MORPHODYNAMIC MODELING OF THE TAGUS ESTUARY INLET

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Abstract

A morphodynamic model of the Tagus estuary inlet is implemented and validated. The model reproduces the known behavior of the inlet. The application of the model provides new insight into the inlet's behavior and allows the test of scientific hypotheses.

Key words: Morphodynamics; Numerical modeling; Tidal inlet.

1. Introduction

Existing knowledge on the evolution of the Tagus estuary inlet morphology derives mostly from analyses of bathymetric surveys and aerial images. The limitations of this approach prevent a detailed understanding of the processes responsible for this evolution, as well as the prediction of the future evolution. A 2DH morhodynamic model was therefore applied to shed new light into the sediment dynamics of this tidal inlet. Description of the method

2. Methods

The morphodynamics of the Tagus estuary inlet is simulated with the SCHISM modelling system, which includes modules for circulation (Zhang et al., 2016), wave propagation (Roland et al., 2013) and sediment dynamics (Guerin et al., 2016). The model is applied to the whole estuary (Fortunato et al., 2017a), forced by regional circulation and wave models (Fortunato et al., 2017b) and atmospheric reanalyses (ERA-INTERIN).

3. Preliminary results

The hydrodynamic modules are very accurate: tidal elevations and the significant wave heights are reproduced with root mean square errors of the order of 5 cm and 24 cm, respectively. Although the reproduction of the bathymetric evolution is less accurate, the model reproduces the known qualitative behavior of the inlet mouth, such as the northward advance of the Bugio Bank and the eastward migration of emerged sandbanks.

The response of the morphology to selected environmental forcings was identified. Waves are the dominant driver. Sediment fluxes increase by roughly an order of magnitude when Hs doubles. The impact of waves is maximal when they come from the South. Sediment pathways in the estuary mouth are then determined for representative maritime winters and summers. Results are consistent with the known behavior (Figure 1): fluxes are directed seaward along the navigation channel and landward over the Bugio Bank. Sediment transport over this bank is fed by the littoral drift from the Costa da Caparica beaches and by sand that moves out of the estuary and follows along the edges of the bank.

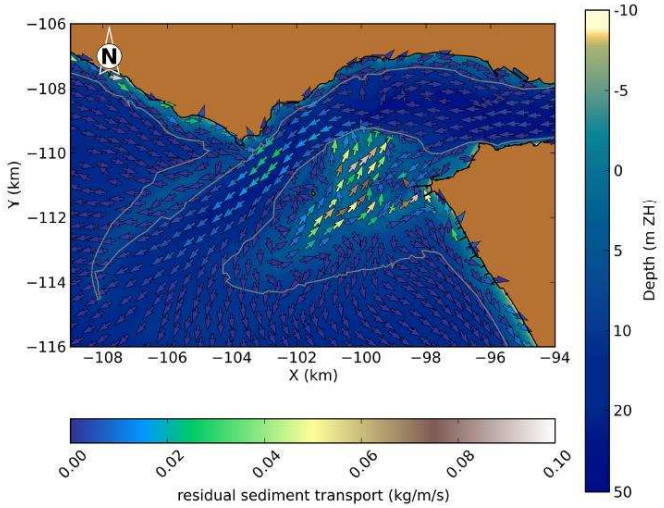

Figure 1 - Residual transport during a mean maritime winter (1990/91)

4. Conclusões

The model presented herein provides new insight into the morphodynamics of the Tagus inlet and allows the test of scientific hypotheses. For instance, preliminary results show that sediment fluxes over the Bugio Bank are directed towards the estuary in the winter, whereas in the summer they can be directed seawards.

Acknowledgments

The present work was funded by the Agência Portuguesa do Ambiente, and benefited from previous efforts funded by the Administração do Porto de Lisboa.

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