Urban-integrated strategies for Climate Change adaptation at coastal communities

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INTRODUCTION

Coastal regions are increasingly vulnerable to the impacts of climate change, with rising sea levels and a surge in extreme weather events, a trend reinforced by the latest climate projections (IPCC, 2023). Among the most imperiled regions in Europe are the urban coastal areas of the Macaronesia Islands, marked by low-lying settlements, making them highly prone to flooding and severely confined. Traditional flood mitigation methods aren't suitable due to the unique challenges presented by these locations, such as limited space and challenging terrain, making them financially unfeasible.

In pursuit of sustainable development and heightened resilience, a novel methodology is proposed within the LIFE-Garachico project in Tenerife, Spain. This approach revolves around designing adaptation measures considering the evolving perception and acceptable risk levels of the population. These adaptations must align with risk reduction principles following IPCC guidelines, recognizing the dynamic relationships between current, future, perceived, and acceptable flood risks. Simultaneously, they acknowledge that complete prevention of coastal flooding is impossible, necessitating that Macaronesia's coastal communities learn to coexist with such events. This comprehensive methodology seeks public engagement through information campaigns and stakeholder involvement at local and regional levels to ensure that adaptation measures are effective, integrated in the urban landscape and embraced by the community.

METHODOLOGIES AND STUDY CASE

The methodology followed starts with an evaluation of present and future situation of the region: a full probabilistic high-resolution coastal flooding risk assessment is developed within IPCC framework (IPCC, 2022), obtaining the consequences in damages and bussiness affection for the community of a number of flooding episodic events, characterized by their return period. The existing coastal dynamics in this region exhibit a highly intricate behavior, primarily attributable to the varied seabed topography and the composition of the urban waterfront. Thus, a combination of numerical (wave propagation, CFD models and flooding models) and statistical (hybrid downscaling) approaches is required to accurately model the highly non-linear sea level-wave interactions with the bathy-topography. A cross-match with the building and urban elements vulnerability layer and assets and services' value layer provides information about the extreme events' potential consequences.

Then, a comparison between the actual consequences, the variations derived from climate change (accounting for a number of RCPs and emission scenarios) and the acceptable levels of risk (obtained through a dialogue with the community) allows to stablish the degree of necessity of the flooding adaptation measures portfolio, which is conformed by hard and soft measures.

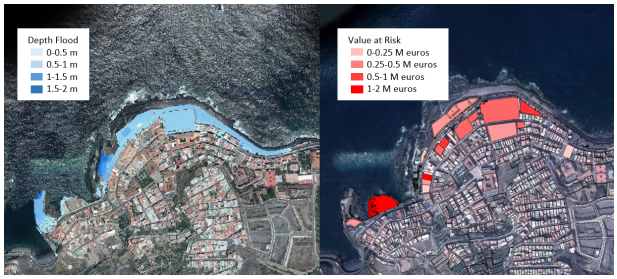

Figure 1 - CC-risk assessment for LIFE-Garachico

Finally, a number of laboratory experiments is performed to assess the measure's effectiveness in mitigating the impact of wave overtopping on the buildings situated along the promenade at the municipality's waterfront. The outcomes of this analysis will be integrated into a comprehensive methodology that evaluates risk reduction through the implementation of adaptation measures and determines the optimal timeframe for their implementation in this location. Consequently, the proper integration of the adaptation measures within the urban environment is a key factor when assessing the adequacy of the portfolio, jointly with the acceptability of each measure by the affected community.

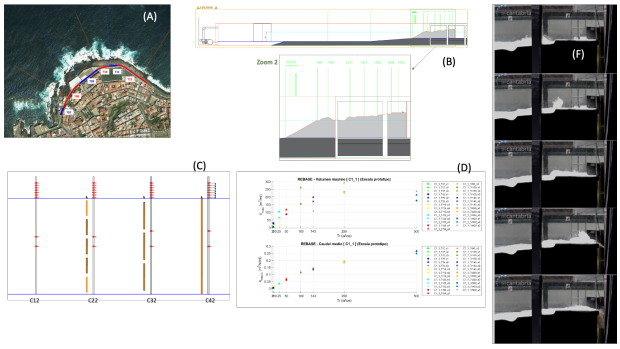

Figure 2 - Adaptation assessment for LIFE-Garachico

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