LABORATÓRIO NACIONAL
DE ENGENHARIA CIVIL

PROJECT MOSAIC.PT – MULTI-SOURCE FLOOD RISK ANALYSIS FOR SAFE COASTAL COMMUNITIES AND SUSTAINABLE DEVELOPMENT

Final Report

REPORT 7/**2023 – DHA/NEC**

LABORATÓRIO NACIONAL
DE ENGENHARIA CIVIL

PROJECT MOSAIC.PT – MULTI-SOURCE FLOOD RISK ANALYSIS FOR SAFE COASTAL COMMUNITIES AND SUSTAINABLE DEVELOPMENT

Final Report

FCT – Fundação para a Ciência e a Tecnologia

Lisbon • January 2023

R&D HYDRAULICS AND ENVIRONMENT

REPORT 7/**2023 – DHA/NEC**

Title

PROJECT MOSAIC.PT – MULTI-SOURCE FLOOD RISK ANALYSIS FOR SAFE COASTAL COMMUNITIES AND SUSTAINABLE DEVELOPMENT
Final Report

Authors

LNEC – HYDRAULICS AND ENVIRONMENT DEPARTMENT

Paula Freire
Assistant Researcher, Estuaries and Coastal Zone Unit

André B. Fortunato
Principal Researcher, Estuaries and Coastal Zone Unit

Filipa S. B. F. Oliveira
Assistant Researcher, Estuaries and Coastal Zone Unit

Alberto Azevedo
Assistant Researcher, Estuaries and Coastal Zone Unit

Alphonse Nahon
Postdoctoral Research, Estuaries and Coastal Zone Unit

Ana Rilo
Senior technician, Estuaries and Coastal Zone Unit

Anabela Oliveira
Senior Researcher, Information Technology in Water and Environment Research Group

Gonçalo Jesus
Assistant Researcher, Information Technology in Water and Environment Research Group

Ricardo Martins
IT Expert, Ports and Maritime Structures Unit

Conceição Fortes
Senior Researcher, Ports and Maritime Structures Unit

LNEC – CONCRETE DAMS DEPARTMENT

Maria João Henriques
Senior Researcher, Applied Geodesy Unit

CES – CENTRO DE ESTUDOS SOCIAIS (UNIVERSIDADE DE COIMBRA)

Alexandre O. Tavares
Associate professor with Aggregation

Pedro P. dos Santos
Integrated Researcher (PhD), Institute of Geography and Spatial Planning, University of Lisbon

Leandro Barros
Research Fellow

Collaboration

LNEC – HYDRAULICS AND ENVIRONMENT DEPARTMENT

Américo Louro
IT Expert, Information Technology in Water and Environment Research Group

AV DO BRASIL 101 • 1700-066 LISBOA
e-mail: lnec@lnec.pt
www.lnec.pt

Report 7/2023

File no. 0604/1101/21070

PROJECT MOSAIC.PT – MULTI-SOURCE FLOOD RISK ANALYSIS FOR SAFE COASTAL COMMUNITIES AND SUSTAINABLE DEVELOPMENT

Final Report

Abstract

The final technical report of the project *Mosaic.pt – multi-source flood risk analysis for safe coastal communities and sustainable development* (ref. PTDC/CTA-AMB/28909/2017) is presented. The project was funded by the Portuguese Foundation for Science and Technology (FCT - Fundação para a Ciência e a Tecnologia) and took place between 2018 and 2022. The project aimed to develop tools to support coastal flood risk management, based on the integration of predictive models and real-time monitoring data, and taking into account territorial diversity. The main outcomes included: knowledge improvement on historical coastal flooding occurrences and associated damages along the continental Portuguese coast, and the definition of critical coastal typologies and risk factors; increase capacity for coastal flooding prediction with the development, implementation and validation of a real-time prediction system at a local scale that incorporates models and data; development and implementation of a WebGIS platform to access multi-source data that can be used as a decision-support tool.

Keywords: Coastal flooding / Critical typologies / Real-time prediction and monitoring / Territorial vulnerability / WebGIS platform for multi-source data

PROJETO MOSAIC.PT – MULTI-SOURCE FLOOD RISK ANALYSIS FOR SAFE COASTAL COMMUNITIES AND SUSTAINABLE DEVELOPMENT

Relatório Final

Resumo

Apresenta-se o relatório final do projeto *Mosaic.pt – Análise do risco de inundação costeira a partir de múltiplas fontes para comunidades seguras e desenvolvimento sustentável* (ref. PTDC/CTA-AMB/28909/2017), financiado pela Fundação para a Ciência e a Tecnologia, e que decorreu entre 2018 e 2022. O projeto visa desenvolver ferramentas de apoio à gestão do risco de inundação na zona costeira, integrando modelos de previsão e monitorização em tempo real, tendo em conta a diversidade do território. Dos resultados salienta-se: a melhoria do conhecimento do histórico de ocorrências de inundação e danos associados na zona costeira continental portuguesa, assim como a definição de tipologias críticas e fatores de risco; o aumento da capacidade de previsão da inundação costeira, através do desenvolvimento, implementação e validação à escala local de sistema de previsão em tempo real que integra modelos e dados; a criação de uma plataforma WebSIG que integra dados multi-fonte e que pode ser usada como instrumento de apoio à decisão.

Palavras-chave: Inundação costeira / Tipologias críticas / Previsão e monitorização em tempo real / Vulnerabilidade territorial / Plataforma WebSIG para dados multi-fonte

Table of contents

List of figures

List of tables

1 | Introduction

1.1 Objectives

The present document constitutes the final report of the project *Mosaic.pt – multi-source flood risk analysis for safe coastal communities and sustainable development*, funded by the Portuguese Foundation for Science and Technology.

The major identifying elements of the project are listed below:

- Project reference: PTDC/CTA-AMB/28909/2017
- Call / Program / Area: PTDC 2017 / 3599-PPCDT / Ciências do Ambiente
- Scientific Domain: Natural sciences
- Main Area: Earth and Related Environmental Sciences
- Secondary area: Environmental Sciences
- Principal Investigator: Paula Maria de Santos Freire
- Principal Contractor: National Laboratory for Civil Engineering (LNEC)
- Participating Institution: Centre for Social Studies (CES) of the University of Coimbra
- Starting date: 01-10-2018
- Final date: 30-09-2022
- Funding (National Funding): € 238.585,87

1.2 The project Mosaic.pt

1.2.1 Context, objectives and workplan

Each year, coastal flooding affects millions of people around the world with high socio-economic losses that will grow with sea level rise and extreme water levels increase (Kulp et al., 2019; Kirezci et al., 2020). In Portugal, the coastal zone extends for 987 km with diverse geomorphologies and land-use occupations. About 60% of the population inhabits coastal municipalities, where the risk of sea level rise is high and will keep on increasing (EC, 2009; Antunes, 2019). Although the authorities had foreseen the storm Hercules in January 2014 and warned the populations, losses in the coastal zone were more than 16 million euros and about 20 people had to be assisted (Santos et al., 2015). To adequately contribute to emergency planning and response in uncertain future conditions, coastal floods predictions should incorporate the several risk dimensions, such as territory vulnerability and exposure (Bedsworth and Hanak, 2010; UNISDR, 2015).

The objective of the Mosaic.pt project was to develop an innovative flood risk framework for coastal zones, integrating predictive models and real-time monitoring data, and taking into account the diversity and complexity of the territory. Specific objectives were:

- To improve flood prediction in different coastal typologies, through the integration of data from multiple (in-situ and remote) sources and numerical models;
- To identify the coastal typologies affected by flooding aiming to support the development of an integrated risk analysis methodology;
- To contribute to the emergency response capacity of the coastal management institutions and the affected communities.

To accomplish the proposed objectives the project approach considered two spatial scales of analysis: a regional scale and an observatory scale for development and validation of the predictive, monitoring and data integration methodologies, and evaluation of the different dimensions of vulnerability. Following this concept, the project work plan was built on 10 activities (Figure 1.1):

- Activity 1 - Critical typologies selection through preliminary flood evaluation
- Activity 2 - Numerical modeling of coastal inundation
- Activity 3 - Vulnerability dimension assessment
- Activity 4 - Development of a multi-source monitoring and predictive methodology
- Activity 5 - Risk framework design
- Activity 6 - Institutional capability for emergency response
- Activity 7 - Safe communities involvement and response
- Activity 8 - Data management
- Activity 9 - Project scientific and technical management
- Activity 10 - Project dissemination and communication

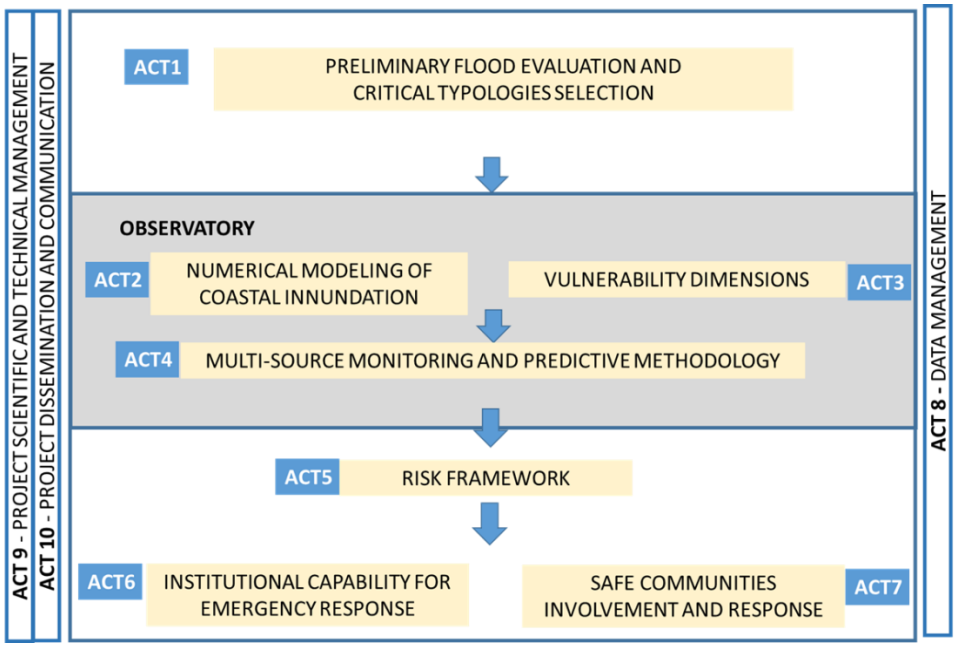


Figure 1.1 – Mosaic.pt project Activities

1.2.2 Project team

The Mosaic.pt team is presented in Table 1.1.

Table 1.1 – Project team

Institution	Researcher
LNEC	Paula Freire *(project Principal Investigator and leader of Activities 1, 5 , 9 and 10)*
	André Fortunato *(Co-Principal Investigator and leader of Activity 2)*
	Anabela Oliveira *(leader of Activities 4 and 8)*
	Alberto Azevedo
	Alphonse Nahon (*doctoral researcher*)
	Ana Rilo
	Conceição Fortes
	Filipa Oliveira
	Gonçalo Jesus
	João Nuno Oliveira (*Ceased to collaborate with the project in 31-12-2021*)
	João Rogeiro (*Ceased to collaborate with the project in 05-09-2022*)
	Maria João Henriques
	Nádia Braz (*Ceased to collaborate with the project in 11-03-2022*)
	Ricardo Martins
	Teresa Reis
	Alice Bortoli (*Research fellow*)
	Luís Simões Pedro (*Technical staff*)
	Fernando Brito (*Technical staff*)
	Hugo Silva (*Technical staff*)
CES	Alexandre Tavares *(leader of Activity 6 and 7)*
	Pedro Santos *(leader of Activity 3)*
	Jorge Alexandre de Almeida (*ceased to collaborate with the project in June 2021*)
CES/LNEC	Leandro Barros (*Research fellow*)

Also collaborating with the project were:

- IT Expert Miguel Rocha (LNEC), in Activity 4;
- Masters' student Jules Buquen (LNEC), in Activity 4
- Senior technician Joana Simão (LNEC), in Activity 2
- Masters' student Paulo Cabrita (LNEC), in Activity 2
- Luís Perdiz (CES), in Activities 5, 6 and 7

1.3 Report structure

This report is structured in 14 sections. Section 1 presents the major identifying elements of the project as well as its context and objectives, general structure and the team. Sections 2 to 11 correspond to the project Activities, and present the objectives and the main results. Section 12 lists the project publications, and section 13 presents the institutions, projects and people that collaborated with the project. Finally, the main results are summarized in section 14, together with a critical appraisal. The projects' publications are referred along the text in square brackets.

2 | Activity 1 - Critical typologies selection through preliminary flood

2.1 Overview

This activity aimed to:

- Characterize coastal flood events in the Portuguese West coast and to develop a database of flood occurrences;
- Select “observatories” for developing detailed tasks of activities 2, 3 and 4;
- Characterize the coastal flood processes in the observatories.

The main results of this activity, described below, were:

- A geographic database of coastal flood events in mainland Portugal between 1980 and 2018;
- An improved knowledge of historic flood events and their associated damages;
- The characterization of the observatories’ morphological state and their short-term response to different oceanographic and meteorological forcings.

2.2 Evaluation of historical events and database development

A literature review, as well as the compilation and analysis of the newspaper information on overtopping and flooding events on the west coast of mainland Portugal were carried out. A geographic database of coastal flooding occurrences for the period 1980-2018 for the continental Portuguese coast zone was constructed based on the hemerographic analysis of three national and five regional newspapers [A6, C1, C11]. The database was constructed on a set of fields that characterize each occurrence, the area affected, the associated triggering factors and the impacts (Figure 2.1). This database provides relevant information about coastal overtopping and flooding occurrences at a regional scale that did not exist before for the Portuguese coast. The database information was analyzed and compared to flooding forcing conditions. These conditions were obtained from hindcast models of the daily maximum significant wave height Hs (Hsmax) and sea level (Fortunato et al., 2019) [A6]. The regional spatial distribution of occurrences shows that the area between Ovar and Marinha Grande (Portuguese central west coast) was the one with the highest number (Figure 2.2). The temporal distribution of the yearly number of occurrences indicates that the highest number corresponded to 2014, and was largely associated with the storm Hercules in early January (Figure 2.3). The number of occurrences by category of losses and damages reveals that damages in public areas were the ones with the highest number of occurrences; in terms of human impacts, the displaced sub-category was the one with the highest expression (Figure 2.4).

A critical analysis of the use and importance of historical data to obtain flood risk information was performed along with the methodologies applied to qualitative sources [A10, A11, C6, C28].

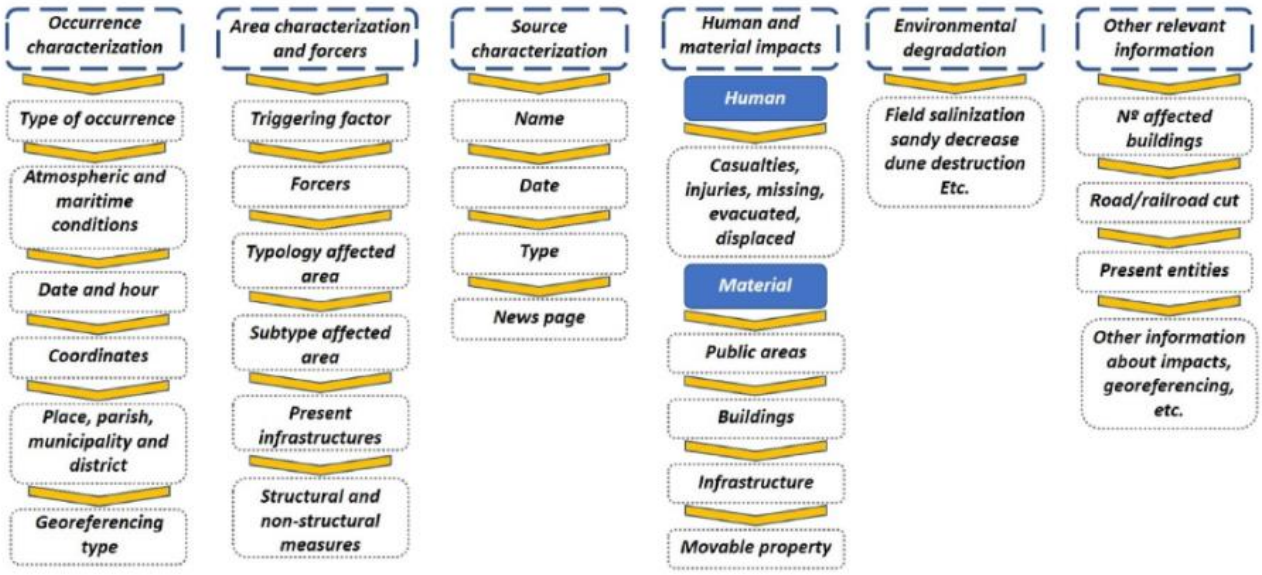


Figure 2.1 – Structure of Mosaic.pt database (source: [6])

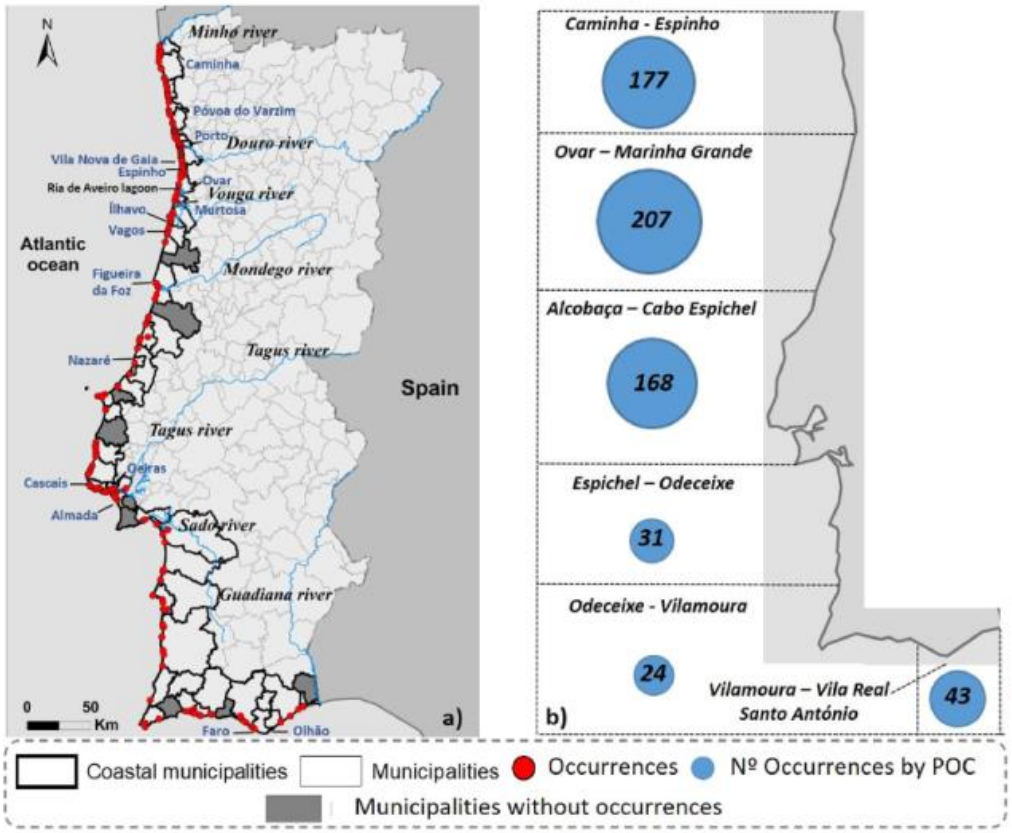


Figure 2.2 – Spatial distribution of database occurrences: a) Continental Portugal; b) Spatial Coastal Zone Plans - POC (source: [6])

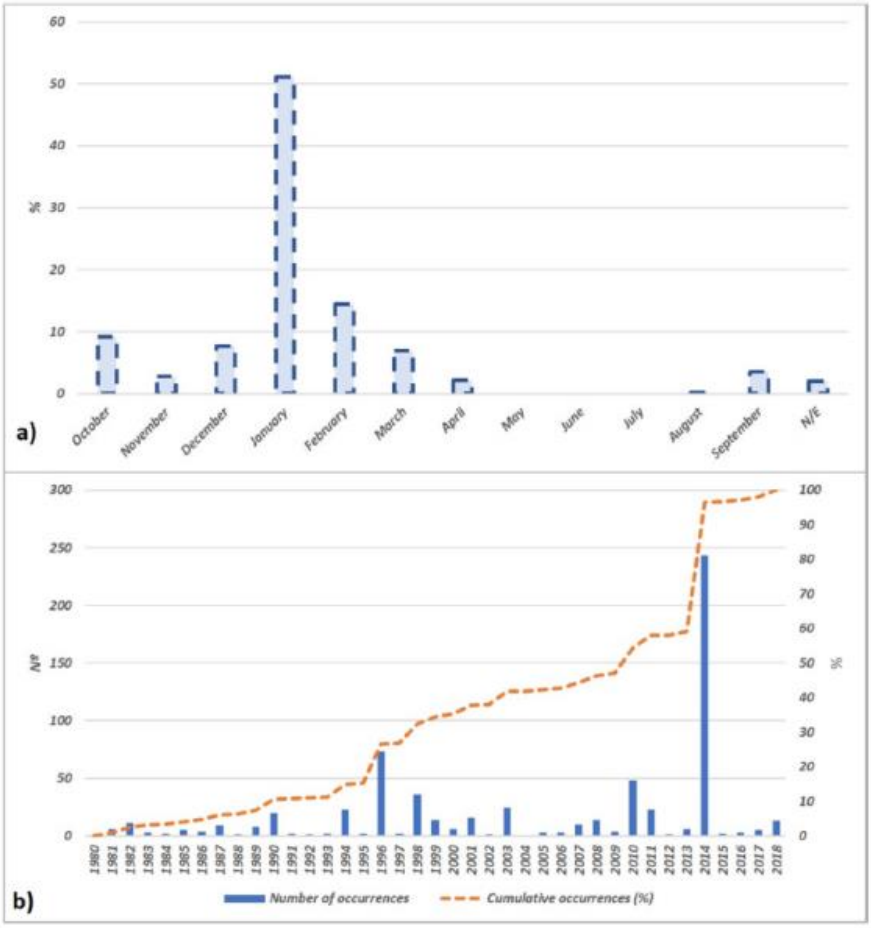


Figure 2.3 – Temporal distribution of database occurrences: a) monthly; b) annual (source: [6])

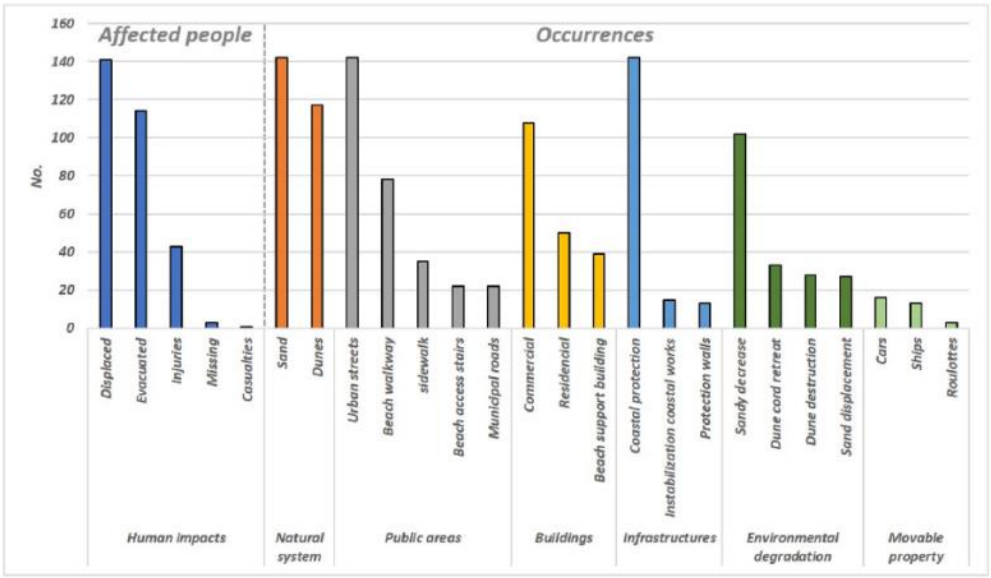


Figure 2.4 – Main losses and damages of the Mosaic.pt database occurrences (source: [6])

2.3 Observatory selection

An exploratory analysis was carried out in several coastal areas located in the Portuguese central west coast, with a historical record of overtopping and flood events, and showing different territorial contexts (Figure 2.5). Based on the historical information and data acquired in-situ, three observatories were chosen: Costa Nova, Cova-Gala and São Pedro de Moel beaches (Figure 2.6). In these observatories, comprehensive local studies, namely predictive models development (Activity 2), vulnerability assessments (Activity 3) and the development of the multi-source monitoring and prediction methodology (Activity 4) were carried out during the project.

Barra-Costa Nova is a coastal stretch south of the Aveiro Lagoon's inlet, approximately 2 km long, characterized by a low-lying sandy beach limited by a fragile dune system, which is susceptible to coastal erosion and flooding. During the last decades several interventions took place to protect the urban fronts, with the construction of groynes and longshore defense structures. The Cova-Gala beach is a sandy beach-dune system about 2 km long, located south of the Mondego river mouth. Since the mid XXth century this sector was subjected to several human interventions, including the construction of the Mondego river mouth jetties, seawalls, groynes, tubes placement to reinforce the dune, and several interventions related with the port regularization, including dredging and artificial nourishment. Finally, the São Pedro de Moel beach is an embayed narrow beach approximately 400 m long. The beach backshore is limited by a seawall, an alongshore defense structure and an active cliff carved in consolidated rocks at both extremes. Rocky outcrops and boulders cover the beach lower foreshore and nearshore zones, which are alternately covered and uncovered by sand.

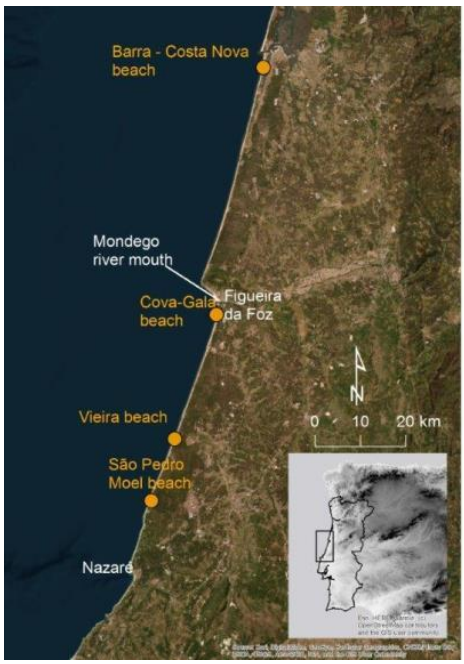


Figure 2.5 – Mosaic.pt project study areas

a)

b)

c)

Figure 2.6 – Mosaic.pt observatories: a) Barra – Costa Nova; b) Cova-Gala; c) São Pedro de Moel

2.4 Characterization of coastal flood processes in the observatory

The morphological state of the observatories and the short-term response to different oceanographic and meteorological conditions (spring high tide level, storm surge, high wave height), which can promote overtopping and inland flooding were characterized through 15 field campaigns between February 2019 and March 2020 (Table 2.1). Data acquired during the campaigns included: GPS/GNSS and drone topographic surveys; superficial sediment sampling; and report on territorial elements affected by overtopping/flooding [R1, R2, R5] (Figure 2.7). Between March 10 and 12, 2020, a hydrodynamic data acquisition campaign was carried out at the Cova-Gala observatory [R3] (Table 2.1) to acquire hydrodynamic (wave and current) and topographic data to validate the hydro- and morphodynamics numerical models developed in Activity 2.

Table 2.1 – Mosaic.pt field campaigns overview: date, location and activities

Date	Beach	Activities
08/Jan/2019	Cova-Gala, Vieira, Pedrógão and São Pedro de Moel	Sediment sampling
04/Feb/2019	Cova-Gala	GPS/GNSS topographic survey, territorial elements report
11/Feb/2019	Cova-Gala	Sediment sampling, drone topographic, territorial elements report survey
12/Feb/2019	São Pedro de Moel	GPS/GNSS topographic and drone surveys
19/Feb/2019	São Pedro de Moel and Vieira	GPS/GNSS topographic survey, territorial elements report
21/Feb/2019	Cova-Gala	GPS/GNSS topographic survey, territorial elements report
25/Feb/2019	Cova-Gala, Vieira and São Pedro de Moel	GPS/GNSS topographic survey, territorial elements report
27/Feb/2019	Vieira beach	drone survey
26/March/2019	Cova-Gala, Vieira and São Pedro de Moel	GPS/GNSS topographic survey, territorial elements report
26/September/2019	Cova-Gala, Vieira and São Pedro de Moel	GPS/GNSS topographic survey, territorial elements report
30/September/2019	Cova-Gala, Vieira and São Pedro de Moel	GPS/GNSS topographic survey, territorial elements report
28/November/2019	Cova-Gala, Vieira and São Pedro de Moel	GPS/GNSS topographic survey, territorial elements report
21/January/2020	Cova-Gala and São Pedro de Moel	GPS/GNSS topographic survey, territorial elements report
10-12/03/2020	Cova-Gala	Hydrodynamic monitoring, drone survey
	Cova-Gala and São Pedro de Moel	GPS/GNSS topographic survey

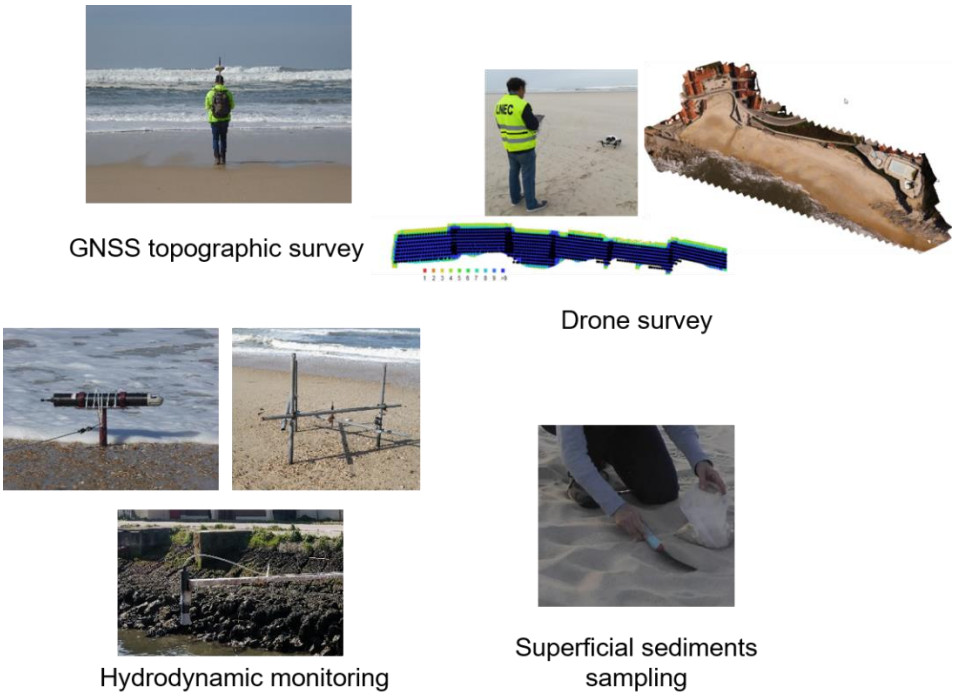


Figure 2.7 – Aspects of the field data campaigns at the Mosaic.pt observatories

Morphological indicators were obtained based on topographic field data and their evolution analyzed taking into account the oceanographic and meteorological overtopping conditions. Results showed that under the same forcing conditions the short-term response of the cross-shore beach profile depends on the nature of the lower and upper limits of the beach face, on the profile gradient and on its alongshore context [A1] (Figure 2.8). A comparative analysis of overtopping and flooding conditions in Cova-Gala and São Pedro de Moel during recent events showed that the main trigger of overtopping are the water level and beach cross-shore profile gradient in Cova-Gala, while the wave set-up and incoming wave direction can force inland inundation in São Pedro de Moel beach, independently of the beach morphological state [C3] (Figure 2.9).

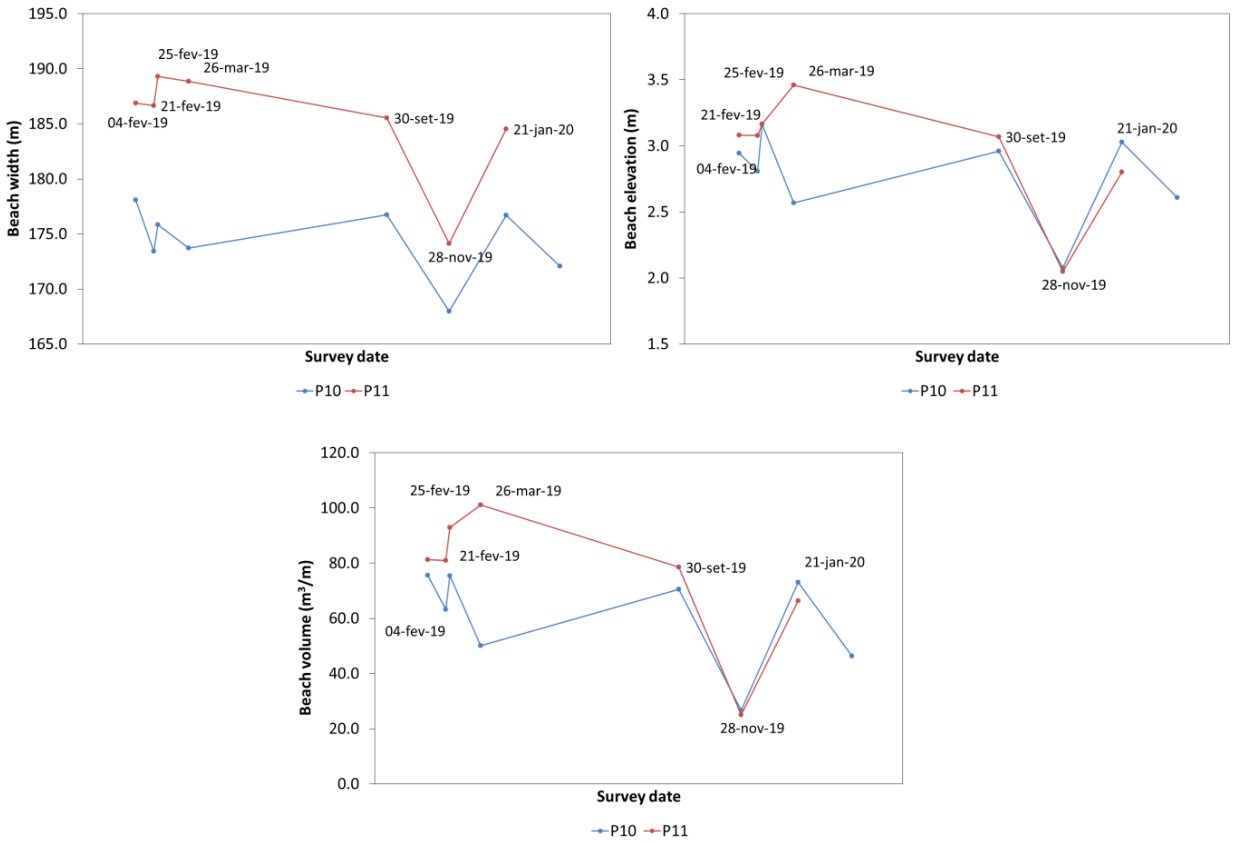


Figure 2.8 – Example of Cova-Gala beach morphological indicators (source: [C3])

Figure 2.9 – Aspects of Cova-Gala dune overwash on 21/02/2019 (left) and São Pedro de Moel inundation on 22/12/2019 (right)

For the Cova-Gala observatory, the characterization of the morphological state was complemented with topo-bathymetric surveys from the COSMO monitoring program (of the Portuguese Environment Agency - APA). The comparison of all the surveys yielded the characterization of the seasonal and annual morphological evolution of this observatory since 2019 (Figure 2.10). This characterization accounted for the impact of the nourishment operations performed by the port authority in the

observatory to restore the littoral drift captured by the river mouth jetties. The results highlight the vulnerability of the two southern cells of the Cova-Gala groyne field and the short duration of the geotextile encapsulated-sand bags based solution, implemented south of the southern groyne.

The results of Activity 1 contributed to the validation of the flood predictive models (Activity 2) and to support the design of the risk framework (Activity 5).

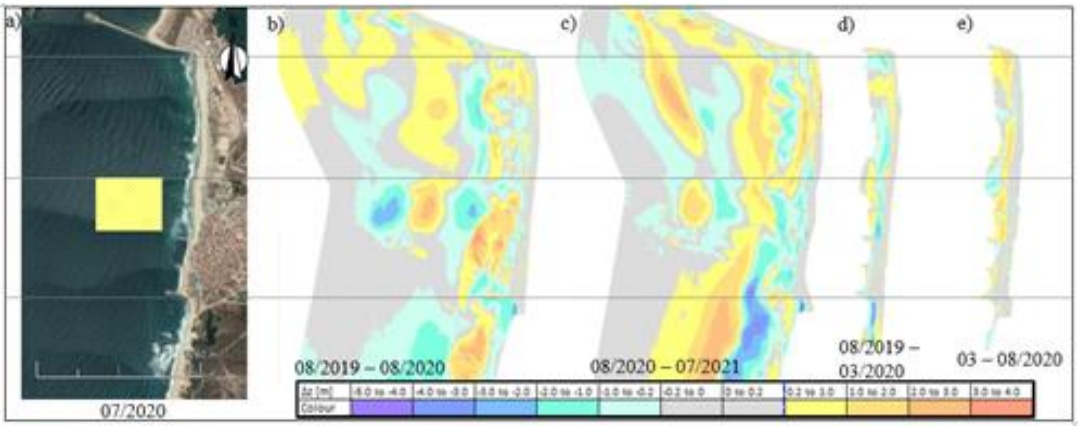


Figure 2.10 – Cova-Gala coastal zone: dredged deposit location (a); and maps of the morphological differences, ∆z, in 08/2019 - 08/2020 (b), 08/2020 - 07/2021 (c), 08/2019 - 03/2020 (d), and 03/2020 - 08/2020 (e)

3 | Activity 2 - Numerical modeling of coastal inundation

3.1 Overview

The main objective of this activity was to develop and test an approach to provide short-term predictions of hydro-morphological variables (including inundation), combining process-based numerical models and remote sensing data.

The main results achieved, described below, were:

- A hydrodynamic forecast system implemented in Cova-Gala [A4]; detailed validation and experimentation with the process-based model XBeach, and development of methodology to generate inundation maps [A13]; implementation of XBeach in the backend of LNEC's OPENCoastS platform (Oliveira et al., 2019); comparison of the performance of XBeach and empirical formulae to estimate the overtopping of defense structures [C7]; morphodynamic simulations for the Caparica coast [A14].
- Development and implementation in a public platform (WORSICA, https://worsica.incd.pt/index) of a method to extract shoreline data from satellite images [C24, R6]; development and assessment of a method to assimilate the satellite-derived shoreline data into morphodynamic models [C21].

3.2 Development of flood predictive models for the selected coastal typologies

This activity aimed at developing, implementing, and testing a suite of hydro-morphological models to predict inundation and morphological evolution in real-time. This suite is composed of large-scale models for tides (FES2014) and waves (WW3), an intermediate model for coupled circulation and waves (SCHISM) and a small-scale model for tides, short-waves and infra-gravity waves (XBeach). The use of empirical formulae for overtopping was also foreseen, but then abandoned considering the results obtained herein.

XBeach (1D and 2D) was first run in morphodynamic mode at the Caparica coast [A14, C16] and compared with empirical overtopping formulations, for several storms. The run-up, overtopping and inundation area were evaluated, contributing to the establishment of a Bayesian network in the scope of a companion project [C16]. The XBeach 1D overtopping results were tested and compared with empirical formulations in São Pedro de Moel beach [C2, T1] and Cova-Gala [C7]. In general, XBeach provided the best results [C2, C7, T1], so empirical formulae were abandoned. These studies highlighted the sensitivity of the model XBeach, and the need for a thorough calibration based on extensive datasets.

The Cova-Gala beach was therefore selected as the primary case study due to the availability of extensive bathymetric surveys, its vulnerability and the variability of its morphology (estuary/beach, groyne field and jetties, protected/unprotected dune). The occurrence of inundation events during the

project also allowed the creation of a useful set of field data to validate the models [A1]. Several surveys carried out by the team provided additional data required to validate the models [R2, R6]).

The intermediate model (SCHISM) was implemented using OPENCoastS, LNEC's infrastructure for on-demand forecast generation [A4]. The model was first validated with field data (Figure 3.1) and has been producing daily forecasts since 2020.

The local model (XBeach) was implemented next [A13]. An extensive validation of the model (Figure 3.2) combined with sensitivity analyses showed the ability of the 2D-surfbeat version of the model XBeach to provide accurate and robust predictions of coastal inundation and provided important insights into the most appropriate choices of the model's parameters (Milestone 2.1). XBeach non-hydrostatic was applied in 1D to determine run-up and overtopping in several profiles of the Cova da Gala beach, for the storm of February 2019. A sensitivity analysis was conducted to establish some model parameters. XBeach non-hydrostatic was also applied in 2D to evaluate the inundation extent. Results were compared with in situ measurements [C20, C29], and a sensitivity analysis of the parameters of XBeach was carried out. XBeach was also implemented in the backend of LNEC's OPENCoastS platform. This implementation greatly simplifies the generation of forecast systems coupling the SCHISM and XBeach models.

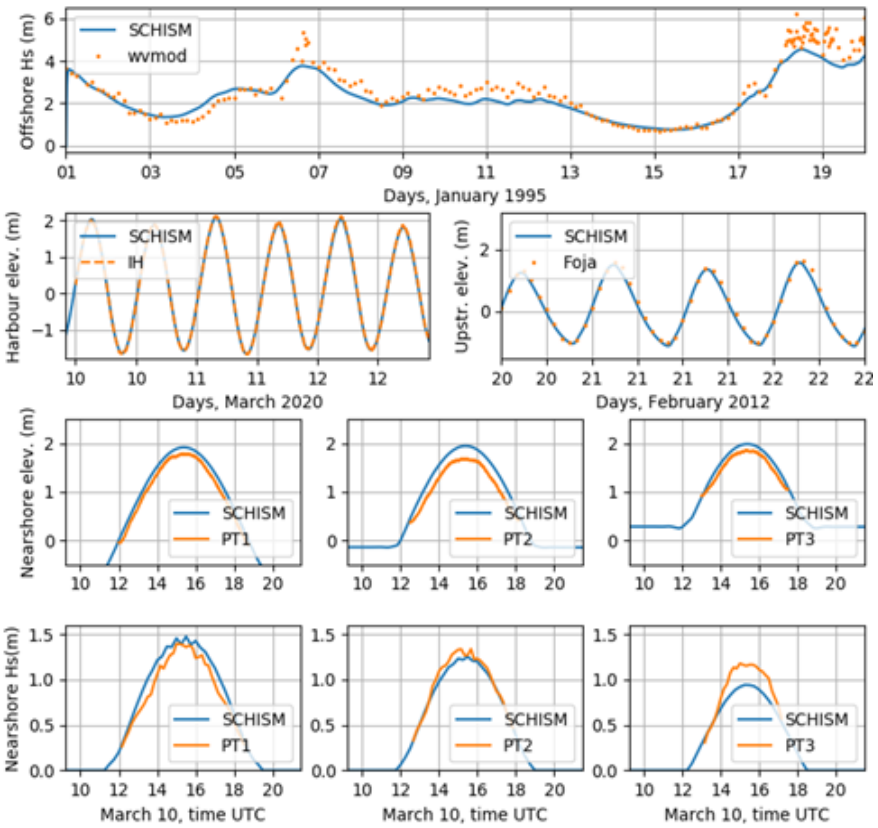


Figure 3.1 – Plots of modelled (blue lines) and observed (orange points and lines) elevation and significant wave height (Hs) for the different datasets available for validation (source: [C4])

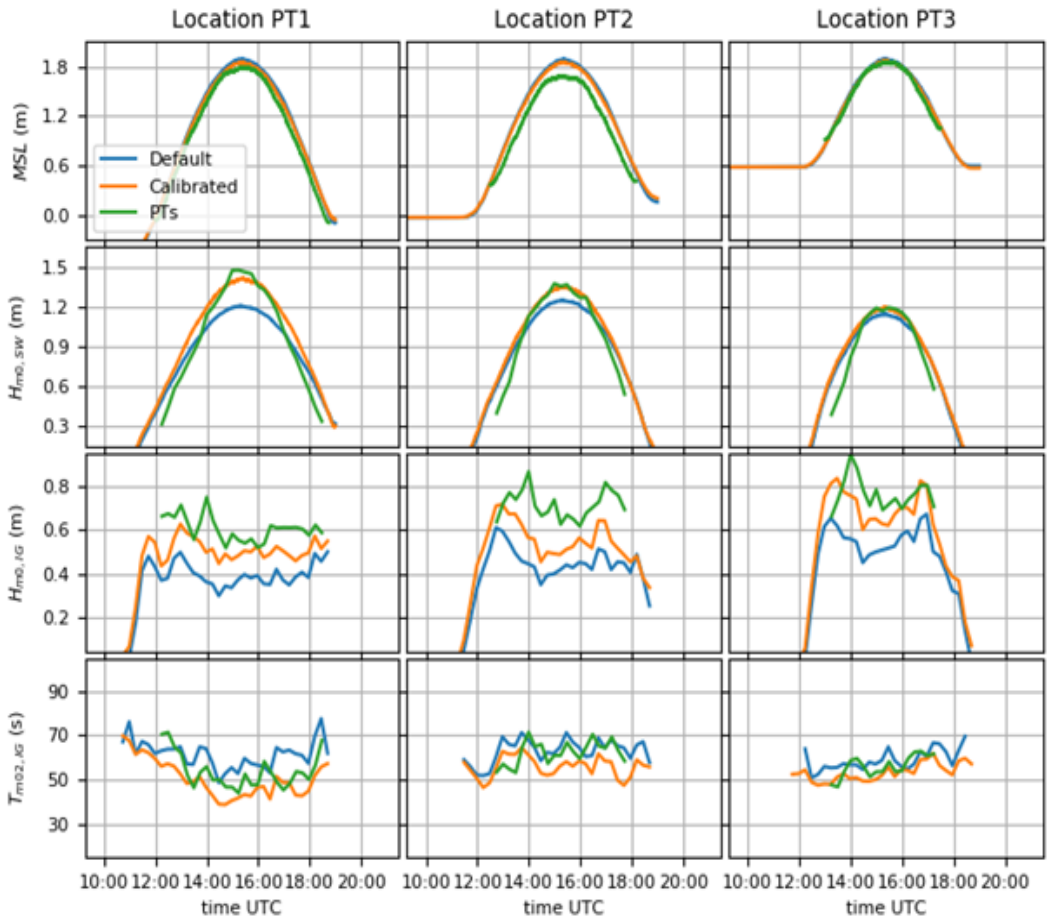


Figure 3.2 – Observed and modelled nearshore water levels and mean wave parameters at the Cova-Gala beach, modelled curves obtained with the original 2D-surfbeat model with default and calibrated settings (source: [A13])

3.3 Bathymetry data assimilation in real-time predictions

A method to extract intertidal elevation contours from satellite images was developed and implemented in a publicly-available platform (WORSICA, https://worsica.incd.pt/index), then tested in Cova-Gala [R6]. A method to assimilate the satellite-derived intertidal elevation contours into morphodynamic models was then developed and implemented (Figure 3.3). However, preliminary tests suggested that the quality of the contours remains a severe limitation in the assimilation of these data into morphodynamic models [C21]. This limited quality stems both from the horizontal resolution of Sentinel 2 images, and from the difficulty in estimating the bed elevation at the shoreline. Simultaneously, numerical tests demonstrated the importance of accurate intertidal bathymetry for overtopping predictions [C26]. Hence, further work is needed to improve the quality of satellite-derived contours to assimilate in morphodynamic models.

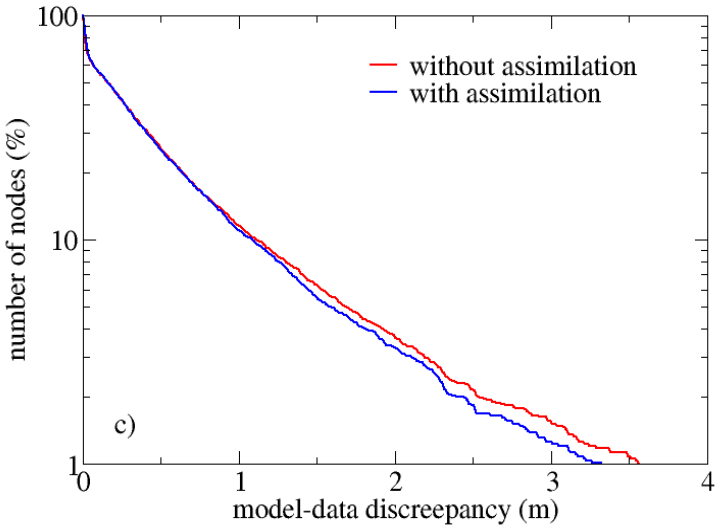


Figure 3.3 – Assessment of the data assimilation method (source: [C21])

4 | Activity 3 - Vulnerability dimension assessment

4.1 Overview

The objective of this activity was to assess the vulnerability in the observatory considering its different social and territorial dimensions. This task was also intended to assess the efficiency of installed flood mitigation infrastructures and local perceptions.

The main results were:

- Inventory of structural interventions in the observatory areas and along the Central Portuguese coast;
- Inventory of exposed elements in the observatory areas;
- Development of a replicative methodology for the assessment of territorial vulnerability, and the respective assessment in the observatory areas;
- Portrait of the local perceptions and values of residents and users of the coastal areas, from the qualitative analysis of newspapers.

4.2 Assessment of natural and building local exposure and vulnerability

A multidimensional methodology called Coastal Territorial Vulnerability Index (CTVI) was developed and applied in the three observatories (Barra - Costa Nova, Cova-Gala e São Pedro de Moel) with a historical record of coastal impacts, to analyze, evaluate and interpret the local vulnerability. The methodology considers four components of coastal territorial vulnerability (Figure 4.1): morphology, land value, buildings and public areas characteristics. These four components are combined to calculate and map the CTVI in the observatory areas (Figure 4.2). The methodology highlights the differences for the analyzed areas, allowing the differentiation of natural and artificial areas. The creation of the methodology was based on the collection and treatment of a wide variety of variables (33) that represent the territorial complexity and multidimensionality of vulnerability.

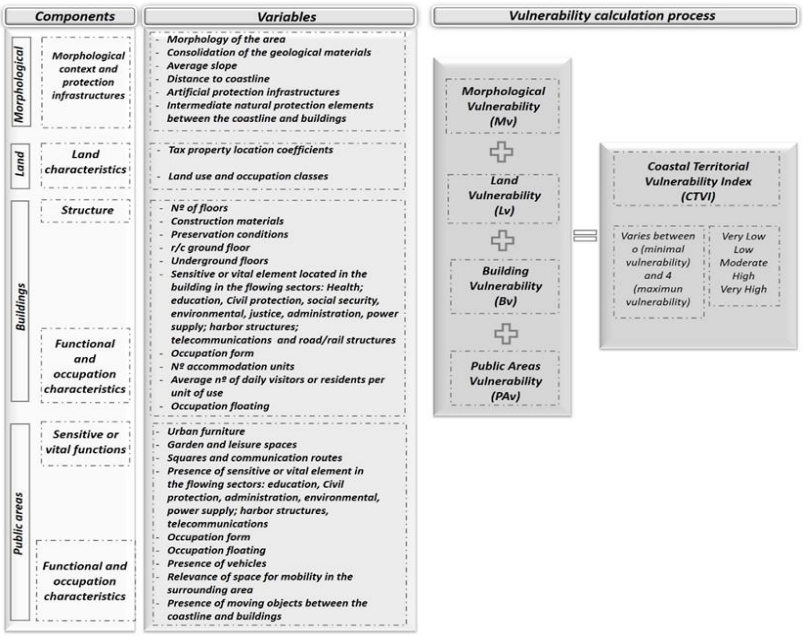


Figure 4.1 – Components, variables and calculation process of the Coastal Territorial Vulnerability Index (source: [A7])

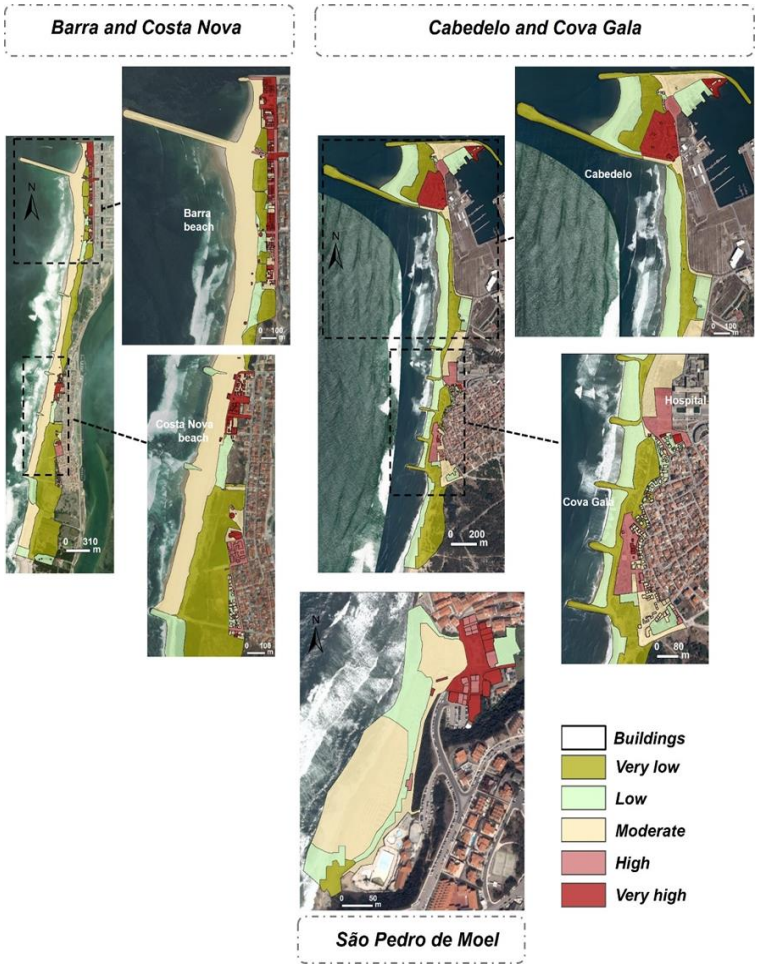


Figure 4.2 – The Coastal Territorial Vulnerability Index in the study areas (source: [A7])

4.3 Assessment of the installed mitigation infrastructures and practices

Diagnosis of the impact of structural and non-structural measures at place was achieved with the contribution of 1) the field campaigns carried out by the LNEC team (mainly in the São Pedro de Moel and Cova-Gala study areas) and 2) with the analysis performed over the database of infrastructures and interventions done along the coast under the responsibility of the Portuguese Environment Agency (APA), in the last 30 years (Figure 4.3 and Figure 4.4) [T2]. The work related to the collection and subsequent treatment and georeferencing of the different variables that make up the methodology developed.

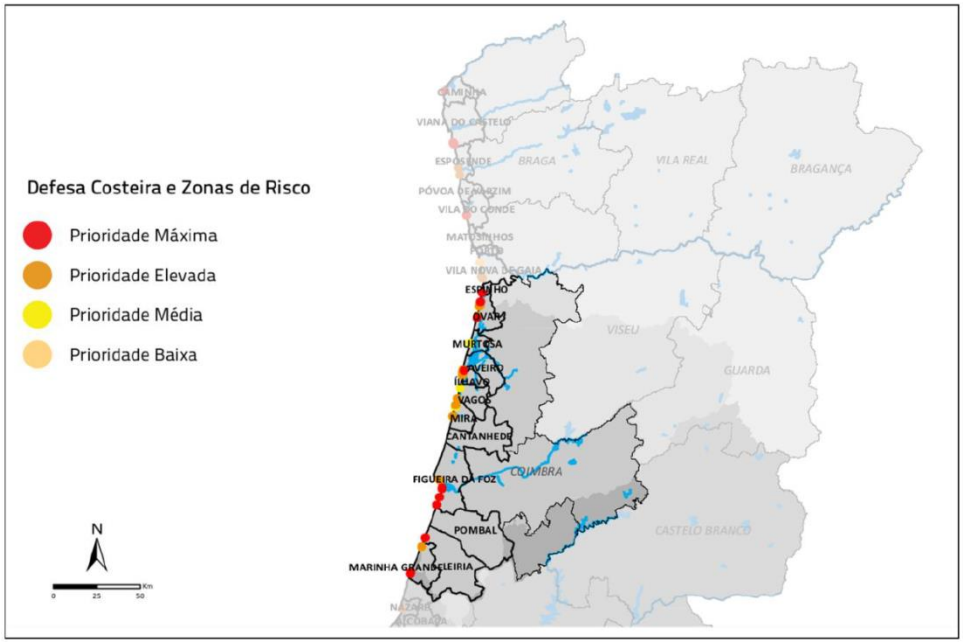


Figure 4.3 – Coastal protection priority interventions: maximum (red) to low (salmon) priority. Adapted from the Action Plan for the Protection and Valorization of the Coastal Areas - PAPVL 2012-2015 (source: [T2])

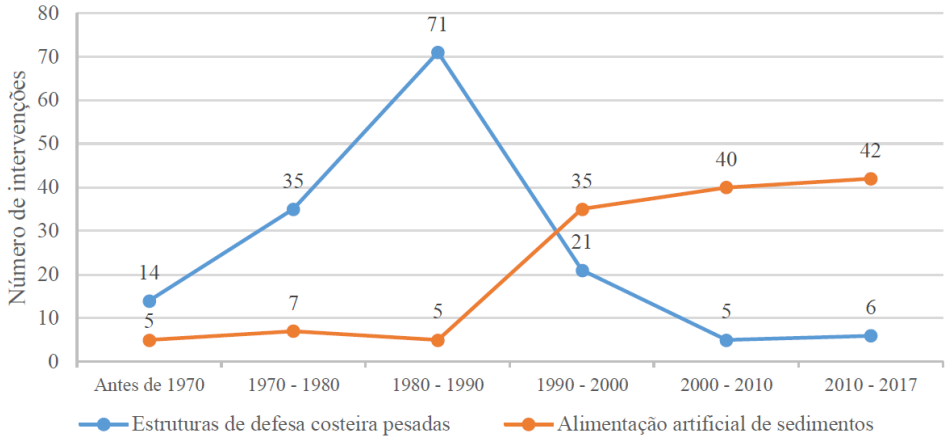
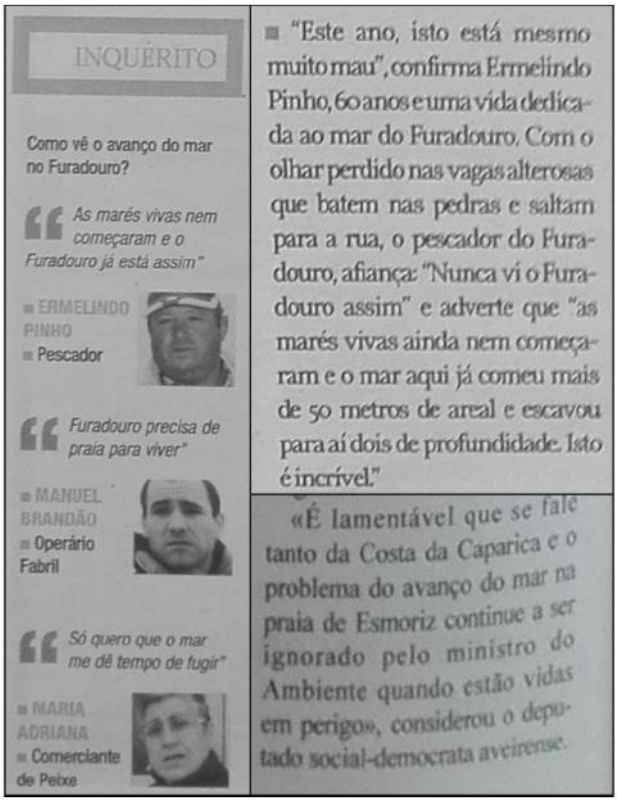


Figure 4.4 – Interventions of coastal defense from 1950 to 2017 in Portugal: hard structural coastal defense (blue); artificial sand reposition (orange) (source: [T2])

4.4 Local perceptions, values and practices appraisal

The pandemic phase did not allow the full development of this activity, namely with regard to the realization and questionnaires representing local perceptions, values and flood interviews mitigation local practices. However, work was carried out in the previous task (*Assessment of the installed mitigation infrastructures and practices*), related to the qualitative analysis of the news that formed the basis of the hemographic analysis of the database referred in Activity 1, which is part of a master thesis developed during the project (Figure 4.5) [T2]. The Q-Methodology was also applied in the Local Communication Workshop of the project (see section 10), which allowed a brief analysis of local perceptions, values and flood mitigation local practices [C18, A7].


INQUÉRITO

Como vê o avanço do mar no Furadouro?

"As marés vivas nem começaram e o Furadouro já está assim"

ERMELINDO PINHO
Pescador

"Furadouro precisa de praia para viver"

MANUEL BRANDÃO
Operário Fabril

"Só quero que o mar me dê tempo de fugir"

MARIA ADRIANA
Comerciante de Peixe

"Este ano, isto está mesmo muito mau", confirma Ermelindo Pinho, 60 anos e uma vida dedicada ao mar do Furadouro. Com o olhar perdido nas vagas alterosas que batem nas pedras e saltam para a rua, o pescador do Furadouro, afiança: "Nunca vi o Furadouro assim" e adverte que "as marés vivas ainda nem começaram e o mar aqui já comeu mais de 50 metros de areal e escavou para aí dois de profundidade. Isto é incrível."

«É lamentável que se fale tanto da Costa da Caparica e o problema do avanço do mar na praia de Esmoriz continue a ser ignorado pelo ministro do Ambiente quando estão vidas em perigo», considerou o deputado social-democrata aveirense.

Figure 4.5 – Example of residents' perception of coastal hazards, extracted from the newspapers. Example newspaper "Diário de Aveiro", 2010.02.25 (source: [T2])

5 | Activity 4 - Development of multi-source monitoring and predictive methodology

5.1 Overview

This activity aimed at developing a methodology to provide an integrated monitoring framework for coastal inundation and erosion in multiple coastal typologies, aggregating all available information sources as: conventional and low-cost fixed stations, remote sensing from satellites and unmanned aerial vehicle-UAV (from LNEC), and model-supported forecast systems.

The main results, described below, were:

- Multi-source and real-time monitoring methodology;
- WebGIS platform to access multi-source data.

5.2 Development of a multi-source and real-time monitoring methodology, combining conventional and low-cost sensors and forecast systems

The new monitoring framework was developed and tailored to the conditions of the observatories under study. The procedure started with the deployment of a forecast system in one of the observatories (Cova-Gala) as described in Activity 2. The service OPENCoastS [A4] was used as the starting point for a first deployment, taking advantage of the automatic comparison with processed Sentinel 2 images. This system was complete with the installation of a low cost, remote sensing device that provides water levels and allows for comparison with model predictions. Other sensors were considered, but the very harsh conditions at the Cova Gala beach prevented the installation of in-situ sensors at the beach and the absence of a pole nearby the beach for installation of a local camera prevented the usage of this monitoring source.

In the São Pedro de Moel observatory, local conditions prevented the deployment of a forecast system. Monitoring was established with the installation of a camera in collaboration with the local municipality taking advantage of an existing pole. Camera images were processed at 1 min intervals and served as input for several algorithms that aimed at defining the inundation water line, the breaking zone and the run-up [C23, C24, C25].

The two applications of Mosaic.pt illustrated the flexibility of combining information sources at the coast, demonstrating that several solutions can be created and tailored to the specific site conditions. Results were able to achieve the required outcomes.

A versatile WebGIS platform was developed to access multi-source data, hydrodynamic and morphodynamic predictions, and historical information [A5] that can be used as a risk management

supporting tool (Figure 5.1). Most of the data produced during the project was made available in the Mosaic.pt WebGIS platform.

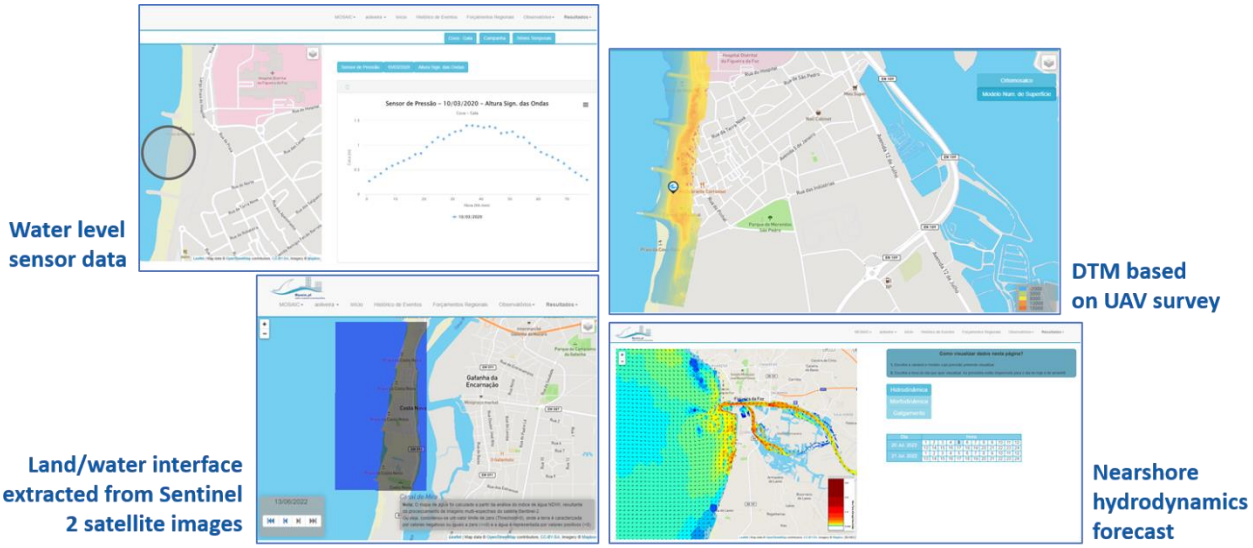


Figure 5.1 – Examples of products from Mosaic.pt WebGIS platform

5.3 Automatic validation with satellite images, establishing a new set of products with reliable remote sensing data assimilation

Satellite-derived products retrieved from the WORSICA platform were tested within the scope of Cova-Gala observatory [R6]. The main objective was to assess the quality of the geomorphological information retrieved from single and multiple satellite images. For single images, the waterline extraction workflow was incremented for obtaining subpixel details (Figure 5.2 a). The extracted subpixel waterlines were converted into elevation contours by associating them with a vertical elevation; elevations were computed from instantaneous FES2014 tidal prediction summed to the instantaneous atmospheric inverse barometer. For multiple images, elevation time series were used to create digital elevation models (DEMs) of the intertidal beach area. To do so, a series of images is first converted into a spatial repartition of the frequency of inundation (Figure 5.2 b). For each image pixel, the frequency of inundation is then converted into an elevation based on the corresponding percentile of water level over the temporal period covered by the set of images. Comparison was made against survey data for the summers of 2019, 2020 and 2021 (Figure 5.3). For the satellite-derived elevation contours, the Root Mean Square differences with the ground truth were of 0.50 m to 0.71 m, against 0.09 m to 0.34 m for the DEMs.

Alternate methodologies were developed through the installation of on-site cameras. The workflow was based on an installation of a camera in the São Pedro de Moel observatory (Figure 2.6) and comprised two alternative processing methodologies.

In the first one, the remote camera images were processed using Python 3, OpenCV, numpy (mathematical module) and scikit-learn/scikit-image (modules for image processing and machine learning). The methodology follows three steps: 1) image averaging and masking, 2) lines extraction and 3) image rectification. The averaging procedure filters out the variability associated with wind waves, making the data readily comparable to phase-averaged wave models. Processing the images before their rectification is expected to minimize errors. First, images are time averaged. The image bank is composed of all images obtained between 10 minutes before and 10 minutes after a specific time. Figure 5.4a illustrates an average image from the São Pedro Moel camera, at daylight with a temporal resolution of 1 minute. Then, features that can complicate line detection are eliminated using a mask created by the user specifically for these images (Figure 5.4b). Secondly, the wet/dry interface, the run-up and the breaker lines (which indicate the position of submerged bars over which waves break) are determined. The RGB image is converted to the HSV (Hue-Saturation-Value) colorspace, and the K-Means algorithm is applied for image segmentation and feature classification (Figure 5.4c). K-Means is an unsupervised machine learning algorithm that defines (randomly) the class' centroid values of each of the K clusters. Pixels are classified by calculating the difference of the centroid value with the pixel value, choosing the cluster class that has the nearest/smallest difference as the candidate, and iterating until the convergence of the cluster values. For the clustering, the color component(s) of the image must be specified a-priori, in this case Hue from HSV. Extracting the water lines requires the determination of the K-Means classes on the image for wet sand, dry sand, water, and wave foam. These classes are used to define the corresponding boundary lines: two classes for the wet/dry boundary line (dry sand, wet sand); three classes for the run-up line (wet sand, run-up wave and run-up middle); and one class for the breaker lines (wave foam). For each boundary detection, an image is generated with the chosen classes. To detect the wet/dry boundary and run-up lines, OpenCV’s morphology to close loose pixels and the Canny algorithm as edge detection to generate the lines are applied. To detect and distinguish the breaker lines, which use the same class, the corresponding areas on the image to indicate where to extract each one are defined, and the skeletonize algorithm from scikit-image to generate them is applied.

An alternative approach for this remote detection was also performed using Microsoft Azure cognitive services. The proposed solution will be compared and, simultaneously, fed by the other machine learning approach that uses expert knowledge to detect the water boundaries in a beach area. This approach will be validated in the future with the application of the Microsoft Azure cognitive services, in recognizing and classifying stationary camera frames of one of the MOSAIC.pt case studies sites.

The cloud-based framework is divided in two parts (Figure 5.5): the local server procedures and the cloud-based ones. In the mentioned figure, arrows 1.a, 1.b and 1.c refer to the procedures currently in place. These are necessary because their outcomes will feed the database storage that will support the required cognitive training process. The cognitive services are able to detected objects or shapes in images, according to a determined set of features identified in the training images dataset. If done from scratch, we would need to identify on each frame the relevant visual aspects, which would be a long and difficult process. Using the images constructed with the current procedures, we are able to use domain models to detect and identify domain-specific content of the camera frames. Once the

training process is finalized, we will be using only the Cloud-based procedures to promote the intended detection, as identified in Figure 5.5 by the arrows 2.a and 2.b.

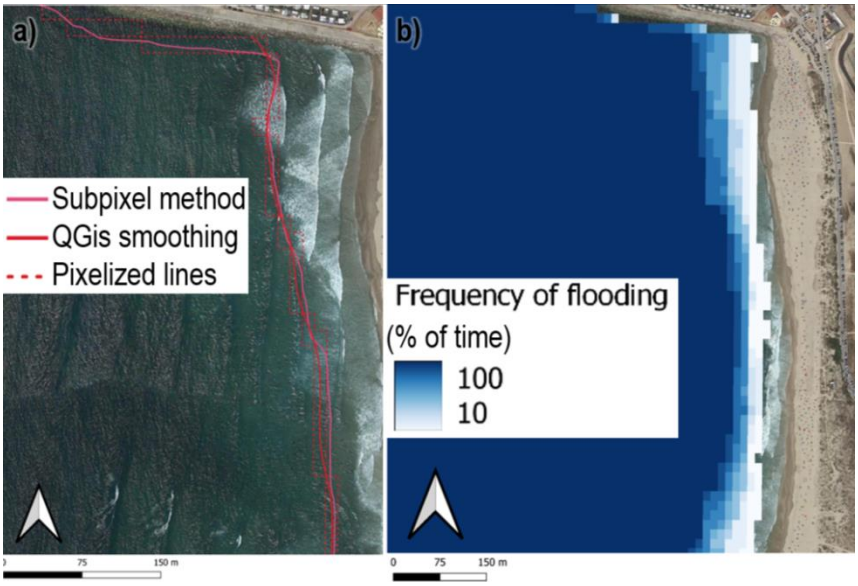


Figure 5.2 – a) Computed subpixel waterline compared with the original pixel-resolved lines and their smoothed counterpart obtained with a GIS software; b) Example of a spatial repartition of flooding frequency used for DEM generation

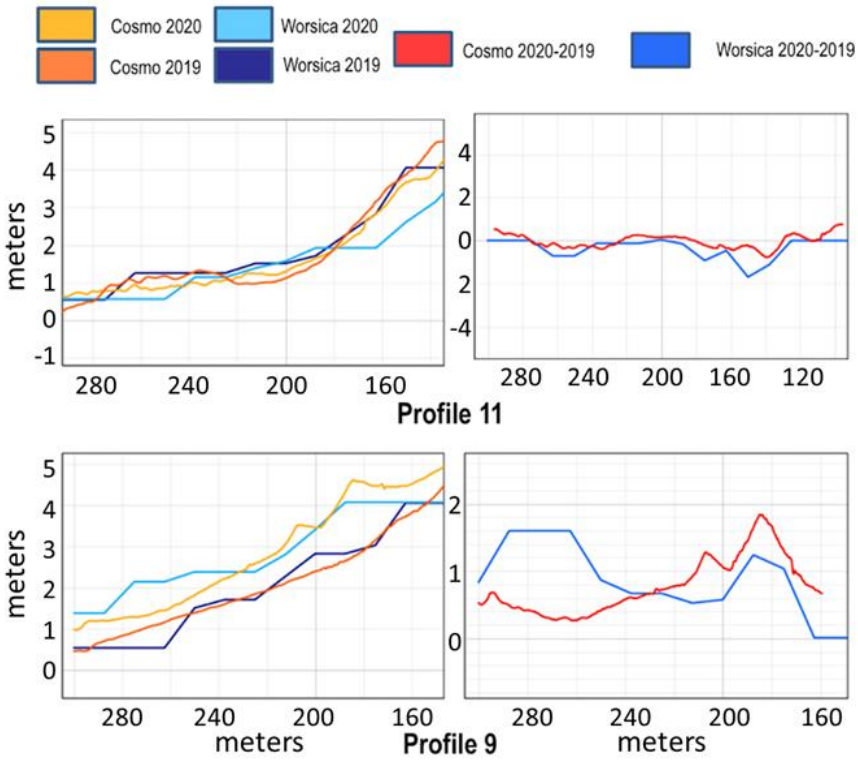


Figure 5.3 – Beach evolution from summer 2019 to summer 2020: comparison of satellite derived DEMs (Worsica) with ground truth. Left: selected topographic beach profiles; right: evolution along selected profiles

a) **b)**

c)

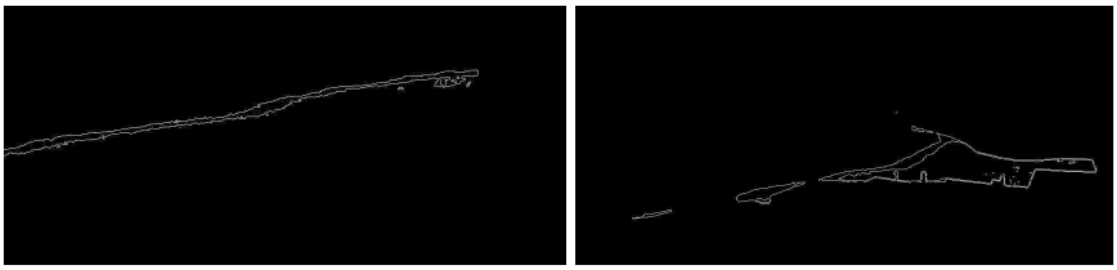


Figure 5.4 – a) Average RGB image obtained on March 11, 2020, from São Pedro de Moel remote camera; b) Average Image filtered with mask and applied K-Means in HSV colorspace; c) Images of detected breaker line (left) and wet/dry (right) boundary line

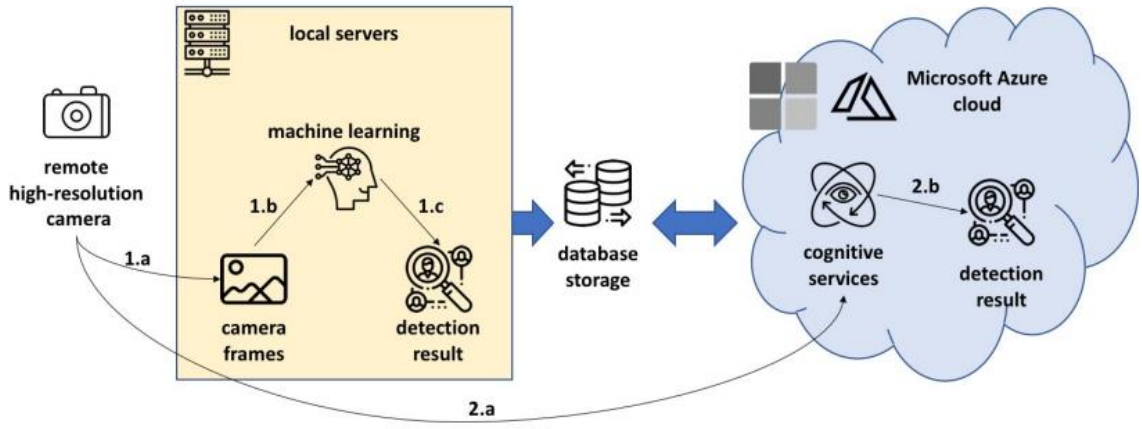


Figure 5.5 – Cloud based framework

6 | Activity 5 - Risk framework design

6.1 Overview

The aim of this activity was to develop a comprehensive flood risk framework to support emergency planning and response. The territorial complexity and the multidimensionality of territorial vulnerability identified in activities 1 and 3, imposed to carry out a holistic and multidimensional analysis that would allow the identification and differentiation of local characteristics. Therefore, it was necessary to carry out a local scale analysis in the different coastal sectors in study. Consequently, the initially proposed methodology has been changed to meet the objectives and two approaches were followed for two different spatial scales of analysis (regional and observatory scales).

The main results, described below, were:

- The identification of critical coastal typologies to overtopping and flooding for the continental Portuguese coast;
- Coastal typologies and associated risk factors characterization in the observatories;
- Inundation maps for different hazard scenarios in Cova-Gala observatory.

6.2 Regional scale

A new methodology for defining coastal typologies considering the territory complexity was developed at a regional scale. The history of occurrences obtained in Activity 1 allowed the definition of 53 sectors (Figure 6.1) along the Portuguese continental coast all affected by flooding and overtopping events. A set of 17 variables representing the different aspects of the territorial complexity (e.g. coastal morphology, elements at risk, coastal protection and hazard forcings) were defined to characterize the sectors and treated with statistical techniques, namely Cluster Analysis and Principal Component Analysis.

The results allowed the identification of critical coastal typologies to overtopping and flooding for the continental Portuguese coast, representing the natural and artificialized coastal diversity. This innovative approach also allowed the identification of the main impact factors contributing to support risk reduction and contingency measures [A12, C19]. The results contribute to a “simplification” of the reality of the coastal zone, allowing for the identification of different typologies, whether from the point of view of coastal zone management or coastal disaster risk reduction. The information obtained contributes to the definition and implementation of differentiated mitigation and adaptation measures, taking into account the relevance and priorities identified in each sector and typology. The definition of coastal typologies developed contradicts the top-down and “one size fits all” trend associated with coastal zone management. The diversity, multidimensionality and complexity of this territory can only be analyzed from a bottom-up perspective in which the combination of different characteristics that differentiate each area can be analyzed and valued.

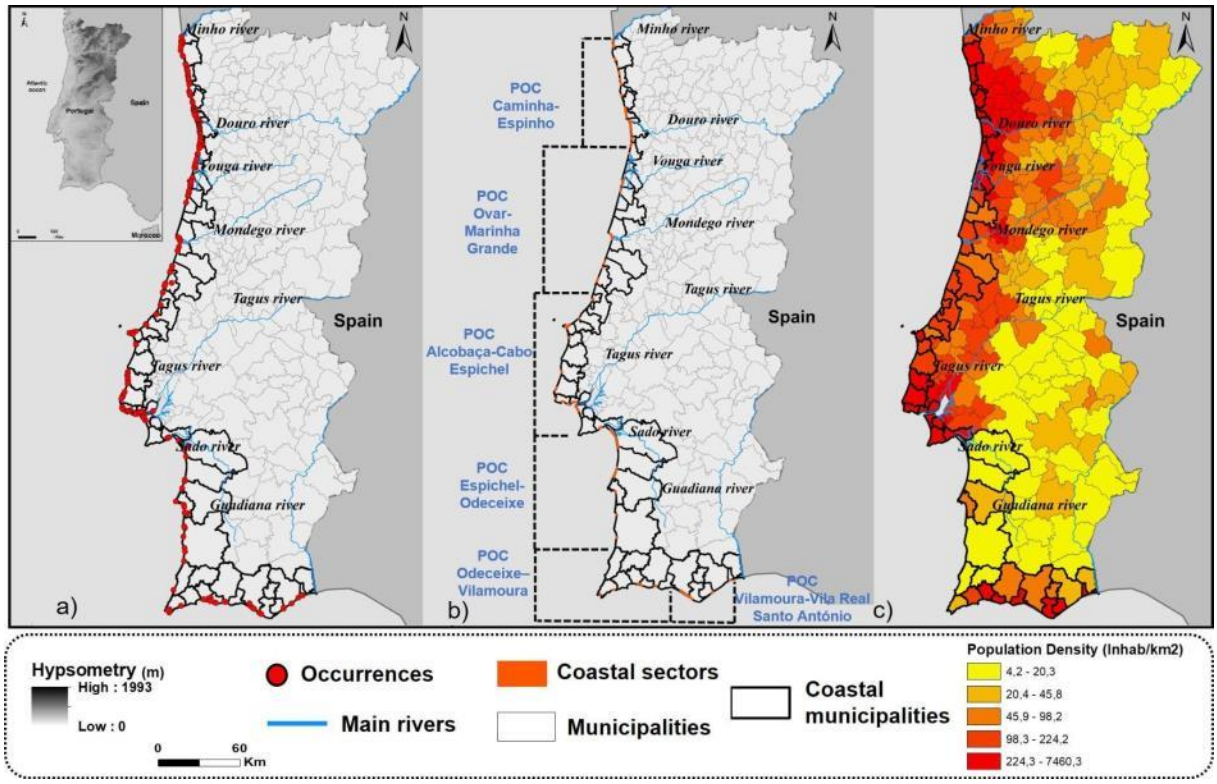


Figure 6.1 – a) Coastal municipalities and occurrences distribution; b) coastal sectors and POCs; c) population density of mainland Portugal by municipality (source: [A12])

6.3 Local scale

On a local scale, overtopping and flood risk analysis was performed for different coastal typologies [T2]. For the Cova-Gala observatory, coastal flood maps were created for three scenarios. These scenarios were based on the storm Hercules that hit mainland Portugal in early 2014. The first scenario used the waves and water levels hindcasted for the peak of Hercules; these were dynamically downscaled using the same model workflow presented in [A13]. The second and third scenarios used the same wave forcing, but were combined with a tidal + surge water level of +2.20 m. This water level corresponds to a return period of ~70 years and was summed to both the present Mean Sea Level (MSL; 0.19 m ALTH39, 2nd scenario) and to a MSL which, due to sea level rise, could be expected to occur in about 50 years of time (0.49 m ALTH39, 3rd scenario) [A13, C28]. For the three scenarios, a series of runs were performed to account for the stochasticity of the long- and short-wave fields. Based on each series, an exposure index was computed for each scenario. The exposure index ranges for zero (low exposure) to one (high exposure), and was mapped as shown in Figure 6.2.

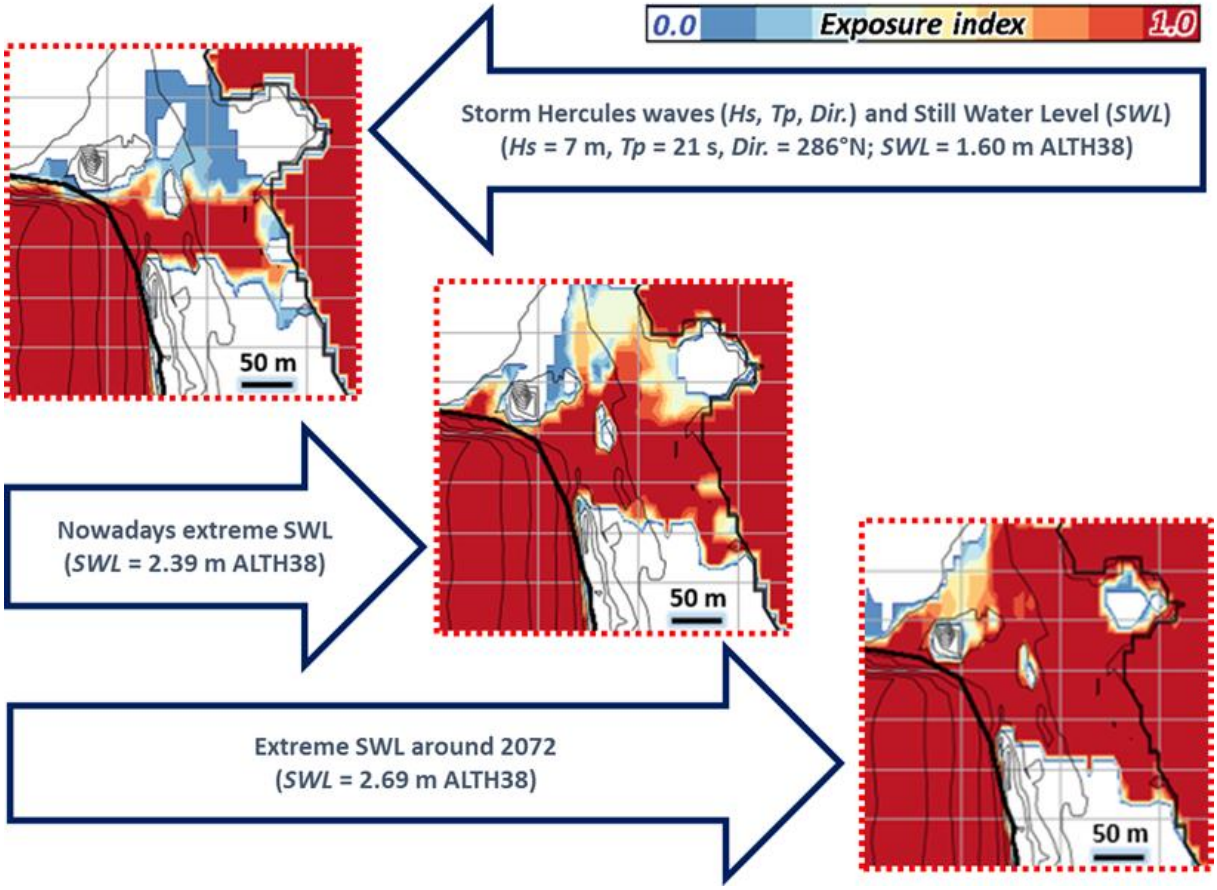


Figure 6.2 – Overtopping exposure maps created for Cabedelo area in Cova-Gala observatory

The results of this activity as well as the information collected in-situ in Activity 1 allowed the identification of relevant information for a comprehensive coastal flood assessment and a suitable decision supporting tools development. The dedicated WebGIS platform presented in Section 5 can be managed in real time as a decision support tool allowing multi-source data and information access [A5, C8, C13].

7 | Activity 6 - Institutional capability for emergency response

7.1 Overview

This activity aimed at contributing to improve the response capacity of the institutions responsible for the emergency management with the design of a comprehensive real-time emergency response system.

The main results, described below, were:

- Definition of requirements and procedures for the put-in place of an early warning system for coastal flooding;
- Screening of the regional, municipal and local stakeholders with competences in the coastal flooding emergency response system.

7.2 Evaluation of installed institutional capacity for emergency response

A qualitative analysis of the coastal management plans (POC) was conducted for the entire main Portuguese coastal zone, and in particular in the observatory study areas. The analysis included the evaluation of the protection measures (structural and non-structural), the planned uses and constraints in use based on coastal zonation and public regulations (Table 7.1) [T2]. A comparison between the 1st and 2nd generation planning instruments (1999 and 2017) was also performed.

Table 7.1 – Comparison of measures and interventions proposed for the Cova Gala Observatory between the Coastal Management Plans of 1999 (POOC) and 2017 (POC)

POOC - 1999		POC - 2017	
(1) Interventions based on defensive infrastructure	Total (0)	(1) Interventions based on defensive infrastructure	Total (0)
(2) Re-qualification of infrastructures or interventions of sand reposition	Total (1)	(2) Re-qualification of infrastructures or interventions of sand reposition	Total (5)
Dune rehabilitation near urban front-line (the area of intervention is smaller that the one covered by the POC 2017)		Dune rehabilitation near urban front-line Dune system rehabilitation south of the beach Pier re-qualification and conservation Artificial sand deposition laterally to the pier Assessment study for the bypass of sediments extracted from the Figueira da Foz port	
(3) Spatial planning measures	Total (4)	(3) Spatial planning measures	Total (7)
Construction of 6 beach facilities Construction of 2 pedestrian walkways Landscape and environmental re-qualification Public spaces re-qualification and existing facilities' upgrade		Construction of 1 beach facility Cova's intervention plan – removal of degraded buildings and re-qualification of the urban front-line Road connection between the Cova beach and the Gala beach Creation of an artificial sand foreland (promontory) Relocation of 1 building Invasive species control Vehicle interdiction of circulation in dunes	
(4) Sensitizing and risk management actions	Total (1)	(4) Sensitizing and risk management actions	Total (2)
Creation of a environmental educational centre		Monitoring and evaluation of the coastal defense structures Monitoring and evaluation of risk zones	

7.3 Design of a real-time emergency response system

A real-time forcasting system based on OPENCoastS was implemented for the Cova-Gala observatory, as described in Activity 2 (Figure 7.1). The forecasts are made accessible through Mosaic.pt's WebGIS platform to be integrated in a real-time emergency response system (Figure 7.2).

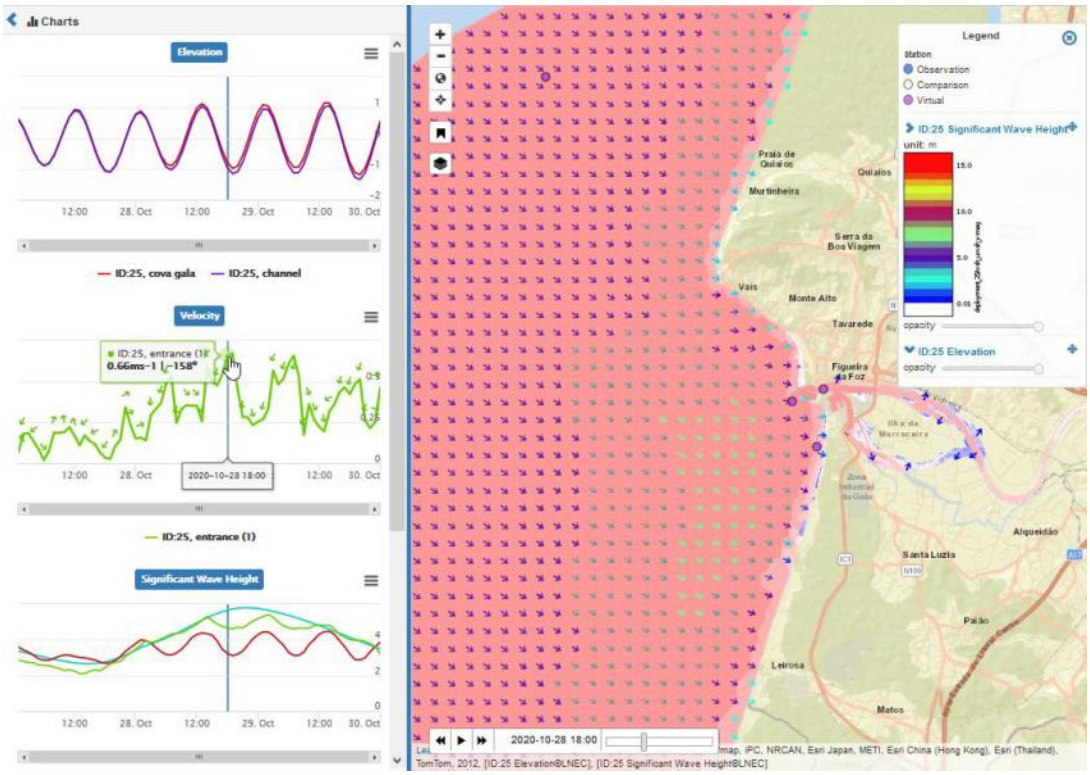


Figure 7.1 – Implementation and validation of an operational forecasting system for nearshore hydrodynamics with OPENCoastS. Source: Nahon et al. (2020) [C4]

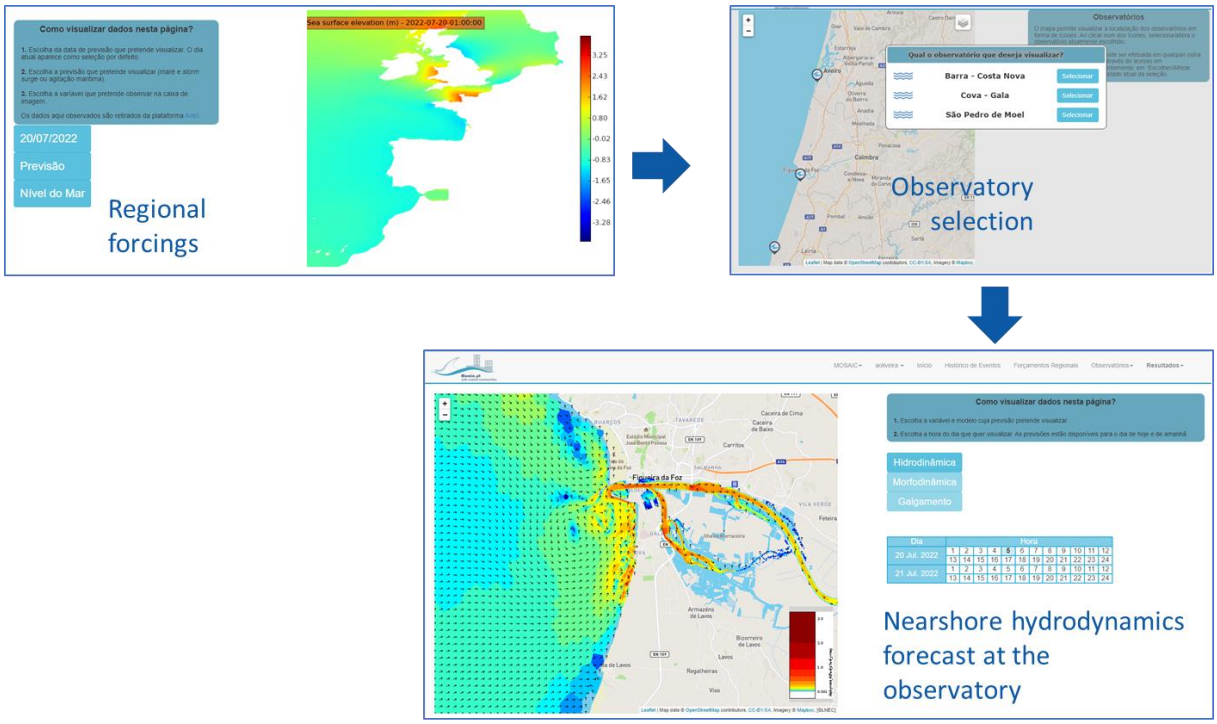


Figure 7.2 – Example of the Mosaic.pt WebGIS platform forecast products at regional and intermediate scales

8 | Activity 7 - Safe communities involvement and response

8.1 Overview

The objective of this activity was the evaluation of the emergency response capabilities of the community as well as the development of guidelines of how the community should be prepared.

The obtained results, described below, were:

- The validation of the institutional actors and local representatives based on the historical events reported and on the participatory methodologies applied;
- The screening and interests, values and conflicting topics in the conciliation of the use of coastal areas and the goal of disaster risk reduction from hazardous coastal processes;
- The production of materials and methodologies to be applied in training actions related with the management of coastal areas.

8.2 Identification of focal elements

In this activity, a survey from coastal and emergency-related legislation and local contexts was performed that identified the cross-scale focal points. Complementarily, the online technical workshop that occurred in October 2020 and the local dissemination session of September 2022 contributed to the validation of the previously identified actors, and allowed for the screening of local involved parts (from the local economy, local users and residents) that are “invisible” at the regional and national levels of decision.

8.3 Design and application of participative methodologies

After the October 2020 online technical workshop, a survey was conducted with the participants that resulted in the expression of expertise and views on the management strategies that are, in the abstract (i.e., not specific to a particular site), more efficient according to sustainability and disaster risk reduction goals. During the September 2022 local session, a Q-methodology dynamics was applied to almost 40 participants in Cova-Gala study area (Table 8.1 and Table 8.2). The results supported to local oral auscultation through discussion with the scientific community and local decision-makers (civil parish and municipality). Additionally, Q-methodology results were statistically analyzed providing the responders visions and interests in regard to four perspectives: occupation of the coastal zone (group 1 of statements); coastal hazards (group 2 of statements); management and planning on the coastal zone (group 3 of statements); relevance of forecasting and early warning in risk scenarios (group 4 of statements).

Table 8.1 – Statements (A1 to A16) applied during the Q-Methodology dynamics in the Cova-Gala Local Workshop

Group 1: on the occupation and evolution of the coastal zone (4 questions)
A2: The present evolution of the coastline is only determined by oceanographic, atmospheric, geological and morphological factors.
A10: The human occupation of the coastline and the different activities carried out there have been adapting to the projections of rising sea levels.
A12: The coastline of mainland Portugal is characterized by its natural heritage and economic potential.
A14: The demographic and tourist pressure on the coast generates conflicts of various kinds.
Group 2: on coastal risks (4 questions)
A1: Structural coastal protection works (spurs, longitudinal adhering works or others) are the option to stabilise the line and safeguard people and property.
A8: Relocation and planned retreat are the response to the increased intensity and frequency of extreme events.
A5: The articulation of the various public and private entities in coastal risk management is the answer to deal with the territorial complexity of coastal areas.
A16: Non-structural coastal protection works (resettlement or sediment replacement, dune cordon reinforcement or others) are the option to stabilize the coastline and safeguard people and property.
Group 3: on coastal zone management, planning and management (4 questions)
A13: Integrated and sustainable coastal zone management requires institutional cooperation, accessibility to data and information mechanisms, communication and involvement of the various stakeholders.
A15: The Coastal Zone Programs (POC's) reflect the dimensions (economic, social, environmental, cultural and territorial) and the multiplicity of risks with expression in the coastal zone.
A7: The model of coastal zone governance reflects scientific and technical knowledge.
A4: The model of coastal zone governance reflects the knowledge and interests of local communities and frequent users.
Group 4: on the importance of forecasting risk scenarios (4 questions)
A9: Forecast models for risk scenarios should be based on historical databases of coastal inundation and overtopping events.
A6: Forecast models for risk scenarios should incorporate territorial vulnerability and exposure of buildings and infrastructure.
A11: Forecast models for risk scenarios should incorporate monitoring, real time data production and the construction of dynamic models of coastal inundation and overtopping.
A3: Forecast models for risk scenarios should contribute to warning and alert and to allocate civil protection resources.

Table 8.2 – Participants' points of view regarding the Group 1 statements, as expressed during the Q-Methodology dynamics in the Cova-Gala Local Workshop

Statements		Increasing level of disagreement			Nor agree or disagree	Increasing level of agreement		
		III	II	I		I	II	III
The present evolution of the coastline is only determined by oceanographic, atmospheric, geological and morphological factors.	A2	7	5	6	6	3	3	1
The human occupation of the coastline and the different activities carried out there have been adapting to the projections of rising sea levels.	A10	5	12	8	6	1	0	0
The coastline of mainland Portugal is characterized by its natural heritage and economic potential.	A12	0	1	5	17	5	3	1
The demographic and tourist pressure on the coast generates conflicts of various kinds.	A14	0	2	7	14	7	1	1

8.4 Development of training activities and specific mitigation actions

In this activity, part of the results from the previous activities was applied in lectures and training activities to post-graduation students and professionals from the fields and civil protection, geology, geography, engineering, and other Social Sciences (psychology and sociology). During the MEC2022 conference at LNEC (6-8 June 2022), one course of a new service targeted at detecting shoreline and run-up areas (WORSICA) and one course of a software targeted and forecasting water circulation and quality (OPENCoastS+) were delivered to post-graduate students, scientists and practitioners from the regional and local authorities.

9 | Activity 8 - Data management

9.1 Overview

This activity aimed the development of a Data Management Plan (DMP) to handle data collection, sharing and preservation during the project. A Data Management Plan was developed and implemented [R4].

9.2 Data Management Plan and its implementation

This task aimed at developing the necessary tools for data sharing, by placing the data in an open access repository and organizing it along a data management plan that support the data management life cycle for all data that will be collected, processed or generated by the project. This plan should present the methodology and standards compliance of the data collected and generated in the project and the ways to access it.

A Data Management Plan (DMP) was developed to handle data collection, sharing and preservation during the project, using a software promoted by the European Commission for DMP construction. The DMP planned to be updated at months 19-20, but data description did not change and a single DMP was used [R4].

The choice of the repository started with Zenodo, for the open publications (https://zenodo.org/search?page=1&size=20&q=mosaic.pt) but a different choice was made for the data. An open research data infrastructure to allow third parties to access, mine and exploit the data was built using an instanciation of Dataverse, a software promoted by FCT for data repository purposes. Dataverse has advanced tools for metadata generation and was deemed more adequate for the project data. Given data uploading to Dataverse is complex, a temporary excel file was built to help the researchers to characterize their data and thus provide metadata for the data to be upload in the repository.

10 | Activity 9 - Project scientific and technical management

10.1 Overview

This activity aimed the scientific and technical management of the project.

The main results were:

- A kick-off project meeting, monthly general meetings, and a final project meeting;
- The realization of a Technical Project Workshop;
- Three scientific progress reports and a final report of the project.

10.2 Management

The project scientific and technical management was ensured by the Principal Investigator (PI), assisted by the Co-Principal Investigator and the coordinators of the activities, in order to guarantee the fulfilment of the work program. In addition to the kick-off project meeting that took place in LNEC on 23/10/2018, the scientific and technical project management included monthly online meetings with all the team during the full project duration (ANNEX I). These meetings allowed the discussion of each activity's progress, planning the future actions and discussing management issues. For each meeting a minute was prepared and disseminated within all project team. Several sectorial task meetings took place whenever needed. Specific meetings with local stakeholders from the observatories also took place during the project. A final project meeting took place online on 28/10/2022 in which the activity's leaders presented the main achievements of each activity.

A Technical Project Workshop took place live streaming on 19/10/2020, under the theme "Coastal flood risk management". The workshop aimed to present and discuss with the scientific community, coastal managers, stakeholders, and the general public the relevant project achievements in the scope of coastal risk management. The workshop included 9 oral communications, 2 from the project team and 7 from invited speakers representing different institutions: Portuguese Agency of the Environment, the Aveiro and Figueira da Foz Port Authority, Marinha Grande Municipality, universities of Aveiro, Coimbra, Lisbon and Algarve (ANNEX II). The workshop had 329 inscriptions from 138 different institutions and the maximum number of simultaneous participants was 154. A feedback survey about the workshop was performed and the main results are available in the project webpage (http://mosaic.lnec.pt/pdfs/MOSAIC_Inqu%C3%A9ritoWorkshop1.pdf). The results showed that 51% of the attendees worked in organizations that might benefit from project results, 25% worked in scientific institutions; citizens represent 12%, and 6% were residents in the project study areas. Participants pointed out the relevance of stakeholders' participation in project dissemination actions, and the importance to discuss flood risk management measures with the coastal communities.

Due to delays in several activities and the constraints arising from the pandemic situation, it was decided to join the second technical project workshop, initially proposed, with the final technical workshop that is described in Section 11.

Partnerships with the Portuguese Agency of the Environment and the National Emergency and Civil Protection Authority were formalized, and a Collaboration Protocol was signed with the Marinha Grande Municipality for collaboration and information transfer during the project.

Three annual scientific progress reports and a final report were submitted to FCT in due time.

11 | Activity 10 - Project dissemination and communication

11.1 Overview

This activity aimed to ensure an effective communication and wide dissemination of the project findings addressing three main target groups: scientific and technical communities; end-users and stakeholders, local communities, and general public.

The results, described below, were:

- A project website in Portuguese and in English;
- A wide dissemination of the project at both national and international levels;
- The realization of the Final Project Workshop;
- The realization of a dedicated Local Communication Workshop.

11.2 Dissemination and communication

The dissemination and communication of the project outcomes took place throughout the project using different channels for different targeted audiences.

A dedicated webpage in Portuguese and English was developed and maintained:

EN: http://mosaic.lnec.pt/index_en.php

PT: http://mosaic.lnec.pt/

The project dissemination to the scientific community was made essentially through publications in peer-review international journals and presentations at national and international conferences. The project's publications included 11 papers in peer-review international journals, and 2 submitted, one paper published in a national journal, 14 publications in proceedings of international conferences and 15 of national conferences and 6 reports. Advanced training was also achieved through two PhD theses and two master's degree theses. In addition, targeting the scientific and technical communities, other channels were used as: ResearchGate, LNEC's Site, Newsletter from LNEC's Hydraulics and Environment Department (ANNEX III).

The dissemination and communication of the project to managers, local and national stake-holders and general public was made through different channels including:

- A flyer of the project was prepared for project dissemination (http://mosaic.lnec.pt/pdfs/Folheto_MOSAIC.pdf)
- A QR Code was generated including information of the project;
- Specific meetings with stakeholders and end-users for the project presentation;
- News in regional and local newspaper, Facebook, etc (ANNEX III).

The Technical Project Workshop (described in Section 10) and the Final Project Workshop (described below) promoted a broad dissemination of the project results both to the scientific community and to managers and technicians to national and local stakeholders (ANNEX II).

In order to have a broader audience to communicate the project findings, the Final Project Workshop was organized as a special session in the scope of the conference MEC2022 (*6ª Conferência sobre Morfodinâmica Estuarina e Costeira*- http://mec2022.lnec.pt/index.html) that took place in LNEC on 6-8 June 2022. This special session under the theme "Coastal flooding: processes, vulnerability and risk" was organized in collaboration with the EWCOAST project (https://www.cima.ualg.pt/ew-coast/) and took place on 07/06/2022 (ANNEX IV). The session accounted for 6 oral communications of the Mosaic.pt project and promoted the dissemination of project findings within the scientific community and national stakeholders (e.g. Portuguese Agency of the Environment). Other 3 oral communications from the project took place in other conference sessions.

The Local Communication Workshop took place on 28/09/2022 in the *Desportivo Clube Marítimo da Gala* (Figueira da Foz), with the support of the Figueira da Foz municipality and the São Pedro parish council. This communication session had as target-public the local stakeholders community aimed to present and discuss the most relevant results of the project for the Cova-Gala (Figueira da Foz) observatory. The event included a presentation of the project and a moment to acquire the participants' viewpoints about different aspects of coastal risks, applying the participatory Q-Methodology technique followed by a period of discussion (see program in ANNEX V). The workshop had more than 30 participants, including representatives of the Figueira da Foz municipality and São Pedro parish council, local associations, the local population and the media (Figure 11.1). In addition, news from the session were published in the most important local newspapers (o Diário de Coimbra e o Diário As Beiras – ANNEX III).

Figure 11.1 – Aspects of the Local Communication Workshop

12 | Publications of the project

12.1 Papers in international journals

[A1] Freire, P., Oliveira, F. S. B. F., Oliveira, J. N. C., 2020. Coastal Flooding Process: Comparing Different Coastal Typologies Response to Extreme Hydrodynamic Conditions. Jour. of Coastal Research, SI 95: 797-802. https://doi.org/10.2112/SI95-155.1

[A2] Oliveira, J. N. C., Oliveira, F. S. B. F., Freire, P., Trigo-Teixeira, A. A., 2020. A Hybrid Monitoring-modelling Analysis on the Storm Induced Sediment Dynamics of a Structure-controlled Beach. Jour. of Coastal Research, SI 95: 605-609. https://doi.org/10.2112/SI95-118.1

[A3] Rilo, A., Tavares, A. O., Freire, P., Zêzere, J. L., Haigh, I. D., 2020. Enhancing Estuarine Flood Risk Management: Comparative Analysis of Three Estuarine Systems. Journal of Coastal Research, SI 95: 935-939. https://doi.org/10.2112/SI95-182.1

[A4] Oliveira, A., Fortunato, A.B., Rodrigues, M., Azevedo, A., Rogeiro, J., Bernardo, S., Lavaud, L., Bertin, X., Nahon, A., de Jesus, G., Rocha, M., Lopes, P. 2021. Forecasting contrasting coastal and estuarine hydrodynamics with OPENCoastS. Environmental Modelling & Software, 143:105132. https://doi.org/10.1016/j.envsoft.2021.105132

[A5] Rocha, M., Oliveira, A., Freire, P., Fortunato, A.B., Nahon, A., Barros, J.L., Azevedo, A., Oliveira, F.S.B.F., Rogeiro, J., Jesus, G., Martins, R.J., Santos, P.P., Tavares, A.O., Oliveira, J., 2021. Multi-Hazard WebGIS Platform for Coastal Regions. Appl. Sci. 2021, 11, 5253. https://doi.org/10.3390/app11115253

[A6] Tavares, A. O., Barros, J.L., Freire, P., Santos, P.P., Perdiz, L., Fortunato, A.B., 2021. A coastal flooding database from 1980 to 2018 for the continental Portuguese coastal zone, Applied Geography, Volume 135, 2021, 102534, ISSN 0143-6228. https://doi.org/10.1016/j.apgeog.2021.102534

[A7] Barros, J. B., Tavares, A.O., Santos, P.P., Freire, P., 2022. Enhancing a Coastal Territorial Vulnerability Index: anticipating the impacts of coastal flooding with a local scale approach. Coastal Management, 50:5, 442-468, https://doi.org/10.1080/08920753.2022.2107858

[A8] Nahon, A., Idier, D., Bertin, X. Guérin, T., Marieu, V. et al., 2022. Modelling the contribution of wind waves to Cap Ferret's updrift erosion. Coastal Engineering, Elsevier, 2022, 172, pp.104063. https://doi.org/10.1016/j.coastaleng.2021.104063

[A9] Oliveira, F.S.B.F., Oliveira, J.N.C., 2022. Topo-bathymetric behaviour of a beach controlled by a groyne field and a dune-seawall backshore. Journal of Coastal Conservation. SI Adapt Our Coast For a Sustainable Future. (in press)

[A10] Rilo, A., Tavares, A.O, Freire, P., Zêzere, J. L., 2022. Dealing with multisource information for estuarine flood response evaluation in two western European coastal areas. Int J Disaster Risk Sci, 13, 199–213 (2022). https://doi.org/10.1007/s13753-022-00403-8

[A11] Rilo, A., Tavares, A.O., Freire, P.; Zêzere, J.L., Haigh, I.D., 2022. Improving Estuarine Flood Risk Knowledge through Documentary Data Using Multiple Correspondence Analysis. Water 2022, 14, 3161. https://doi.org/10.3390/w14193161.

[A12] Barros, J.L., Santos, P.P., Tavares, O.A., Freire, P., Fortunato, A.B., Rilo, A., Oliveira, F.S.B.F., 2022. The complexity of the coastal zone: definition of typologies as a contribution to Coastal Disaster Risk Reduction and Management, International Journal of Disaster Risk Reduction (submitted).

[A13] Nahon, A., Fortunato, A.B., Oliveira, F.S.B.F., Azevedo, A., Henriques, M.J., Silva, P.A., Baptista, P., Freire, P., 2022. Modelling and mapping surfbeat-driven overtopping in the shadow of a jettied tidal inlet, Coastal Engineering (submitted).

12.2 Papers in national journals

[A14] Ferreira, A.M., Fortes, C.J.E.M., Reis, M.T., Garzon, J.L, 2020. Análise de eventos de risco através de modelação numérica XBeach. Caso de Estudo – Costa da Caparica, Revista Recursos Hídricos 41, nº2(2):51-63. http://mosaic.lnec.pt/pdfs/v41n2_cti-4.pdf

12.3 Proceedings in international conferences

[C1] Barros, J. L., Freire, P., Perdiz, L., Tavares, A. O., 2020. Flooding Occurrences in the Portuguese Continental Coastal Zone: A Database for the Period 1980-2018. In Baraldi, Di Maio & Zio (org.), Proceedings of the 30th European Safety and Reliability Conference and the 15th Probabilistic Safety Assessment and Management Conference, Singapore: Research Publishing, 7p. https://www.rpsonline.com.sg/proceedings/esrel2020/html/4202.xml

[C2] Cabrita, P., Ferreira, A. M., Fortes, C., Ferreira Ó., Freire, P., 2020. Testing storm impact modelling at São Pedro de Moel beach. Atas das 6as Jornadas de Engenharia Hidrográfica / 1as Jornadas Luso-Espanholas de Hidrografia, 03, 04 e 05 de novembro de 2020, 99-102, Instituto Hidrográfico, Lisboa. http://mosaic.lnec.pt/pdfs/Cabrita_etal_Livro_Atas_6JEH_2020.pdf

[C3] Freire, P., Oliveira, F. S. B. F., Oliveira, J. N. C., 2020. Critical flood conditions in two beaches of the Portuguese central west coast. Atas das 6as Jornadas de Engenharia Hidrográfica / 1as Jornadas Luso-Espanholas de Hidrografia. 603, 04 e 05 de novembro de 2020, 316-319, Instituto Hidrográfico, Lisboa. http://mosaic.lnec.pt/pdfs/Freire_etal_Livro_Atas_6JEH_2020.pdf

[C4] Nahon, A.B., Fortunato, A., Azevedo, Oliveira, F.S.B.F., Oliveira, J.N.C., Rogeiro, J., Jesus, G., Oliveira, A., Silva, P.A., Freire, P., 2020. Implementation and validation of an operational forecasting system for nearshore hydrodynamics with OPENCoastS. Atas das 6.as Jornadas de Engenharia Hidrográfica / 1.as Jornadas Luso-Espanholas de Hidrografia, 03, 04 e 05 de novembro

de 2020, 203-206, Instituto Hidrográfico, Lisboa. http://mosaic.lnec.pt/pdfs/Nahon_etal_Livro_Atas_6JEH_2020.pdf

[C5] Oliveira, J.N.C., Oliveira, F.S.B.F., Trigo-Teixeira, A.A., 2020. Modelling 2DH beach morphodynamics in XBeach: model versions and hydrodynamic modes performance. Atas das 6.as Jornadas de Engenharia Hidrográfica / 1.as Jornadas Luso-Espanholas de Hidrografia, 03, 04 e 05 de novembro de 2020, 147-150, Instituto Hidrográfico, Lisboa. http://mosaic.lnec.pt/pdfs/JNOliveira_etalLivro_Atas_6JEH_2020.pdf

[C6] Rilo, A., Tavares, A. O., Freire, P., Zêzere, J. L., 2020. O contributo de fontes históricas para a avaliação da vulnerabilidade à inundação em estuários. Atas das 6.as Jornadas de Engenharia Hidrográfica / 1.as Jornadas Luso-Espanholas de Hidrografia, 03, 04 e 05 de novembro de 2020, 320-323, Instituto Hidrográfico, Lisboa. http://mosaic.lnec.pt/pdfs/Rilo_etal_Livro_Atas_6JEH_2020.pdf

[C7] Bortoli, A.M., Ferreira, A., Fortes, C.J.E.M., Nahon A., 2021. Análise de eventos de inundação com o recurso a modelação numérica Xbeach e a fórmulas empíricas. Caso de estudo: Cova-Gala. X Congresso sobre Planeamento e Gestão das Zonas Costeiras dos Países de Expressão Portuguesa, 6 a 10 de dezembro, Rio de Janeiro, Brasil. 292-295pp. ISBN 978-989-8509-29-1. Editora APRH Congresso sobre Planeamento e Gestão das Zonas Costeiras dos Países de Expressão Portuguesa, 3 pp. http://mosaic.lnec.pt/pdfs/publicacoes_out2022/conf_int/Bortolietal_CPGZCPEP_2021.pdf

[C8] Oliveira, A., Azevedo, A., Jesus, G., Martins, R., Rocha, M., Nahon, A., Fortunato, A. B., Rogueiro, J., Freire, P., 2021. MOSAIC.pt – A novel methodology and Web GIS portal for flood, erosion and overtopping risk management in coastal regions. MedGU2021 (in press). http://mosaic.lnec.pt/pdfs/pub_nov2022/Oliveira_etal2021MEDGU.pdf

[C9] Oliveira, F.S.B.F., Oliveira, J.N.C., Freire, P.M.S., 2021. Evolução da morfologia costeira a sul da embocadura do rio Mondego, de 2011 a 2019. X Congresso sobre Planeamento e Gestão das Zonas Costeiras dos Países de Expressão Portuguesa, 3 pp. http://mosaic.lnec.pt/pdfs/OliveiraFSBO_et_al.pdf

[C10] Oliveira, J.N.C., Oliveira, F.S.B.F., Freire, P.M.S., 2021. Caracterização sedimentológica do trecho costeiro subaéreo da Cova-Gala, Portugal. X Congresso sobre Planeamento e Gestão das Zonas Costeiras dos Países de Expressão Portuguesa, 3 pp. http://mosaic.lnec.pt/pdfs/OliveiraFSBO4_v4_FO_JO.pdf

[C11] Barros, J. L., Tavares, A. O., Santos, P. P., Freire, P., 2022. Coastal flooding in the Portuguese continental coastal zone: historical record and impacts between 1980 and 2018, 2º International Conference on Urban Risks, ICUR 2022, 25 e 26 de junho, Lisboa. http://mosaic.lnec.pt/pdfs/publicacoes_out2022/conf_int/Barros_etal_2022_ICUR.pdf

[C12] Nahon, A., Fortunato, A. B., Oliveira, F.S.B.F., Freire, P., 2022. Mapping coastal overtopping in the shadow of large ebb-tidal deltas with XBeach surfbeat: insights from the western coast of Portugal. EGU General Assembly 2022, 1p. http://mosaic.lnec.pt/pdfs/pub_jul2022/EGU22-12388-print_final.pdf

[C13] Oliveira, A, Rocha, M., Jesus, G., Fortunato, A.B., Nahon, A., Rogeiro, J., Freire, P., 2022. A multi-hazard WebGIS platform to share coastal observatories data and model predictions, 7th IAHR Europe Congress, September 7th – 9th, 2022, Athens, Greece: 277-278.

http://mosaic.lnec.pt/pdfs/publicacoes_out2022/conf_int/Oliveira_etal_2022IAHRGrecia_oetal.pdf

[C14] Oliveira, F.S.B.F. e Oliveira, J.N.C., 2022. Topo-bathymetric behaviour of a beach controlled by a groyne field and a dune-seawall backshore. 16th International Conference Littoral 22, Lisboa, Portugal, 2 pp. (in press). http://mosaic.lnec.pt/pdfs/publicacoes_out2022/conf_int/Oliveira&Oliveira_2022.pdf

12.4 Proceedings in national conferences

[C15] Freire, P., Fortunato, A. B., Tavares, A. O., Oliveira, A., Santos, P. P., 2019. Multi-source flood risk analysis for safe coastal communities and sustainable development. 5ª Conferência sobre Morfodinâmica Estuarina e Costeira, Lisboa, 24-26, de junho 2019 - Livro de Resumos: 71-72. Faculdade de Ciências da Universidade de Lisboa. ISBN:978-989-20-9612-4. http://mosaic.lnec.pt/pdfs/pub_nov2022/Freire_etalMEC_2019.pdf

[C16] Ferreira, A. M., Fortes, C.J.E.M., Reis, M.T., Garzon, J.L., 2021. Análise de eventos de risco através de modelação numérica xbeach. caso de estudo – Costa da Caparica. Livro de Atas do 15.º Congresso da Água, março, online, 5p (2021). ISBN 978-989-8509-27-7. Editora: APRH. https://www.aprh.pt/congressoagua2021/docs/15ca_67.pdf

[C17] Barros, J. L., Santos, P.P., Tavares, Oliveira, A., Freire, P., 2022. Inundações e galgamentos costeiros: uma base de dados de ocorrências e seus impactos para a costa continental portuguesa entre 1980 e 2018, in Chamusca, P., Nunes, A., Bento-Gonçalves, A. (Eds), O compromisso da Geografia para territórios em mudança – Livro de Atas do XIII Congresso da Geografia Portuguesa: 279-284, Associação Portuguesa de Geógrafos/ Universidade de Coimbra. Faculdade de Letras, maio de 2022. http://mosaic.lnec.pt/pdfs/publicacoes_out2022/conf_nacionais/Barros_etal_CGeog_2022.pdf

[C18] Barros, J.L., Tavares, A.O., Santos, P.P., Freire, P., 2022. Coastal territorial vulnerability index: the importance of a local approach in anticipating the impacts of coastal flooding, in Livro de Resumos da 6ª Conferência Morfodinâmica Estuarina e Costeira, 83-84, LNEC, ISBN 978-972-49-2322-2. http://mosaic.lnec.pt/pdfs/pub_jul2022/Barros_etal_proceedings_mec2022.pdf

[C19] Barros, J.L., Tavares, A.O., Santos, P.P., Freire, P., Fortunato, A. B., Rilo, A., 2022. Coastal flooding occurrences, impacts and territorial complexity in the definition of coastal typologies, in Livro de Resumos da 6ª Conferência Morfodinâmica Estuarina e Costeira, 85-86, LNEC, ISBN 978-972-49-2322-2. http://mosaic.lnec.pt/pdfs/pub_jul2022/Barros_elal2_proceedings_mec2022.pdf

[C20] Bortoli, A., Fortes, C.J.E.M., Zozimo, A. C., Simão, J., Nahon, A., 2022 - Praia da Cova da Gala: modelação numérica com o XBEACH2D. Livro de Atas do 10as Jornadas de Engenharia Costeira e Portuária, Sines, 7 e 8 de abril de 2022. 12p. Editora PIANC.

http://mosaic.lnec.pt/pdfs/publicacoes_out2022/conf_nacionais/Bortolietal_10s%20JornPortuguesasEngenhariaCosteiraPortu%C3%A1ria_2022.pdf

[C21] Fortunato, A.B., Azevedo, A., Martins, R.J., 2022. Assimilation of shoreline data into morphodynamic model predictions, in Livro de Resumos da 6ª Conferência Morfodinâmica Estuarina e Costeira, 33-34, LNEC, ISBN 978-972-49-2322-2. http://mosaic.lnec.pt/pdfs/pub_jul2022/Fortunato_etal_proceedings_mec2022.pdf

[C22] Freire, P., Fortunato, A.B., Tavares, A.O., Oliveira, A., Santos, P.P., Nahon, A., Barros, L., Rocha, M., Oliveira, F. S. B. F., Fortes, C., Jesus, G., Azevedo, A., Oliveira, J., Bortoli, A., Rilo, A., Rogeiro, J., Martins, R., Henriques, M.J., 2022. Mosaic.Pt Flood Risk Framework To Support Management In Coastal Zones, in Livro de Resumos da 6ª Conferência Morfodinâmica Estuarina e Costeira, 71-72, LNEC, ISBN 978-972-49-2322-2. http://mosaic.lnec.pt/pdfs/pub_jul2022/Freire_etal_proceedings_mec2022.pdf

[C23] Jesus, G., Martins, R., Rogeiro, J., Oliveira, A., Azevedo, A., Fortunato, A.B., Oliveira, F.S.B.F., Nahon, A., 2022. Using Microsoft Azure Cognitive Services for Flood Risk Classification, TEST&E, 2pp, (in press). http://mosaic.lnec.pt/pdfs/pub_nov2022/2022TESTE_jetal.pdf

[C24] Martins, R., Azevedo, A., Jesus, G., Oliveira, A., Fortunato, A.B., Oliveira, F.S.B.F., Nahon, A., Freire, P., 2022. Automatic identification of the wave runup line from camera images, in Livro de Resumos da 6ª Conferência Morfodinâmica Estuarina e Costeira, 45-46, LNEC, ISBN 978-972-49-2322-2. http://mosaic.lnec.pt/pdfs/pub_jul2022/Martins_etal_proceedings_mec2022.pdf

[C25] Martins, R., Jesus, G., Oliveira, A., Azevedo, A., Fortunato, A. B., Oliveira, F. S. B. F., Nahon, A., 2022. A methodology for water boundary detection using high-resolution remote camera images. Resumo para 3rd Conference on Testing and Experimentation in Civil Engineering (TEST&E 2022), Monte da Caparica, Portugal, 2pp (in press). http://mosaic.lnec.pt/pdfs/pub_nov2022/Martins_etalTESTE2022.pdf

[C26] Nahon, A., Fortunato, A.B., Oliveira, F.S.B.F., Freire, P., 2022. Impact of a sandy shore morphology on overtopping, in Livro de Resumos da 6ª Conferência Morfodinâmica Estuarina e Costeira, 73-74, LNEC, ISBN 978-972-49-2322-2. http://mosaic.lnec.pt/pdfs/pub_jul2022/Nahon_etal_proceedings_mec2022.pdf

[C27] Oliveira, F.S.B.F., Oliveira, J.N.C., Freire, P.M.S., Fortunato, A.B., Nahon, A., 2022. Morphological evolution of Cova-Gala: update with the cosmo 2020 and 2021 topo-bathymetry, in Livro de Resumos da 6ª Conferência Morfodinâmica Estuarina e Costeira, 75-76, LNEC, ISBN 978-972-49-2322-2. http://mosaic.lnec.pt/pdfs/pub_jul2022/Oliveira_etal_proceedings_mec2022.pdf

[C28] Rilo, A., Tavares, A.O., Freire, P., Zêzere, J. L., 2022. Using historical estuarine flood data: a conceptual approach, in Livro de Resumos da 6ª Conferência Morfodinâmica Estuarina e Costeira, 41-42, LNEC, ISBN 978-972-49-2322-2. http://mosaic.lnec.pt/pdfs/pub_jul2022/Rilo_et_al_proceedings_mec2022.pdf

[C29] Simão, J., Bortoli, A., Fortes, C.J.E.M, Zózimo, A. C., Reis, M.T., Nahon, A., 2022. Praia da Cova-Gala: Modelação numérica das tempestades de fevereiro 2019 com o modelo XBeach, in Livro de Resumos da 6ª Conferência Morfodinâmica Estuarina e Costeira, 77-78, LNEC, ISBN 978-972-49-2322-2. http://mosaic.lnec.pt/pdfs/pub_jul2022/Simao_etal_proceedings_mec2022.pdf

12.5 Reports

[R1] Freire, P., Oliveira, F.S.B.F., Oliveira, J.N., Henriques, M.J., 2019. 2019. Mosaic.pt Field campaigns. Cova-Gala, Vieira and São Pedro de Moel beaches, January-March 2019. Report 334/2019, LNEC. 52p. http://mosaic.lnec.pt/pdfs/rel334_2019.pdf

[R2] Henriques, M. J., 2020 - MOSAIC.PT - Levantamentos Fotogramétricos com Drone das Praias de Cova-Gala, Vieira e São Pedro de Moel em 2019. RELATÓRIO 3/2020 – DBB/NGA, LNEC, 35p. http://mosaic.lnec.pt/pdfs/rel003_2020.pdf

[R3] Nahon A. (coord.), 2020. MOSAIC.pt Field Campaigns. Cova-Gala beach, March 2020. Report 347/2020, DHA/NEC, 34 p. http://mosaic.lnec.pt/pdfs/rel347-2020_DHA-NEC.pdf

[R4] Oliveira, A., Freire, P., 2020. Data Management Plan for the MOSAIC.pt Project. Report 342/2020 DHA/GTI, LNEC, 13 p. http://mosaic.lnec.pt/pdfs/rel342-2020_DHA-GTI_en.pdf

[R5] Henriques, M. J., 2021 - MOSAIC.PT - Levantamentos Fotogramétricos com Drone da Praia de Cova-Gala em 2020. RELATÓRIO 47/2021– DBB/NGA, LNEC, 17p. http://mosaic.lnec.pt/pdfs/rel047-2021_DBB-NGA.pdf

[R6] Buquen, J., 2022. Interannual morphological evolution of an intermediate beach derived from satellite imagery: Cova-Gala, Portugal, Université de La Rochelle, pp. 12. http://mosaic.lnec.pt/pdfs/publicacoes_out2022/Relatorios/Buquen_rapport_stage.pdf

12.6 Theses

[T1] Cabrita, P., 2020. Testing storm impact modelling at São Pedro de Moel beach. Dissertação de mestrado. Faculdade de Ciências e Tecnologia, Universidade do Algarve. https://sapientia.ualg.pt/bitstream/10400.1/15292/1/Thesis2020_PauloCabrita_a54406.pdf

[T2] Perdiz, L., 2020. Galgamentos costeiros na Costa Ocidental Portuguesa - Analise do risco em três casos de estudo. Dissertação de mestrado em Geociências. Departamento de Ciências da Terra da Faculdade de Ciências e Tecnologia da Universidade de Coimbra. https://estudogeral.sib.uc.pt/handle/10316/99418

[T3] Oliveira, J.N.C., 2022. Beach morphodynamics modelling for the improvement of coastal protection solutions. PhD thesis in Civil Engineering. Instituto Superior Técnico. Universidade de Lisboa, 190 pp. https://scholar.tecnico.ulisboa.pt/records/-pJ-uVYywiFtthnjlLJRFcF9OScWt_PUcpQb

[T4] Barros, J. L., 2022. A relevância do uso e ocupação do solo e da vulnerabilidade territorial para a compreensão dos impactos e dos forçadores locais de gestão do risco. Tese de doutoramento, Instituto de Investigação Interdisciplinar da Universidade de Coimbra.

13 | Acknowledgments and collaborations

People and institutions that made their data available, supported or participated in field data acquisition and data analysis, and supported project communication activities are listed below:

- Agência Portuguesa do Ambiente
- Autoridade Nacional de Emergência e Proteção Civil
- Instituto Hidrográfico
- Câmara Municipal da Marinha Grande
- Câmara Municipal da Figueira da Foz
- Junta de Freguesia de São Pedro (Figueira da Foz)
- Administração do Porto de Figueira da Foz, S.A.
- Desportivo Clube Marítimo da Gala
- Rui Taborda and Ana Silva (Lisbon University)
- Paulo A. Silva, Paulo Renato Baptista, Tiago C. A. Oliveira, Rita Cavalinhos, Diogo Santos, Thiago Gavazzoni (Aveiro University)
- Theo Moura (Independent researcher)
- José Vidal and Cristina Coelho

Collaborations with projects:

- EWCOAST project, funded by FCT

14 | Main results and critical appraisal

The project's scientific objectives were clearly achieved. The Mosaic.pt project contributed to improve knowledge on coastal overtopping and flooding processes, and to enhance the capacity-building of participant institutions through improved tools and approaches. The main results towards the project objectives are: knowledge improvement on historic flood events and associated damages at the Portuguese continental coast, through an original geographic database of flooding occurrences; characterization of the Mosaic.pt observatories response to different overtopping and flooding forcings; the implementation and validation of a hydrodynamic forecast system at the observatory scale; development and assessment of methods to improve predictive models by shoreline updating data extracted from Sentinel images; flood hazard assessment at the observatory scale for different scenarios through numerical modeling; development of a replicative methodology for territorial vulnerability assessment and application in the observatory areas; multi-source and real-time monitoring methodology development; development and implementation of a dedicated WebGIS platform to access multi-source data; critical coastal typologies to flooding for the continental Portuguese coast assessment based on a new methodology developed within the project; requirements for a coastal flooding emergency response system identification; portrait of the perceptions to risk of local residents and users; identification of interests, values and conflicts of the coastal areas use and disaster risk reduction measures.

A broad dissemination and communication of the project results to different targeted audiences was achieved through diverse channels. The expected output indicators were in general exceeded (Table 14.1): 11 papers published and 2 submitted in peer-review international journals (3 proposed); one paper in a national journal (0 proposed); 14 communications in international conferences (7 proposed); 15 communications in national conferences (11 proposed); 6 reports (3 proposed). The exception is the publication in book chapters, clearly compensated by a higher number of papers in international journals. Advanced training was also achieved through two PhD thesis (one proposed), two master's degree theses (2 proposed), 3 fellowship reports, and the integration of knowledge in several lectures and training activities to post-graduation students.

Other output indicators are:

- A geographic database of coastal flooding occurrences the continental Portuguese coast zone [A6, C1, C17]
- A dissemination video on coastal erosion and flooding processes (product) - https://youtu.be/Km0uIjRUM7A
- Models:
  - Model for the Territorial Vulnerability Assessment [A7, C18]
  - Model for the Territorial Typification of Coastal Flood Risk Sectors [A12, C19]

- Model applications:
  - Hydrodynamic forecast system of Cova-Gala and Mondego estuary [A4, C4]
  - Local scale hydrodynamic applications of XBeach to Cova-Gala [A13, C12, C25, C28]
  - Local scale applications of XBeach to Costa da Caparica [A14, C16]
  - Local scale applications of XBeach to the São Pedro de Moel beach [C2]
  - Local-scale morphodynamic applications of XBeach to Cova-Gala [A2, C5]
  - Regional scale application of WaveWatch III to the Portuguese coast [A6, A12]
- Innovative processes:
  - Software to extract coastlines from satellite images [C21]
  - Software to assimilate coastline data into a morphodynamic model [C21]
  - Mosaic.pt Web platform [A5, C13]
  - Software to identify waterlines from camera images [C23, C24, C25]
  - Coupling between models XBeach and SCHISM within the forecast platform WIFF

Table 14.1 – Expected and accomplished output indicators

Description	proposed	achieved
A - Publications		
Books chapters	3	**0**
Papers in international journals	3	**11***
Papers in national journals	0	**1**
B - Communications		
Communications in international meetings	7	**14**
Communications in national meetings	11	**15**
C – Reports	3	**6**
D - Organization of seminars and conferences	5	**3**
E - Advanced training		
PhD theses	1	**2**
Master theses	2	**2**
Others	3	**3**
F - Models	0	**2**
G - Computational applications	4	**6**
H - Pilot plants		
I - Prototypes		
J - Products	1	**1**
K - Productions/artistic creations		
L - Innovative processes	2	**5**
M - Databases	1	**1**
N – Knowledge integration in university education activities	3	**3**
Webpage	1	**1**

* plus 2 submitted

Lisbon, LNEC, January 2023

APPROVED

The Head of the Estuaries and Coastal Zone Unit

Luís Portela

COORDINATOR

Paula Freire
Assistant Researcher

The Director of the Hydraulics and Environment Department

Helena Alegre

References

ANTUNES, C., 2019 – **Assessment of Sea Level Rise at West Coast of Portugal Mainland and its Projection for the 21st Century**. J. Mar. Sci. Eng. 7(3), 61, 17p.

BEDSWORTH, L.W.; HANAK, E., 2010 – **Adaptation to Climate Change**. Journal of the American Planning Association. 76:4, pp. 477-495.

EC, 2009 – **The economics of climate change adaptation in EU coastal areas. Country overview and assessment**. European Commission, Maritime Affairs. https://ec.europa.eu/maritimeaffairs/sites/maritimeaffairs/files/docs/body/portugal_climate_change_en.pdf.

FORTUNATO, A. B.; MEREDITH, E. P.; RODRIGUES, M.; FREIRE, P.; FELDMANN, H., 2019 – **Nearfuture changes in storm surges along the Atlantic Iberian coast**. Natural Hazards, 98/3, 1003–1020.

KIREZCI, E.; YOUNG, I.R.; RANASINGHE, R.; MUIS, S.; NICHOLLS, R.J.; LINCKE, D.; HINKEL, J., 2020 – **Projections of global scale extreme sea levels and resulting episodic coastal flooding over the 21st. Century**. Scientific Reports, 10, 11629, 12p.

KULP, S.A.; STRAUSS, B.H., 2019 – **New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding**. Nature Communications, 10, 4844, 12p.

OLIVEIRA, A.; FORTUNATO, A. B.; ROGEIRO, J.; TEIXEIRA, J.; AZEVEDO, A.; LAVAUD, L.; BERTIN, X.; GOMES, J.; DAVID, M.; PINA, J.; RODRIGUES, M.; LOPES, P., 2019 – **OPENCoastS: An open-access service for the automatic generation of coastal forecast systems**, Environmental Modelling & Software, Volume 124, 104585, ISSN 1364-8152, https://doi.org/10.1016/j.envsoft.2019.104585.

SANTOS, A.; MENDES, S.; CORTE-REAL, J., 2015 – **Impacts of storm Hercules in southwestern Europe**. RIMMA - Risk Information Management, Risk Models, and Applications, Horst Kremers and Alberto Susini (eds), Lecture Notes In Science, Vol. 7, 39-48.

UNISDR, 2015 – **Sendai framework for disaster risk reduction 2015–2030**. United Nations International Strategy for Disaster Reduction. https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf. Accessed November 2019.

Annexes

ANNEX I
Project meetings

Designation	**Local; date**	
Kick-off Meeting	LNEC, 23/10/2018	
Team general meetings	LNEC, 26/07/2019; 04/10/2019; 08/11/2019; 06/12/2019	Online, 10/01/2020; 07/02/2020; 06/03/2020; 01/04/2020; 08/05/2020; 03/06/2020; 03/07/2020; 18/09/2020; 02/10/2020; 06/11/2020; 11/12/2020; 08/01/2021; 12/02/2021; 07/03/2021; 09/04/2020; 07/05/2021; 07/06/2021; 02/07/2021; 17/09/2021; 15/10/2021; 12/11/2021; 07/01/2022; 04/02/2022; 04/03/2022; 08/04/2022; 13/05/2022; 24/06/2022; 22/07/2022; 19/09/2022
Final Project Meeting	Online, 28/10/2022	
Technical Project Workshop	Online, 19/10/2020	
Final Project Workshop	LNEC, 07/06/2022	
Local Communication Workshop	Desportivo Clube Marítimo da Gala (Figueira da Foz), 28/09/2022	

ANNEX II
Technical Workshop

Introdução

O projeto Mosaic.pt (http://mosaic.lnec.pt/), coordenado pelo LNEC e com a parceria do Centro de Estudos Sociais, visa desenvolver um quadro de referência inovador de apoio à gestão do risco de inundação costeira, integrando modelos de previsão e de monitorização em tempo real, e tendo em conta as diferentes dimensões da vulnerabilidade do território.

Este Workshop Técnico visa a apresentação de resultados do projeto e promover o debate sobre o risco de inundação costeira, através de apresentações de convidados de instituições de investigação e entidades com responsabilidade na gestão costeira.

Programa

10h00 Abertura
Alexandre Tavares, Centro de Estudos Sociais (Universidade de Coimbra)

10h10 Mosaic.pt: Análise do risco de inundação costeira a partir de múltiplas fontes para comunidades seguras e desenvolvimento sustentável
Paula Freire (Laboratório Nacional de Engenharia Civil)

10h30 Mosaic.pt: Plataforma web integrada para a gestão do risco de inundação costeira
Anabela Oliveira (Laboratório Nacional de Engenharia Civil)

10h50 Carlos Caetano, Vereador da Câmara Municipal da Marinha Grande

11h10 Intervalo

11h30 Galgamento e inundação costeira no litoral de Portugal Continental: exemplos e implicações no ordenamento da zona costeira
Celso Pinto (Agência Portuguesa do Ambiente)

11h50 Fátima Alves, Presidente dos Portos de Aveiro e Figueira da Foz

12h10 Ana Carvalho, Vice-presidente da Câmara Municipal da Figueira da Foz

12h30 Almoço

14h00 Custos e benefícios de diferentes estratégias de mitigação do risco de inundação costeira
Carlos Coelho (Universidade de Aveiro)

14h20 Grandes impactos de eventos meteorológicos não extremos
Pedro Dinis (MARE)

14h40 Modelação de medidas de redução de risco para evitar futuros impactos de tempestades em zonas costeiras
Óscar Ferreira (Universidade do Algarve)

15h00 O registo geológico na definição de risco tsunamigénico em Portugal
Pedro Costa (Universidade de Coimbra)

15h20 Intervalo

15h40 Discussão
Rui Taborda (Instituto Dom Luiz, Universidade de Lisboa)

17h00 Encerramento

Inscrições

A participação é livre, embora sujeita a inscrição mediante o preenchimento deste formulário:

Data e horário

O Workshop Técnico realiza-se no dia 19 de outubro de 2020, entre as 10h00 e as 17h30, e será transmitido em Live streaming. O link será enviado aos participantes registados.

Contactos

Secretariado | LNEC | DIDCT
tel: +351 21 844 38 66 email: cursos@lnec.pt
LNEC | Av. do Brasil 101 | 1700-066 Lisboa | Portugal

Organização

LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL
ces Centro de Estudos Sociais Universidade de Coimbra

Financiamento

FCT Fundação para a Ciência e a Tecnologia

http://mosaic.lnec.pt/

ANNEX III
Dissemination

Newspapers

MARINHA GRANDE

RISCO DE INUNDAÇÃO COSTEIRA EM ESTUDO

Investigadores do Laboratório Nacional de Engenharia Civil (LNEC) e do Centro de Estudos Sociais da Universidade de Coimbra estiveram, por estes dias, na Marinha Grande, no âmbito de um projeto de investigação que visa analisar o risco de inundação costeira

A informa o foi dada na reuni o de c mara desta segunda feira, 25 de fevereiro, pelo vice-presidente da autarquia. De acordo com Carlos Caetano, o "MOSAIC.pt", assim se denomina o estudo, tem por objetivo analisar o risco de inunda o costeira a partir de m ltiplas fontes para comunidades seguras e desenvolvimento sustent vel.

O estudo, que ter uma dura o de 36 meses, vai incidir, numa fase inicial e segundo explicou o autarca, em apenas duas reas: na Freguesia da Costa da Caparica e no Munic pio da Marinha Grande.

De acordo com Carlos Caetano, a Marinha Grande foi escolhida por possuir dois tipos de costa: arenosa e com dunas; e rochosa e com arribas. O vice-presidente deu ainda conta que as prospe es no terreno arrancaram na segunda feira, que o projeto n o ter custos para o Munic pio, entidade a que caber , no entanto, disponibilizar apoio ao n vel log stico e de recursos humanos.

"Criar um sistema de alerta em caso de inunda o", visando a prote o de reas urbanas , de acordo com o edil, o objetivo do Mosaic.pt.

Segundo a informa o expressa no site do Centro de Estudos Sociais da Universidade de Coimbra, o Mosaic.pt visa "desenvolver um quadro de refer ncia inovador de apoio gest o do risco de inunda o na zona costeira, incluindo estu rios, com base na integra o de modelos de previs o e monitoriza o em tempo real das vari veis relevantes ao processo de inunda o, e tendo em conta as diferentes dimens es da vulnerabilidade do territ rio". referido que "a orla costeira continental portuguesa apresenta um risco elevado a situa es de galgamento e inunda o, demonstrado pelo impacto de eventos recentes, que tender a aumentar face subida do n vel m dio do mar", pelo que "urge assim integrar conhecimentos sobre os perigos, vulnerabilidade e exposi o de pessoas e bens, no desenvolvimento de estrat gias que contribuam para melhores formas de planeamento e de resposta emerg ncia".

FURTAVA ARTIGOS EM LAVANDARIAS SELF-SERVICE

APANHADO PELA PSP EM FLAGRANTE DELITO

Um indivíduo, de 33 anos, foi detido em flagrante delito pela PSP na manhã do último sábado, 23 de fevereiro, pelas 7h30, pela prática do crime de furto em interior de estabelecimento comercial praticado na Marinha Grande

Segundo as autoridades, assim que tiveram conhecimento do furto, foram de imediato enviados agentes para o local, sendo que nas dilig ncias que se seguiram, "a PSP intercetou, nas imedia es do il cito, o suspeito acima referido, tendo apreendido um Ipad, v rios produtos alimentares, cheques e diversos documentos". O homem tinha na sua posse alguns artigos usados para a pr tica de il citos criminais: um gorro, um passa montanhas (esp cie de gorro com abertura para os olhos), tr s luvas e diversas ferramentas utilizadas para arrombamento.

Em nota de imprensa, a PSP faz saber que o indiv duo, a quem foi aplicada a medida de coa o de pris o preventiva, " o principal suspeito de diversos crimes, que t m ocorrido nas cidades de Leiria e Marinha Grande, nomeadamente nas esta es de lavagens de ve culos e nas lavandarias de self-service".

ESTACIONAMENTO PAGO

APLICAÇÃO 'ACAUTELA' MULTAS

A not cia publicada na ltima edi o do JMG a respeito da aplica o que a TUMG disponibiliza aos utilizadores dos lugares de estacionamento pago, suscitou algumas d vid as no que respeita forma de comprovar, em tempo real, que o estacionamento se encontra pago. Alguns leitores questionaram de que forma poderiam os condutores usar a aplica o no telem vel e ficarem descansados quanto a eventuais multas passadas pela PSP, entidade a quem cabe verificar o pagamento.

Solicitados os esclarecimentos autarquia, esta fez saber que "os agentes de fiscaliza o, neste caso da Pol cia de Seguran a P blica, t m acesso informa o dos ve culos com estacionamento autorizado, atrav s duma aplica o tamb m instalada num smartphone, pelo que os utilizadores n o necessitam de fazer prova do pagamento no momento do estacionamento, uma vez que a aplica o permitir confirmar quais os ve culos autorizados e n o autorizados".

INICIATIVA DA JSD

DAVID JUSTINO NA MARINHA GRANDE

O audit rio do Edif cio da Resinagem, na Marinha Grande, acolhe este s bado, 2 de mar o, pelas 14h30, a realiza o de um debate alargado sobre o Financiamento das institui es de Ensino Superior. Numa organiza o conjunta da JSD da Marinha Grande e da Distrital de Leiria, a confer ncia ter como orador convidado David Justino, vice-presidente do PSD e ex-Ministro da Educa o, especialista nas mat rias da educa o e uma refer ncia nacional na rea educativa. Para a JSD local, "fundamental debater esta problem tica, alertar para a situa o ca tica e procurar encontrar solu es para o Ensino Portugu s".

PARCERIA COM A UNIVERSIDADE DE MANCHESTER

POOL-NET PROMOVE MINI-MBA

Tem in cio esta sexta feira, dia 1 de mar o, a 2.ª edi o do "Mini MBA – Human Centered Manufacturing", dinamizado pela Associa o POOL-NET no mbito de uma parceria com a Universidade de Manchester, no Reino Unido, e a Consultora IBC – International Business Consulting.

O curso, que decorrer at ao pr ximo m s de junho, ser ministrado em l ngua inglesa nas instala es da incubadora de empresas OPEN, na Zona Industrial da Marinha Grande. Com esta forma o, que decorre do sucesso alcan ado com a a o piloto dinamizada em 2017, a POOL-NET "assume e refor a a sua miss o junto dos seus associados e stakeholders, contribuindo para o refor o das compet ncias ao n vel da lideran a, inova o e tecnologia, e da imagem de excel ncia da nossa Ind stria, no caminho para o refor o da sustentabilidade das nossas organiza es".

"Pensamento estrat gico e tecnol gico", "Ind stria 4.0" e "Perfis de compet ncias" s o apenas alguns dos assuntos abordados nos Semin rios que ser o abertos Ind stria e a outros participantes que tenham interesse nos referidos temas. Mais informa es no site www.toolingportugal.com.

Marinha Grande

As consequências da subida do nível médio do mar motiva projeto Foto de arquivo: Joaquim Dâmaso

Especialistas estudam praias para prevenir inundações

Carlos S. Almeida

Universidade de Coimbra e o Laboratório Nacional de Engenharia Civil estão a estudar os impactos da subida do nível médio da água do mar e o risco de inundação costeira no concelho da Marinha Grande.

O estudo, já em curso no terreno, decorre no âmbito do projeto MOSAIC.pt, pretendendo fazer a avaliação de toda a costa para criar um sistema de alerta e alarme para os riscos de inundação, quando há tempestades. Marinha Grande e Costa da Caparica foram selecionadas para o início dos trabalhos, revelou na última segunda-feira, Carlos Caetano, vice-presidente do município. Os investigadores começaram esta semana os trabalhos no concelho, sendo que a colaboração de município será alvo de um protocolo a assinar em breve, revelou ainda. "O nível das águas do mar está a subir, é inevitável e vão existir perturbações no futuro, os episódios de galgamento da costa vão ser cada vez mais frequentes", salientou. Este projeto aposta na proteção das zonas habitadas.

O autarca explica que o facto de a orla costeira do concelho reunir "dois tipos de costa da região Centro", foi determinante, pois a Marinha Grande conta com uma costa com praias arenosas e dunas a norte, e rochosas a sul.

População de Albergaria tem de conviver com aterro durante sete anos

A população de Albergaria terá de conviver com o aterro da Valorlis durante mais sete anos. Carlos Caetano, vice-presidente da Câmara da Marinha Grande, explicou na última sessão da Assembleia Municipal, dia 22, que se prevê que o aterro seja selado dentro de sete anos.

As queixas de maus cheiros, provenientes do aterro e notados sobretudo na zona de Albergaria, foram levantadas por Carlos Wilson, deputado municipal do MpM. Lembrou que uma recente ação da Associação Marinha em Movimento, em Albergaria, o assunto foi levantado por habitantes da localidade. "As pessoas estão perplexas com os efeitos nocivos para a saúde dos cheiros. Vamos viver o resto da vida com o aterro?", questionou. Carlos Caetano adiantou que o aterro vai continuar a ser utilizado até atingir o fim de vida, o que se prevê aconteça dentro de sete anos. O vice-presidente garantiu que uma das tarefas da autarquia passa por "fazer pressão sobre a Valorlis para que estes episódios não se repitam ou sejam resolvidas com maior rapidez". Carlos Caetano reportava-se a uma fuga que, adianta, ocorreu em dezembro, quando estavam a proceder a furações no aterro "e o gás esteve a libertar-se durante algum tempo". De acordo com o número dois do executivo socialista da Marinha Grande, uma vez encerrado o aterro, terá de ser escolhida uma nova localização. E, dessa feita, o deverá ser instalado noutro concelho: "caberá a outros fazer o sacrifício", afirmou.

14 Jornal de Leiria 7 de Março de 2019

Sociedade

Concelho integra projecto *Mosaic.pt* com LNEC e Universidade de Coimbra

Cientistas estudam subida do mar nas praias da Marinha Grande

Daniela Franco Sousa
daniela.sousa@jornaldeleiria.pt

As praias do concelho da Marinha Grande, bem como a Costa da Caparica, no concelho de Almada, estão a ser estudadas pela Universidade de Coimbra e pelo LNEC - Laboratório Nacional de Engenharia Civil, adiantou ao executivo o vereador Carlos Caetano. O objectivo deste projecto, denominado *Mosaic.pt*, é perceber que tipo de impacto pode ter a subida do nível do mar, ou seja, perceber quais os riscos da inundação costeira. No caso da Marinha Grande, adiantou o autarca, a escolha teve em conta o facto de este concelho congregar costa arenosa, a Sul, bem como costa rochosa (a Norte).

No site do projecto, explica-se que o *Mosaic.pt* "visa desenvolver um quadro de referência inovador de apoio à gestão do risco de inundação na zona costeira, incluindo estuários, com base na integração de modelos de previsão e monitorização em tempo real das variáveis relevantes ao processo de inundação, e tendo em conta as diferentes dimensões da vulnerabilidade do território".

Salienta que "a orla costeira continental portuguesa apresenta um risco elevado a situações de galgamento e inundação, demonstrado pelo impacto de eventos recentes, que tenderá a aumentar face à subida do nível médio do mar. Urge assim integrar conhecimentos sobre os perigos, vulnerabilidade e exposição de pessoas e bens, no desenvolvimento de estratégias que contribuam para melhores formas de planeamento e de resposta à emergência".

São objectivos do *Mosaic.pt*, melhorar a capacidade de previsão do galgamento e inundação e contribuir para melhorar a capacidade de resposta à emergência. O *Mosaic.pt* conta com o financiamento da Fundação para a Ciência e para a Tecnologia.

Praias da Marinha Grande integram estudo sobre risco de inundação costeira

Ctt de Alvaiázere

Al-Baiäz alerta para eventual destruição de património

Daniela Franco Sousa
daniela.sousa@jornaldeleiria.pt

A Associação de Defesa do Património Al-Baiäz, de Alvaiázere, alertou o Presidente da República "para a eventual destruição, total, do património histórico móvel dos Correios" que estará em curso, "solicitando as diligências que, perante a alta gravidade do caso, urge empreender". Já os CTT "negam categoricamente que qualquer tipo de património de valor histórico esteja a ser destruído".

"Existiam, nas estações dos CTT, milhares de objectos de valor histórico, com dezenas e, nalguns casos, com centenas de anos. A nossa associação - em razão da importância histórica que Alvaiázere teve na história dos correios nos séculos XVII e XVIII - tentou criar um núcleo museológico, adquirindo alguns desses objectos, mas viu-se confrontada com a impossibilidade de o fazer, pelo facto de todos esses materiais, de todas as estações do País, terem sido vendidos, pela actual administração dos CTT, a empresas de sucata", relata a Al-Baiäz. E acrescenta: "tanto quanto nos foi dado saber, está em curso a destruição, irreversível, de um património histórico de incalculável valor".

Já a empresa informa que "as lojas CTT contam com vários objectos, desde mobiliário a publicidade e equipamentos obsoletos. Contam também com equipamentos ou outros artigos que são aproveitados".

Nota que "os artigos de mobiliário sem qualquer tipo de valor são removidos e abatidos por um sucateiro credenciado". Quanto a "equipamentos ou outros artigos que podem ser reaproveitados são reutilizados em outras lojas CTT ou seguem devidamente acondicionados para os armazéns da empresa e aí preservados". Assim, sublinha, "artigos de valor histórico e património valioso não são enviados para sucata, nem objecto de qualquer destruição".

Célia Marques, presidente da Autarquia, confirma que uma viatura dos CTT retirou mobiliário do interior da estação, que foi encerrada em Outubro, mas não sabe qual o seu destino. Admite que possa tê-lo retirado por questões de segurança.

Iniciativas de sensibilização em Leiria

Mulher Século XXI em acções de rua contra violência doméstica

A associação Mulher Século XXI vai avançar hoje e amanhã, dias 7 e 8, com acções de rua pela sensibilização e prevenção do fenómeno da violência doméstica. Hoje, a partir das 10:30 horas, no Largo do Papa, via Centro Comercial Maringá, decorre a acção *Mulher Século XXI*, que conta com distribuição de material alusivo ao Dia de Luto Nacional pelas Vítimas de Violência Doméstica e pela Violência Contra as Mulheres.

Esta será um acção móvel com ponto de partida na Praça Rodrigues Lobo e finalizará nas imediações do Centro Comercial Maringá.

Já amanhã, pelas 15:30 horas, na Praça Rodrigues Lobo, na Fonte Luminosa e na rodoviária, decorre uma acção de parceria entre a Mulher Século XXI e a delegação de Leiria da Cruz Vermelha. Esta iniciativa chama-se *Elas também Receberam Flores* e consiste na distribuição de flores, também sensibilização da população face ao fenómeno da violência doméstica e violência no namoro, através de dramatizações inesperadas e recolha de opiniões através de *vox pop*.

Antigas oficinas municipais ganham jardim

Pombal aposta em vários parques no centro da cidade

A Câmara Municipal de Pombal está apostar em vários parques verdes no centro da cidade. No âmbito da inauguração do Bioparque de Pombal, situado na Charneca, Diogo Mateus, presidente daquela Autarquia, anunciou que a abertura daquele equipamento vai em linha do que tem sido o esforço do Município de criar diversas zonas de lazer no concelho. Diogo Mateus referiu, entre as novas zonas de recreio, o Parque Verde da cidade de Pombal, uma área de cerca de 50 mil metros quadrados, onde cerca de metade da propriedade já foi adquirida pelas Autoridades. Diogo Mateus informou ainda do projecto de recuperação do espaço onde funcionavam as oficinas da Câmara, numa das margens do rio Arunca, que também terá jardim, uma zona onde o rio não está emparedado e para onde pode ser estudada uma ciclovia. "É um espaço de mais de 20 mil metros quadrados, no centro da cidade, que pode ter zona de apoio, onde os animais de estimação podem ter mais espaço de passeio, zonas de patinagem e de bicicleta, para as várias gerações da família", esmiuçou o presidente da Câmara Municipal de Pombal.

Diário de Coimbra
TERÇA-FEIRA | 26 FEV 2019 | 13

REGIÃO DAS BEIRAS

Figueira da Foz

Obras a Sul do 5.º molhe a decorrer mas a comunidade desconfia do efeito

Cova-Gala A lua cheia e a maré de lua contribuiram para o mar revoltoso que, nos últimos dias, voltou a "fazer das suas" na freguesia de S. Pedro. A população está preocupada, mas a Agência Portuguesa do Ambiente diz que tudo está normal

Bela Coutinho

Apesar de estarem a decorrer as obras de reforço dunar na zona da Praia da Cova (a Sul do 5º molhe), a cargo da APA (Agência Portuguesa do Ambiente), a comunidade está em "sobressalto". Nos poucos minutos que o nosso Jornal esteve na zona, muitos populares saltavam a "vedação", para ir espreitar os estragos das "luas", a de março e a cheia.

Aos 89 anos, Carlos Pereira Mano, toda a vida pescador (agora reformado), olha desolado para a área que já não tem dunas e, sem dúvidas, garante que «sem pedra, o mar leva tudo outra vez. O ambiente não quer pedras, mas assim não resolve nada», diz, recordando o tempo em que o "poço da vila" (ver fotos) ficava a mais de 200 metros da praia.

Comunidade local não acredita no efeito das obras, face à força do mar, defendendo a colocação de pedra. "Vai ser dinheiro deitado ao lixo", dizem

«Aquela casa, há alguns meses, estava a 50 metros do mar, agora está a 28», sustenta, temendo o pior. «Julgam que isto é a Holanda. Lá até pode servir, mas aqui não vai resultar em nada», garante, referindo-se aos sacos enormes que estão a ser enterrados, para "travar" a fúria do mar. «Quem manda nisto não percebe nada e basta ver o prolongamento do molhe Norte, que está a causar tudo estes efeitos e foi a maior asneira que se podia ter feito», diz o covagalense acarinhado por toda a comunidade, que, com orgulho afirma que foi ele que fez o campo de futebol.

A seu lado, Luís Tavares vai concordando com o amigo. A casa dele não está em perigo, pois mora junto à Igreja, mas «dói ver isto tudo a ser levado e estou preocupado. Basta só o mar levantar um bocadinho e leva a areia toda que estão a colocar, se não meterem pedra e cimento por cima. A água passa por cima dos sacos, faz redemoinho e deita tudo abaixo».

Carlos Alberto Nunes (mais conhecido como Pinguim), também ele um "lobo do mar", garante que «não tarda muito, o mar entra pelo pinhal e vai tudo ao fundo (referindo-se às casas que existem na zona). «O dinheiro que ali foi gasto (referindo-se a outra intervenção efectuada em 2015) para nada e agora vai ser a mesma coisa, se não puserem pedra» E também ele recorda o quanto «tínhamos que andar para chegar ao mar» e agora «não tarda, está nas casas».

BELA COUTINHO

Obra da APA ainda está a decorrer mas a força das marés voltou a afectar o cordão dunar a Sul do 5.º molhe

Há alguns anos, o "poço da Vila" era local de encontro e saudade

"Poço da Vila" estava ontem totalmente "descarnado"

APA recorda que a obra "ainda nem vai a meio", que a protecção "ainda não é visível" e que se os trabalhos correrem bem, terminam "daqui a 2 meses"

Contactada pelo nosso Jornal, fonte da APA, assegura que a obra «ainda nem vai a meio, não está concluída» e que as marés de lua não tiveram «consequências». Acreditando que os objectivos (de proteger pessoas e bens) «estão garantidos», a mesma fonte assegura que «ainda não é visível a protecção, só se vêem as estruturas». Por isso, só depois de terminada é que se pode avaliar, quanto a previsões para essa conclusão é que nada é garantido. «Depende das condições do mar. A obra começou numa altura difícil (Inverno), e para garantir rapidamente segurança e correr tudo bem, serão precisos pelo menos dois meses», conclui.

O investimento previsto nesta intervenção ultrapassa os 500 mil euros e a obra deverá depois ser complementada com a reposição de areia, a retirar da barra e que deverá "engordar" aquela e as outras praias a sul, numa intervenção da administração do porto da Figueira da Foz (APFF).

LNEC e Universidade de Coimbra monitorizam a área

Enquanto decorriam as obras da APA, ontem, uma equipa do LNEC (Laboratório Nacional de Engenharia Civil), esteve na praia da Cova a efectuar o levantamento topográfico, aproveitando a altura de marés vivas e agitação marítima. Trata-se de um projecto de investigação do LNEC e do Centro de Estudos Sociais da Universidade de Coimbra, no âmbito do projecto "mosaic.pt", que visa desenvolver um quadro de referência inovador de apoio à gestão do risco de inundação na zona costeira, incluindo estuários, com base na integração de modelos de previsão e monitorização em tempo real das variáveis relevantes ao processo de inundação e tendo em conta as diferentes dimensões da vulnerabilidade do território, particularmente numa altura em que o nível médio do mar, tende a subir, segundo o que nosso Jornal apurou ontem no local.

Diário de Coimbra

REGIÃO DAS BEIRAS

BELA COUTINHO

Paula Freire, Manuel Domingues e Jorge Aniceto na sessão promovida pelo LNEC

Deposição de areia na Cova Gala ajuda na questão da erosão

Mosaic Projeto do Laboratório Nacional de Engenharia Civil contribui para análise de risco de inundação costeira

Bela Coutinho

O Desportivo Clube Marítimo da Gala acolheu ontem uma sessão de divulgação do "Projecto Mosaic.pt - Relevância e contributo para a análise de risco de inundação costeira", que pretende desenvolver ferramentas de apoio à gestão do risco de inundação na costa, desenvolvido nos últimos quatro anos pelo Laboratório Nacional de Engenharia Civil (LNEC), em parceira com o Centro de Estudos Sociais da Universidade de Coimbra e financiado pela Fundação para a Ciência e Tecnologia.

«O interesse foi desenvolver metodologias que integram modelos e dados de campo, nesse apoio da gestão», explicou ao nosso Jornal Paula Freire, uma das técnicas presentes na sessão, realçando que o projeto se desenvolve em várias escalas de análise, designadamente a costa continental portuguesa e três zonas de "observatório", com estudos mais de detalhe, como o caso da área entre o Cabedelo e a Cova Gala. «Fizemos uma análise de evolução morfológica e implementação de modelos que nos permitem construir cenários de inundação para diferentes situações» e os resultados, «mostram que embora haja alterações significativas morfológicas dos fundos, o facto de se estar a fazer depósito de dragados nesta zona, tem estabilizado e mitigado o problema».

E quanto às causas que levaram ao agravamento da situação naquela freguesia, particularmente a sul do 5.º esporão, a investigadora aponta para «a fragilidade de uma zona que está a sul dos molhes do porto. É natural que seja uma zona mais enfraquecida e muitas vezes, quando a praia está muito rebaixada, os fenómenos de galgamento e inundação ocorrem», sustentou.

Na sessão, que contou com a participação de vários técnicos da Câmara Municipal e elementos da comunidade (estes últimos a manifestarem a sua preocupação e a pedirem soluções), e do vereador Manuel Domingues que realçou que a erosão costeira «é um problema do dia a dia, quer a questão do Cabedelo, quer de S. Pedro, Costa de Lavos e Leirosa. São os locais mais problemáticos (além do assoreamento do porto) e estes trabalhos são importantes porque ficamos com uma perspetiva do que pode vir a acontecer». Ou seja, «estes estudos feitos pelos melhores técnicos do país, também nos podem ajudar a tomar algumas decisões e a pressionar as instâncias governamentais para intervirem, o que é uma necessidade, nomeadamente no que respeita à transferência dos inertes da zona norte para sul».

Já na sua intervenção, o autarca realçou que estão a efetuar o Plano Municipal para Alterações Climáticas, sendo que, «algumas soluções serão apresentadas brevemente», garantiu.

DB-IA

Estudo alerta para risco de inundações no Cabedelo

Paula Freire, Manuel Domingues e Jorge Aniceto

●●● Um estudo do Laboratório Nacional de Engenharia Civil (LNEC) e do Centro de Estudos Sociais da Universidade de Coimbra (CES-UC), apresentado ontem no Desportivo Clube Marítimo da Gala, alerta para o risco de inundações no Cabedelo. O trabalho foi realizado ao abrigo do "Projeto Mosaic.pt – Relevância e contributo para a análise de risco de inundação costeira".

Para o Cabedelo, "uma das zonas mais fragilizadas" da costa ocidental portuguesa, adiantou a investigadora Paula Freire, do LNEC, ao DIÁRIO AS BEIRAS, foram simulados três cenários. Duas das simulações baseiam-se numa tempestade com a mesma intensidade da "Hércules", que assolou a costa em 2014.

Se a tempestade acontecesse com o atual estado do mar, haveria galgamento; se o contexto fosse com um nível de mar extremo, a inundação atingirá toda a zona circundante. O terceiro cenário tem como referência a previsível subida do nível médio do mar, que, segundo vários estudos, atingirá os 30 centímetros dentro de 50 anos.

Sul à espera de obras estruturantes

O vereador Manuel Domingues, mostrando-se preocupado com a erosão no sul do concelho e defendendo a aplicação de medidas destinadas a mitigar o problema, disse que, além de diligenciar junto das entidades do Estado, a câmara da Figueira da Foz "está disponível para comparticipar a elaboração de estudos e projetos". E, disse ainda, "também pode contribuir com um esforço financeiro, que já tem vindo a assumir".

O presidente da Junta de São Pedro, Jorge Aniceto, defendeu medidas que possam ir além das "intervenções de caráter provisório". Por seu lado, Eurico Gonçalves, do SOS Cabedelo, afirmou que o movimento cívico continua "extremamente preocupado, porque têm sido apresentadas soluções pontuais para um problema estrutural". | **Jot'Alves**

FACEBOOK AND OTHERS


facebook
Email or phone
Password
Log In
Forgot Account?
SESSÃO DE DIVULGAÇÃO
Projeto Mosaic.pt
Relevância e Contributo para a Análise do Risco de Inundação Costeira
28 de Setembro 2022
14:45 - 17:15
Desportivo Clube Marítimo da Gala, Figueira da Foz
http://mosaic.lnec.pt/
O projeto Mosaic.pt, coordenado pelo LNEC e com a parceria do Centro de Estudos Sociais, tem como objetivo desenvolver ferramentas de apoio à gestão do risco de inundação na zona costeira, tendo em conta a diversidade do território. Esta Sessão de Divulgação visa a apresentação de resultados do projeto à comunidade local, e promover o debate sobre riscos na zona costeira através de um espaço de participação dos presentes.
14h45 Receção dos participantes
15h00 Sessão de abertura - Município da Figueira da Foz, Laboratório Nacional de Engenharia Civil
15h15 Apresentação do Projeto Mosaic.pt
15h45 Dinâmica participativa sobre riscos na zona costeira
16h15 Filme "A erosão costeira"
Município da Figueira da Foz
August 25 at 3:00 PM
Sessão de Divulgação "Projeto Mosaic.pt - Relevância e contributo para a análise de risco de inundação costeira"
Realiza-se a 28 de setembro, entre as 14h45 e as 17h15, nas instalações do Desportivo Clube Marítimo da Gala, a sessão de divulgação subordinada ao tema "Projeto Mosaic.pt - Relevância e contributo para a análise de risco de inundação costeira"
Este evento enquadra-se na fase de divulgação de resultados do projeto Mosaic.pt, projeto coordenado pelo Laboratório ... See more
17
1 Comment 12 Shares
Like
Comment
Share
Most relevant
Sergio Borges
Vejam as fotos de 2 anos atras e de agora nas praias ao Sul da Costa de Lavos 3090-458 Figueira da Foz
Uma das prainhas que tínhamos junto ao molhe, já foram.
3w
See more of Município da Figueira da Foz on Facebook
Log In
or
Create new account

http://www.dha.lnec.pt/newsletter/index.html

LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL

Newsletter #9
Julho 2022

Editorial

No ano em que o LNEC celebra o 75.º aniversário, aqui estamos mais uma vez a mostrar a nossa juventude, a determinação de inovar, a vontade de fazer sempre mais e melhor.

Num tempo em que a sensorização se tem vindo a desenvolver de forma exponencial, o LNEC tem vindo a explorar o novo potencial para melhor conhecer o ciclo da água, nas suas múltiplas vertentes, bem como os usos, as infraestruturas e o ambiente relacionados. Nesta Newsletter destaca-se o projeto AQUAMON, focado na monitorização confiável em ambientes aquáticos estuarinos e costeiros com redes de sensores sem fios. Ler mais

Breves

O LNEC desenvolveu, com a participação da Universidade de Évora, da Fenareg, do Instituto Politécnico de Setubal e de três Associações de Regantes participantes no projeto AGIR, um guia técnico para avaliação da eficiência do uso da água e energia em aproveitamentos hidroagrícolas. Apresenta também uma proposta de sistema de avaliação do uso da água e da energia, em que os balanços hídrico e energético são intrumentos-chave para o cálculo de várias indicadores de desempenho que integram o sistema de avaliação proposto. +

O LNEC desenvolveu, com a participação do IST, o guia sobre avaliação da eficiência energética nos serviços urbanos de águas para diagnóstico, priorização de alternativas, monitorização e revisão do plano de ação. Permite identificar de forma sistemática as principais ineficiências energéticas e localizar os componentes onde ocorrem, direcionando as ações a desenvolver prioritariamente. Em cada parte do Guia, descreve-se a metodologia proposta e ilustra-se a sua aplicação em casos reais de EG participantes no Avaler+. +

Realizou-se no LNEC de 6 a 8 de junho de 2022 a 6ª Conferência sobre Morfodinâmica Estuarina e Costeira - MEC2022. Este evento contou com mais de 40 apresentações, entre formato oral e póster, e foram proferidas duas palestras por dois investigadores convidados de renome: "Hydro-sedimentary dynamics of coastal zones under storm waves" (Xavier Bertin) e "Ecological basis for active remobilisation of stabilised coastal dunes. Really?" (Juan B. Gallego-Fernández). Foi também realizada uma mesa-redonda sobre o futuro da zona costeira em Portugal, com a presença do Vice-Presidente da Agência Portuguesa do Ambiente, Eng.º Pimenta Machado. As atas da conferência encontram-se aqui.
A conferência incluiu a Sessão Especial "Inundação em zonas costeiras: processos, vulnerabilidade e risco" na qual se divulgaram resultados do projeto Mosaic.pt através de 6 apresentações orais

Os resultados do projeto H2020 BINGO, coordenado pelo DHA, foram sintetizados pela investigadora Ana Estela Barbosa e constam duma compilação (em francês) destinada a apoiar os gestores da água franceses a integrar as alterações climáticas tanto no planeamento da atividade como na implementação de medidas de adaptação. +

LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL

PT EN

LNEC INVESTIGAÇÃO SERVIÇOS DIVULGAÇÃO E FORMAÇÃO REDES E PARCERIAS DOCUMENTOS

NOTÍCIAS

LNEC organizou a 6ª Conferência sobre Morfodinâmica Estuarina e Costeira
2022-07-18

Realizou-se no LNEC, entre 06 e 08 de junho de 2022, a 6ª Conferência sobre Morfodinâmica Estuarina e Costeira - MEC2022, uma organização conjunta de LNEC, APRH, Faculdade de Ciências da Universidade de Lisboa, Faculdade de Engenharia da Universidade do Porto, Universidade do Algarve e Universidade de Aveiro.

A sessão de abertura foi presidida pela Diretora do Departamento de Hidráulica e Ambiente do LNEC, Helena Alegre.

O evento contou com mais de 40 apresentações orais e em poster, tendo sido proferidas duas palestras convidadas pelos investigadores Xavier Bertin, da Universidade de la Rochelle ("Hydro-sedimentary dynamics of coastal zones under storm waves") e Juan Gallego-Fernández, da Universidade de Sevilha ("Ecological basis for active remobilisation of stabilised coastal dunes. Really?").

Os resultados do projeto Mosaic.pt foram divulgados na sessão especial "Inundação em zonas costeiras: processos, vulnerabilidade e risco".

O evento incluiu também uma mesa-redonda sobre o futuro da zona costeira em Portugal, que contou com a presença do Vice-Presidente da Agência Portuguesa do Ambiente, José Pimenta Machado.

As atas da conferência encontram-se aqui.

LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL

PT
EN

LNEC INVESTIGAÇÃO SERVIÇOS REDES E PARCERIAS DIVULGAÇÃO E FORMAÇÃO DOCUMENTOS

NOTÍCIAS

Sessão de Divulgação de Resultados do Projeto MOSAIC.pt
2022-11-18

Decorreu em setembro, na Figueira da Foz, uma sessão de divulgação dos resultados do projeto MOSAIC.pt, coordenado pelo LNEC, com a parceria do Centro de Estudos Sociais da Universidade de Coimbra.

Financiado pela FCT, o projeto MOSAIC.pt teve como objetivo o desenvolvimento de um quadro de referência inovador de apoio à gestão do risco de inundação na zona costeira, incluindo estuários, com base na integração de modelos de previsão e monitorização em tempo real das variáveis relevantes ao processo de inundação e tendo em conta as diferentes dimensões da vulnerabilidade do território.

A sessão contou com a presença do Vereador Manuel Domingues da Câmara Municipal da Figueira da Foz e do Presidente da Junta de Freguesia de São Pedro, Jorge Aniceto Pimentel dos Santos, instituições que apoiaram a organização do evento, que incluiu a apresentação e discussão dos principais resultados do projeto e um momento de dinâmica participativa, no qual se auscultaram os presentes sobre diferentes aspetos dos riscos costeiros, seguindo-se um espaço de debate.

« voltar

ANNEX IV
Final Technical Workshop

INUNDAÇÃO EM ZONAS COSTEIRAS (Moderadora: Conceição Freitas)	
14:00-14:15	MOSAIC.PT FLOOD RISK FRAMEWORK TO SUPPORT MANAGEMENT IN COASTAL ZONES - Freire, Paula; Fortunato, André B.; Tavares, Alexandre O.; Oliveira, Anabela; Santos, Pedro P.; Nahon, Alphonse; Barros, José L.; Rocha, Miguel; Oliveira, Filipa S. B. F; Fortes, Conceição; Jesus, Gonçalo; Azevedo, Alberto; Oliveira, João; Bortoli, Alice; Rilo, Ana; Rogeiro, João; Martins, Ricardo; Henriques, Maria J.
14:15-14:30	IMPACT OF SEASONAL CHANGES IN INTERTIDAL BEACH MORPHOLOGY ON MODELLED OVERTOPPING - Nahon, Alphonse; Fortunato, André B.; Oliveira, Filipa S.B.F.; Freire, Paula
14:30-14:45	MORPHOLOGICAL EVOLUTION OF COVA-GALA: UPDATE WITH THE COSMO 2020 AND 2021 TOPO-BATHYMETRY - Oliveira, F.S.B.F., Oliveira, J.N.C., Freire, P.M.S., Fortunato, A.B., Nahon, A.
14:45-15:00	PRAIA DA COVA-GALA: MODELAÇÃO NUMÉRICA DAS TEMPESTADES DE FEVEREIRO DE 2019 COM O MODELO XBEACH - Simão, Joana ; Bortoli, Alice; Fortes, Conceição J.E.M.; Zózimo, Ana Catarina; Reis, Maria Teresa; Nahon, Alphonse
15:00-15:15	THE EWCOAST CONTRIBUTION TO AN EARLY WARNING SYSTEM FOR COASTAL RISKS ASSESSMENT - Ferreira, Óscar; Garzon, Juan; Ferreira, Andreia; Zózimo, Ana Catarina; Fortes, Conceição Juana ; Reis, Maria Teresa
15:15-15:30	METODOLOGIA PARA A DEFINIÇÃO DE ÁREAS INUNDÁVEIS PELA SUBIDA DO NÍVEL DO MAR EM LITORAIS EXPOSTOS, NA COSTA PORTUGUESA -Trindade, Jorge; Zêzere, José Luís; Reis, Eusébio; Rocha, Jorge; Santos, Pedro Pinto; Garcia, Ricardo A.C.; Oliveira, Sérgio C. ; Pereira, Susana; Silva, Andreia
15:30-15:45	COASTAL TERRITORIAL VULNERABILITY INDEX: THE IMPORTANCE OF A LOCAL APPROACH IN ANTICIPATING THE IMPACTS OF COASTAL FLOODING - Barros, José Leandro; Tavares, Alexandre Oliveira; Santos, Pedro Pinto; Freire, Paula
15:45-16:00	COASTAL FLOODING OCCURRENCES, IMPACTS AND TERRITORIAL COMPLEXITY IN THE DEFINITION OF COASTAL TYPOLOGIES - Barros, José Leandro; Tavares, Alexandre Oliveira; Santos, Pedro Pinto; Freire, Paula; Fortunato, André B.; Rilo, Ana; Oliveira, Filipa S. B. F.

Full program in http://mec2022.lnec.pt/pdf/mec2022_programa_final.pdf

ANNEX V
Local Communication Workshop

Mosaic.pt
safe coastal communities

SESSÃO DE DIVULGAÇÃO

O projeto Mosaic.pt, coordenado pelo LNEC e com a parceria do Centro de Estudos Sociais, tem como objetivo desenvolver ferramentas de apoio à gestão do risco de inundação na zona costeira, tendo em conta a diversidade do território. Esta Sessão de Divulgação visa a apresentação de resultados do projeto à comunidade local, e promover o debate sobre riscos na zona costeira através de um espaço de participação dos presentes.

14h45 Receção dos participantes
15h00 Sessão de abertura - Município da Figueira da Foz, Laboratório Nacional de Engenharia Civil
15h15 Apresentação do Projeto Mosaic.pt
15h45 Dinâmica participativa sobre riscos na zona costeira
16h15 Filme "A erosão costeira"
16h30 Discussão participativa
17h00 Síntese
17h15 Encerramento

Evento organizado com o apoio do Município da Figueira da Foz, Junta de Freguesia de São Pedro e Desportivo Clube Marítimo da Gala

FCT Fundação para a Ciência e a Tecnologia
LNEC LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL
ces Centro de Estudos Sociais Laboratório Associado Universidade de Coimbra

www.lnec.pt

AV DO BRASIL 101 • 1700-066 LISBOA • PORTUGAL
tel. (+351) 21 844 30 00
lnec@lnec.pt **www.lnec.pt**