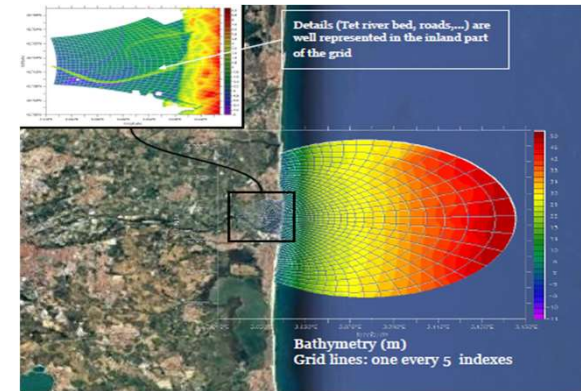
**Marine Monitoring**

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Details (Tet river bed, roads,...) are well represented in the inland part of the grid

Bathymetry (m)
Grid lines: one every 5 indexes



One way nesting

AMM15    1.5 km

**Downscaling of CMEMS models to coastal domains. CMEMS Service Evolution funded project (DHI, UPC, HZG) CMEMS Use Cases / User Uptake**

**Marine Monitoring**

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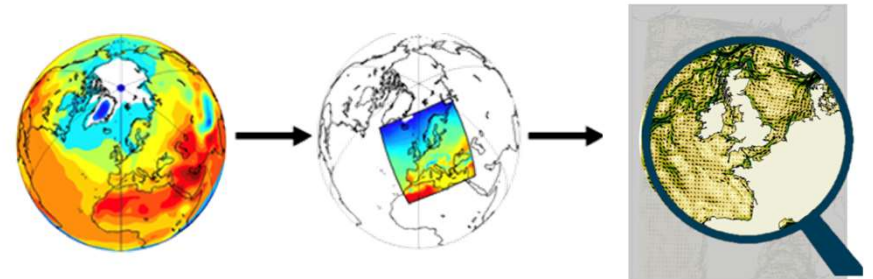


Downscaling of global climate models for marine applications; CMEMS Service Evolution funded project (SMHI)

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Thank you. Questions ?

**BLUE OCEAN** Physical

**WHITE OCEAN** Sea ice

**GREEN OCEAN** Biogeochemical

**BROWN OCEAN** Coastal

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