Title:

Towards an operational hydrodynamics and biogeochemical model of the Tagus estuary

Authors & affiliations:

Marta Rodrigues[1], Daniela Santos[1], João Rogeiro[1], André B. Fortunato[1], Joana Teixeira[1], Anabela Oliveira[1], Ricardo Martins[1]

[1]Laboratório Nacional de Engenharia Civil

Abstract:

Introduction

Climate change and the predicted increase of human activities in estuaries may increase the hazards in these systems. Water observatories can support both the daily and the long-term management of estuarine ecosystems. Although in the past water observatories were mostly based on observations, these tools have evolved to account for forecasts, scenarios analysis and indicators.

This study describes the implementation and validation of the operational hydrodynamics and biogeochemical model of the Tagus estuary (Portugal). The operational model is one of the components of the Tagus estuary observatory, which was implemented to assess the estuarine buffering capacity relative to climate change and anthropogenic pressures.

Methods

The 3D hydrodynamics and biogeochemical model of the Tagus estuary was implemented using the community modeling system SCHISM. The hydrodynamic model is fully coupled to a biogeochemical model that simulates several tracers (e.g. chlorophyll *a*). The biogeochemical model was calibrated and validated by comparison with data from 2010 and 2018, respectively. Both datasets cover the whole estuary. In operational mode, the model is forced by: i) forecasts from IBI-CMEMS and climatology at the oceanic boundary, ii) climatology at the riverine boundaries, and iii) atmospheric forecasts from GFS-NOAA at the surface.

Results and Discussion

Results show the ability of the model to represent the main spatial and temporal patterns of salinity, temperature, nutrients (ammonium, nitrate, phosphate and silicate), chlorophyll *a* and dissolved oxygen in the Tagus estuary. The main differences arise from uncertainties in the boundaries conditions and the existence of other point sources that were not considered in the model.

In operational mode, the model produces daily forecasts of water levels, currents, salinity, temperature and a set of biogeochemical variables. Model forecast are integrated with real-time observations, to support its continuous validation, and allow anticipating events of contamination and the continuous surveillance of the estuary.