

## APPLICATION OF AN ESTUARINE AND COASTAL NOWCAST-FORECAST INFORMATION SYSTEM TO THE TAGUS ESTUARY

M. Rodrigues<sup>1</sup>, J. Costa<sup>1</sup>, G. Jesus<sup>1</sup>, A. Fortunato<sup>1</sup>, J. Rogeiro<sup>1</sup>, J. Gomes<sup>1</sup>, A. Oliveira<sup>1</sup>, L. David<sup>1</sup>

**Paper topic:** Shelf, nearshore and estuarine forecasting systems

### 1. Introduction

Coastal and estuarine nowcast-forecast systems started being developed in the 1990's to provide coastal managers with short-term oceanographic predictions (e.g., waves, tidal currents). Over the years, they evolved in both scope and functionality. Forecasts now include more physical processes, and better functionalities are being developed to convey data and model results to the user. This paper will describe recent advances in the development of a nowcast-forecast system (RDFS-PT, available at [ariel.lnec.pt](http://ariel.lnec.pt)) in operation for the Portuguese coast. This system, which provides wave and circulation forecasts for the Portuguese shelf and two estuaries, is now being extended for water quality (fecal contamination and oil spills), and its interface is being revamped to take advantage of websig technologies.

The RDFS-PT platform integrates numerical models and field data, a set of scripts and programs, and an interface for visualization (Jesus et al., 2012). The architecture of the RDFS-PT platform includes a set of servers integrated in a central system running LINUX. These servers are responsible for running the daily forecasts of the models, which can then be accessed by a Web browser. Model forecasts, data access and management tools are stored in the central system.

### 2. Baroclinic flow and fecal contamination model of the Tagus estuary

Hydrodynamics and fecal contamination in the estuary are simulated with ECO-SELFE. ECO-SELFE is a 3D community model which solves for circulation (SELFE, Zhang and Baptista, 2008) and fecal contamination (Rodrigues et al., 2011), among many other processes. The use of unstructured grids allows for cross-scales simulations, from the small river inputs to the shelf.

In preliminary hindcast simulations, the circulation model was validated with salinity and temperature data from 1988 (Figures 1a,b), covering a range of environmental conditions (David et al., 2013). A preliminary analysis of the coupled hydrodynamic and fecal contamination model was also performed to evaluate the area of influence of the discharge from the Alcântara outfall (Costa et al., 2012). These scenarios accounted for different environmental and discharge conditions (dry- and wet-weather periods). Preliminary validations against data collected during experimental surveys show the models's ability to represent the main patterns observed in fecal contamination indicators – Figures 1a,c.

### 3. Deployment of the operational forecast platform RDFS-PT to the Tagus estuary

The real time baroclinic and fecal contamination model of the Tagus estuary will be deployed using the RDFS-PT platform. The circulation is forced at the open boundaries by real-time river flow data from SNIRH ([snirh.pt](http://snirh.pt)) and forecasts from the regional ocean model of MyOcean ([www.myocean.eu.org/](http://www.myocean.eu.org/)). The fecal contamination model is forced by outputs from a model of the sewage system (David et al., 2013). The circulation model is continuously validated with data from two tide gauges (Cascais and Lisbon, Figure 2a). The coupled circulation/fecal contamination model will be further validated with the data acquired by the on-line monitoring system (located in the Lisbon harbor, Figure 2b), which is being deployed. Model forecasts and data comparisons will be available through a Web browser (Figure 2b).

---

<sup>1</sup> LNEC - National Civil Engineering Laboratory, Av. do Brasil, 101, 1700-066 Lisbon, Portugal. {mfrodrigues, jmcosta, gjesus, afortunato, jrogeiro, jlgomes, aoliveira, ldavid}@lnec

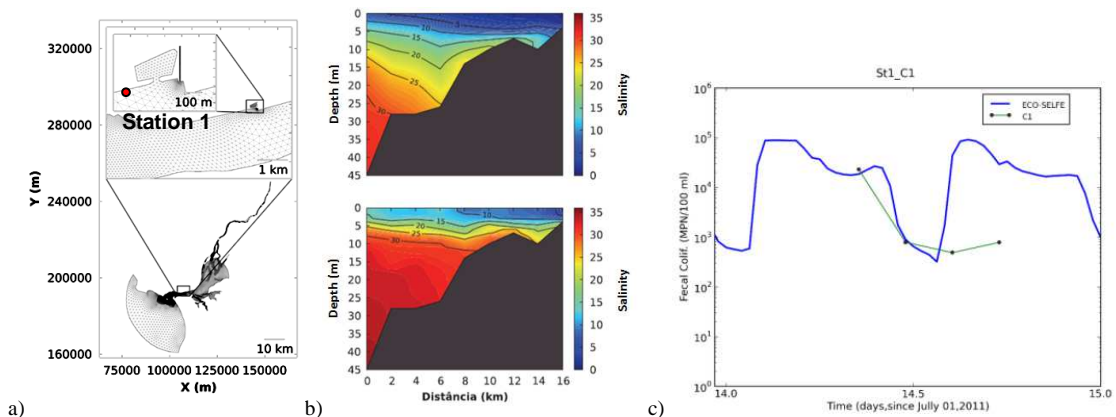


Figure 1. a) Horizontal grid and detail of the discharge from the Alcântara main trunk; b) simulated (top) and observed (bottom) salinity longitudinal profile in the Tagus estuary (adapted from Costa et al., 2012); c) preliminary comparison between fecal coliforms data (from July 2011) and model results at Station 1.

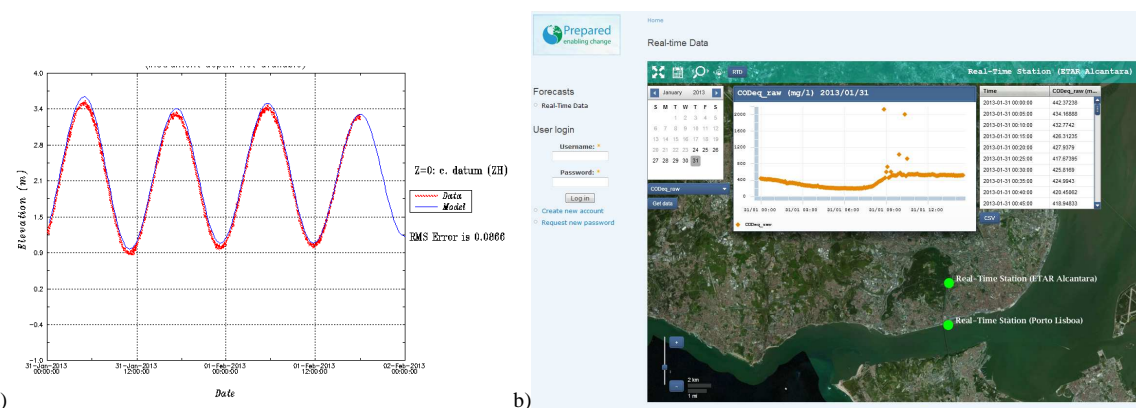


Figure 2. a) Automatic model validation at the Cascais tide gauge; b) websig interface of the RDFS-PT for the Tagus estuary.

## Acknowledgements

This work was developed in the scope of the projects: FP7 Prepared (Grant agreement 244234), AdI SI-GeA (Project n. 23053) and Interreg SPRES (EFDR-EU (SPRES-2011-1/168)). The authors thank J. Zhang and A.M. Baptista for model SELFE, R. Costa for early simulations of the baroclinic flow in the Tagus and all colleagues from LNEC, SIMTEJO and IST that participated in the validation campaigns.

## References

- Costa, R.T., Rodrigues, M., Oliveira, A., Fortunato, A.B., David, L.M., 2012. Alerta precoce da contaminação fecal para o estuário do Tejo: implementação preliminar do modelo hidrodinâmico e de contaminação fecal. *2<sup>as</sup> Jornadas de Engenharia Hidrográfica*, Instituto Hidrográfico, ISBN 978-989-705-035-0, pp. 77-80.
- David, L.M., Oliveira, A., Rodrigues, M., Jesus, G., Póvoa, P., David, C., Costa, R., Fortunato, A., Menaia, J.M., Frazão, M., Matos, R., submitted. Development of an integrated system for early warning of recreational waters contamination. *NOVATECH 2013*.
- Jesus, G., Gomes, J., Ribeiro, N.A., Oliveira, A., 2012. Custom deployment of a nowcast-forecast information system in coastal regions. *Geomundus 2012*.
- Rodrigues, A., Oliveira, A., Guerreiro, M., Fortunato, A.B., Menaia, J., David, L.M., Cravo, A., 2011. Modeling fecal contamination in the Aljezur coastal stream (Portugal). *Ocean Dynamics*, 61/6: 841-856.
- Zhang, Y., Baptista, A.M., 2008. SELFE: A semi-implicit Eulerian-Lagrangian finite-element model for cross-scale ocean circulation. *Ocean Modeling*, 21(3-4), pp. 71-96.