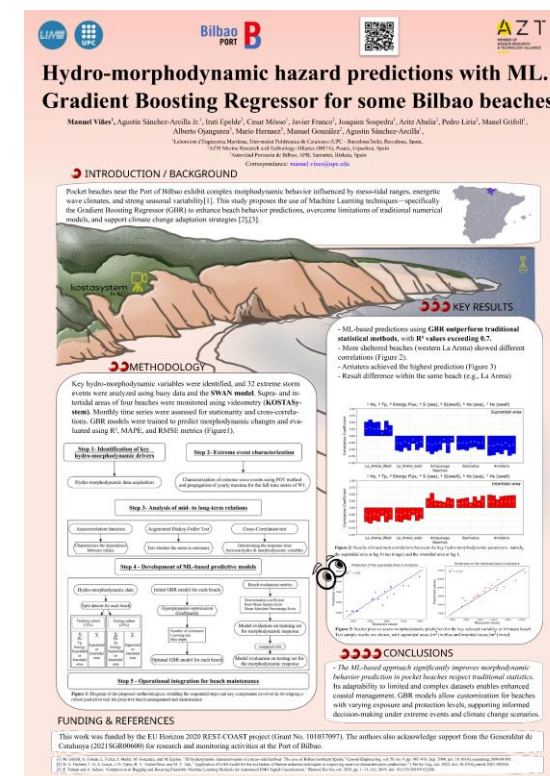


Hydro-morphodynamic hazard predictions with ML. Gradient Boosting Regressor for some Bilbao beaches

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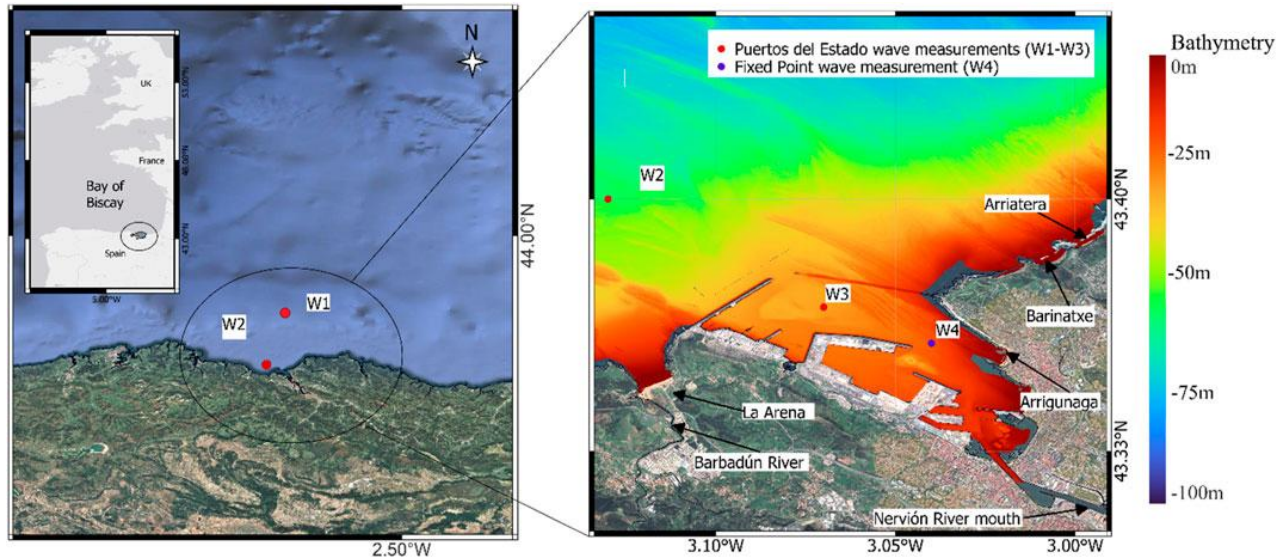


Figure 1. Study area, showing the wave measurement stations, and a detailed view of the coastal zone adjacent to the Nervión estuary, including bathymetry contours.

- W1, W2, W3: wave data from Puertos del Estado
- W4: Fixed measurement point
- Morphodynamic data
- Propagated data

Introduction

Statistical
analysis

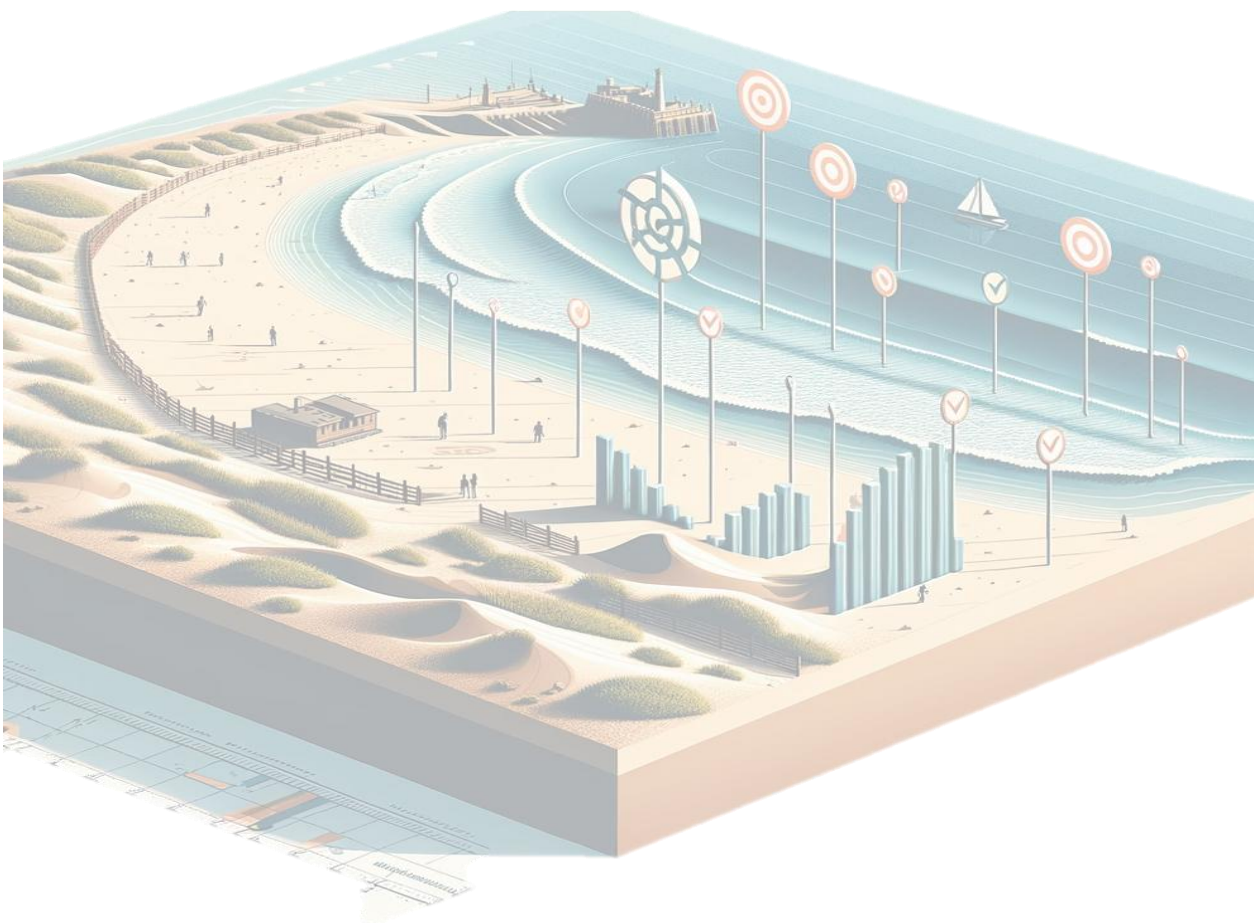
ML
predictions



Main Objective

Design an alternative prediction system based on machine learning to characterize the morphodynamic behaviour of pocket beaches.

- **Extreme events analysis**
Understanding erosion and accretion processes.
- **Correlations between hydro- & morpho-dynamic parameters**
How supratidal and intertidal areas are influenced by wave action
- **Develop a machine learning model for hydro-morphodynamics prediction**
Implementation of supervised learning models for beach maintenance and hard infrastructure.



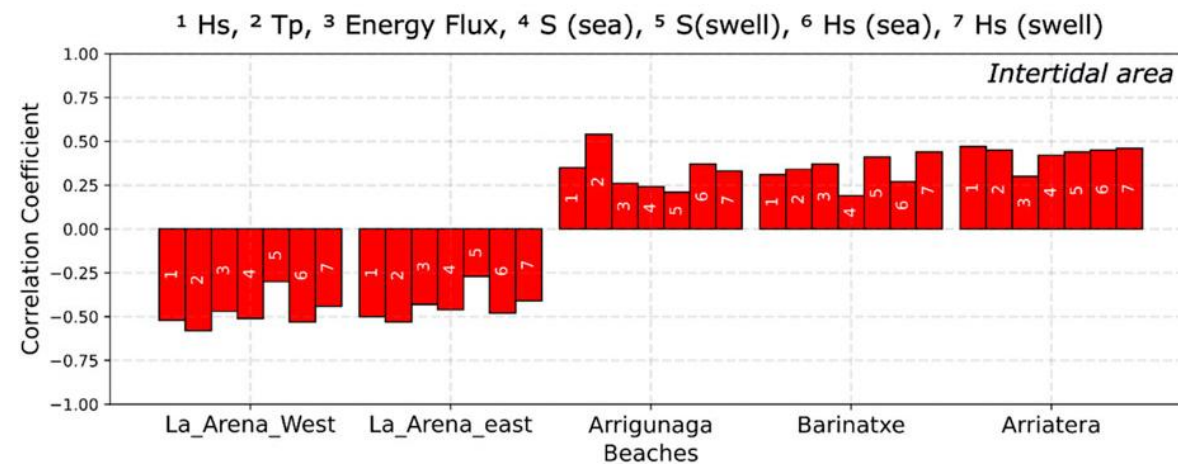
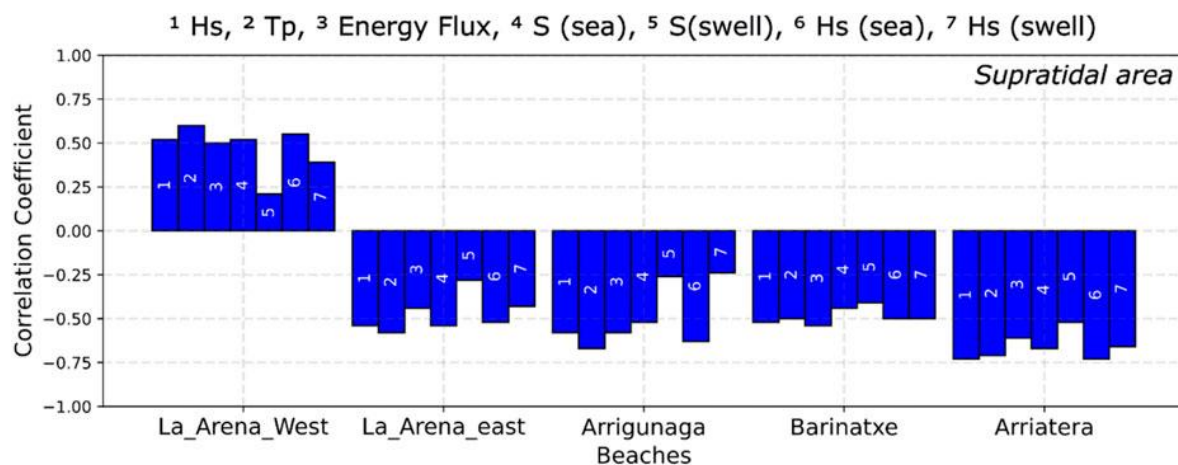
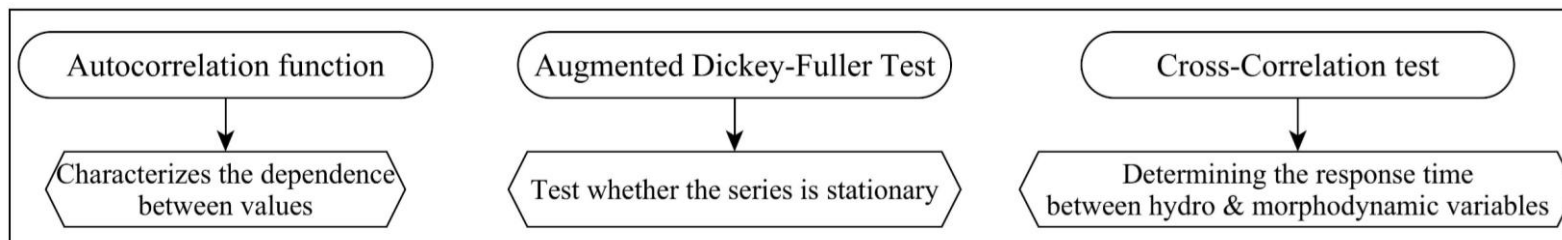
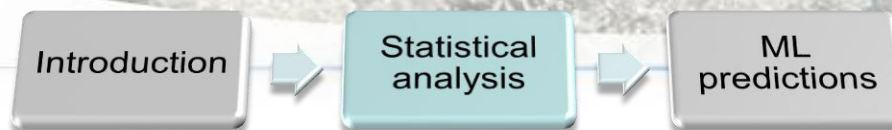
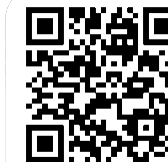


Figure 2. Cross-correlation analysis with hydrodynamic variables for both supratidal and intertidal areas.

SUPRA-TIDAL zone: Most beaches have negative correlations.

INTER-TIDAL zone: Max. correlation occurs one month behind.



Application of machine learning to capture morphological response in the Bay of Biscay

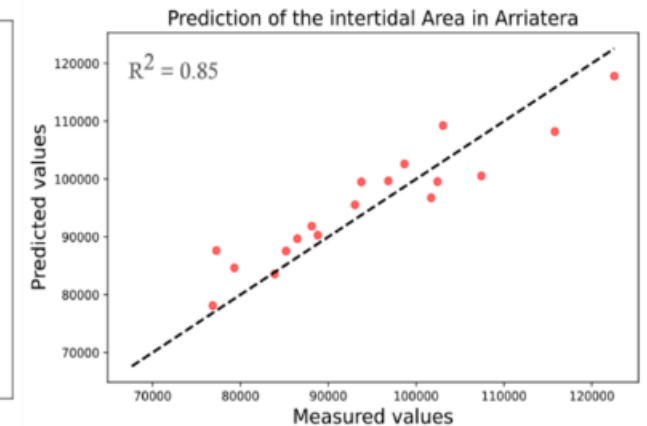
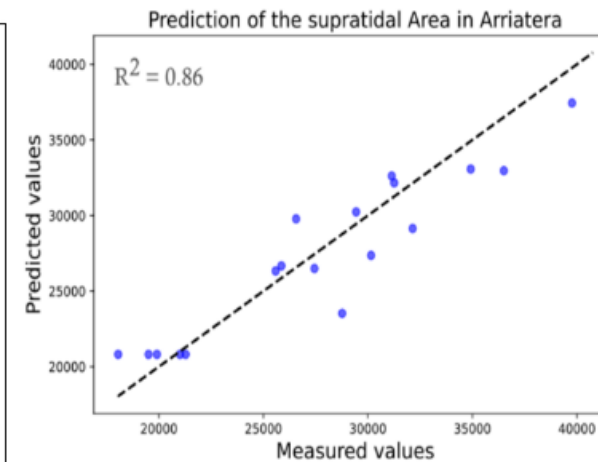
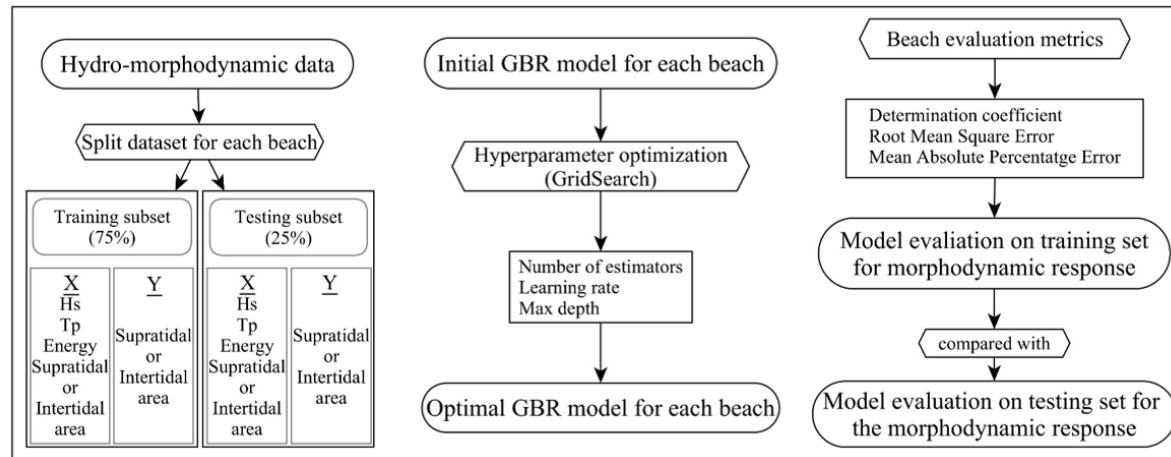


Figure 3. Scatter plots to assess the morphodynamic predictive capacity of the key variables selected for each of the beaches studied. The results of the test samples are shown, with supratidal areas [m2] in blue and intertidal areas [m2] in red.

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