Ocean Predict

SYMPOSIUM OP'24

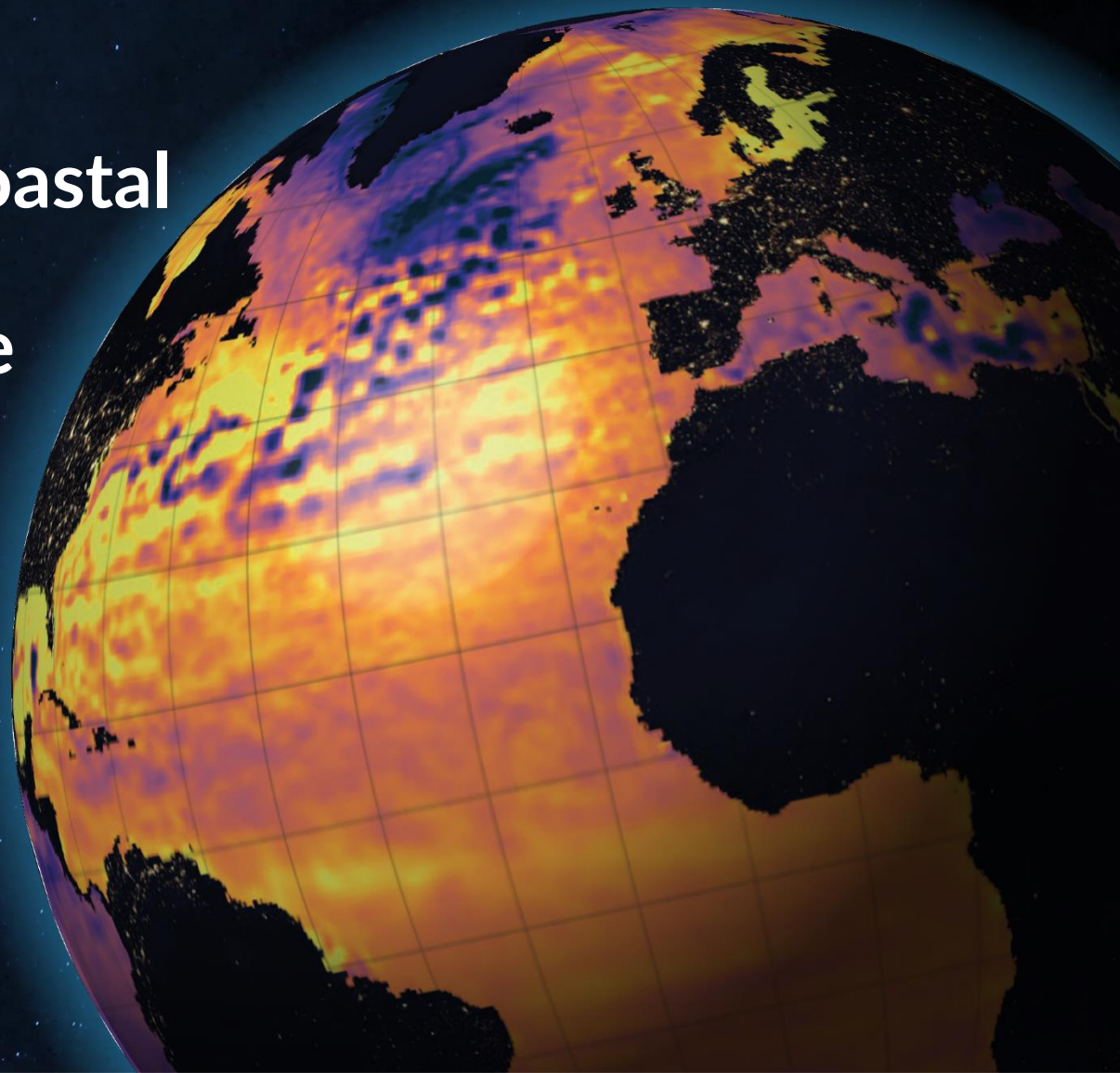
In partnership with unesco Intergovernmental Oceanographic Commission

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

The LisOcean model:

an operational model to provide coastal risks and environmental services co-designed with end-users for the Lisbon Metropolitan Area

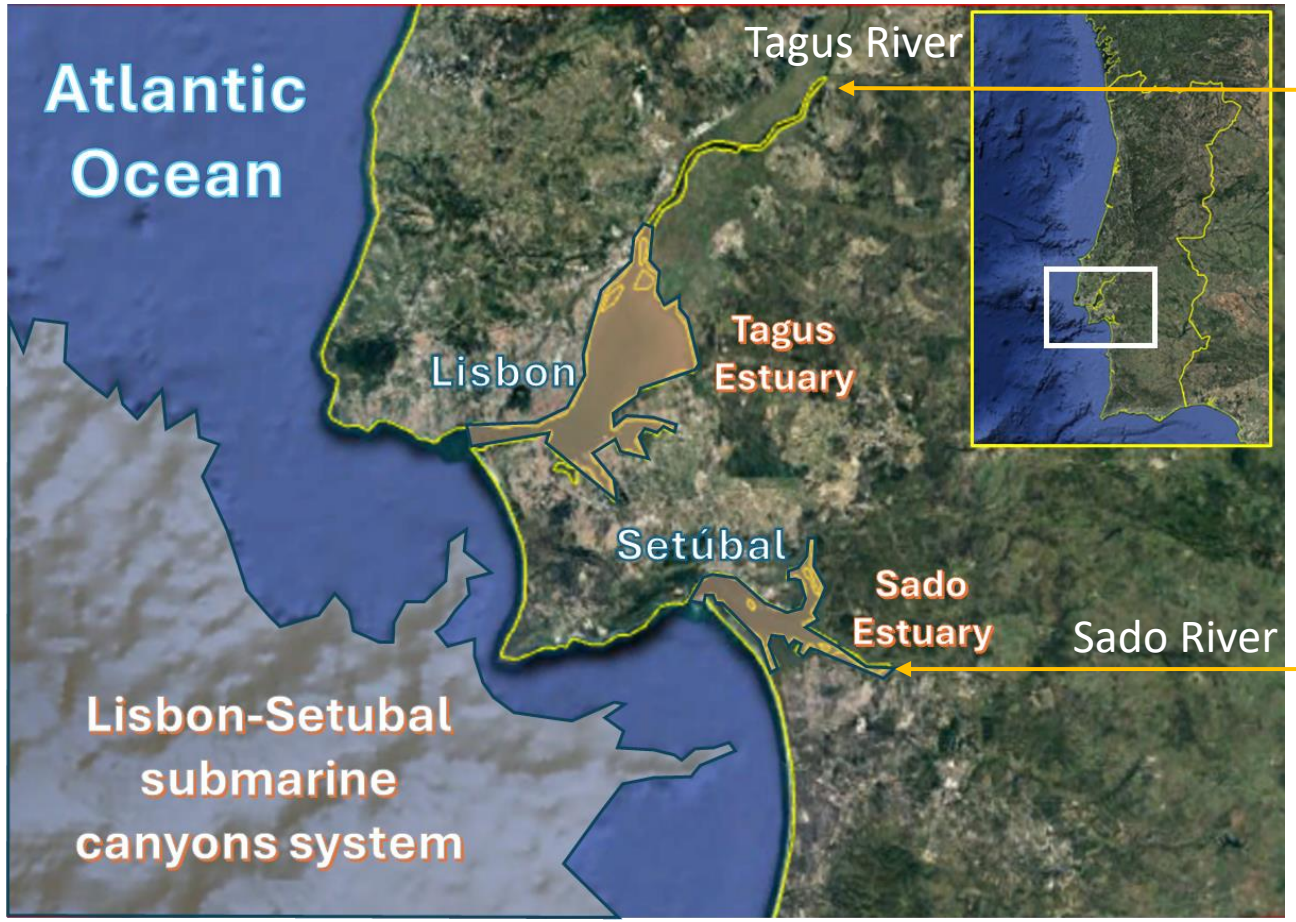
Francisco Campuzano, Cintia Bonanad, **Soraia Romão**,
Luís Pedro Almeida, Andreia Silva, Caio Fonteles,
Luís Figueiredo, Ramiro Neves

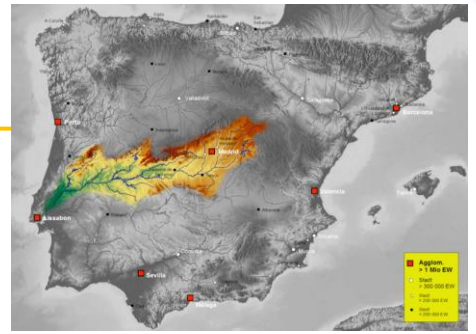


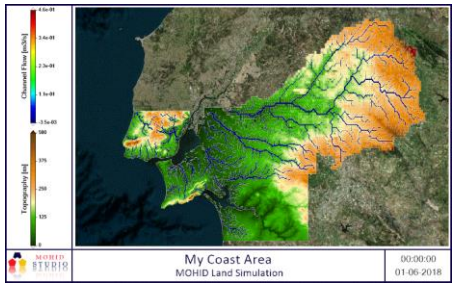
CoLAB +ATLANTIC

Geographical scope and goals

- Many unmonitored fresh water sources (i.e. Sorraia, Trancão, …)
- Towards a complete fresh-water budget of the estuaries



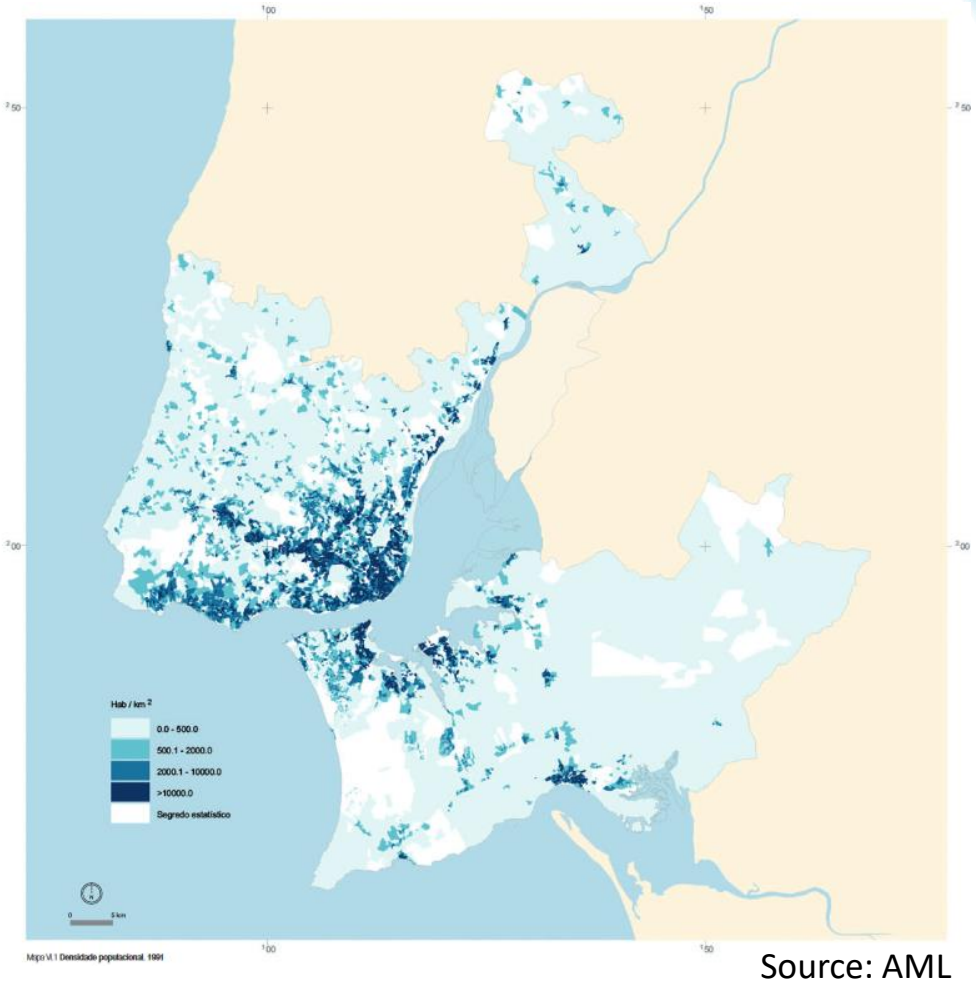




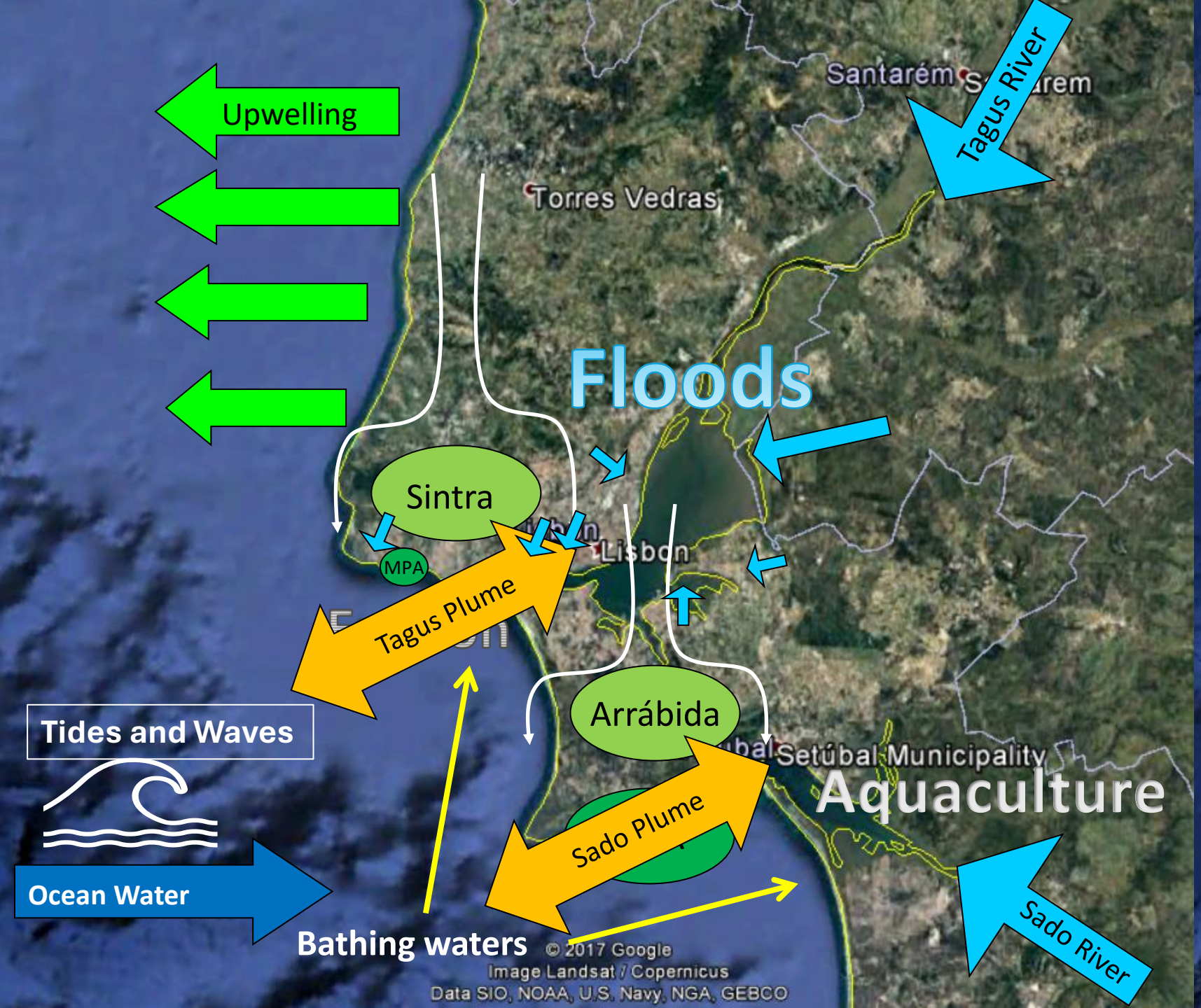
Motivation

In the TSS LIL wants to promote the **aggregation of information collected/generated by different institutions** to facilitate the sustainable development of the blue economy and human activities. The following activities and uses of the coastal zone stand out:

- **Housing**: AML is the most populous metropolitan area in the country (NUTS III), with 2.8 million inhabitants;
- **Ports and tourism**: important commercial ports (Lisbon and Setúbal) and marinas (Cascais, Sesimbra, Troia, etc.);
- **Aquaculture**: large presence and growth in the production of bivalves and other marine products with a focus on the Sado estuary;
- **Research**: headquarters of important research centres and state laboratories, end-users and universities;
- **Environment**: Areas of great environmental interest at European level are included in these boundaries (Natura 2000), including the Avencas marine reserve and the Professor Luiz Saldanha Marine Park, which is an integral part of the Arrábida Natural Park. And the nature reserves of the Tagus and Sado estuaries.

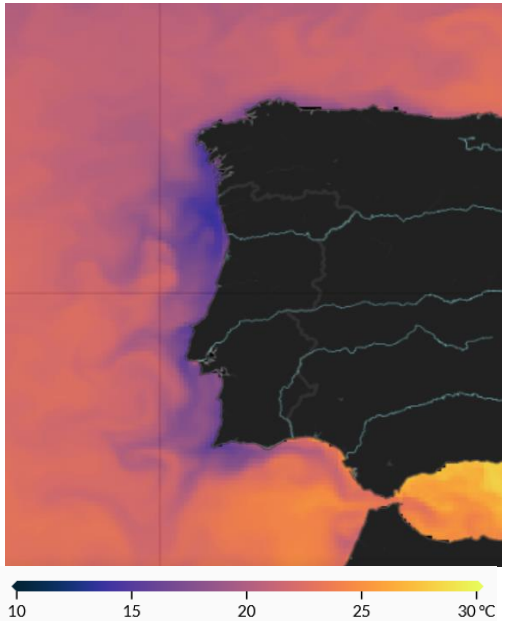


Source: AML


Upwelling
Santarém
Tagus River
Torres Vedras
Floods
Sintra
MPA
Lisbon
Tagus Plume
Arrábida
Setúbal Municipality
Aquaculture
Sado Plume
Tides and Waves
Ocean Water
Bathing waters
Sado River
© 2017 Google
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

+ WHAT IS OUR RECIPE?

Astronomical tide and general circulation

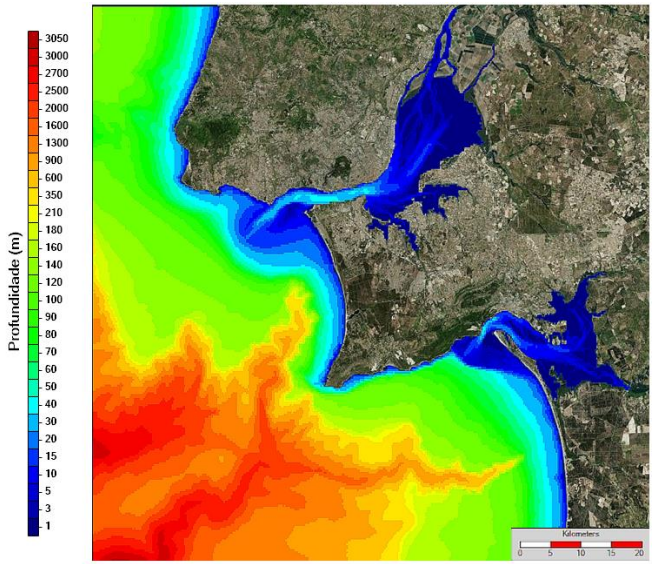


Copernicus Marine Service

cnes CENTRE NATIONAL D'ÉTUDES SPATIALES

+

3D high-resolution bathymetry



MOHID

+

High-quality weather forecast

IPMA

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

+

River flow

apa agência portuguesa do ambiente

EMODnet European Marine Observation and Data Network

CoLAB +ATLANTIC

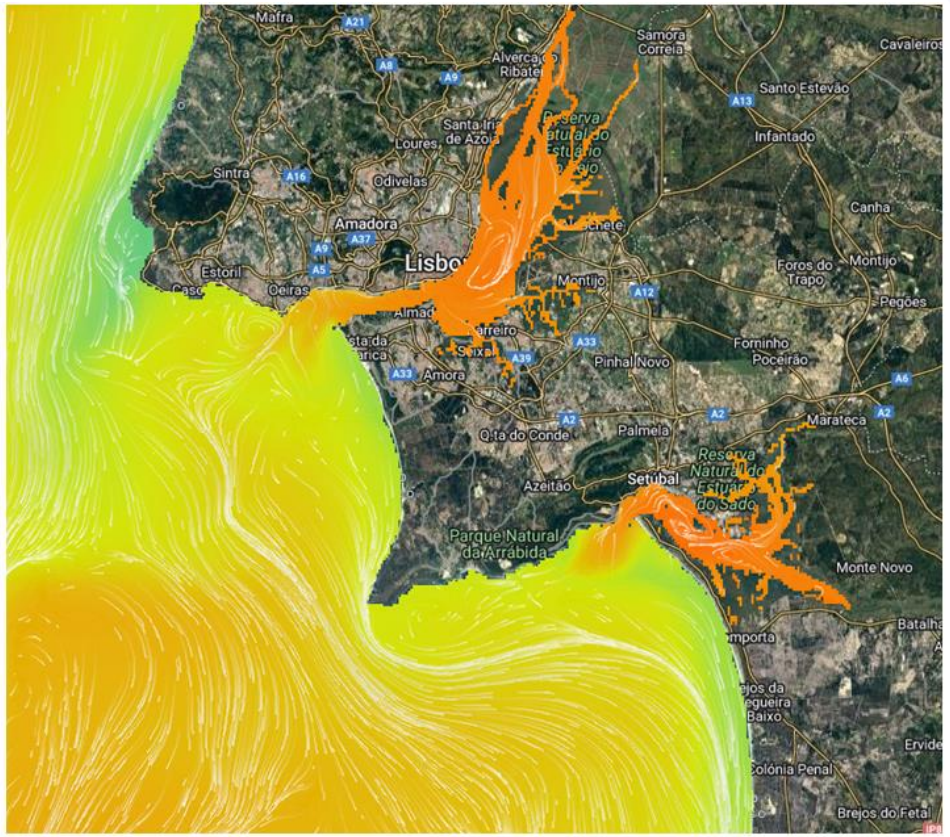
Hydrodynamic model – LisOcean

MOHID

Model implementation:

- Spatial resolution 280 m
- Operational model ~ 3 days forecast
- Hourly surface outputs
- 3H 3D outputs

- Distributed via OPeNDAP
- THREDDS Data Server service
  https://thredds.atlanticsense.com/
- Results available free of charge

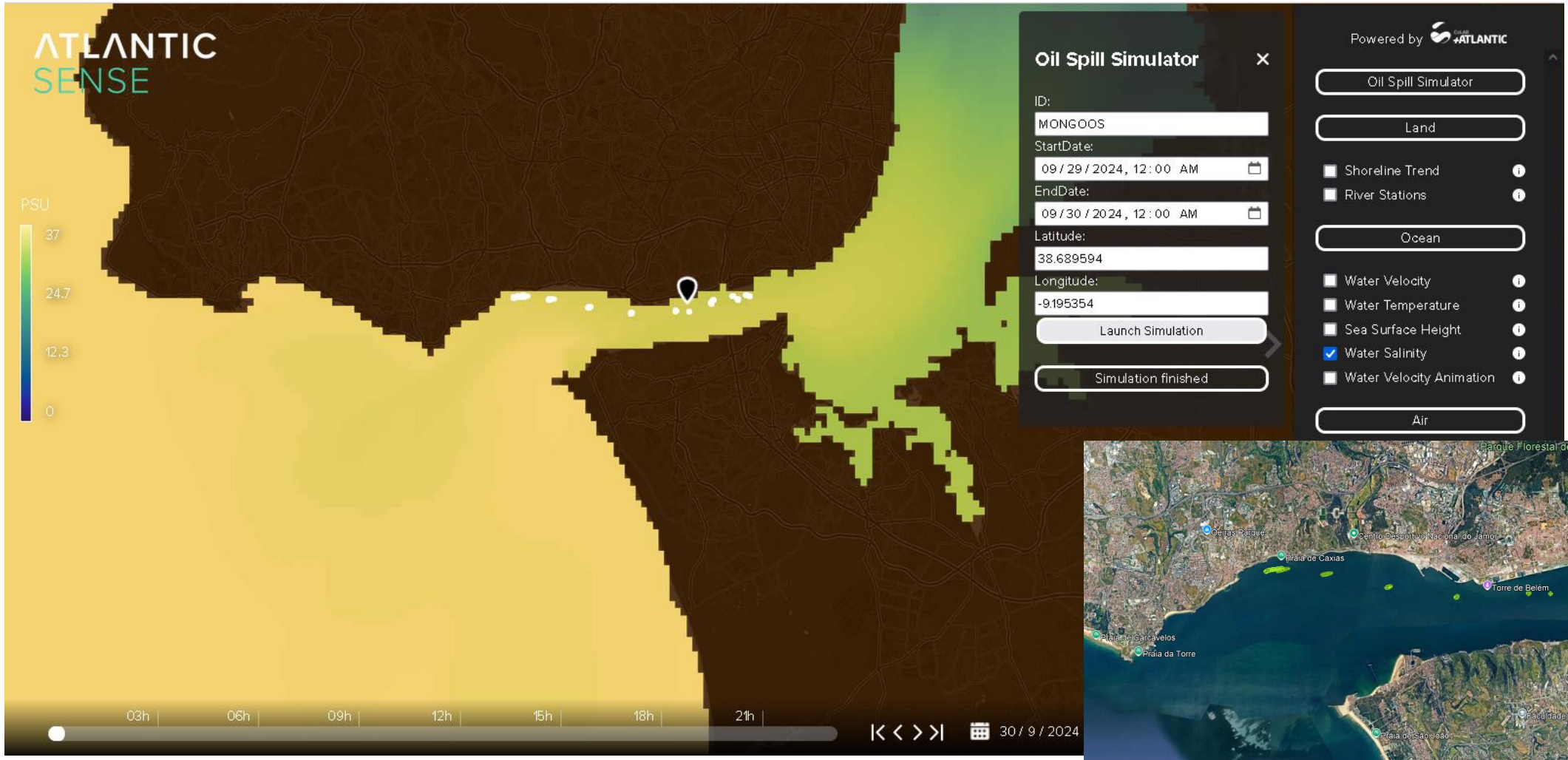


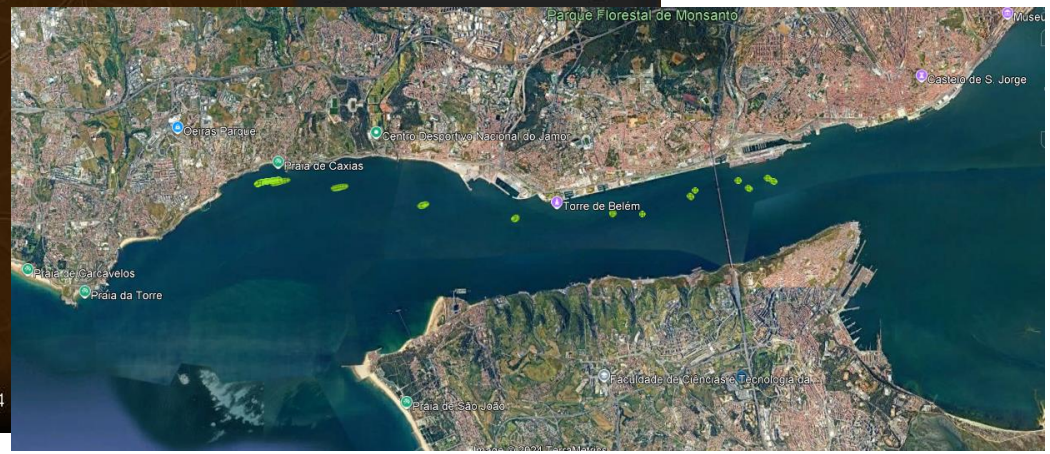
http://pipeline-dito-platform.colabatlantic.com/

COPERNICUS MARINE SERVICE USER ENGAGEMENT PROGRAMME 2022-2028

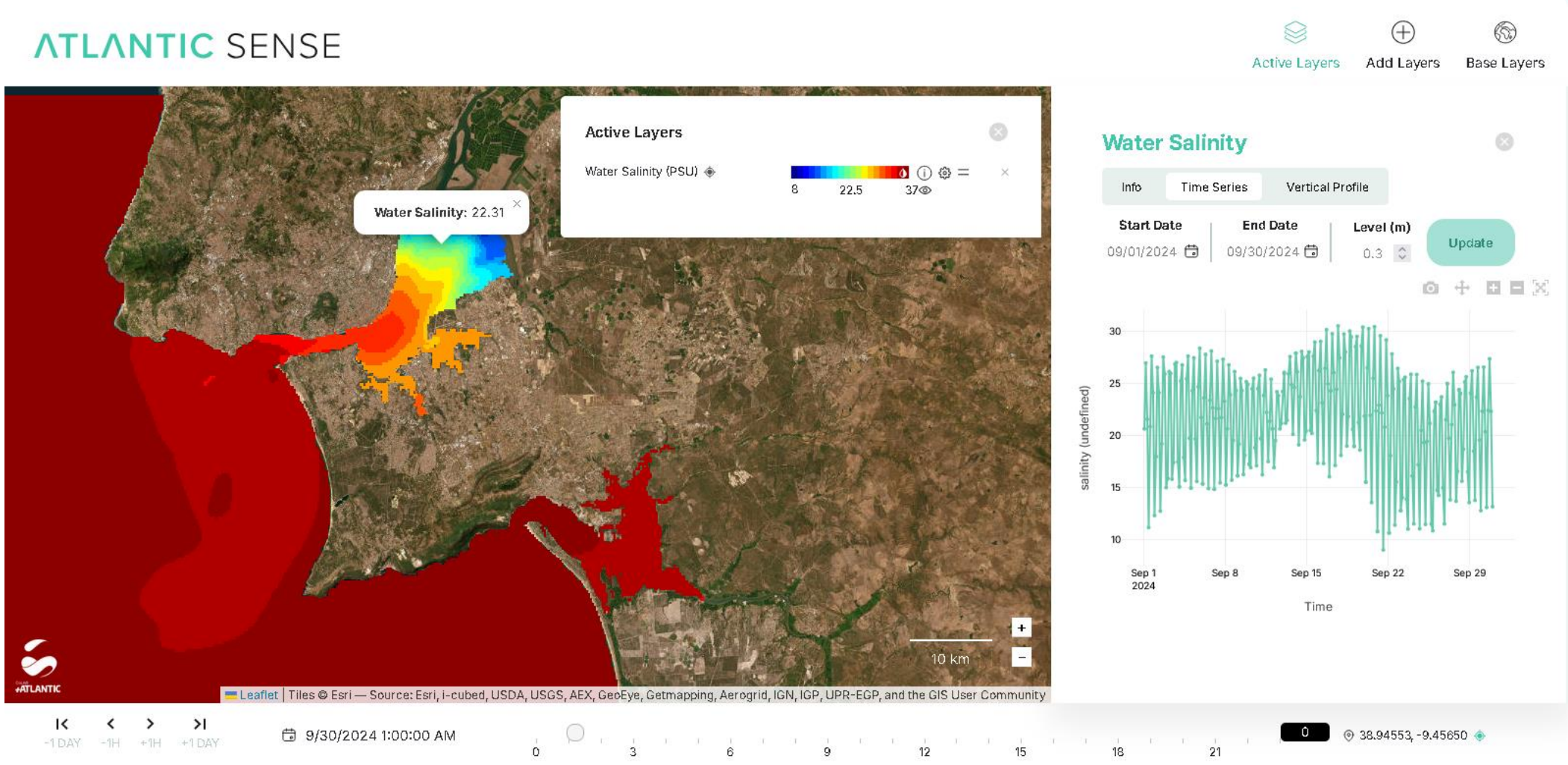
PIPELINE-DITO

ATLANTIC SENSE https://portugal.atlanticsense.com/





ATLANTIC SENSE https://portugal.atlanticsense.com/



Ocean Predict

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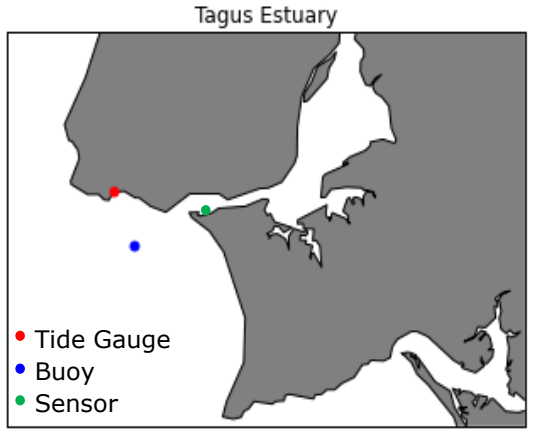
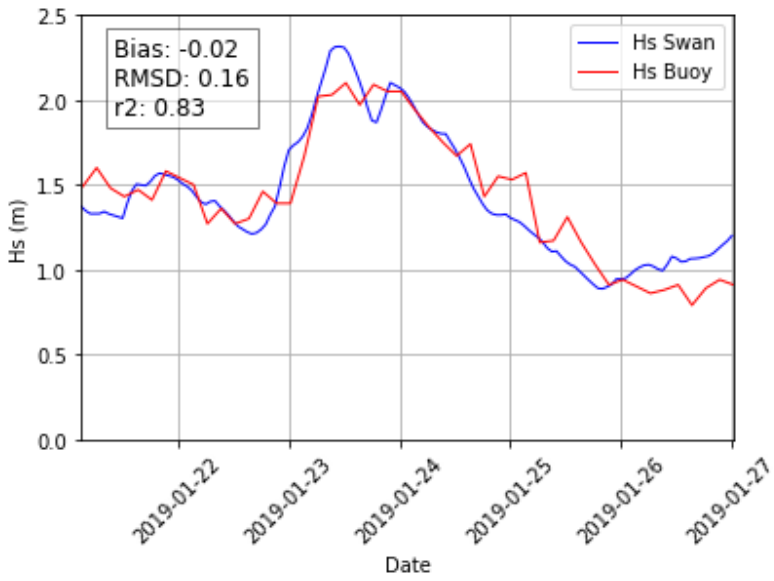
Wave model – LisOcean

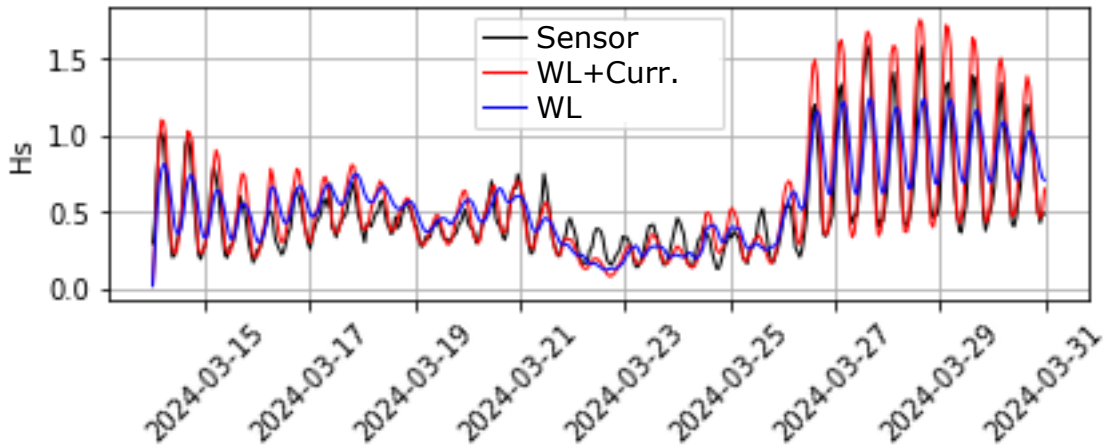
SWAN

Validation:

- Lisbon wave buoy – Port authorities
- Sensor - Coastal e-solutions







	Nível	Nível + Correntes
RMSE	0.18	0.14
r^2	0.82	0.96

Porto de Lisboa

Coastal-e Solutions

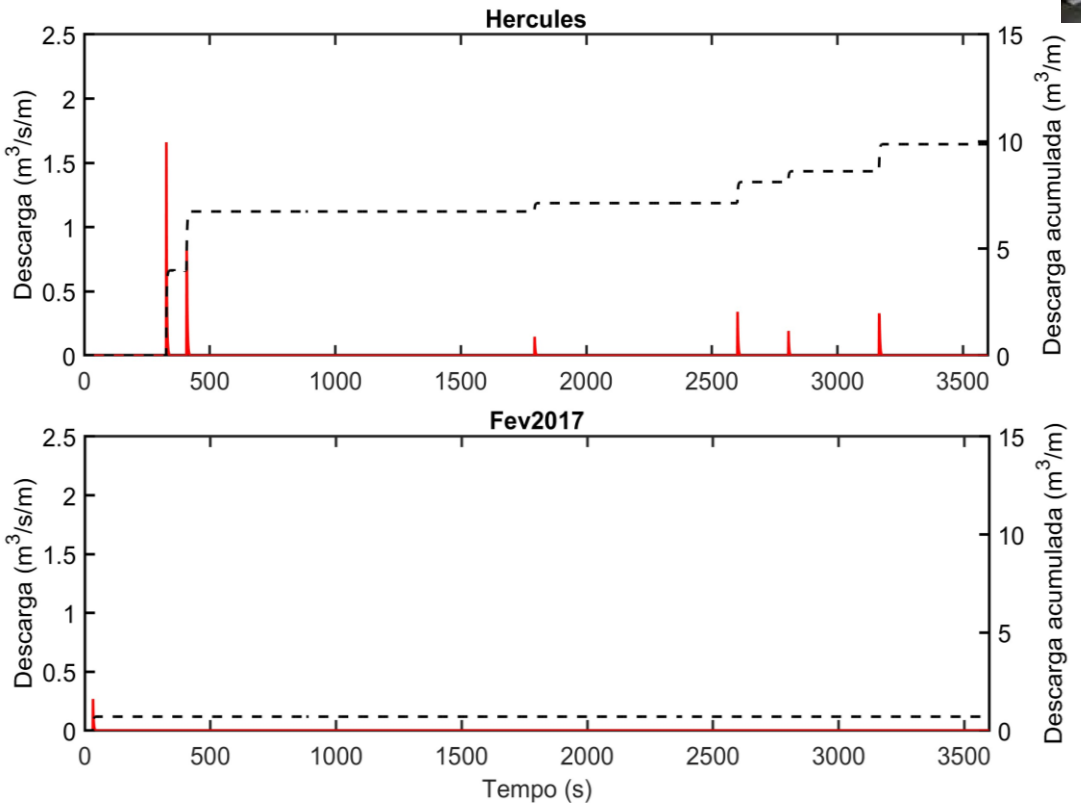
FOCCUS

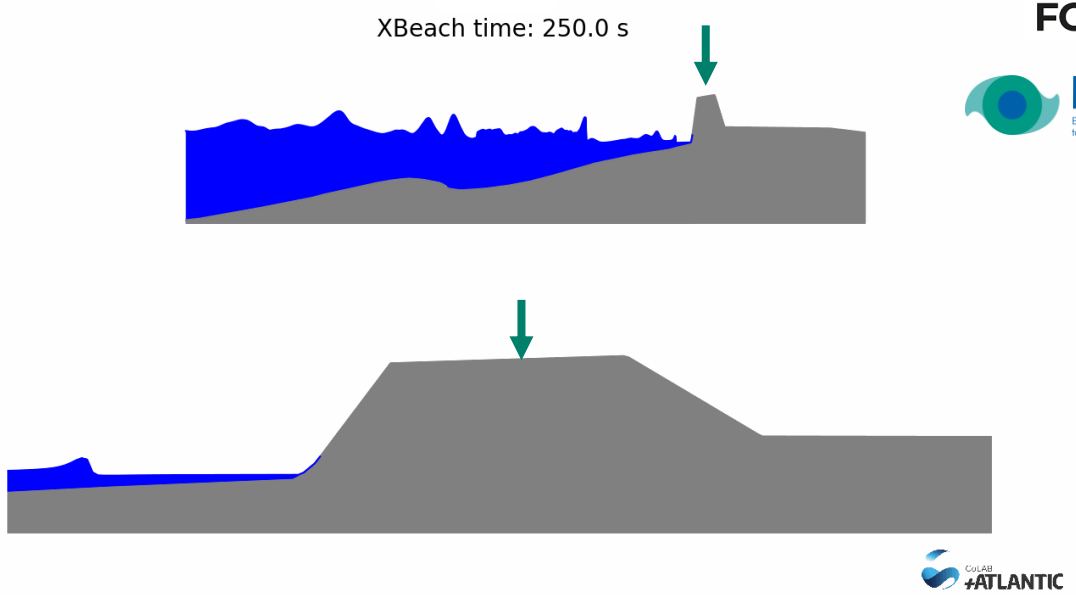
EOatSEE
Earth Observation advanced science tools for Sea level Extreme Events

Coastal risks - Overtopping

XBeach

Costa da Caparica
during storm Hercules





FOCCUS

EOatSEE
Earth Observation advanced science tools for Sea level Extreme Events

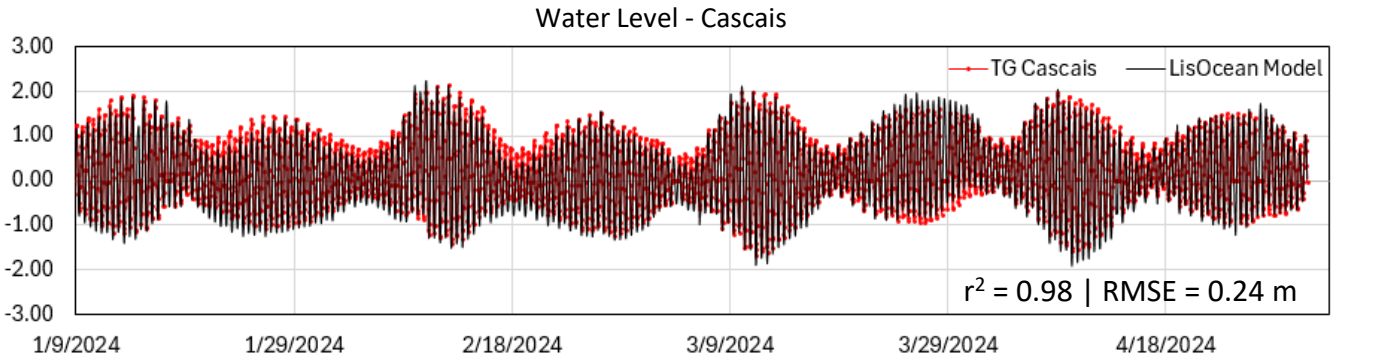
CoLAB +ATLANTIC

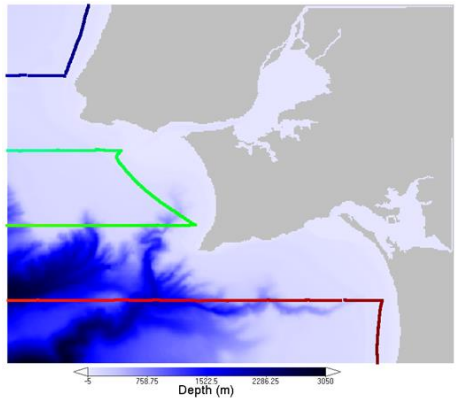
Hydrodynamic model – LisOcean

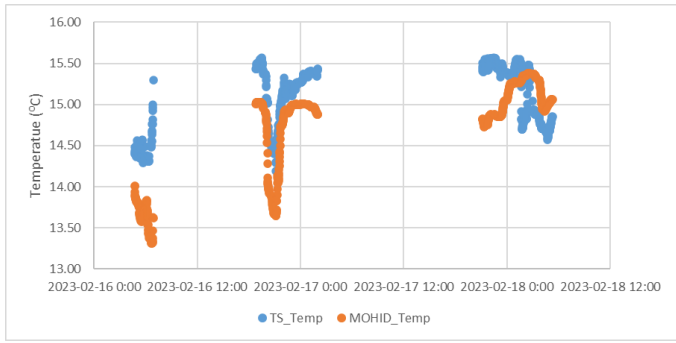
MOHID – Model validation

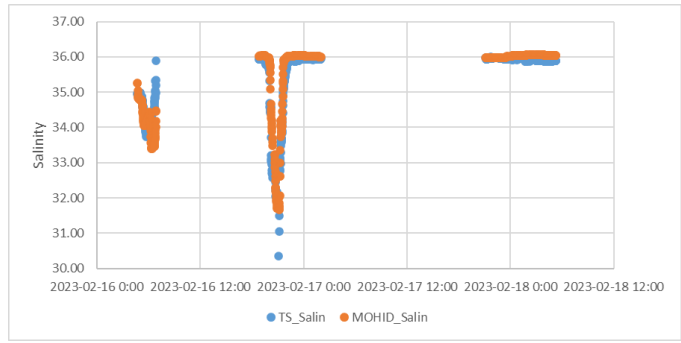
Validation:

- Tide gauges – IH
- CoastNet buoys in the Tagus estuary
- Thermosalinometers – PELAGO Campaign
- Monitoring stations in the Sado estuary – APA
- Thermistors – IPMA





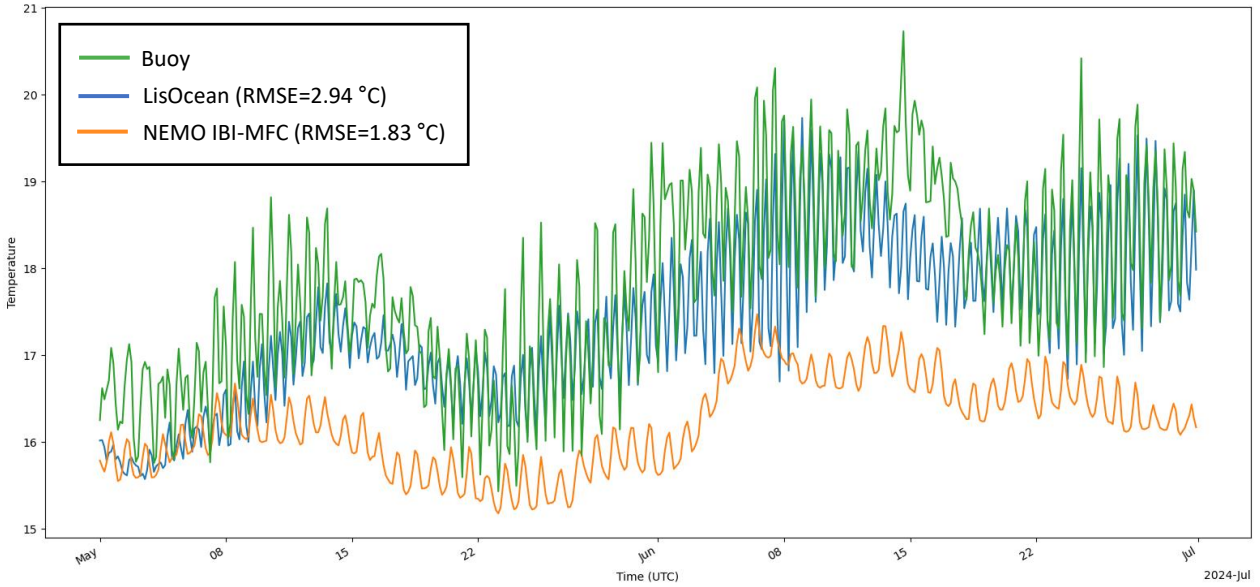




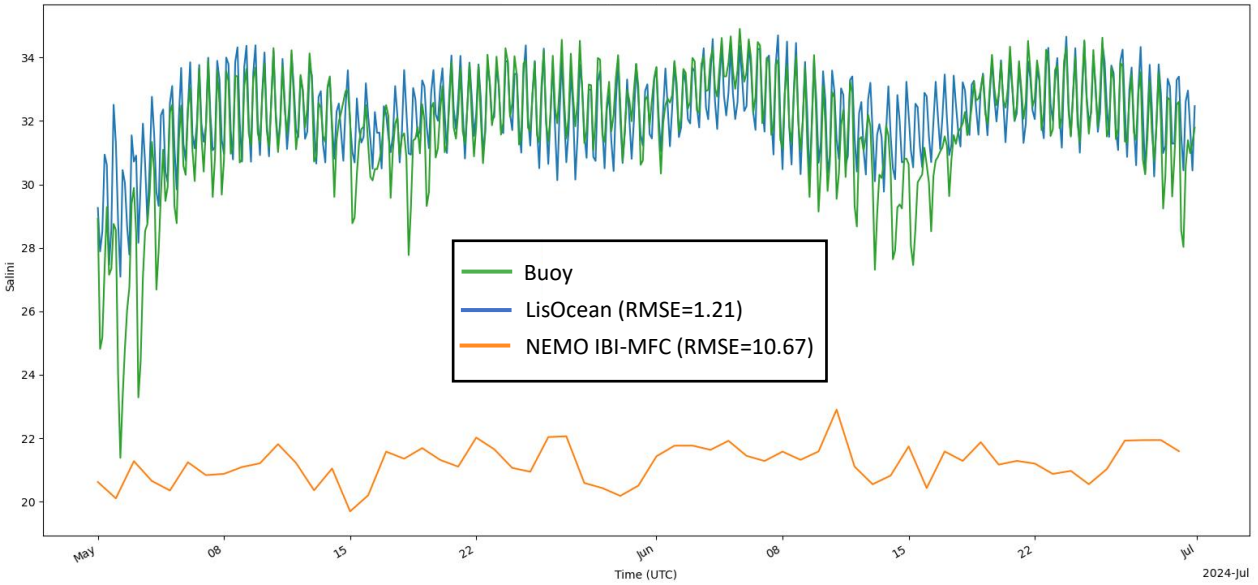
Hydrodynamic model – LisOcean

MOHID – Model validation

Surface mean temperature



Surface mean salinity

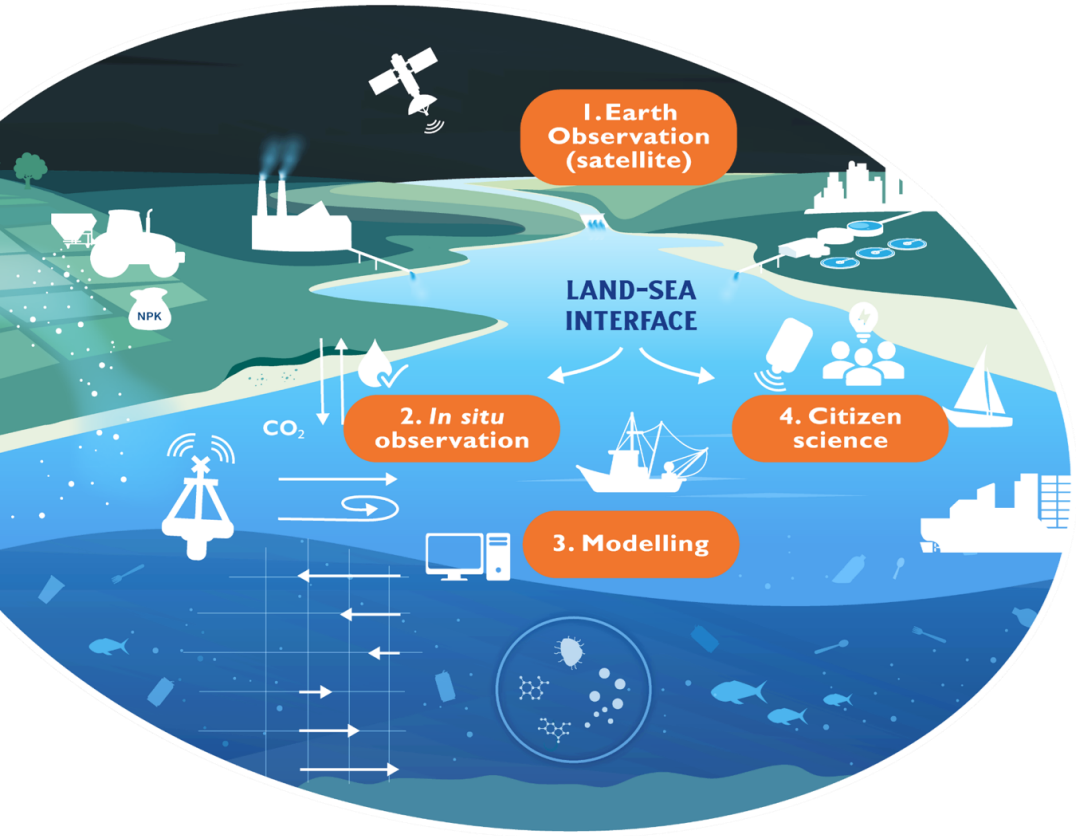


COPERNICUS MARINE SERVICE USER ENGAGEMENT PROGRAMME 2022-2028

COASTNET COASTAL MONITORING NETWORK

About LandSeaLot

Project Objective



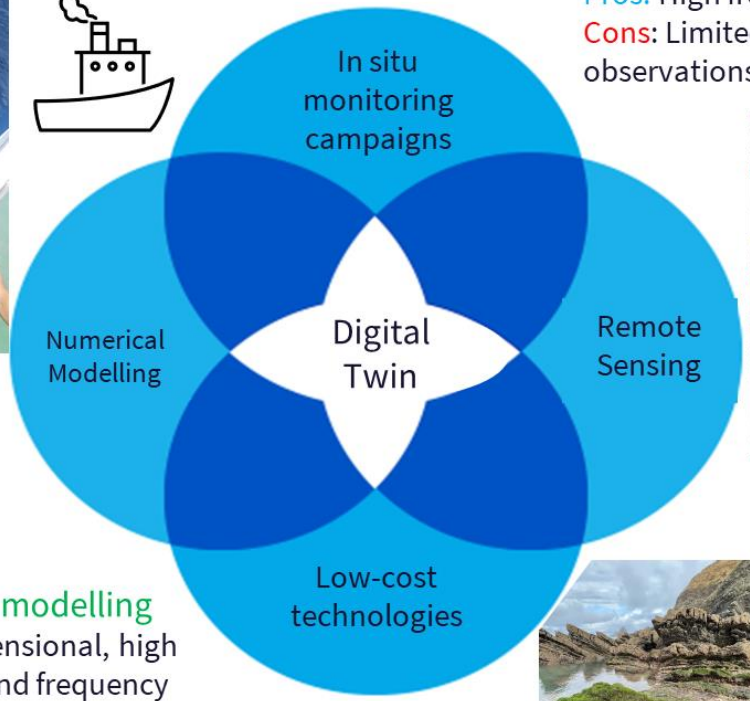
LandSeaLot seeks to **integrate, scale-up and enhance existing observation efforts**, conducted by satellites or in-situ, including by citizen scientists, **together with numerical simulations**, to better study the **land-sea interface**, where terrestrial and marine habitats meet.

Data adquisition in estuarine areas

In situ monitoring campaigns

Pros: wide range of monitoring methods and variables

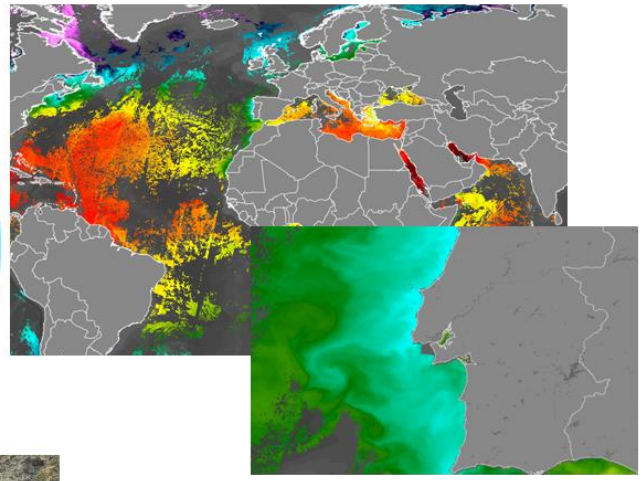
Cons: expensive, low frequency and low coverage

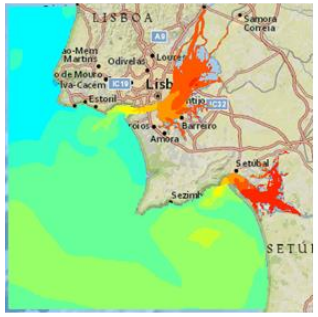


Remote Sensing

Pros: High frequency and large coverage

Cons: Limited number of variables and surface. Need observations for benchmarking. Low resolution for coastal areas.





Numerical modelling

Pros: 3-Dimensional, high resolution and frequency

Cons: level expertise and data for calibration/validation/assimilation needed

Low-cost technologies

Pros: Good value for money

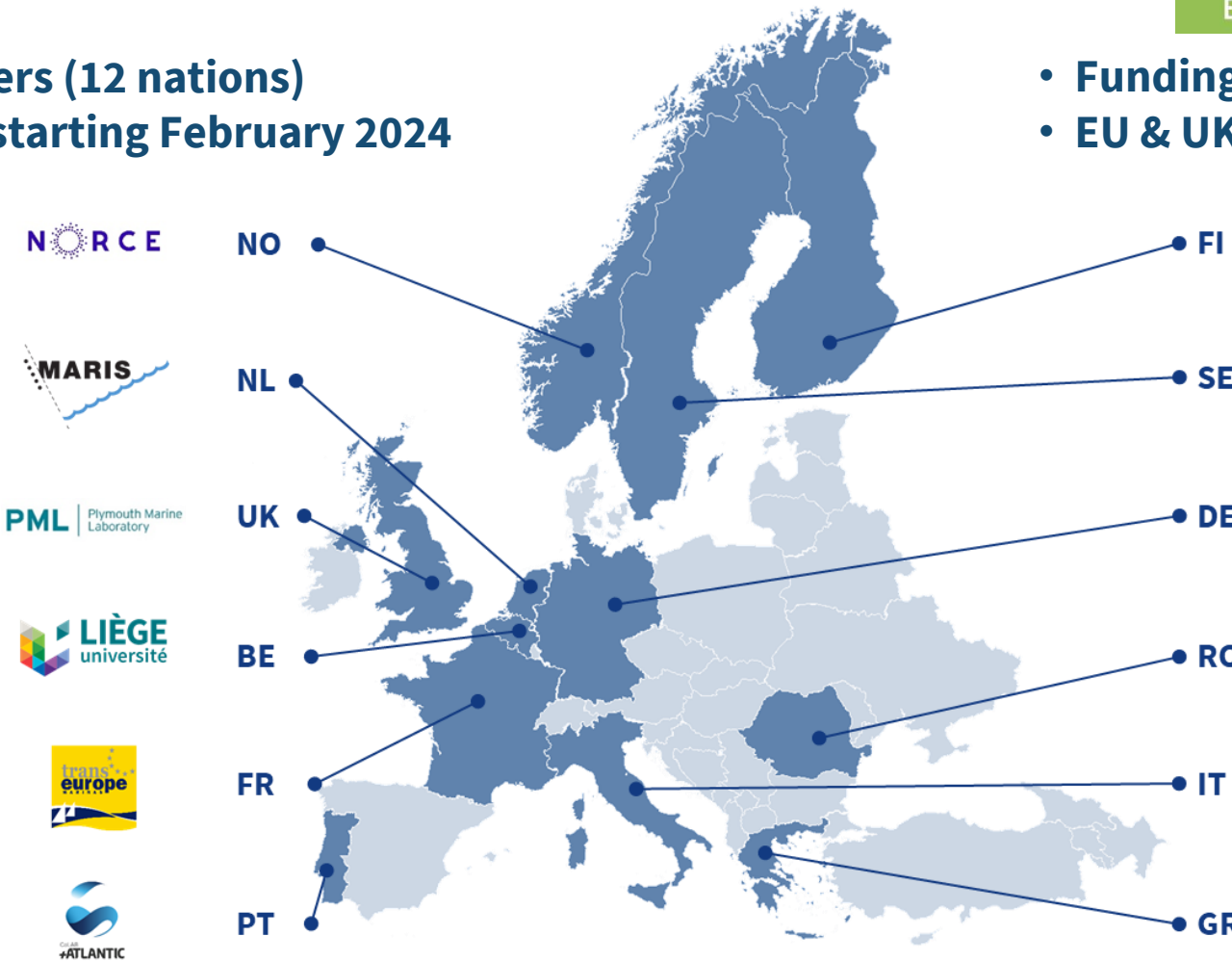
Cons: Limited number of variables

About LandSeaLot

A European project co-funded by Horizon Europe

- 20 partners (12 nations)
- 4 years, starting February 2024

- Funding: € 9,199,778.5
- EU & UKRI funding



COVARTEC — Coastal Ocean Valorisation through Research & Technology

NORCE

Deltares — COORDINATOR

MARIS

UNIVERSITY of STIRLING

PML Plymouth Marine Laboratory

seascape BELGIUM

LIÈGE université

Ifremer

cnrs

trans europe

ATLANTIC

Suomen ympäristökeskus
Finlands miljöcentral
Finnish Environment Institute

SMHI

hereon

Brockmann Consult GmbH

GeoEcoMar

Consiglio Nazionale delle Ricerche

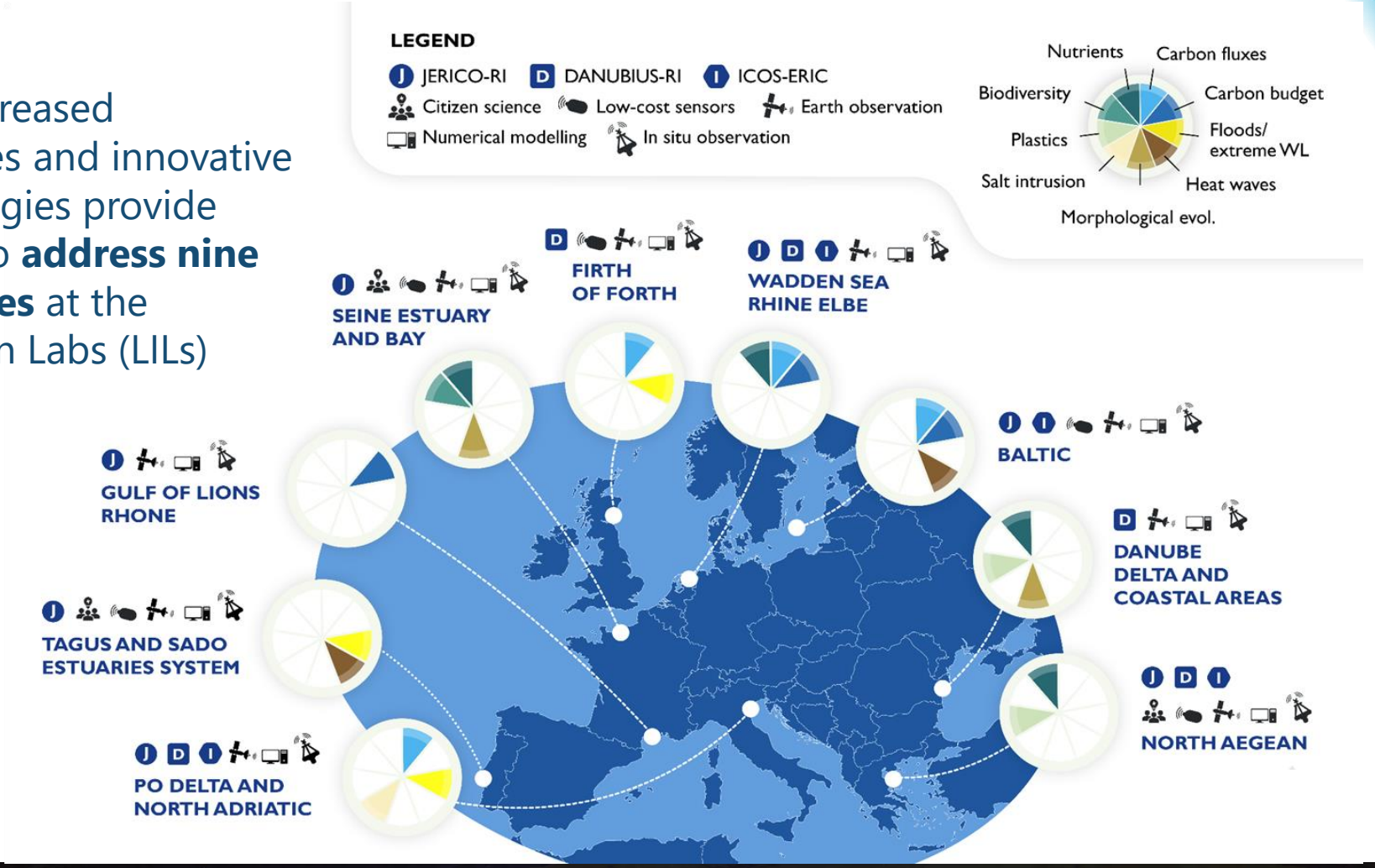
ETT

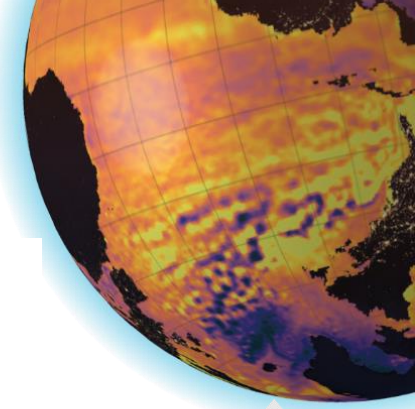
hcmr ΕΛΚΕΘΕ

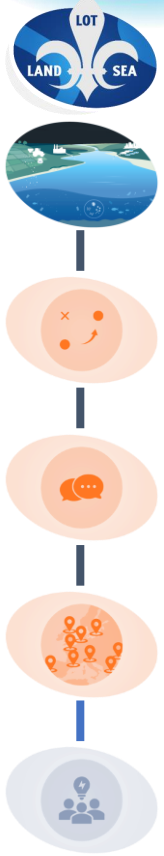
LandSeaLot Integration Labs

Piloting & Testing

Demonstrate how increased observation capabilities and innovative integrative methodologies provide essential knowledge to **address nine key societal challenges** at the LandSeaLot Integration Labs (LILs)







Citizen Science Observers

Co-design with stakeholders the monitoring locations

- Targeting aquaculture producers and marinas users as citizen scientists
- Focusing on water temperature and water level observations
- Improving bathymetry with EO derived information
- Low-cost sensors testbed
- Providing services back through dedicated products

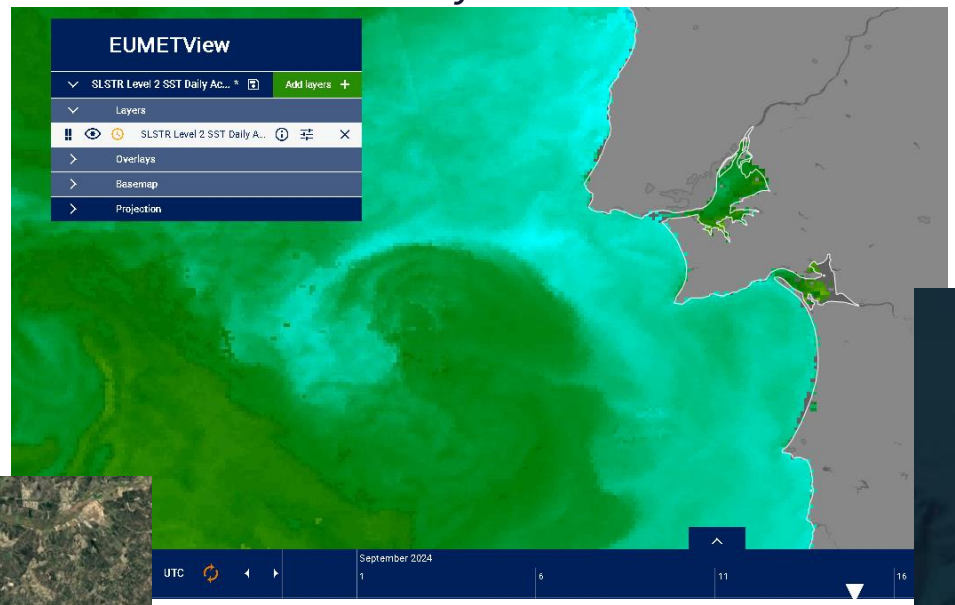
Marine Heat Waves

Advantage of plenty of clear skies in the Mediterranean

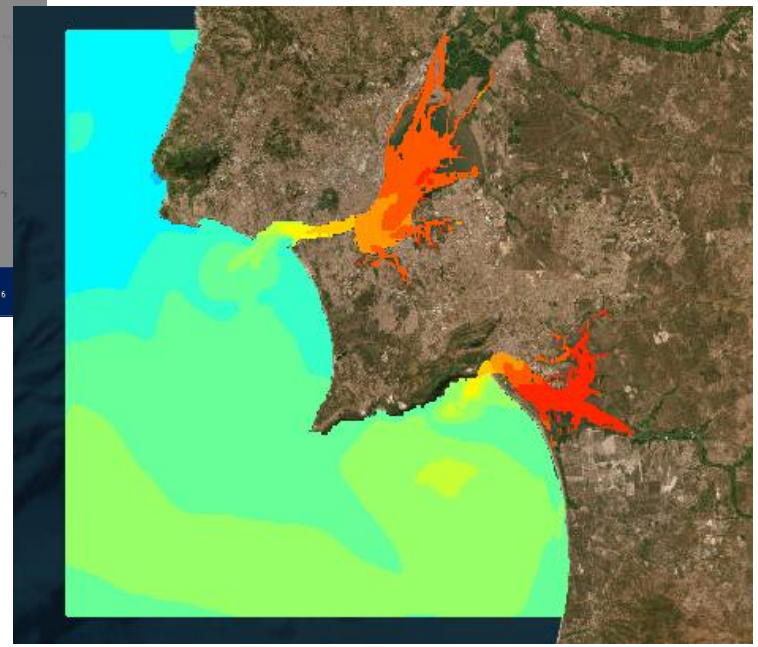
Data catalogue:

- Satellite Data;
- Model;
- In-situ sensors
- Low-cost sensors

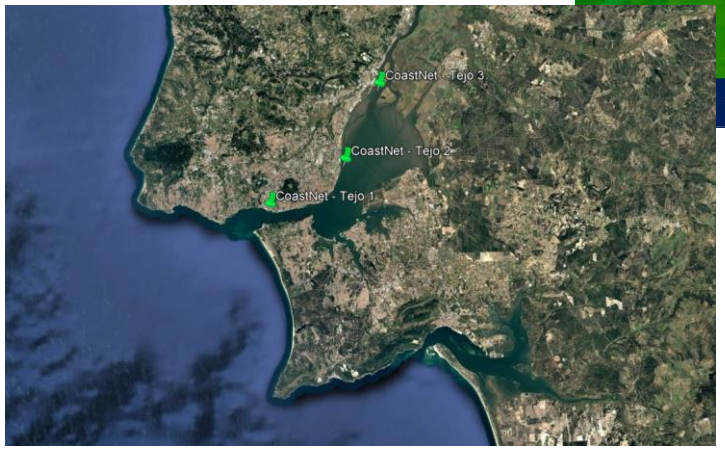
Sentinel3: Daily cumulative SST



Numerical Model



Buoys



Conclusions

- Need for more data in the land-sea continuum
- Near real time river data help to reproduce estuarine patterns but many gaps in river data information
- Society can contribute to collect the data
- Cost-effective technology can help to collect the variability in coastal systems
- Remote sensing new products can be tested in the coastal area (SST, WL)

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Ocean Predict

Ocean Predict

In partnership with unesco Intergovernmental Oceanographic Commission

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

SYMPOSIUM OP'24

ADVANCING OCEAN PREDICTION
SCIENCE FOR SOCIETAL BENEFITS

Thank you!

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e-mail: soraia.romao@colabatlantic.com

CoLAB +ATLANTIC

European Commission

Copernicus Marine Service

EU4oceanobs INTERNATIONAL OCEAN GOVERNANCE EU COMPONENT TO GLOBAL OCEAN OBSERVATIONS

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Met Office

NERSC

MERCATOR OCEAN INTERNATIONAL

Australian Government Bureau of Meteorology

Canada