FullContinuum: Next-generation of models for a full coupling of the river-estuary ocean-atmosphere continuum. (2021-2025)

Application to the North Sea (Belgian Coastal Zone) + Black Sea

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Why?

- The estuary is poorly (not) solved. Boundary conditions are averaged values.

- Resolution is ~1 km at the estuarine mouth, too coarse for addressing the biota.

- To solve the transfer of biogeochemical elements like carbon, nitrogen and phosphorus from the land to the coast;

- ERA-5 forcing too coarse to simulate short term events (e.g.; storms impact on SPM).
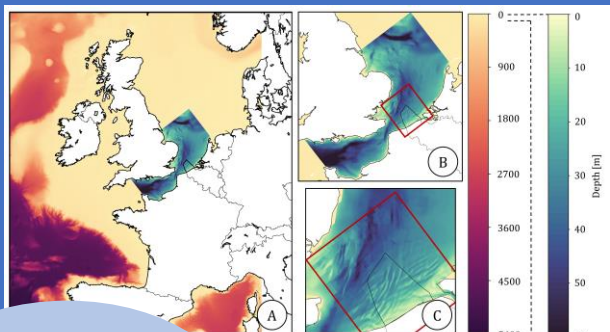
Atmosphere
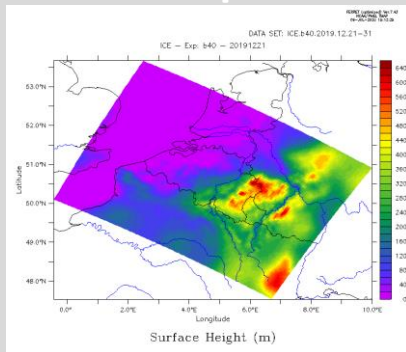
SST, currents,
Charnock coefficient

TASK 4

TASK 5

Uwind, Vwind, Patm, Humidity,
Tair, Cloud, Rain, Radiation

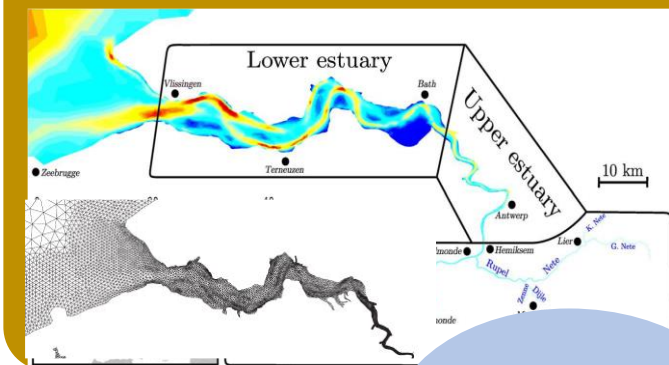Uwind, Vwind, Patm, Humidity,
Tair, Cloud, Rain, Radiation

Ocean

River-Estuary

Water flow, Salinity,
T°, biogeochemical
materials

Tides, Salinity, T°,
biogeochemical
materials

TASK 2

TASK 3

TASK 1

Task 1: Setting and validation of a coupled unstructured grid 3D hydrodynamical biogeochemical model of the Scheldt-SBNS region


SLIM (Second-generation Louvain-la-Neuve Ice-ocean Model)
- Unstructured meshes (finite elements)
- Different hydrodynamic models
  - SLIM1D for river flows
  - SLIM2D for shallow barotropic flows with W&D
  - SLIM3D for hydrostatic baroclinic flows
- Different transport models
  - Eulerian: sediments, age, water quality, ...
  - Lagrangian: coral larvae, plastic debris, seagrass propagules, ...

Hydrodynamical-biogeochemical-sediment model
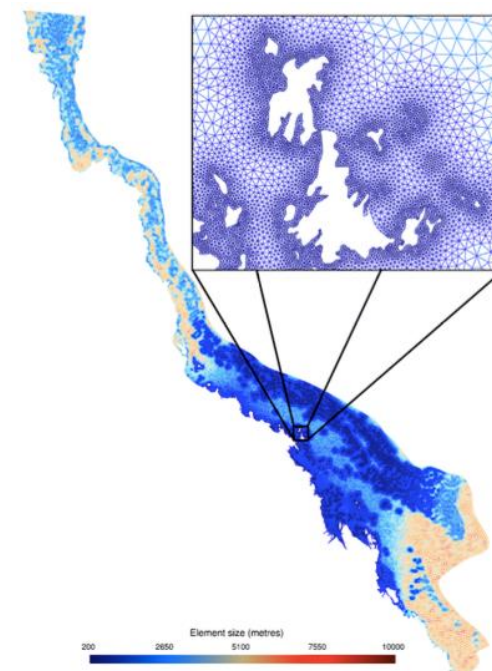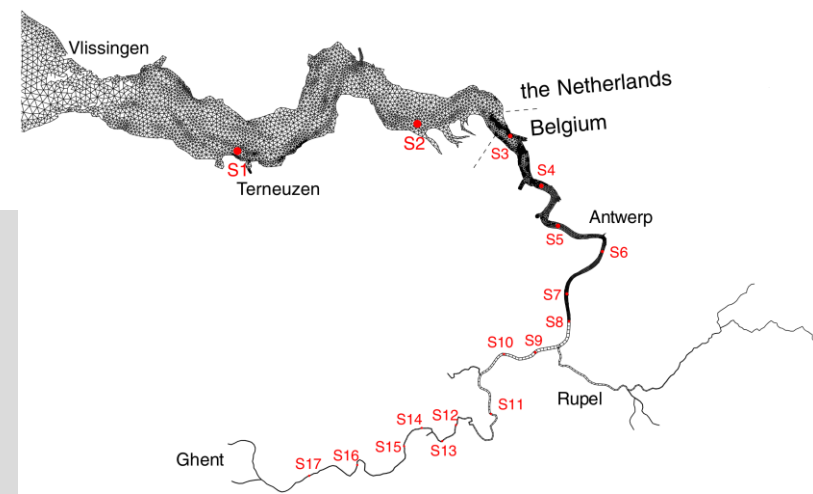
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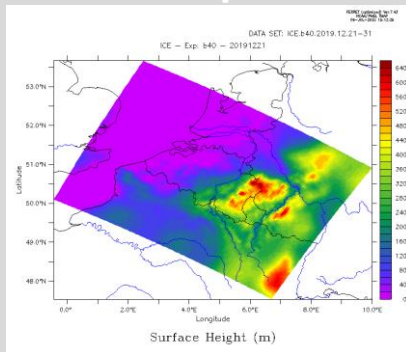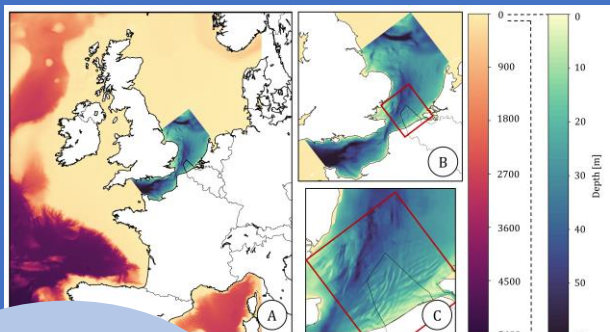
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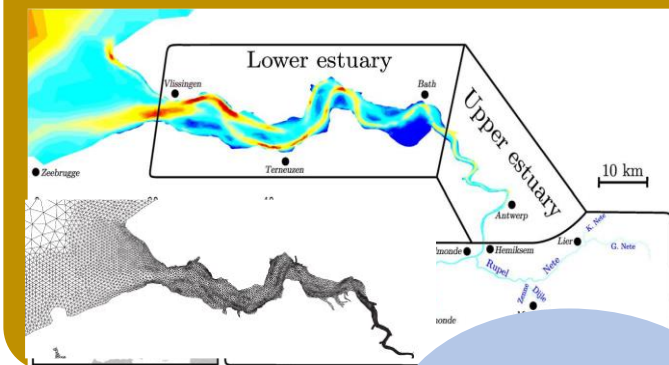Tair, Cloud, Rain, Radiation

Ocean

River-Estuary

Water flow, Salinity,
T°, biogeochemical
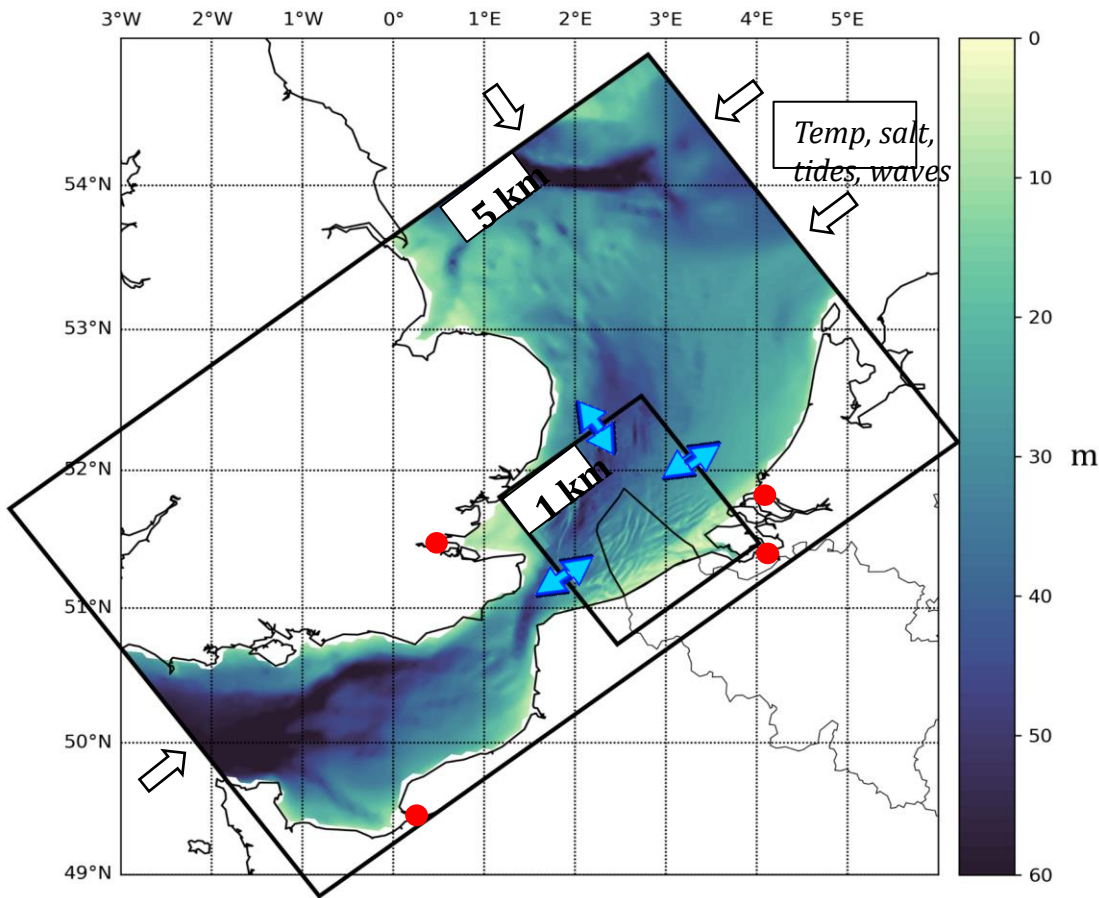materials

Tides, Salinity, T°,
biogeochemical
materials

TASK 2

TASK 3
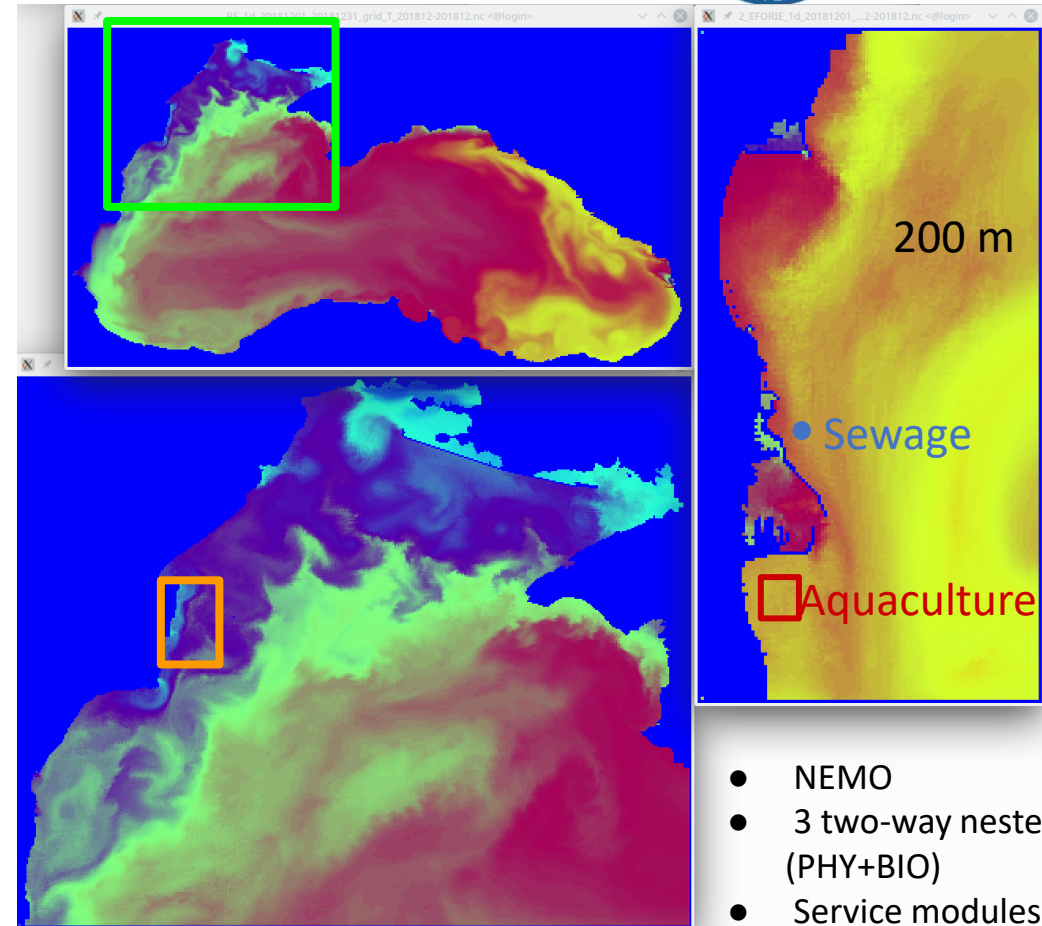
TASK 1

Task 2: Setting and validation of a coupled structured grid 3D hydrodynamical-biogeochemical model of the NWCS and Black Sea

Temp, salt, tides, waves

5 km

1 km

3 km

200 m

Sewage

Aquaculture

- COAWST
- 2 two-way nested domains (PHY+SED+Wave) +BIO
- OWFs
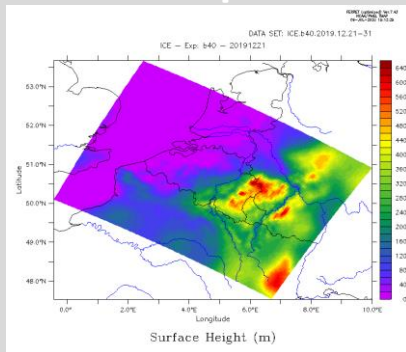
- NEMO
- 3 two-way nested domains (PHY+BIO)
- Service modules for
  - Aquacultures,
  - Fisheries and
  - Oyster beds restoration.

Atmosphere

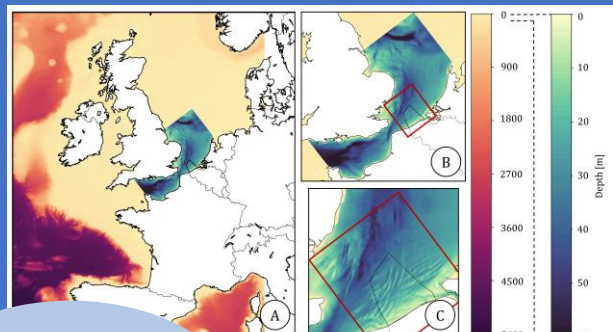SST, currents,
Charnock coefficient

TASK 4

TASK 5

Uwind, Vwind, Patm, Humidity,
Tair, Cloud, Rain, Radiation

Uwind, Vwind, Patm, Humidity,
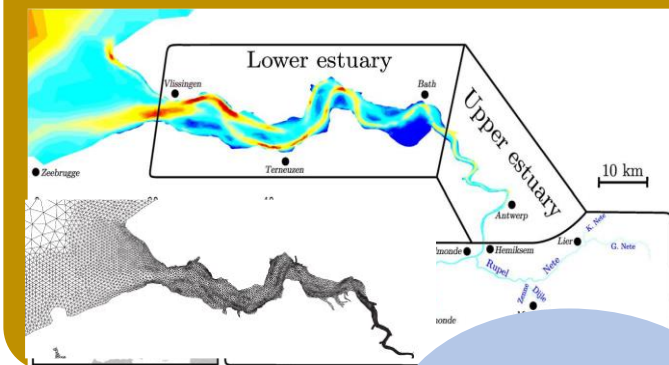Tair, Cloud, Rain, Radiation

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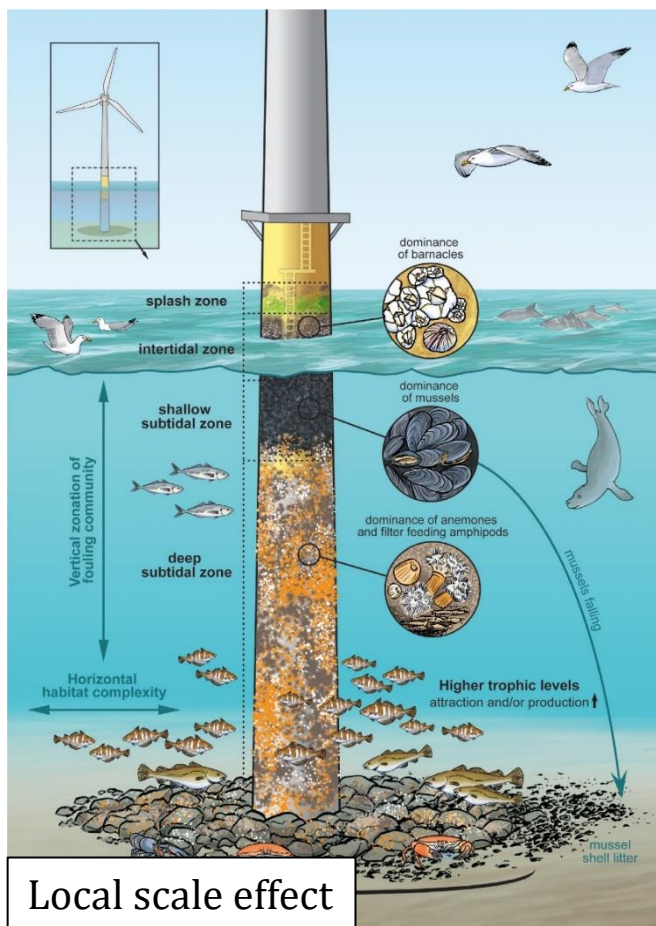
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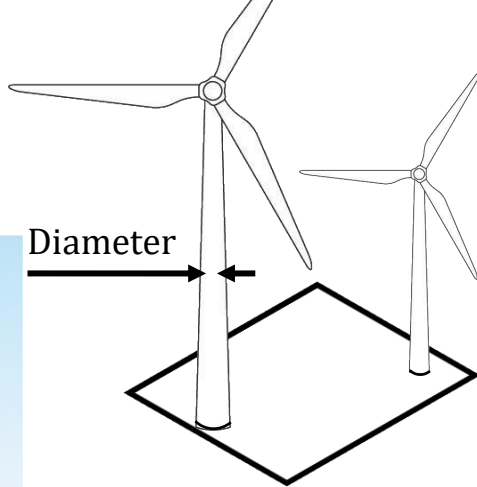materials

TASK 2

TASK 3

TASK 1

Application

Diameter

CE2COAST

JPI Ocean and Climate (2020-2023)

North Sea

Leeds

Manchester

Birmingham
United Kingdom

London

Brussels

Amsterdam
Netherlands

Cologne

Offshore wind farm (OWF) effect

Biodeposition by filter feeders – so what?

Regional effect

https://www.4coffshore.com/offshorewind/

Local scale effect

Degraer. et al. (2020)

0   200 m   5 km   30 km
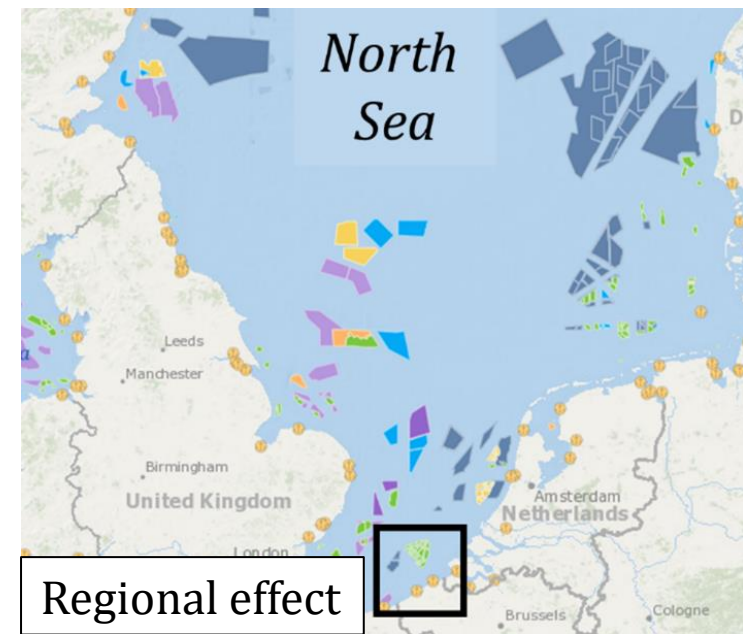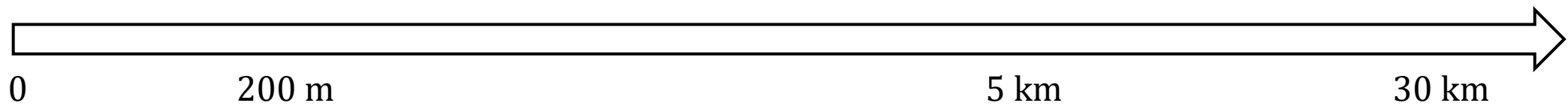
Applications

Bottom O2 level

- Water quality and clarity

- Hypoxia

- Habitat mapping

H2020 BRIDGE (2021-2025)

Hypoxia