

TOPO-BATHYMETRIC MONITORING SOUTH OF THE MONDEGO RIVER MOUTH AFTER THE EXTENSION OF THE NORTH JETTY

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Abstract

This work evaluates the morphological evolution of the coastal frontage south of Figueira da Foz (west coast of Portugal) after the extension of the north jetty based on the analysis of topo-bathymetric surveys located in twelve equidistant transects in the study site. The results show that the study site has large inter-annual morphological variations and the complex morphological behaviour shows an erosive tendency of the beach face downdrift of the structures.

Keywords: Nearshore monitoring; Hydro-topographic profiles; Beach morphodynamics; Erosion; Figueira da Foz.

1. Introduction

The study site is the Portuguese sandy coastal stretch bounded at north by the Mondego river inlet and extending south of Leirosa (orientation NNE-SSW). After the construction of the Mondego river inlet jetties in the 70s, the southern beaches started facing serious erosion problems, particularly troublesome in Gala-Cova, Costa de Lavos and Leirosa. This led to the implementation of combined groyne and seawall defence schemes to intercept the southwards predominant littoral drift and to protect these maritime fronts. The extension of the north jetty in 2008-2010, the regular dredging operations in the Mondego river mouth and the sea level rise can increase erosion and flood problems, particularly during extreme maritime events (APA, 2014). In the present work, twelve topo-bathymetric profiles of the study site are analysed to characterize the morphological evolution during the period 2011-2017.

2. Data and Methods

The 2011 topo-bathymetric data were obtained from the high-resolution LiDAR survey (APA-DGT, 2011) and the 2014-2017 data were surveyed by the Figueira da Foz Port Administration (APFF, S.A.) in the scope of the Environmental Monitoring Plan of the Figueira da Foz Port Maintenance Dredging Operations, during October-November of each year. The twelve profiles are approximately spaced by 1.0 km along the coast (see Figure 1a) and were named according to their proximity to the study site's maritime fronts: Gala-Cova (CG), Costa de Lavos (CL) and Leirosa (L). The interpretation of the morphological evolution is based on the analysis of the following morphological profile parameters: i) dune crest elevation; ii) position of the dune crest, iii) the mean sea level (MSL, 2.08 m CD), iv) the 0 m CD, v) the -10 m CD, and vi) the -20 m CD isobathymetric lines (where CD is the national vertical Chart Datum reference level).

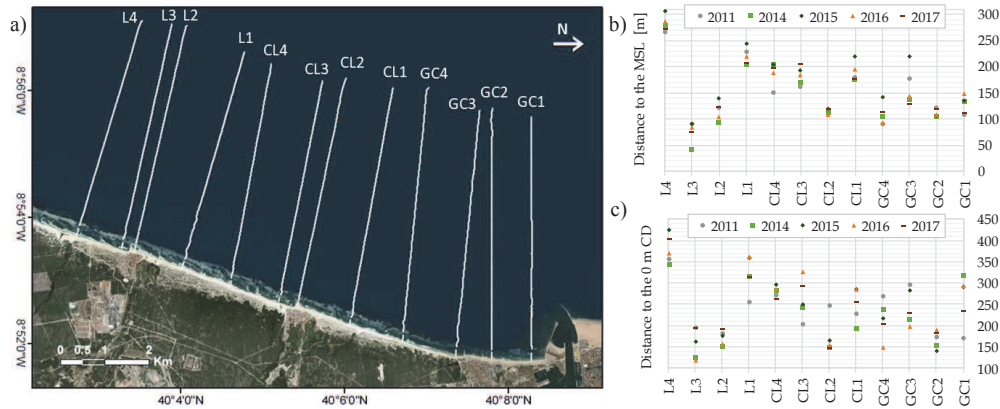


Figure 1. (a) Location of the transects in the study site; evolution of the (b) MSL and (c) 0 m CD positions.

3. Results and Conclusions

The evolution of the above-mentioned morphological parameters across the study site was analysed. Results show that the most stable values of the dune elevation and position parameters are in the natural beach profiles GC4, CL1, CL4, L1 and L4, located in-between and further from Gala-Cova, Costa de Lavos and Leirosa. Downdrift of the groynes, profiles GC3, CL3 and L3 show a lowering of the dune crest height in the last three years, revealing an erosive tendency. In 2015 (Figure 1b) there is a generalized advance in the MSL line, followed by a recession in 2016 that endured until 2017 in profiles GC3 and L3. The 0 m CD line is highly variable (Figure 1c), with a tendency to move landwards in GC2, GC3 and CL2.

The inter-annual variations in the -10 m CD line are larger in profiles GC2 to CL3; the line constantly moves landwards in the profiles updrift of the groynes GC2, CL2 and L2. The profiles GC2 to CL2 have steeper slopes from 0 m CD to -10 m CD, while the profiles CL3 to L3 have steeper slopes further offshore, from -10 m CD to -20 m CD. The -20 m CD line is located further offshore in the northern area of the study site and its position varied more significantly in the profiles GC1 to CL1, being the active beach wider in profiles GC2 to CL2.

In conclusion, there is a large inter-annual morphological variation in the study site, especially adjacent to the Mondego river mouth. In Gala-Cova and Costa de Lavos, the morphological variations in the beach face show an erosive behaviour and no stabilization tendency was found further offshore.

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