CÂMARA MUNICIPAL
VIANA DO CASTELO

Viana do Castelo: Climate Action (VC-Climaax)
Climate risk assessment

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Introduction

The Municipality of Viana do Castelo is located in the northern Portugal (NUTS3 Alto Minho), with an area of approximately 319,02 square kilometers and, a coastline of 24 kilometers. With a resident population of 85778 (INE, 2021), the municipality has seen a negative demographic trend (-3,2% in 20 years).

Previous studies (e.g. EMAAC) have identified high temperatures and heatwaves, excessive rainfall, rising sea levels and strong winds as the key climate-related risks in Viana do Castelo. In this sense, floods (river and coastal), extreme precipitation, wildfires and storms were considered as priority risks that needed to be analyzed using the climate risk assessment (CRA) CLIMAAX methodology (Phase 1).

The main objective of our participation in the CLIMAAX project (VC_Climaax) is making Viana do Castelo a more resilient and less vulnerable territory to climate change. The project also makes possible to support the Municipality of Viana do Castelo in defining the best methodologies of climate risk assessment (CRA), planning, adaptation, and monitoring (Figure-1).

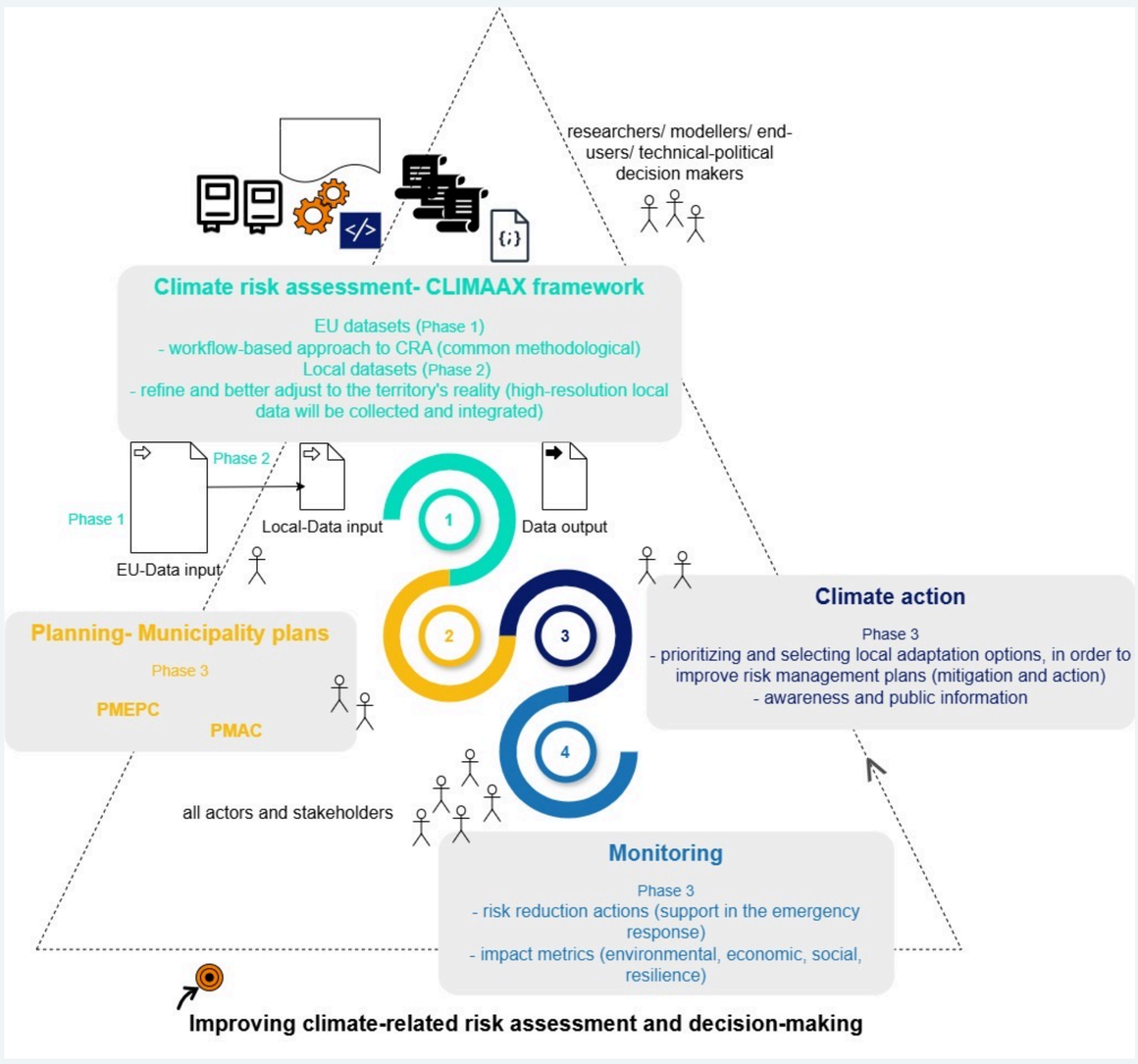


Figure-**1** VC_Climaax project implementation diagram.

Materials and methods

The CLIMAAX framework is based on the principles of social justice, equity, transparency, technical choices (see Table 1), and participatory processes (learning, communication, consultation). These lead, through continued implementation, to information on climate risk that can support adaptation and climate risk management planning (Source: CLIMAAX Consortium).

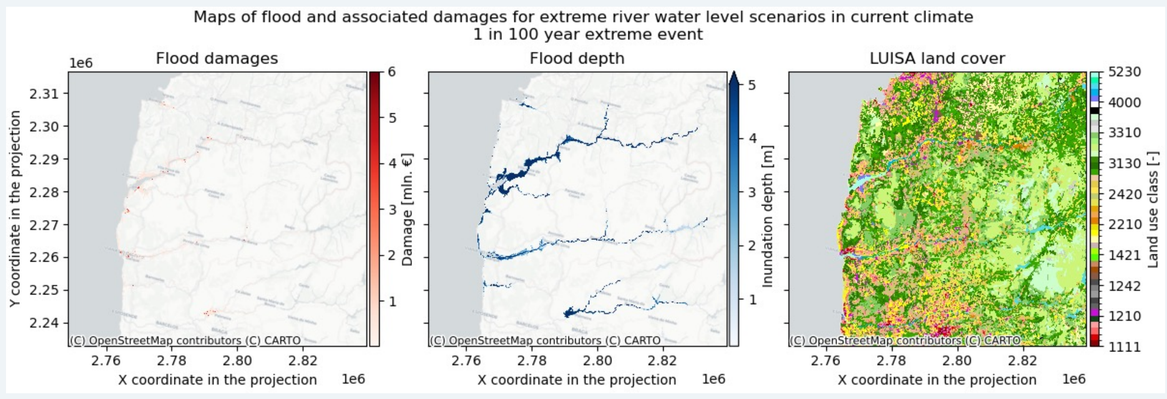
Hazard type	Scenarios	Hazard data	Vulnerability data Exposure data	Risk output
Floods (river *and coastal*)	- RCP 4.5 and RCP 8.5 - all return periods available: 10, 50, 100, 200, 250 and 500 years - Time horizon(s): 2030, 2050, and 2080	- River flood depth and extent maps (JRC and Aqueduct)	- Land use, vulnerability damage curves	- Map flood depth and damage
Fire	- RCP 2.6 and RCP 4.5 - Historical (1981-2005) and future periods (2050 to 2060, and 2045 to 2054) for FWI data	- Fire Weather Index (Fire danger indicators)	- Population density	- Exposed population
Heavy rainfall	- RCP 4.5 - Historical data(1976-2005) and future scenario (2041 to 2070)	- Precipitation intensity for a given return period, impact rainfall thresholds (EURO-CORDEX)	*- Critical infrastructures and population density*	*- Impact rainfall thresholds; Shift in magnitude and frequency*
Storms	- Only simulation for “Klaus” storm (2009) was used	- Footprint of maximum wind gusts (ERA5 reanalysis: “Klaus” windstorm)	- Land use, vulnerability damage curves	- Wind damage map

Table-**1** Technical choices.

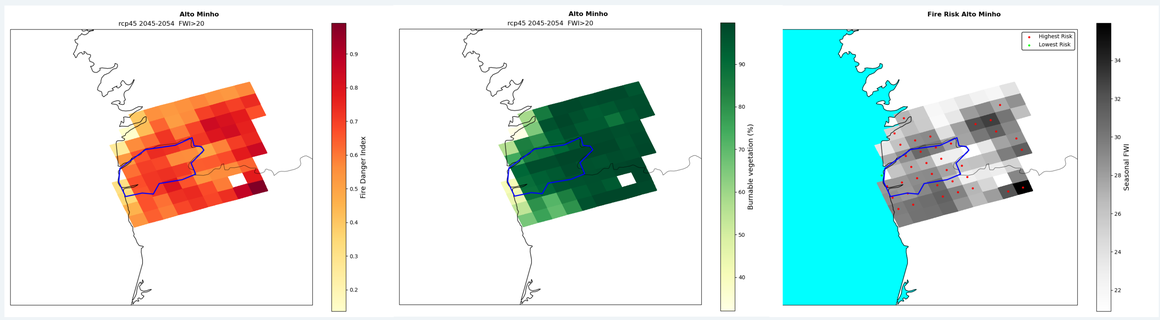
Results

This phase achieved the successful application of the CLIMAAX workflows to all four selected primary hazards.

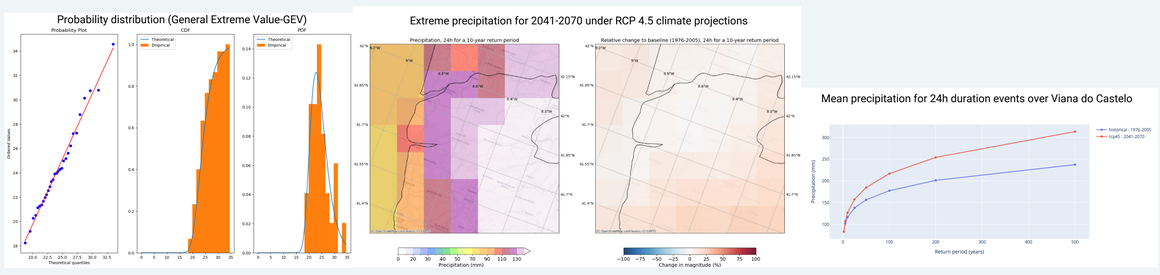
The flood hazard assessment produced maps illustrating the extent of river flooding under various return periods and quantified the potential damage.



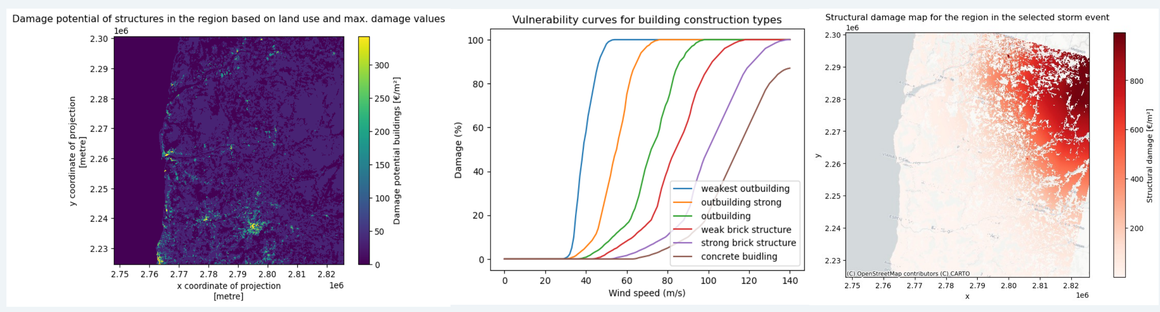
The wildfire workflow generated Fire Weather Index (FWI) maps that clearly show how fire risk is expected to evolve under different climate scenarios.



The extreme precipitation workflow showed how rainfall events are becoming more intense under future climate scenarios.



The storms workflow provided a simulated analysis of the impacts of a major historical storm (Klaus, 2009).



The first phase of the climate risk assessment conducted in the Viana do Castelo district using the CLIMAAX framework has provided valuable insights into the region's susceptibility to climate-related hazards, corroborating the conclusions of prior studies (e.g. PIAAC, EMAAC, PMEPC, PMAC).

Future work / Recommendations

The analyses of the first phase of the climate risk assessment (CRA) has established a foundation for understanding the climate risks facing the region but has also highlighted the need for further improvements in data quality, stakeholder engagement, and workflow usability. The next phase must focus on integrating higher-resolution local data, refining the workflows to enhance their accuracy, exploring the possibility to further the georeferencing of the outputs, and expanding stakeholder participation to ensure that the assessment is both scientifically robust and locally relevant. These improvements will be critical for providing decision-makers with the information they need to develop effective adaptation and resilience strategies for Viana do Castelo municipality.

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