

Theme 7: User applications

A COASTAL AND ESTUARINE OPERATIONAL OCEANOGRAPHY SYSTEM AND DERIVED DOWNSTREAM SERVICES FOR MARINE POLLUTION PREVENTION AND WATER QUALITY MANAGEMENT

Introduction

Nowadays, the availability of data on the physical environment and tools at the coastal and local scale for marine pollution and water quality applications is limited, mainly due to the high spatial resolution required in these areas and the complexity of the processes to be modelled.

Objectives

To face these challenges, this work presents a coastal and estuarine Operational Oceanography System (OOS) based on an innovative combination of numerical and AI-based techniques to provide high-resolution ocean variables and the associated downstream services for marine pollution prevention and water quality management.

Methods

Coastal Modelling and AI-based Estuarine OOS

- Coastal Modelling System (CANT-CMS):** a coastal OOS based on ROMS model and nested to IBI-MFC to provide the forecast (2-5 days) of ocean variables (~300 m spatial resolution) in the Cantabrian coast.
- Estuarine AI-based System (SDR-EMS):** a local OOS based on machine learning techniques (RNN-LSTM) to provide the forecast (2-5 days) of ocean variables (~50 m spatial resolution) in Santander Bay.

(CMS ANALYSIS AND FORECAST IBI-PHY)

ROMS

SDR-LMS

AI/Machine Learning

CICLOPE – AI-based Water Quality Forecast System

CICLOPE: operational forecast system nested to IBI-MFC to provide water quality forecast at bathing areas according to Directive 2006/7/EC in Santander Bay and Cantabrian coast.

Alivio 122

CE: 0.97865
R2: 0.9803
Optimizer: Adam
Batch Size: 160
Hidden Layers: 7
Input Act. Funct: selu
Output Act. Funct: selu
%Test Data: 15

Evento: 0021

Alivio 122 (m3/s)

t (horas)

CICLOPE

IHTESEO -Marine Pollution System

IHTESEO: online modelling system nested to international and national data providers (CMEMS, NOAA, EMODnet...) to provide **worldwide simulations and forecasts**

- Oil spills (**OIL Module**)
- Chemical spills (**HNS Module**)
- Floating elements (**DRIFTER Module**)
- Search and Rescue (**SAR Module**)

pyTESEO TESEO v2

pyTESEO: a Python tool to help users running the model (<https://ihcantabria.github.io/pyteseo/>)

IHTESEO, pyTESEO and the new version of the numerical model (**TESEOV2**) are under development and will be released in 2025.

Results

Coastal and Estuarine OOS

- The Coastal OOS is running in real time (operational) at IHCantabria.
- The Estuarine AI-based OOS is under development and will be released in 2025.

Example of validation and intercomparison of models of the coastal and Estuarine OOS

CICLOPE – Web App

Example of water quality forecast provided by the system at bathing areas (under development).

IHTESEO – Web App

Example of the Web App and oil spill trajectory forecast provided by IHTESEO system.

<https://ihteseo.ihcantabria.com/>

Conclusions

- This work shows the potential of the combination of numerical modelling and machine learning to provide high-resolution data and to implement operational oceanography systems in coastal and local areas (such as estuaries, bays or ports).
- The methods and tools developed will contribute to enhance the ocean monitoring in coastal areas and to improve the prevention and management of marine pollution and bathing water in coastal areas, and specifically, in the Cantabrian coast.

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