



ICG2022-436, updated on 28 May 2023

<https://doi.org/10.5194/icg2022-436>

10th International Conference on Geomorphology

© Author(s) 2023. This work is distributed under the Creative Commons Attribution 4.0 License.



## Tróia sandspit (Sado estuary, Portugal) salt marshes' evolution until the end of the 21<sup>st</sup> century

Miguel Inácio<sup>1,2</sup>, Ana Cunha<sup>1,2</sup>, Maria da Conceição Freitas<sup>1,2</sup>, Vera Lopes<sup>1,2</sup>, Manel Leira<sup>2,3</sup>, and César Andrade<sup>1,2</sup>

<sup>1</sup>Departamento de Geologia, Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal

<sup>2</sup>Instituto Dom Luiz, Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal

<sup>3</sup>BioCost Research Group, Facultad de Ciencias and Centro de Investigación Científicas Avanzadas, Universidade de A Coruña, A Coruña, Spain

Salt marshes are highly valued coastal environments for different services: coastline protection, biodiversity, and carbon storage (blue carbon). However, they are vulnerable to climate changes, particularly sea-level rise (SLR). For this reason, it is essential to project the evolution of marsh areas until the end of the century. This work presents the results of applying a reduced complexity two-dimensional rule-based model developed by the authors: SMRM (Simplified Marsh Response Model). The model requires four parameters: a high-resolution digital terrain model (DTM) (LiDAR survey from 2011), local tidal levels (modeled from Setúbal-Tróia tide gauge), at least one SLR scenario (IPCC RCP4.5, FCUL MOD.FC\_2b and NOAA Extreme were used) and accretion rates (determined through the analysis of <sup>210</sup>Pb and <sup>137</sup>Cs isotopic activity from a core in one of the studied marshes). Furthermore, additional parameters such as the error of the DTM (RMSE) or the acceleration of SLR and accretion rates can be added. The process is done through a MATLAB script and the output is a Geotiff file. The presented results are for the estuarine margin of the Tróia sandspit salt marshes (Sado estuary, Portugal – 40 km south of Lisbon), where six marsh patches (Caldeira de Tróia (CT-N (North) and CT-S (South)), Malha da Costa (MC-N and MC-S) and Comporta (Cmp-N and Cmp-S)) are present, totalizing an area of 109 ha.

Projections indicate that a significant reduction in the marsh area is expected until 2100, that will be transformed in tidal flats/subtidal areas. Depending on the chosen SLR scenario, the losses will be between 6 (IPCC RCP4.5) and 84 % (NOAA Extreme) in area. If sea-level rises around 1 m until the end of the century (FCUL MOD.FC\_2b), a loss of 36 % in global area is expected. The evolution will not be similar along the sandspit. The most mature marshes (MC-S, TC-N and TC-S) will be more resilient to SLR. These projections consider that the surrounding areas will not be occupied until the end of the century, reducing the probability of these areas disappearing in the future. In fact, limited saltmarsh displacement to inland will occur (between 4 and 35 ha – from IPCC RCP4.5 to NOAA Extreme) to adjacent areas with low slopes.

The influence of each parameter was also evaluated in this work through a sensitivity analysis. The results indicate that SLR is the most significant parameter to consider, followed by accretion rates and the error of the DTM. The main conclusion is that the studied salt marshes could be resilient to conservative SLR scenarios but not to more severe projections, even if they have space landwards to expand.

This research was funded by Portuguese Foundation for Science and Technology, I.P./MCTES through national funds (PIDDAC) – UIDB/50019/2020 + PTDC/CTA-GEO/28412/2017 and Ph.D. Grants PD/BD/142781/2018 + PD/BD/106074/2015.