THE POWER OF WAVE ENERGY CONVERTERS ARRAYS TO MITIGATE COASTAL EROSION

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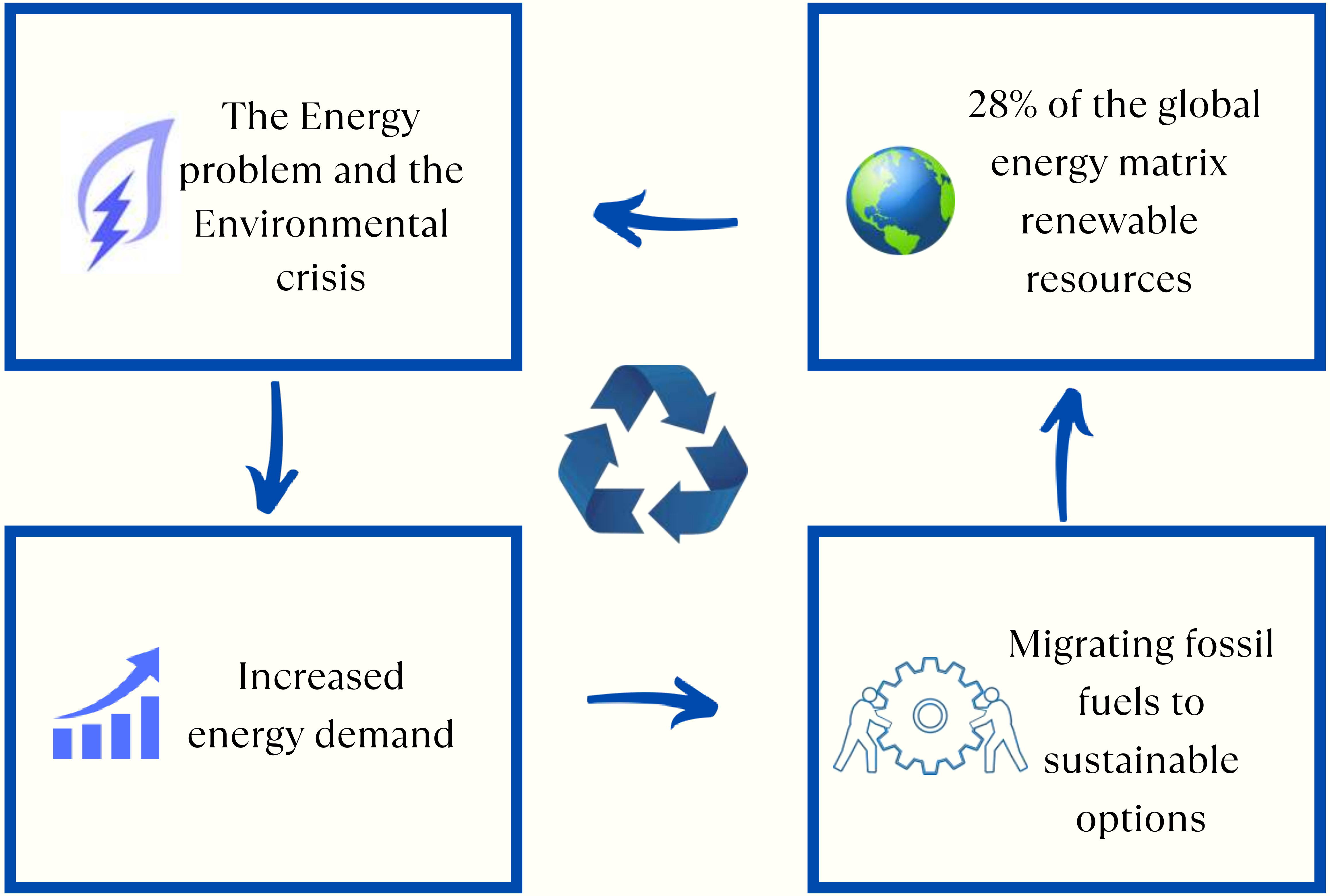
INTRODUCTION



INTRODUCTION

CLIMATE CHANGE

The problem of coastal protection is intensified due to climate change and sediment scarcity.

COASTAL EROSION

A significant percentage of beaches in the world are experiencing worrying erosion rates.

WAVE ENERGY

The multi-purpose use of wave energy converters as a solution for coastal protection and power generation is proposed.

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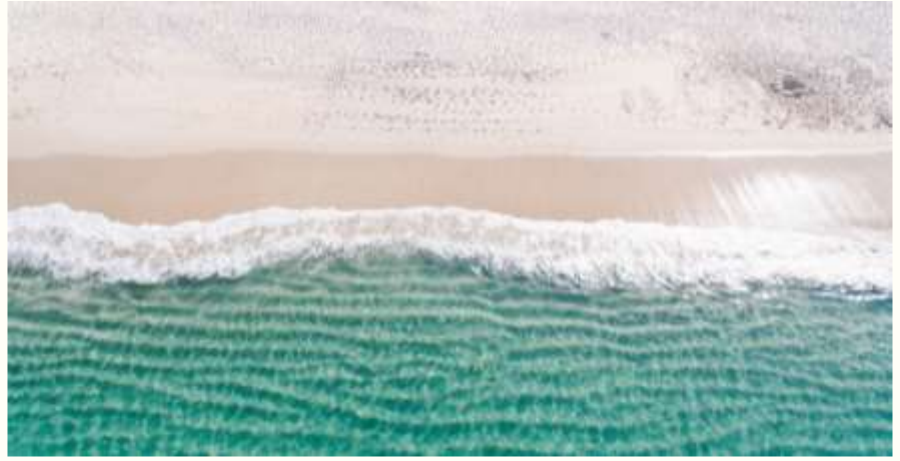

SOLUTION

WECs offer a sustainable solution to protect coastlines and generate power on beaches affected by erosion.

EVALUATION

Assessing the impact of WECs on nearshore bathymetry is essential to understanding their influence on waves and beach morphology.

ANALYSIS

A coupled numerical model (Delft-3D and XBeach) is used to analyze the effects of WECs on the local maritime climate.

METHODOLOGY

WEC array absorption
and protection evaluation

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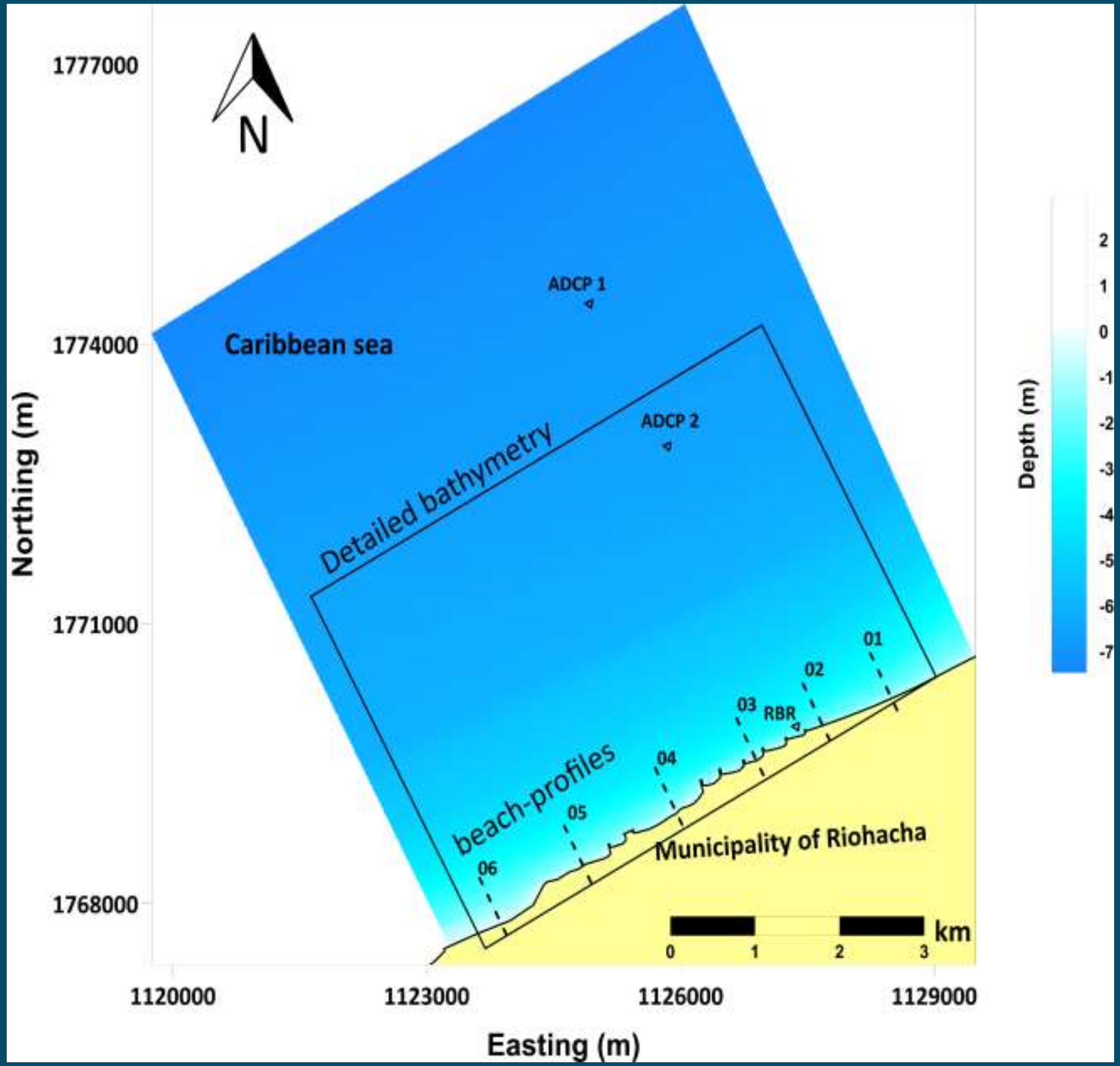
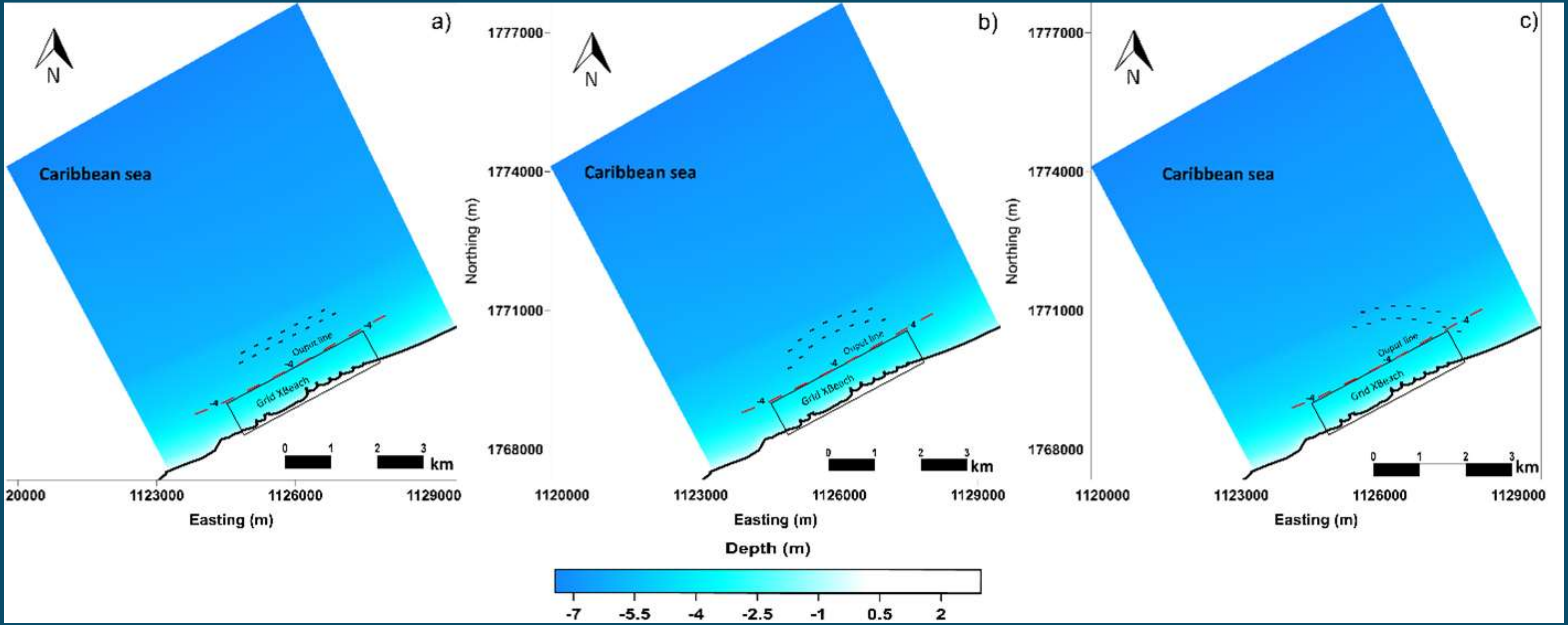
1. **PRIMARY INFORMATION**
   Currents, tide levels, bathymetry, beach profiles, sediment samples, etc.
2. **SECONDARY INFORMATION**
   Global and Regional Data Sources oceanographic data.
3. **EXISTING DEVICE**
   Literature review of existing WEC with transmission and reflection parameters.
4. **ANALYSIS OF MARITIME CLIMATE AND POWER**
   Swell variations and estimation of areas with greater potential.
5. **DELFT-3D WAVE MODELLING**
   Modification of wave fields.
6. **XBEACH MODELLING**
   Nearshore morphology.
7. **ANALYSIS OF RESULTS**
   Discussion and Interpretation of data.

METHODOLOGY



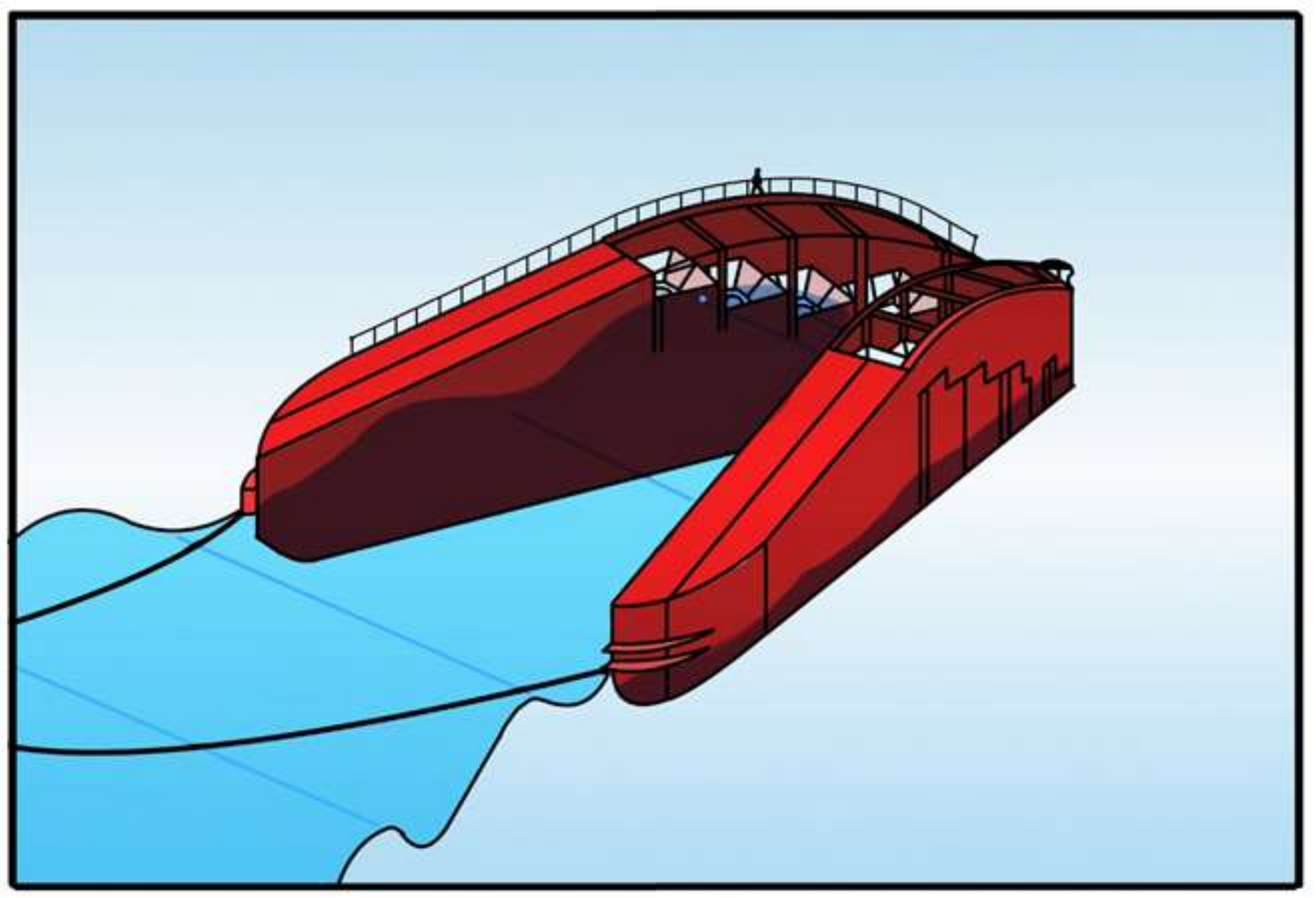
(a) Location of measuring points with ADCP and bathymetric profile. (b) Boat with support structure for the ADCP

METHODOLOGY



Location of different WEC configurations. (a) Case 1. Linear – parallel (b) Case 2. semicircular – perpendicular (c) Case 3 semicircular – oblique

METHODOLOGY



The WaveCat is a floating WEC, consisting of two hulls like a catamaran. However, unlike a catamaran, the hulls are not parallel, but converge.

RESULTS

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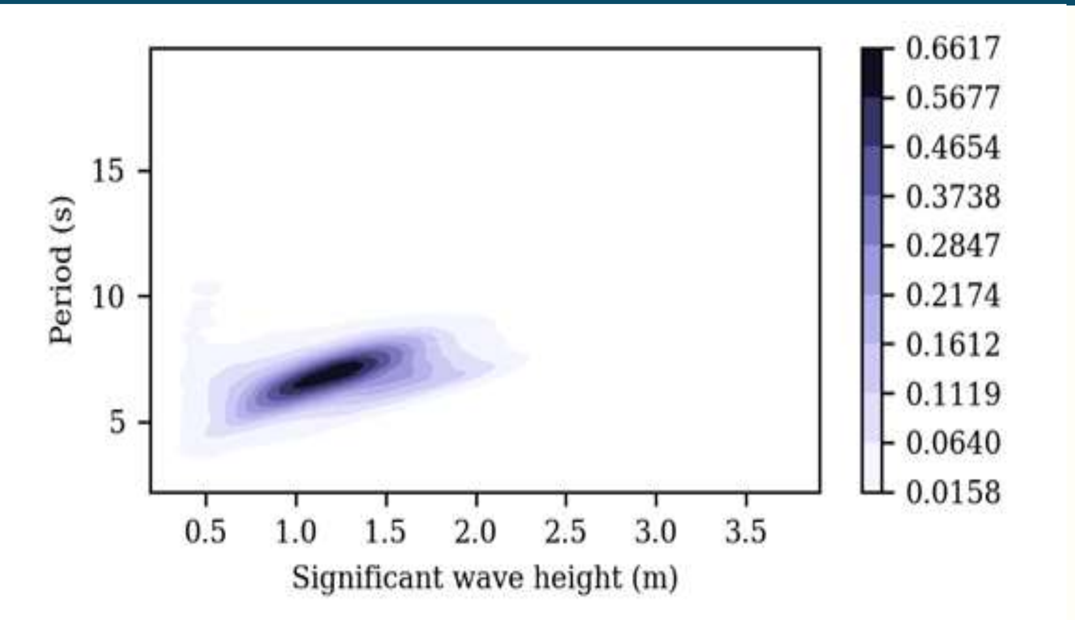
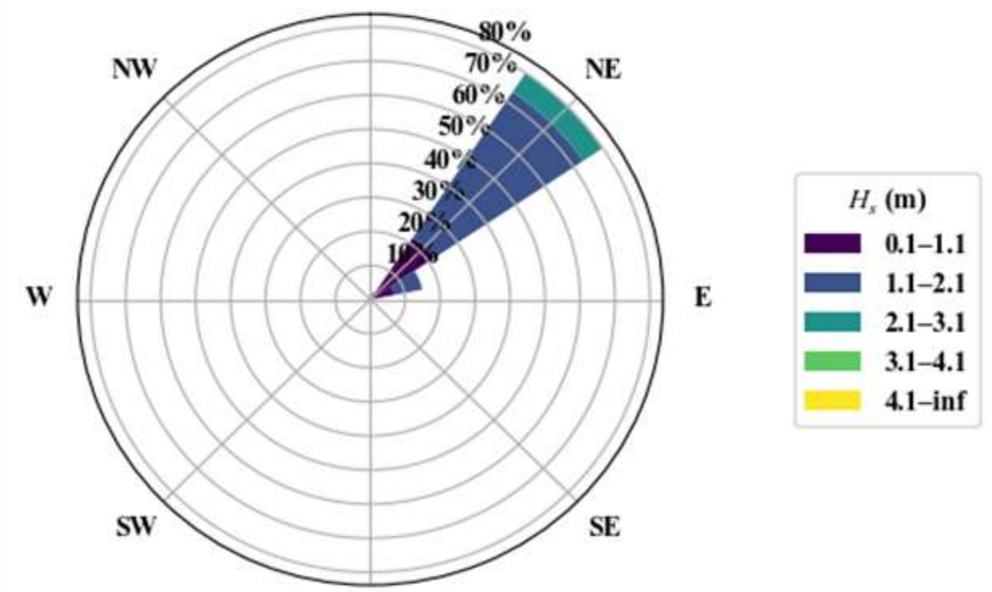
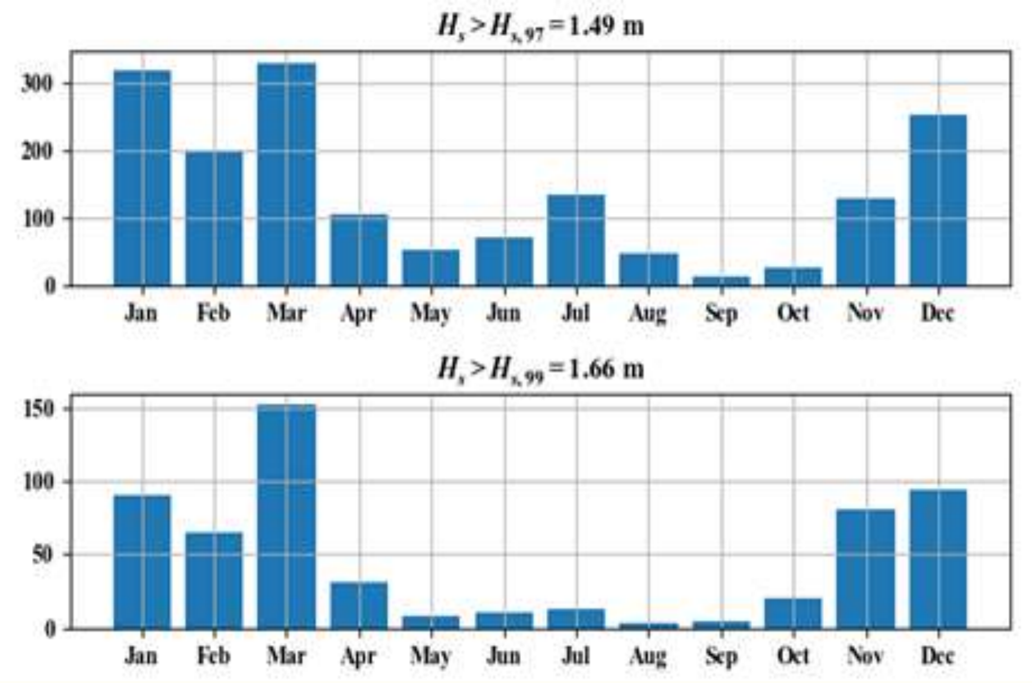
APPMAR



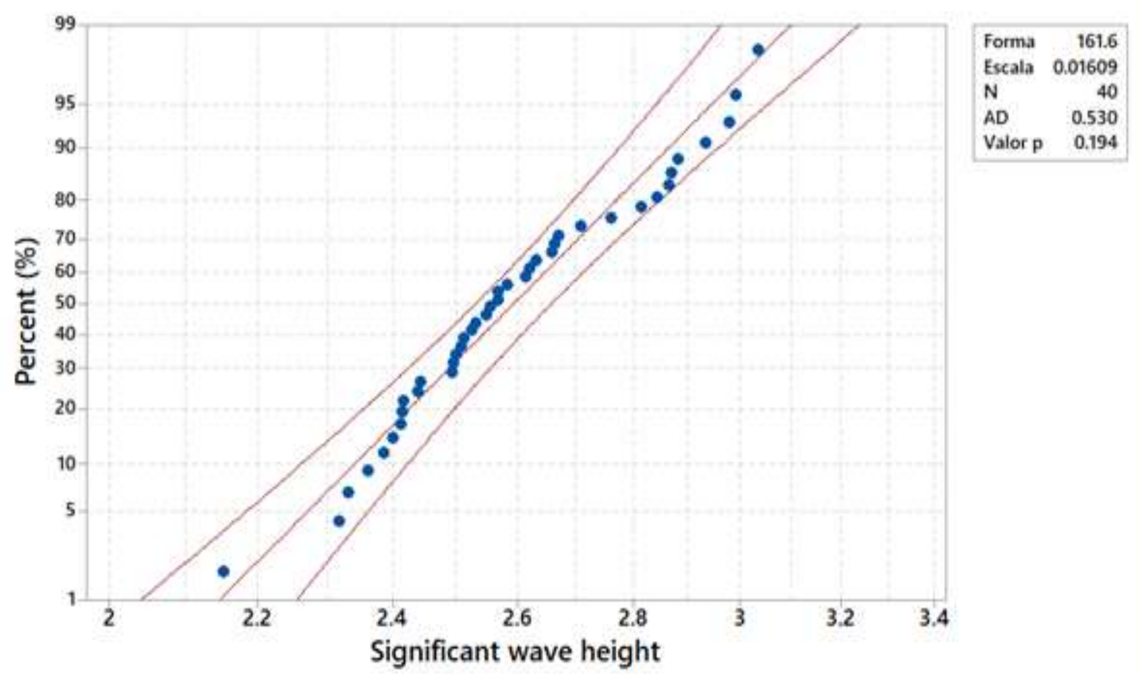
Probability of occurrence Wave height - period



Waves rose for the maritime climate 1979-2019

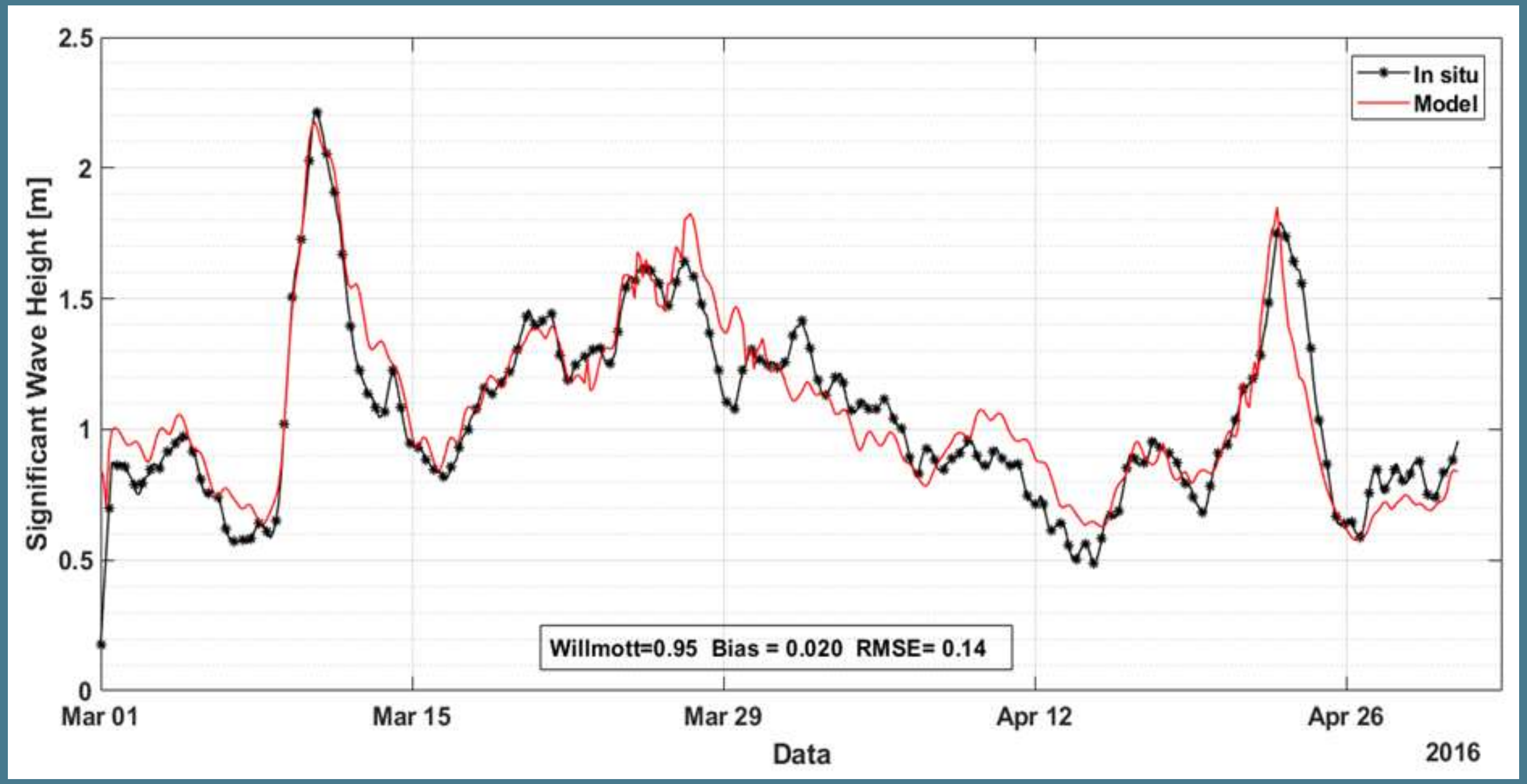


Number of storms 1979-2019



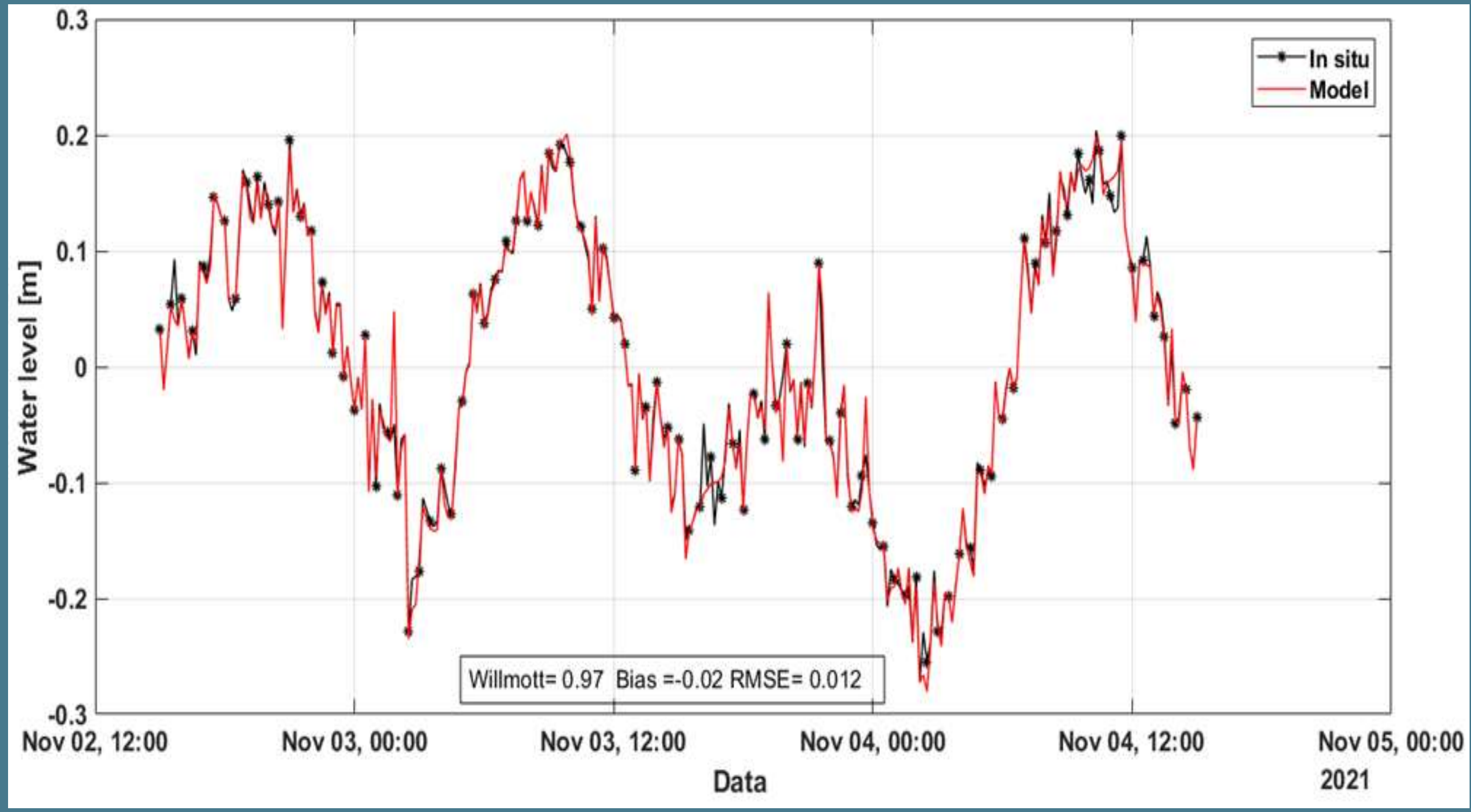
Adjustment of data series distribution of Maximum wave heights

RESULTS



Model Delft-3D (red solid lines) and Hs series measured (black dashed lines) for Dimar buoy 41193

Series of levels by XBeach (red solid lines) And measured levels (black dotted lines) for the RBR sensor in Riohacha.



RESULTS

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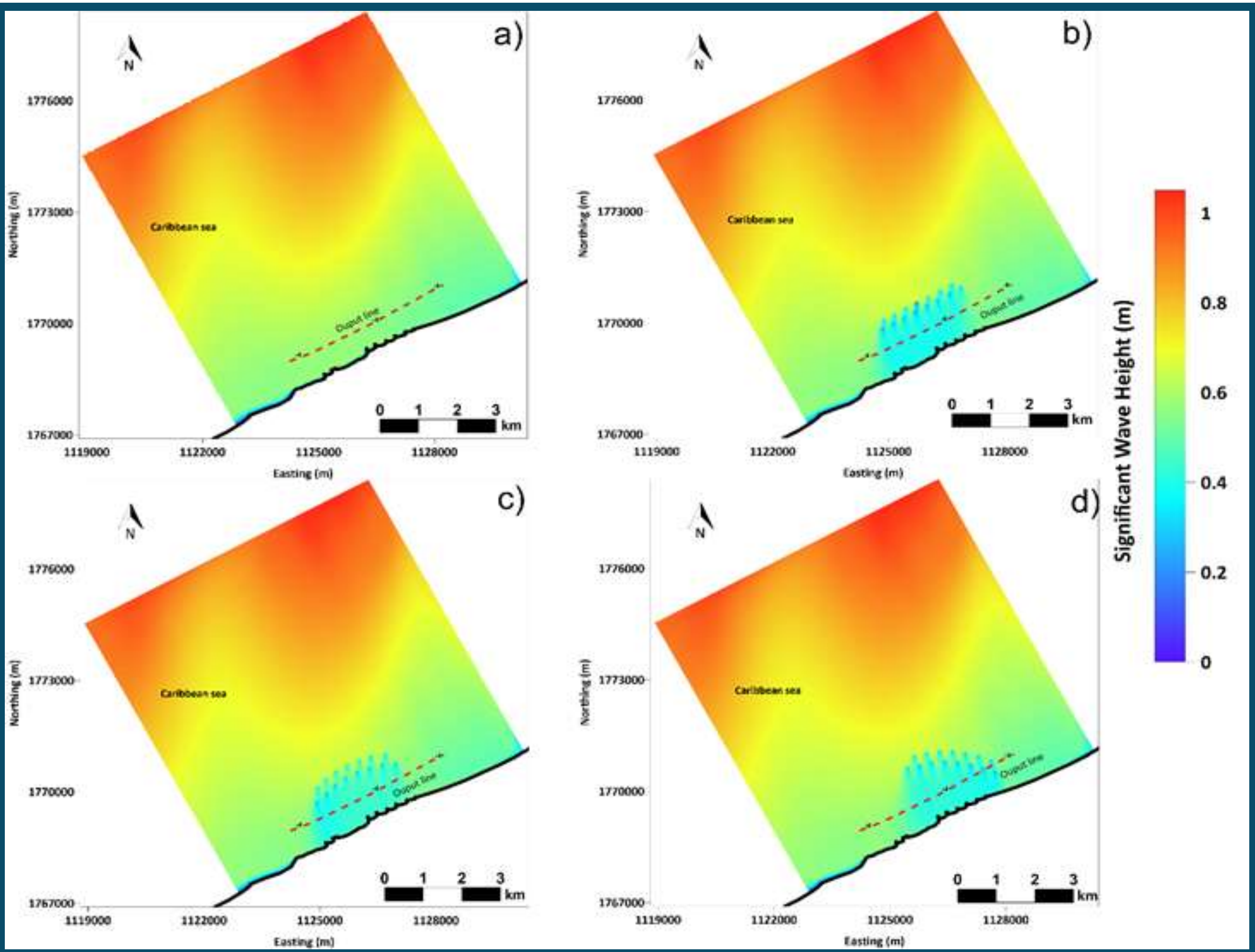
EFFECTS OF WEC MATRIX ON WAVE FIELDS



Significant wave height a) Case 0 without array . b) Case 1 linear - parallel. c) Case 2 semicircular - perpendicular. d) Case 3 semicircular – oblique.

RESULTS

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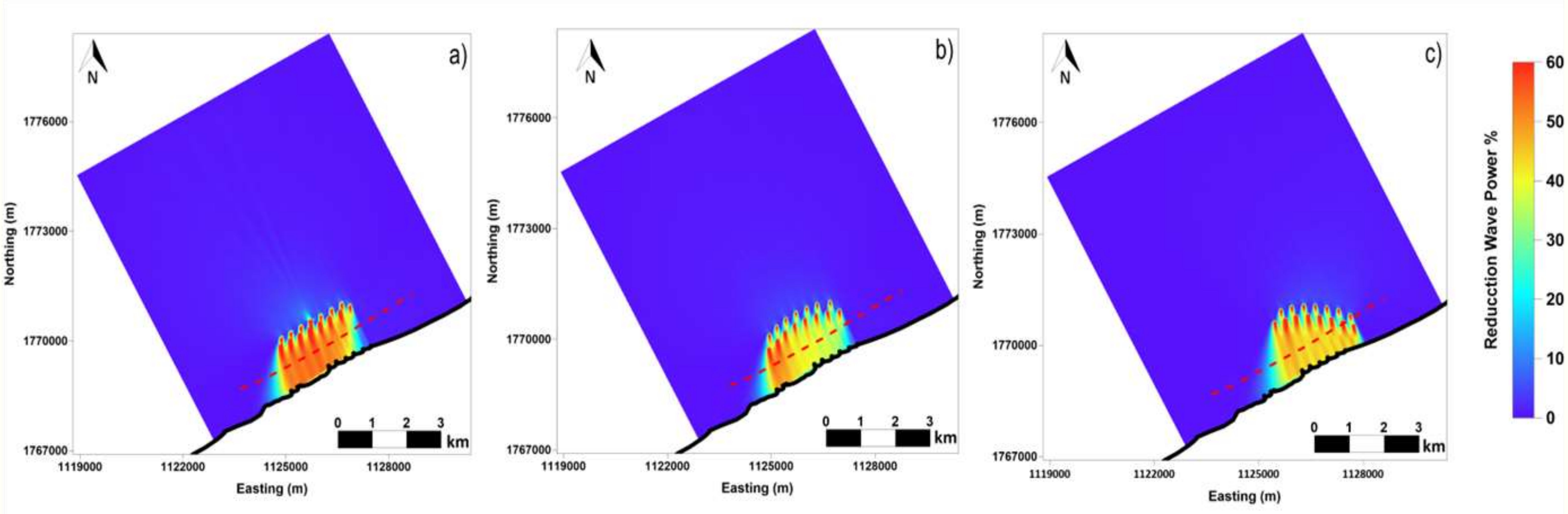
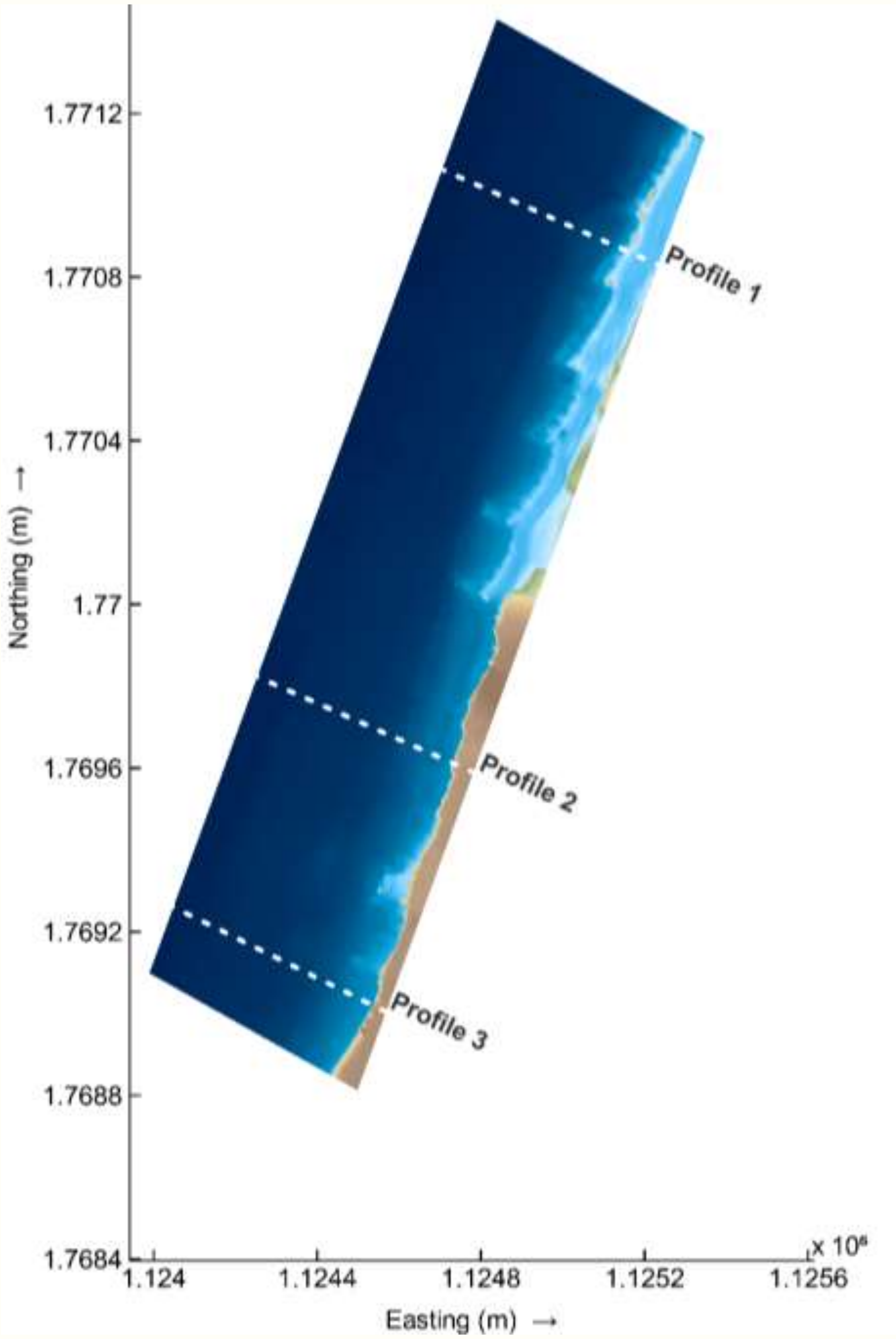
REDUCTION OF WAVE ENERGY DUE TO THE PRESENCE OF MATRIX WECS

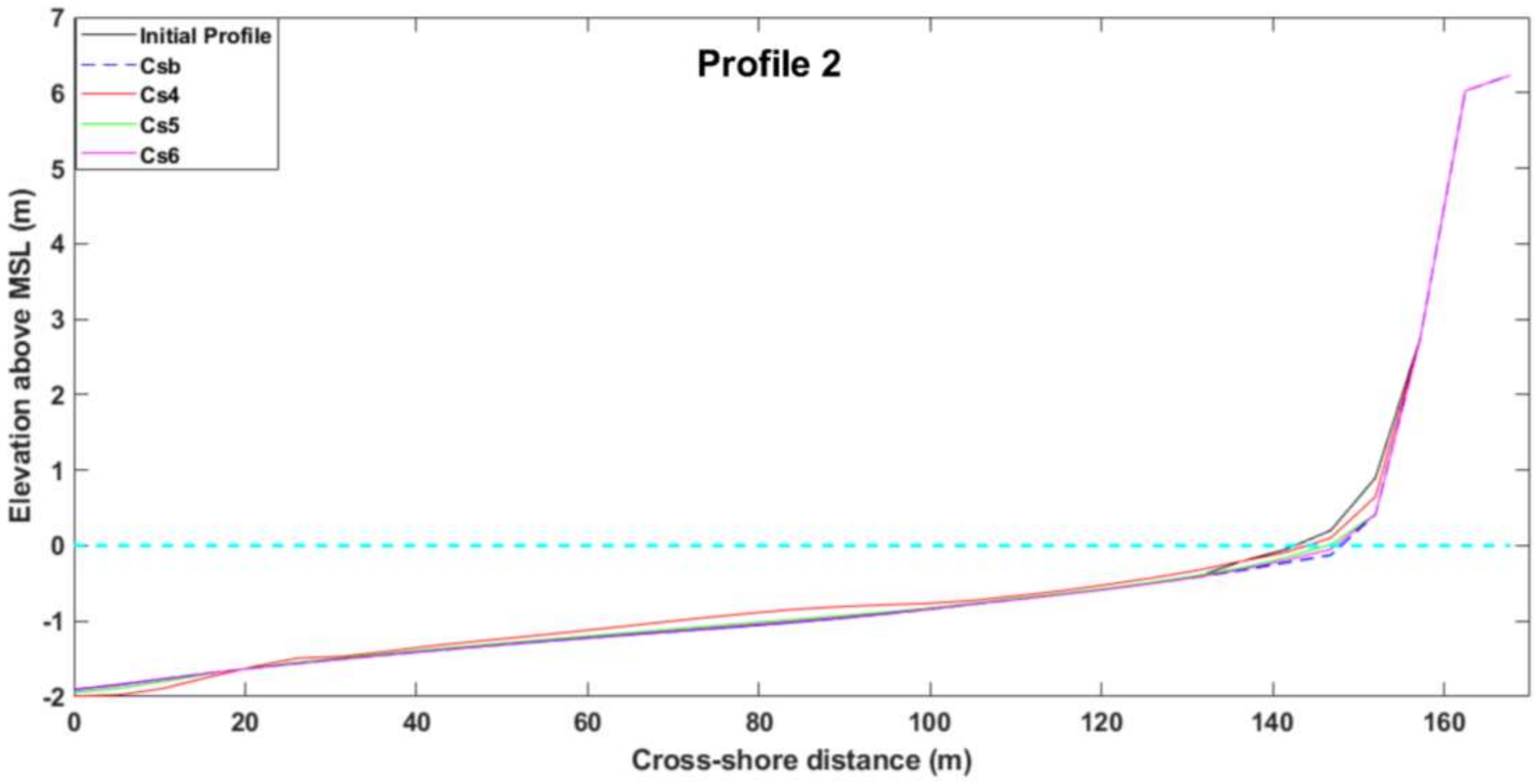


Significant wave height reduction a) Case 1 linear - parallel. b) Case 2 semicircular - perpendicular. c) Case 3 semicircular – oblique.

RESULTS

IMPACT OF THE WECS MATRIX ON COASTAL MORPHOLOGY





CONCLUSIONS

Different configurations and orientations of the offshore devices were evaluated, showing that a linear-perpendicular WEC park offered greater erosion reductions than semicircular configurations.

The optimal location was determined to be 1.3 km from the coast at a depth of 6-8 m. Subsequently, different configurations and orientations of offshore devices at this location were examined.

The methodology can be applied to other coastal areas as a decision-making tool for the development of WEC parks, considering both energy production and coastal hydrodynamic and morphological alterations.

THANK YOU

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