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WATER - ACROSS BOUNDARIES

CONNECT – LOCAL COASTAL MONITORING SERVICE FOR PORTUGAL

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Outline

- Context
- The CONNECT coastal service
- Tagus estuary – Use case #1
- Lessons learned

Societal value of coastal forecasts

- Anticipate contamination events and support emergency actions
- Support water economy daily tasks, leisure and recreation
- Create knowledge to guide management and minimize risks in the coastal areas

Core of the Digital Twins for coastal areas

User-centered platforms that combine models, forecasts, data analysis and dedicated services to support decision-making





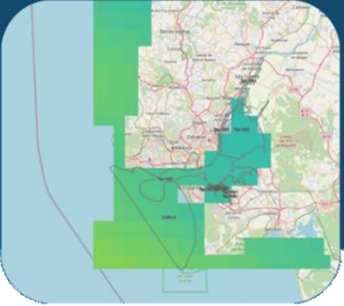
FORECASTS



IN-SITU OBSERVATIONS



SATELLITE



CONNECT delivers a local, high-resolution, coastal monitoring service that seamlessly integrates model-based forecasts and observations to provide blue (physical) and green (biogeochemical) open data on Portuguese estuaries

Use cases

- Support the evaluation of the ecological status of estuaries (WFD)
- Quantify land inputs to the adjacent coastal waters (MSFD)
- Anticipate inundation events (Floods Directive)



Co-design with users

- Address user's requirements and feedback on the coastal service
- Dedicated actions with users



CONNECT coastal service – main features



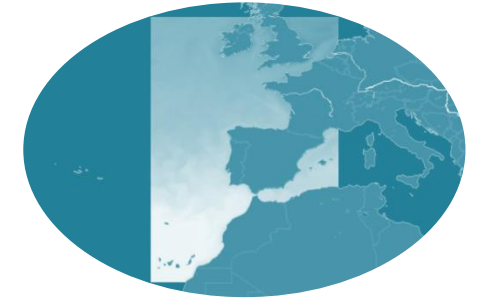
High-resolution operational modelling of estuarine - coastal circulation and water quality, forced by CMEMS regional models



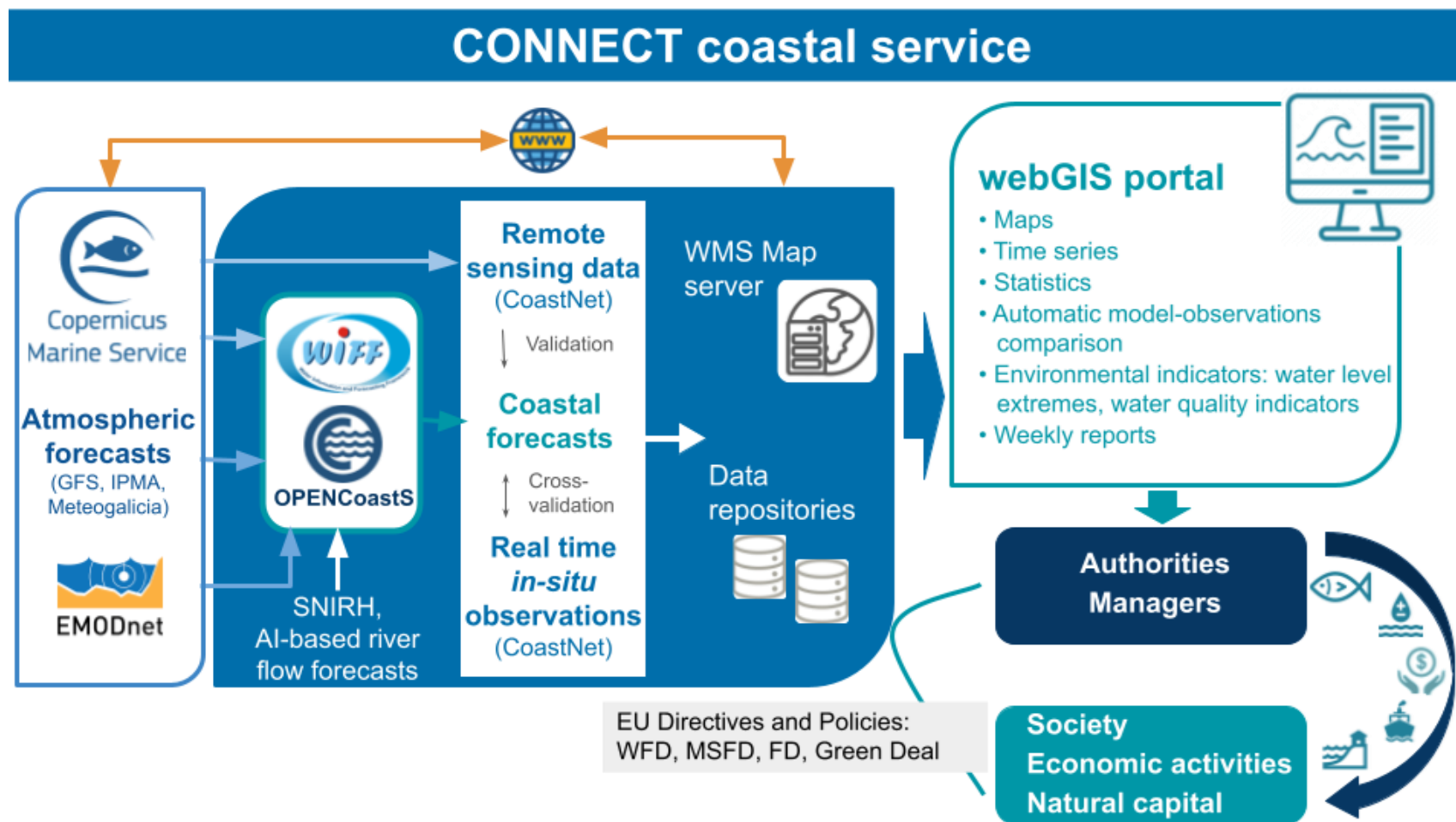
Near-real time *in-situ* data acquisition and Earth-observation data



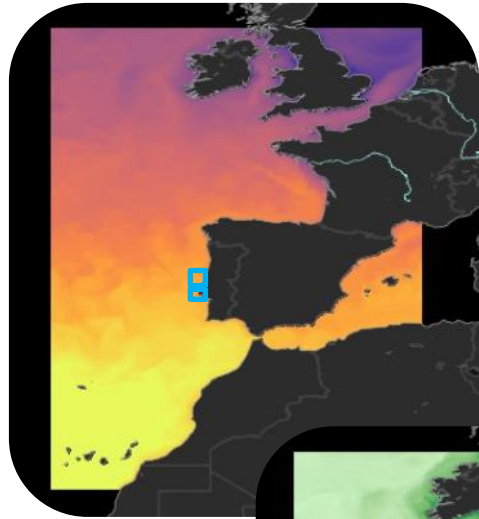
WebGIS portal to access physical and biogeochemical 2-day forecasts and observations



Seamless integration with CMEMS

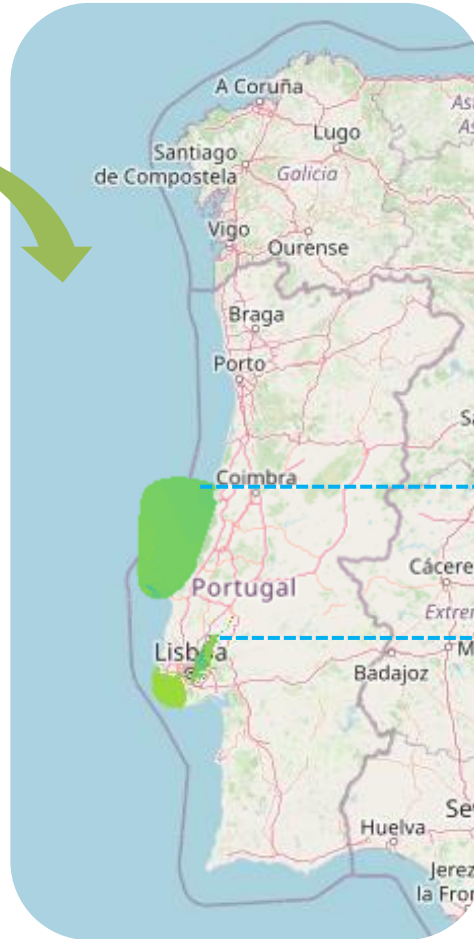


Downscaling CMEMS



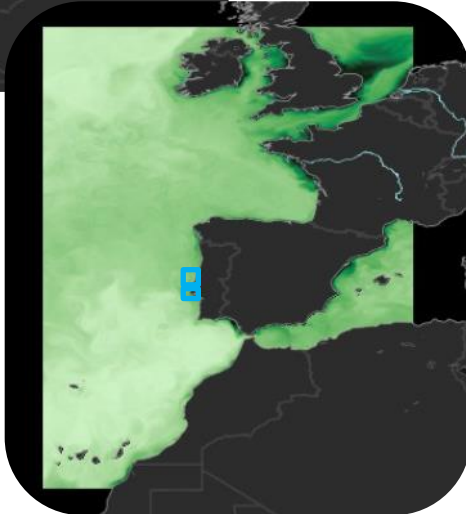
IBI Physics
IBI Biogeochemistry

Downscaling



Mondego estuary
Horizontal resolution:
5-5000m
Vertical grid:
25 SZ levels

Horizontal
resolution:
 $1/36^\circ$
Vertical grid:
50 levels



Tagus estuary
Horizontal resolution:
3/5-1600m
Vertical levels:
39 SZ levels



Tagus estuary – Use Case #1

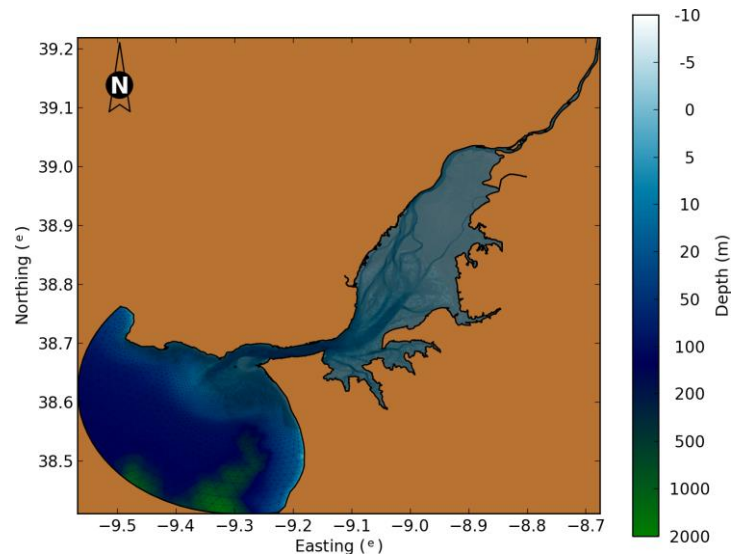
- Ecological and economical values
- Supports different uses that may onset several water quality problems
- The estuarine margins are prone to inundation from various sources, a problem that may be exacerbated by sea level rise



Tagus estuary – numerical models

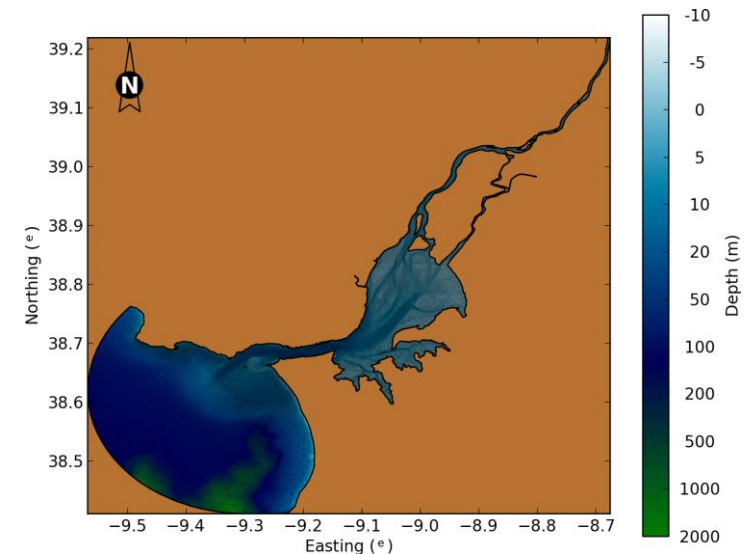
2DH model (SCHISM)

- Barotropic circulation
- Waves
- Inundation of marginal areas
- 175,000 horizontal nodes
- Grid resolution: 3-1600 m
- Depth-averaged



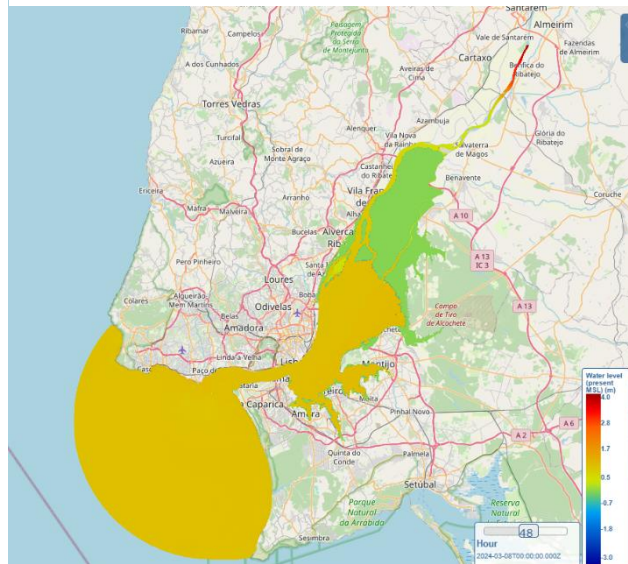
3D model (SCHISM)

- Baroclinic circulation
- Salinity and temperature
- Water quality (nutrients, DO, chlorophyll-a)
- 84,000 horizontal nodes
- Grid resolution: 5-1600 m
- 30-39 nodes per vertical



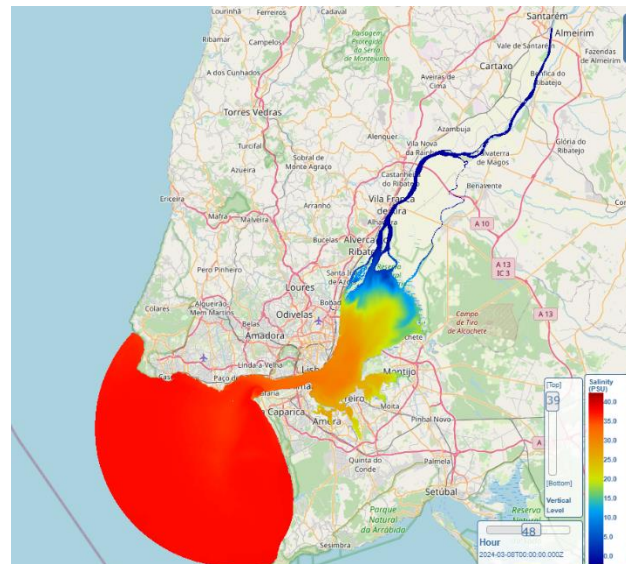
Tagus estuary – daily forecasts and *in-situ* data

Inundation: 2D barotropic model,
waves-currents interaction



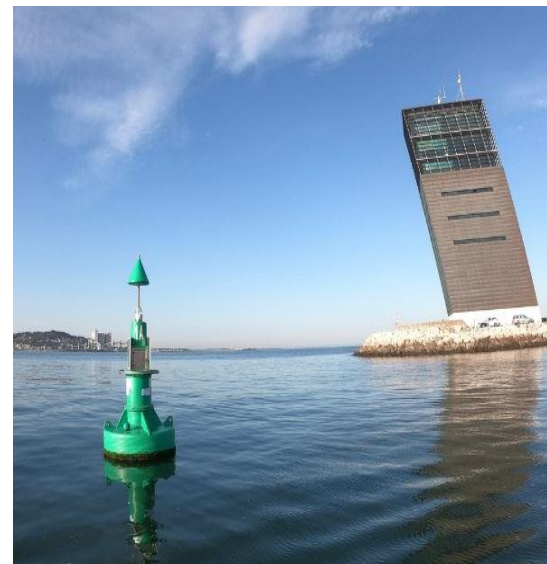
Water levels, Velocity,
Waves (Significant wave height,
Mean period, Direction)

Water quality: 3D baroclinic model,
coupled circulation-biogeochemistry



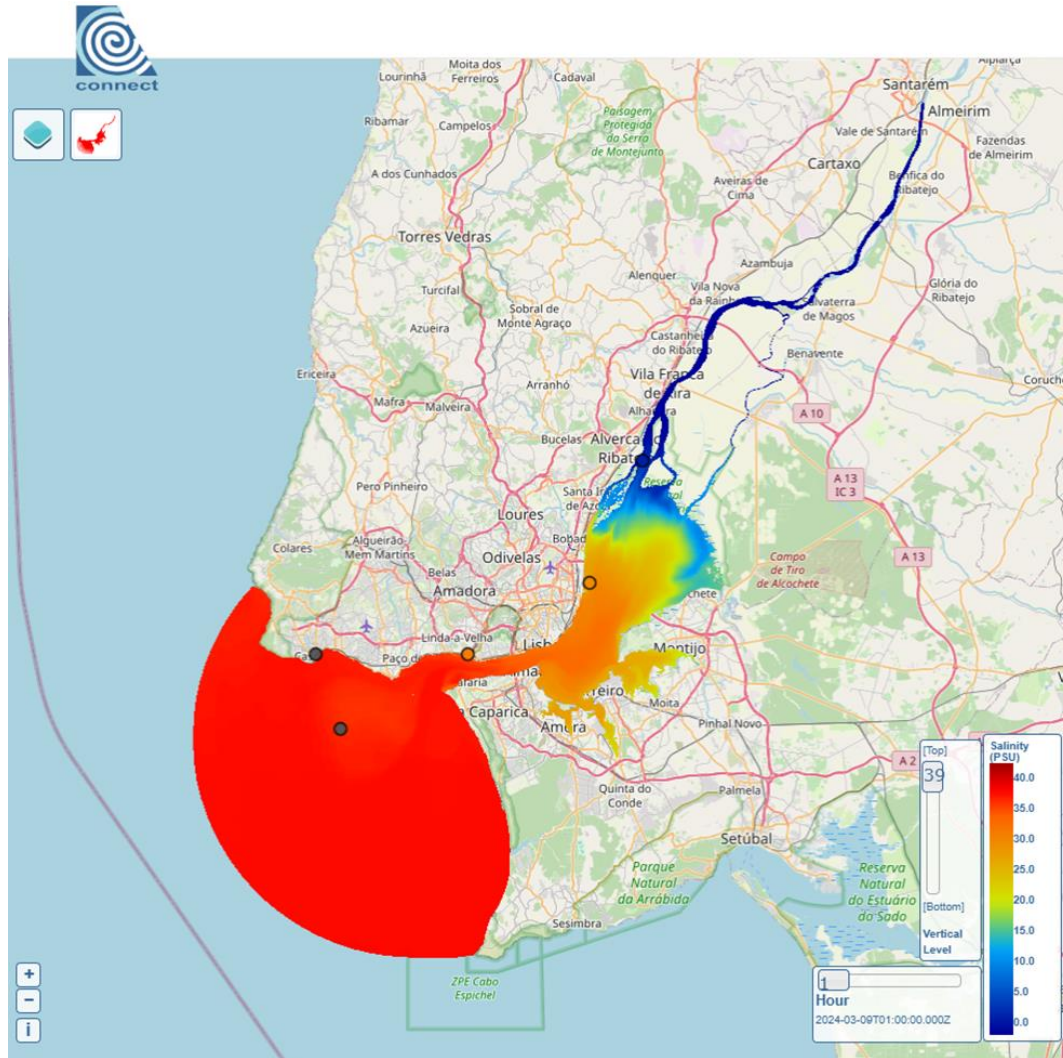
Water levels, Velocity, Salinity,
Temperature, Ammonium, Nitrate,
Phosphate, Silicate,
Dissolved oxygen, Chlorophyll-a

In-situ observation network



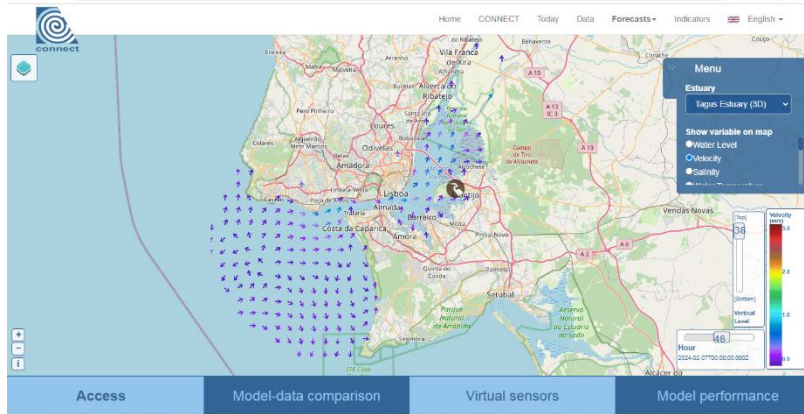
Salinity, Temperature,
pH, Dissolved oxygen,
Chlorophyll-a, Turbidity

CONNECT WebGIS Portal – Today dashboard

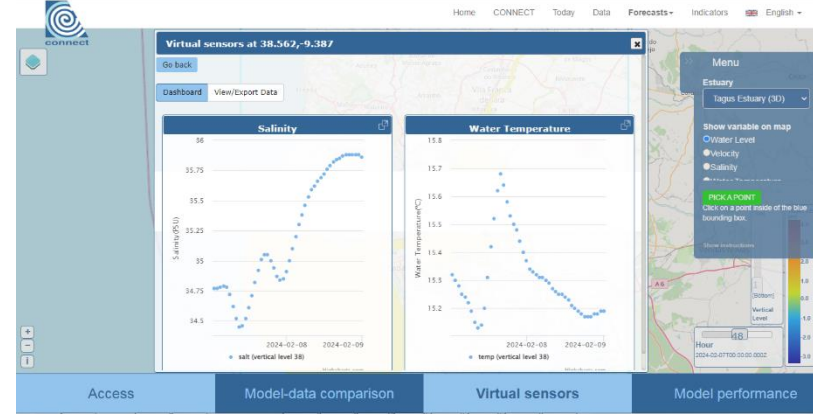


<https://connect-portal.Inec.pt/>

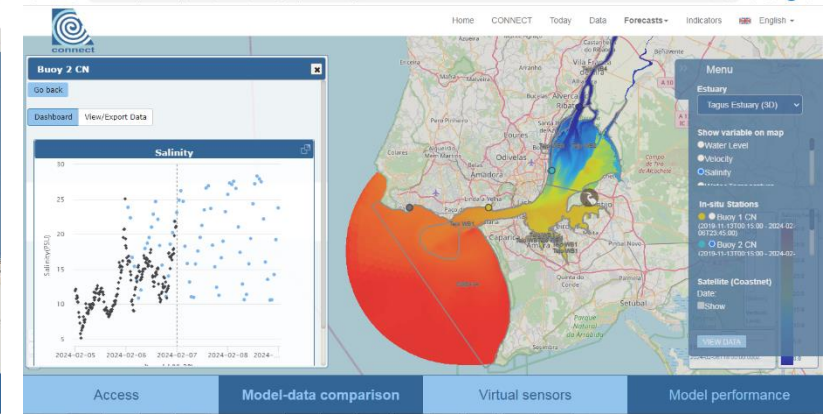
CONNECT WebGIS Portal – main features



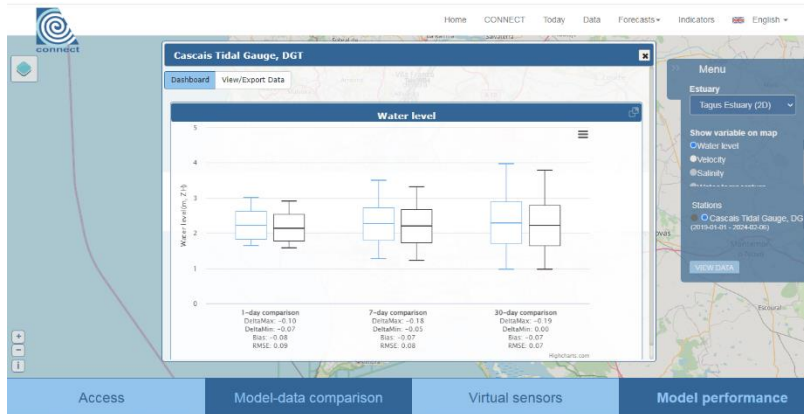
Circulation and water quality forecasts, next 48 hours



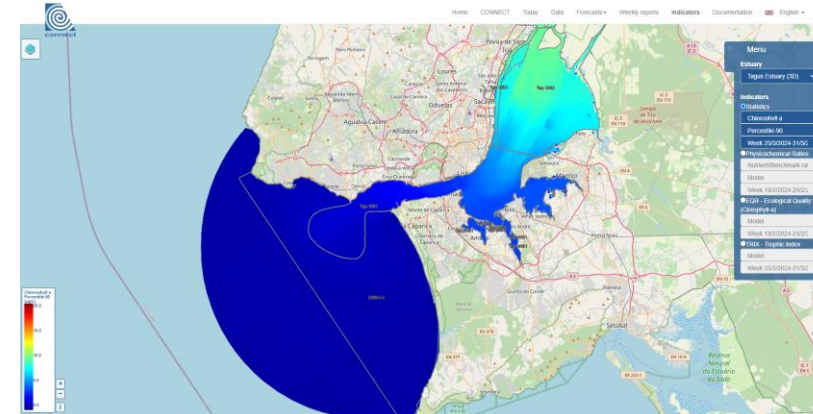
Virtual sensors



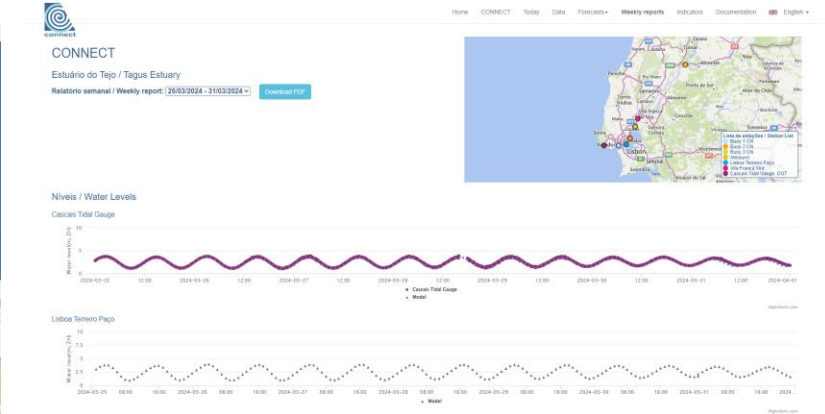
In-situ and satellite observations-model comparison



Model performance

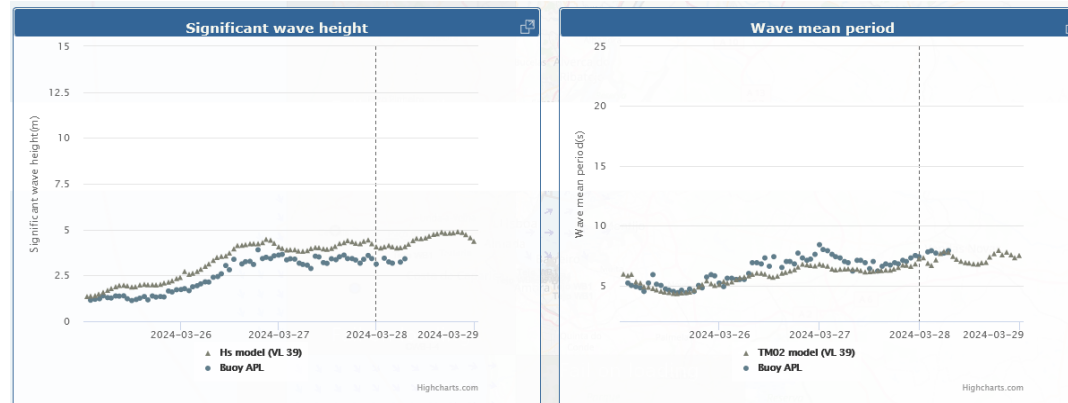


Indicators



Automatic weekly reports

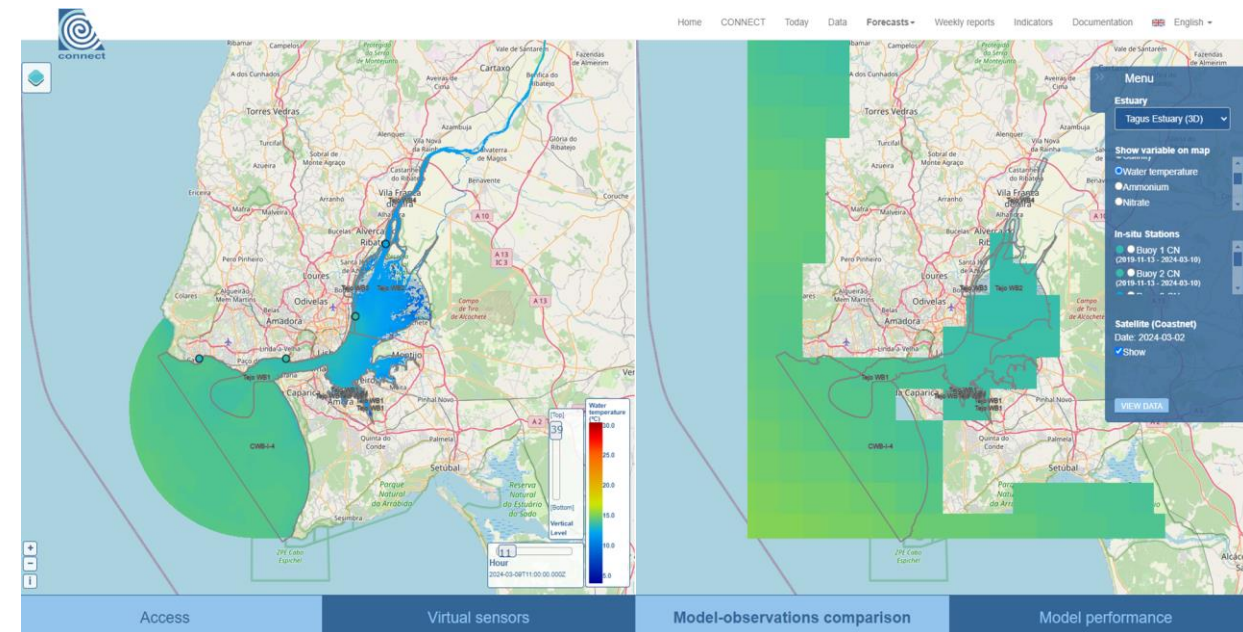
Forecasts validation



Measured and predicted significant wave heights during a major storm



Measured and predicted salinity in the 3 buoys



Temperatures obtained with the 3D model (left), the in-situ sensors (left, circles) and the satellite images (right)

Lessons learned

- The CONNECT coastal service provides continuous knowledge about the status of the estuarine and coastal waters
- Local models can provide useful inputs to the regional models
- River boundary conditions are an important source of uncertainty – AI models are being tested to predict river flows; temperature and biogeochemical forecasts are unavailable
- Comparison between *in-situ* data and satellite images suggest that the latter are reliable in the coastal area but not inside the estuary



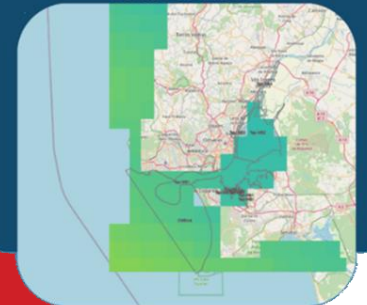
FORECASTS



IN-SITU OBSERVATIONS



SATELLITE



Acknowledgements



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More info here:
connect.lnec.pt

Thank you for your attention!
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