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Recent morphodynamics of the Northern Portuguese coast

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Abstract

Coastal zones are highly dynamic land-ocean interfaces, vulnerable to anthropogenic impacts and natural hazards. The monitoring of coastal morphology and morphodynamics is important to understand their fundamental processes and assess erosion risks, particularly in a climate change scenario, where sea-level rise and intensification of extreme events are likely to increase coastal vulnerability.

In the present work, carried out in the scope of the MarRisk project (Interreg Spain-Portugal, 2017-2020), coastal morphodynamics in recent years was evaluated for stretches of the Northern-Portuguese Atlantic coast. Digital terrain (DTM) and surface models (DSM), derived from LiDAR and aerial photography data, respectively, collected in 2011, 2017 and 2018, were used to assess beach and dune morphodynamics, quantifying sediment budgets, changes in shoreline position and in beach and dune widths and volumes, as well as shoreface slopes. Results were analysed considering the types of beaches found in the region (sandy beaches, sandy beaches with rocky outcrops, pebble and rocky beaches) and the dominant wind and wave patterns.

Overall, the coastline was stable between 2011 and 2017, but retreated between 2017 and 2018. A significant increase in beach/dune volume was observed between 2011 and 2017, but partly attributable to differences in methodologies (i.e. LiDAR-derived DTM versus aerial-photography-derived DSM). The slight decrease observed between 2017 and 2018, was likely linked to seasonal effects. Beach dynamics differed per beach type, with highly dynamic sandy beaches, and less dynamic rocky and pebble beaches. Erosion/accretion patterns were also related to beach exposure, i.e. the direction of the coast line in relation to dominant wave and wind directions, and influenced by the presence of defence structures. Beach slope showed no clear effect on morphodynamics in our data. This work allowed identification of coastal sectors that respond differently to wind and wave regimes and assessment of their sensitivity and vulnerability.

Keywords

coastal vulnerability, coastal erosion, coastal risks, morphodynamics