Copernicus Marine Service

# EU Coastal Use Cases Workshop

September 16, 2024

## SEABEL : SEAmless downscaling of CMEMS NWS forecast to the BELgian coastal zone


Sébastien LEGRAND

Royal Belgian **Institute of Natural Sciences**

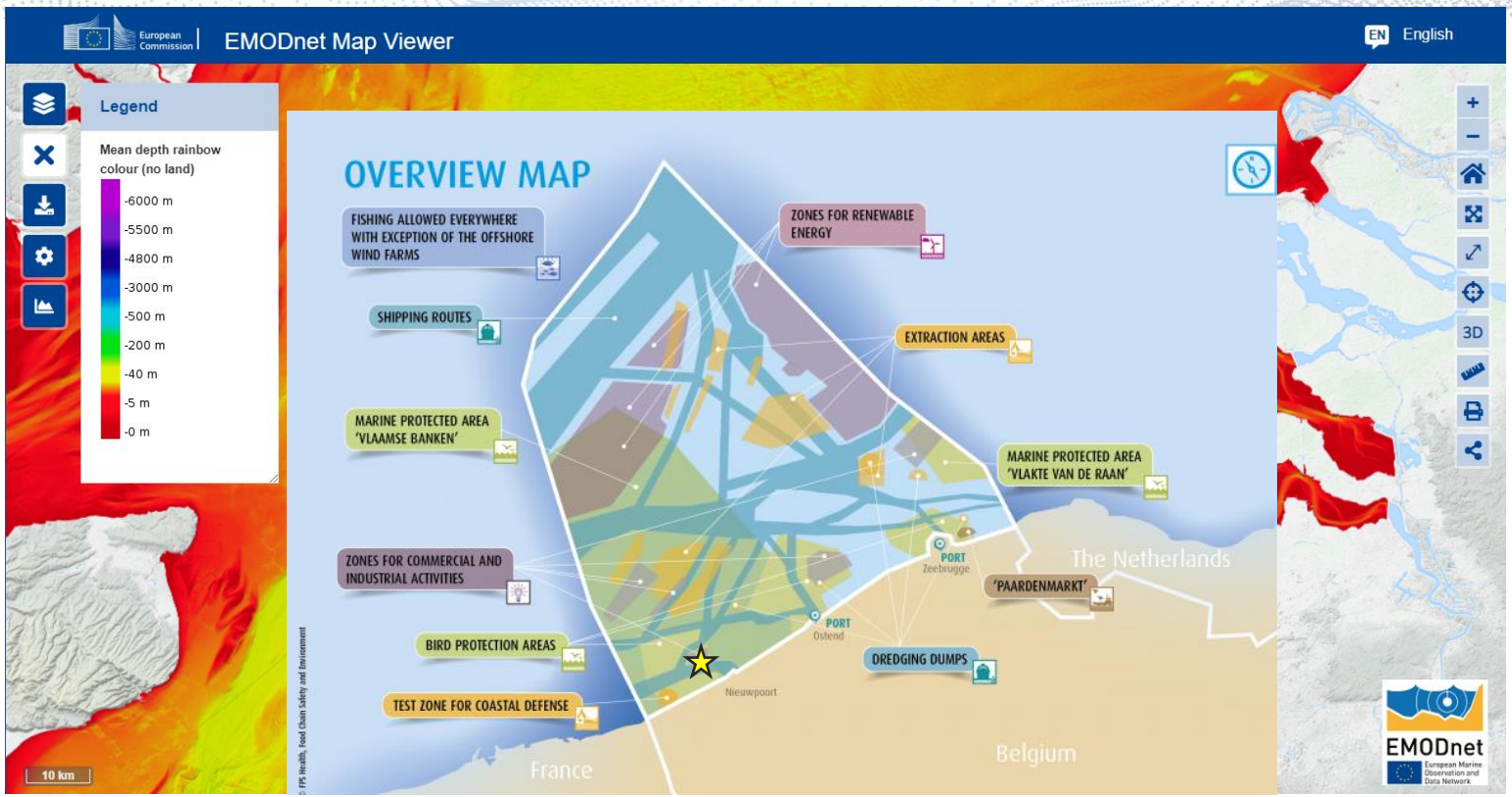

COPERNICUS MARINE SERVICE NATIONAL COLLABORATION PROGRAMME 2022-2028

PROGRAMME OF THE EUROPEAN UNION

Copernicus Europe's eyes on Earth

implemented by MERCATOR OCEAN INTERNATIONAL

# Belgian part of the North Sea



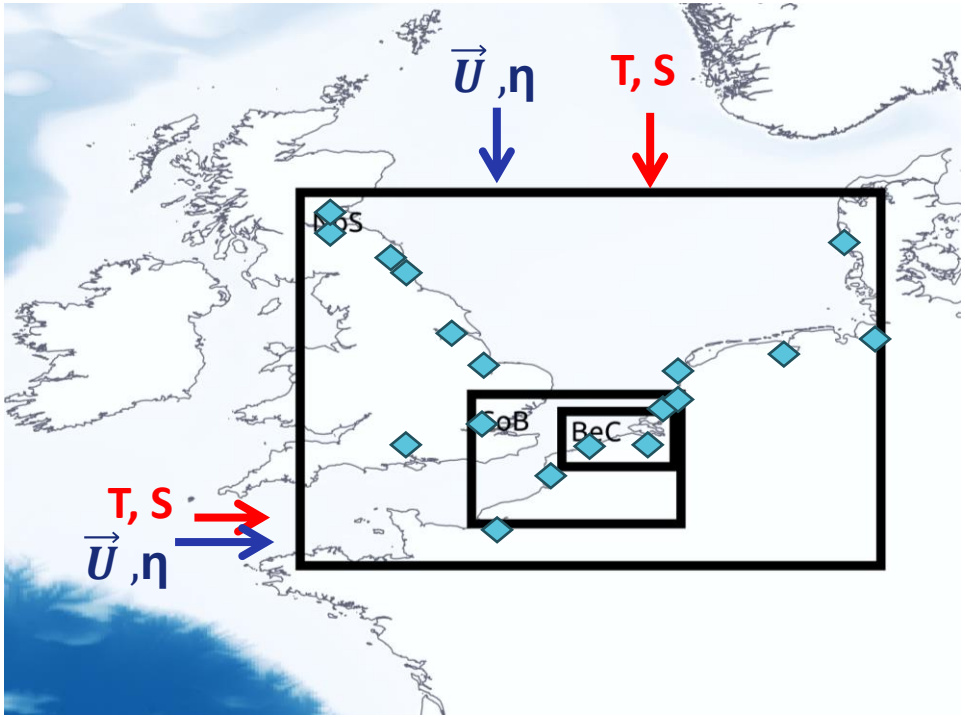
- from CMEMS-NWS Ocean Physics Re-analysis (7km)
- COSAM storm surge model (RBINS)
- 18 rivers / OSPAR climatology -> CMEMS INSTAC

# OPTOS V3, a new Belgian modelling system

Powered by the COHERENS model

## 3 nested levels

- NoS – North Sea and English Channel
  - [4°W, 9.25°E ; 48.5°N, 56.43°N]
  - Horizontal resolution ~ 1,5 km
  - 20 sigma layers
- SoB – Southern Bight of the North Sea
  - [0.3°E, 4.63°E ; 49.73°N, 52.7°N]
  - Horizontal resolution ~ 0,440 km
  - 20 sigma layers
- BeC – Belgian Continental Plate
  - [2.23°E, 4.23°E ; 51.03°N, 52.00°N]
  - Horizontal resolution ~ 0,110 km
  - 20 sigma layers



Copernicus
Marine Service

Flinterstar salvage operation, 2015

- **Seamless Coastal Marine Service #1: MSFD D8C3**

**Spatial extent and duration of significant acute pollution events are minimized.**

PROGRAMME OF THE EUROPEAN UNION

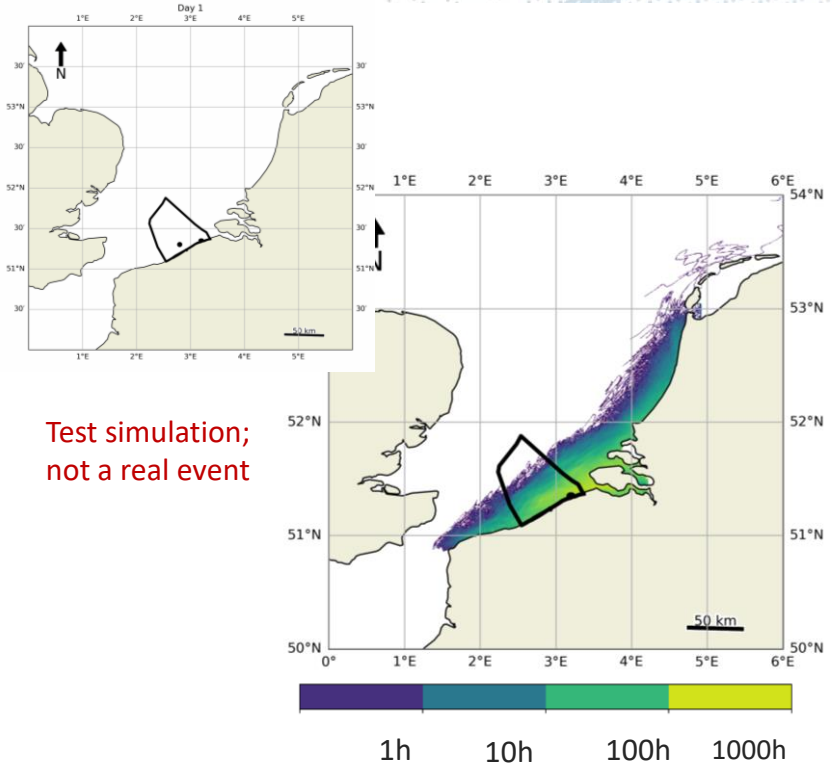
Copernicus Europe's eyes on Earth

implemented by MERCATOR OCEAN INTERNATIONAL

# **OSERIT**, a decision support system for acute maritime pollution

But simulations were limited to max 5 days ahead

# D8C3:
# Spatial extent and duration of significant acute pollution events




Test simulation;
not a real event

SEABEL > refactoring met-ocean forcing in OSERIT

- ✓ Generic, hierarchical definition of domains; each domain has its own set of readers
- ✓ Seamless integration of Belgian and CMEMS forcing in a same simulation
- ✓ No more restriction on simulation duration
  as long as met-ocean forcing are available

Next step : improving counter-measures implementation in the model

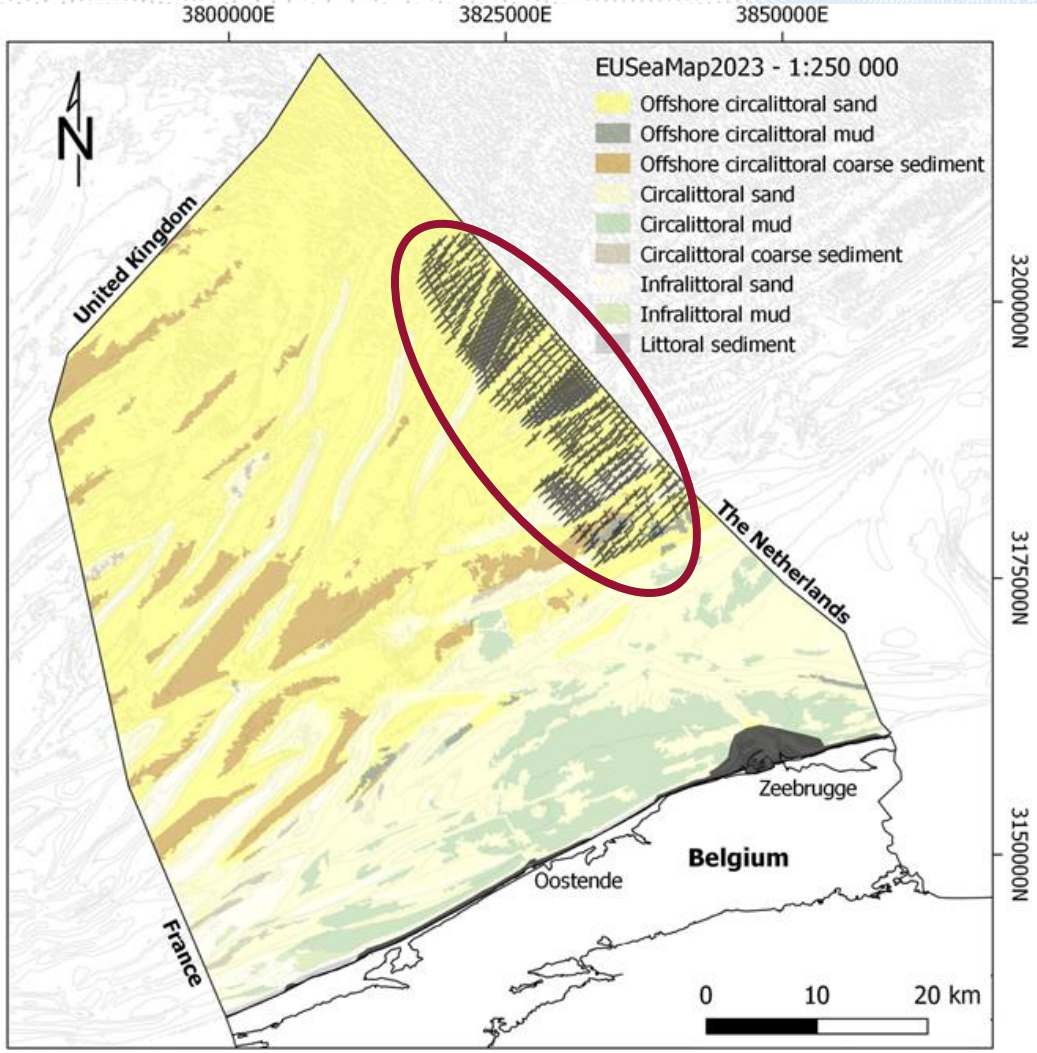
Copernicus Marine Service

# Seamless Coastal Marine Service #2: MSFD D7

**“Permanent alteration of hydrographical conditions does not adversely impact [broadscale benthic] habitats”**

PROGRAMME OF THE EUROPEAN UNION
Copernicus Europe's eyes on Earth
implemented by MERCATOR OCEAN INTERNATIONAL

# D7 assessment for benthic habitats




D7C1 : Indicator based on Bottom shear stress

Alteration of 203 km² potentially impacting sediment resuspension and erosion patterns, due to wakes behind each of the 399 installed wind turbines + 10 high voltage stations

D7C2:

No adverse effect at the scale of the broadscale habitat due to these 399 turbines and 10 stations

# SEABEL : How to assess alteration of hydrographical conditions for pelagic habitats?

1. Building **a Principal Components Analysis model** of the hydrographical conditions in the Belgian waters based(*) :

- SST, SSS and their gradient
- Deficit of Potential Energy
- Tidal and de-tidal surface current
- Relative Vorticity
- Kinetic energy and its dissipation
- Turbulent Kinetic energy and its dissipation
- Significant waves height and waves energy dissipation
- Sea surface turbidity

WORK IN PROGRESS

2. Daily applying the PCA model on the SEABEL forecast

(*) Original idea by Tew-Kai et al. (2020) doi:10.3390/jmse8080585

Copernicus Marine Service

# SEABEL:

- a new forecasting modelling system with a hectometric resolution is being developed
- Seamless integration of CMEMS products as open lateral boundary conditions and rivers discharges
  - Need for
    - instantaneous depth averaged current at a time resolution of max 15’
    - more observation of salinity and temperature at river mouth
- Waiting for next NWS MFC operator before starting operating SEABEL
- SEABEL products are suitable for many applications including MSFD D7 and D8C3 assessments