ECWS 2021

Pima Adapta Costas, a characterisation of flooding and erosion under different climate change scenarios along the Catalan coast

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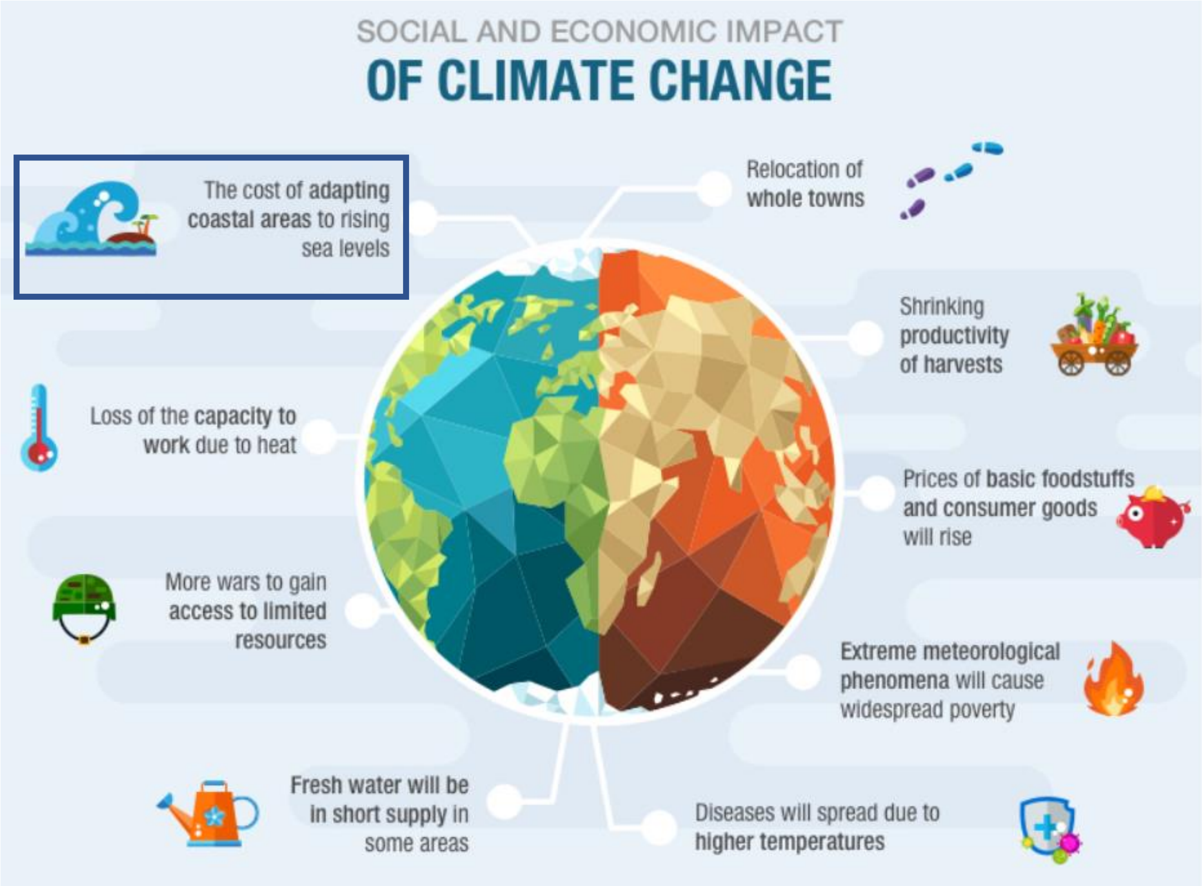
INTRODUCTION

Climate change will heavily impact our coasts in the future.
Combination of sea level rise (SLR) and augment of frequency of high-energetic meteorological events



Predicted socio-economic impacts of climate change described by Iberdrola.

Example of impacts caused by storms.

METHODOLOGY

STEP I. Definition of studied beaches

STEP II.

- Morphobathymetry generation
- Definition of physical parameters

STEP III. XBeach model

STEP IV. Post-processing

STEP V. Visualization

METHODOLOGY

STEP I. Definition of studied beaches

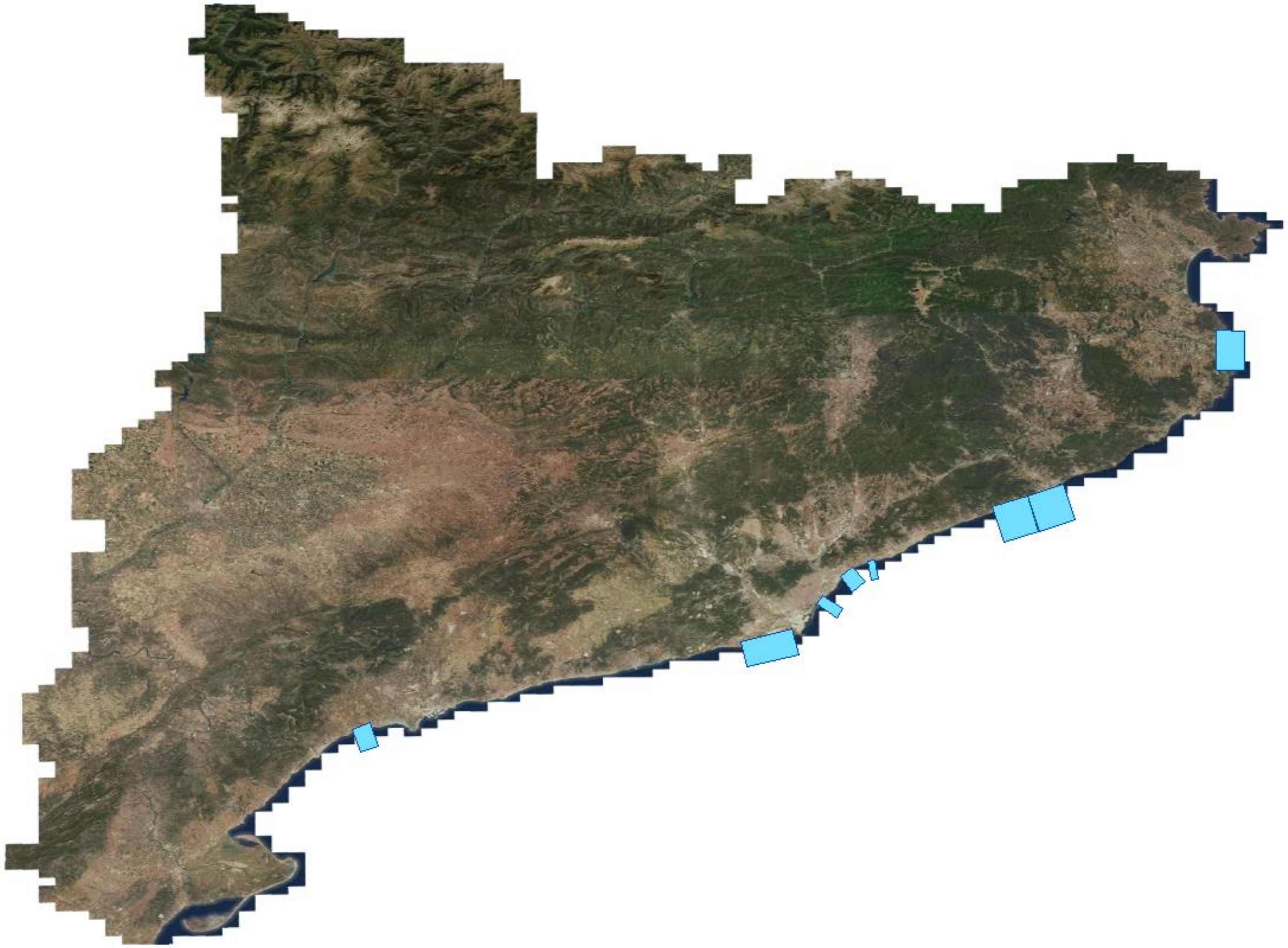
· Selection of 54 beaches of the Catalan coast.

· Grouped in 8 different littoral cells.

· Most populated beaches:

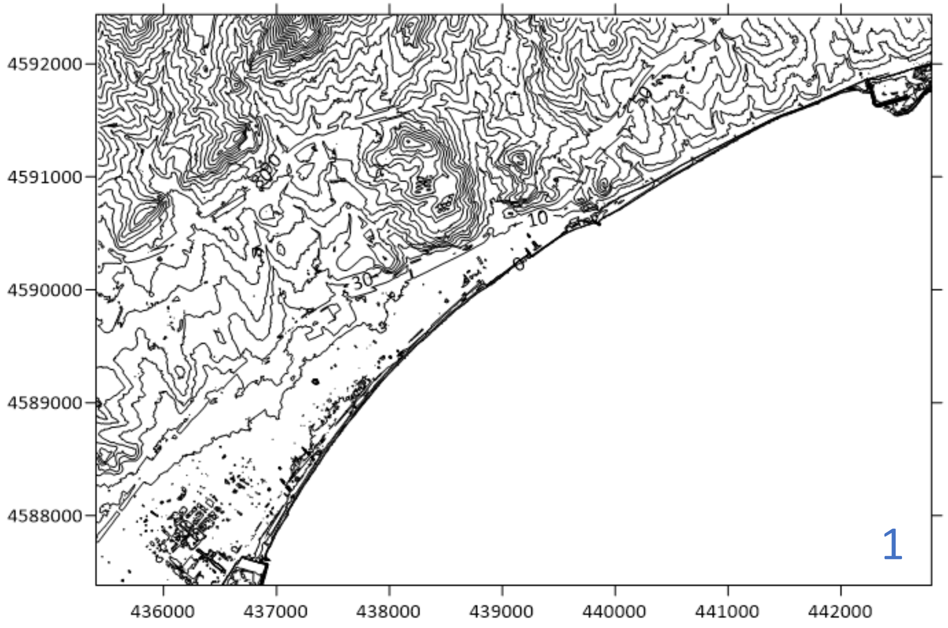
- Tarragona (5), Barcelona(40) and Girona (9)

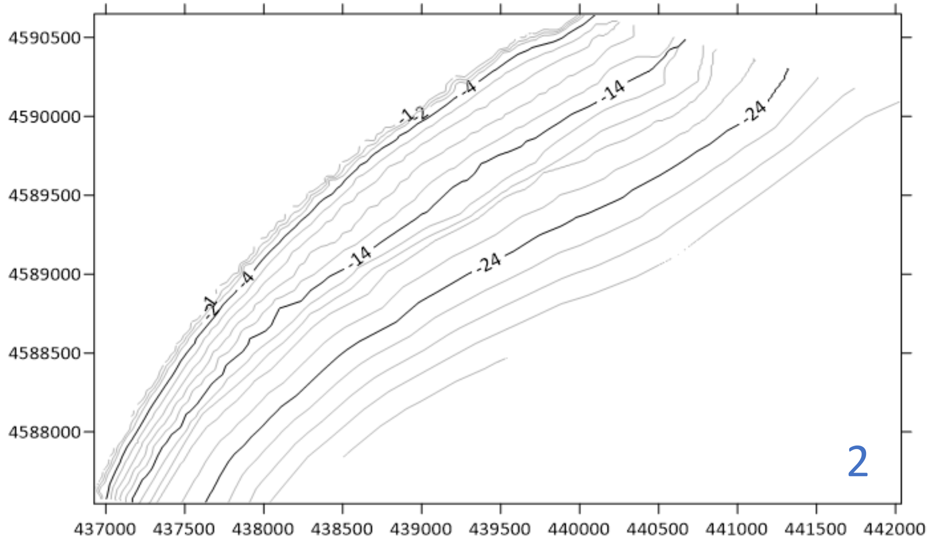
· Attempt to include the most common coastal archetypes of the Catalan coast



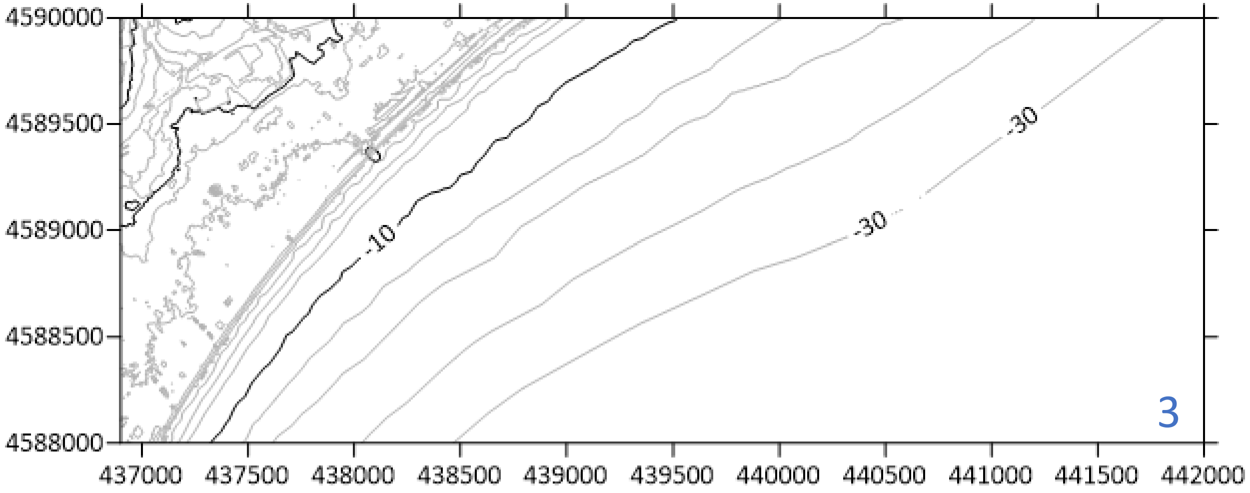
METHODOLOGY

STEP II. Morphobathymetry generation





1. Topography (5x5m)
2. Bathymetry (Isolines)
3. Final grid (combination, 10x10m)



METHODOLOGY

STEP II. Definition of physical parameters

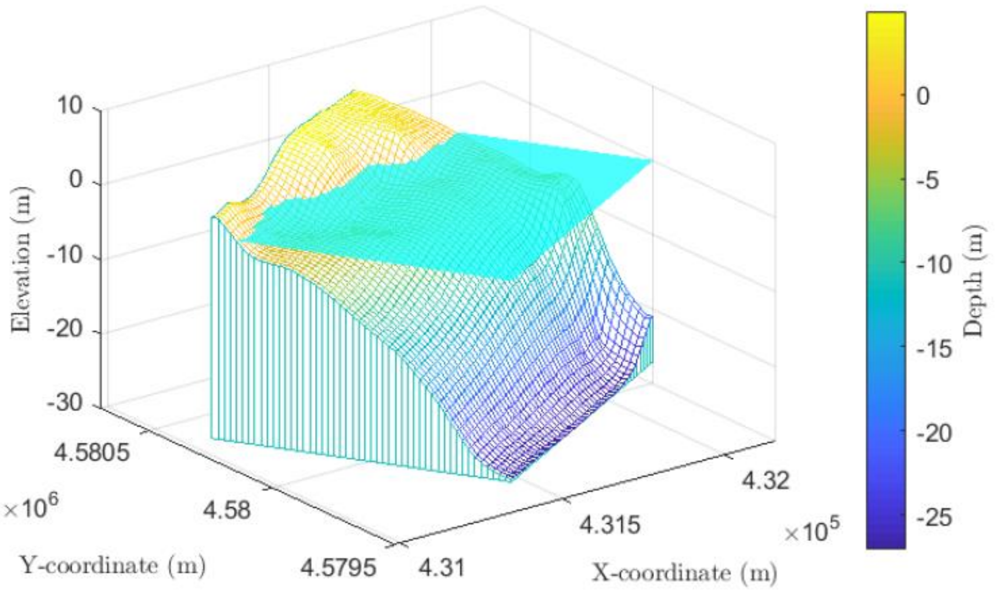
· MWL from IPCC and OCCC
· Wave conditions calculated using POT method
· Granulometry from “Llibre Verd Costa Catalana”

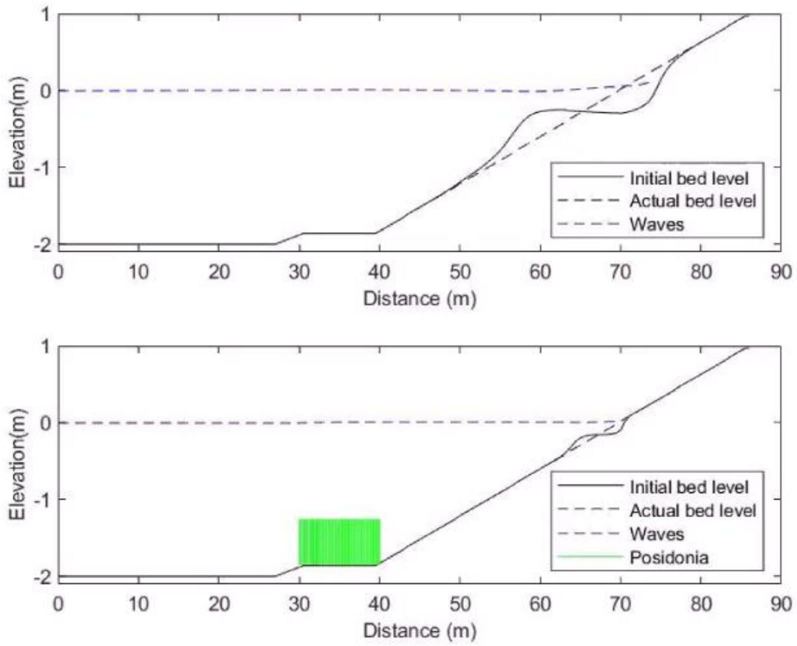
	Tr	Tram	Point	Lat	Long	Dir Normal	Arc Dir	Hs (m)	Tp (s)	Dir	MWL (m)	d50 (mm)	Beach	Num Platges
Present	50	7	Cat11	41.0833 N	1.75 E	SSE	SW, S, SSE, SE, ESE, E	2,5	8,3	S	0	0,2	13, 14, 15, 16, 17, 18, 19, 20, 21 i 22	10
	100	7	Cat11					3,56	9,3	SSW	0	0,2		
	500	7	Cat11					4,06	9,7	SSW	0	0,2		
RCP4.5	50	7	Cat11					3,62	9,7	SSW	0,55	0,2		
	100	7	Cat11					3,84	9,9	SSW	0,55	0,2		
	500	7	Cat11					4,37	10,3	SSW	0,55	0,2		
RCP8,5	50	7	Cat11					3,5	9,4	SSW	0,84	0,2		
	100	7	Cat11					3,72	9,6	SSW	0,84	0,2		
	500	7	Cat11					4,24	10,1	SSW	0,84	0,2		

METHODOLOGY

STEP III. XBeach model

"XBeach is an open-source numerical model which is originally developed to simulate hydrodynamic and morphodynamic processes and impacts on sandy coasts with a domain size of kilometers and on the time scale of storms. Since then, the model has been applied to other types of coasts and purposes."

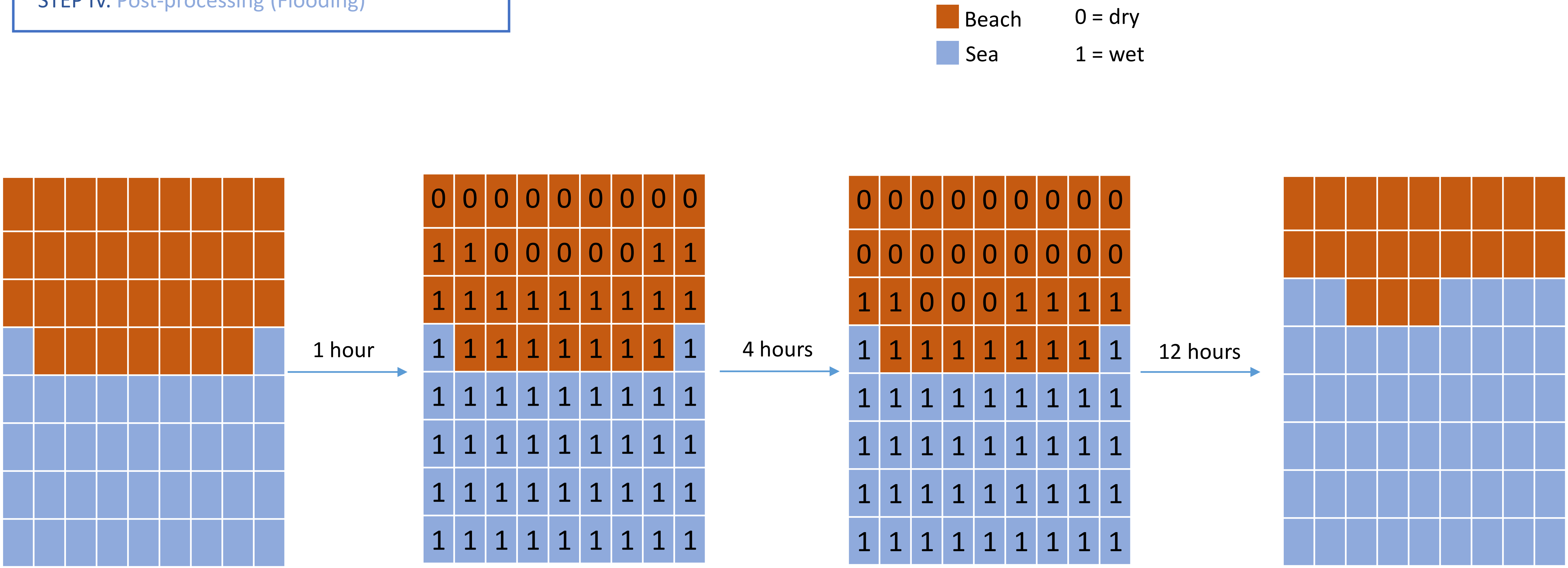




Examples of post-processed XBeach outputs.

METHODOLOGY

STEP IV. Post-processing (Flooding)



* If during the 12 hours simulation, some point has a 1 more than 4 hours, then is considered as wet

METHODOLOGY

STEP IV. Post-processing (Erosion)

· Comparison of level 0m at the start and at the end of the simulation.

· Since climate change will change the water level, also the level associate to each scenario is also studied.

· Present = 0m RCP4.5 = 0.85m RCP8.5 = 1.14m

METHODOLOGY

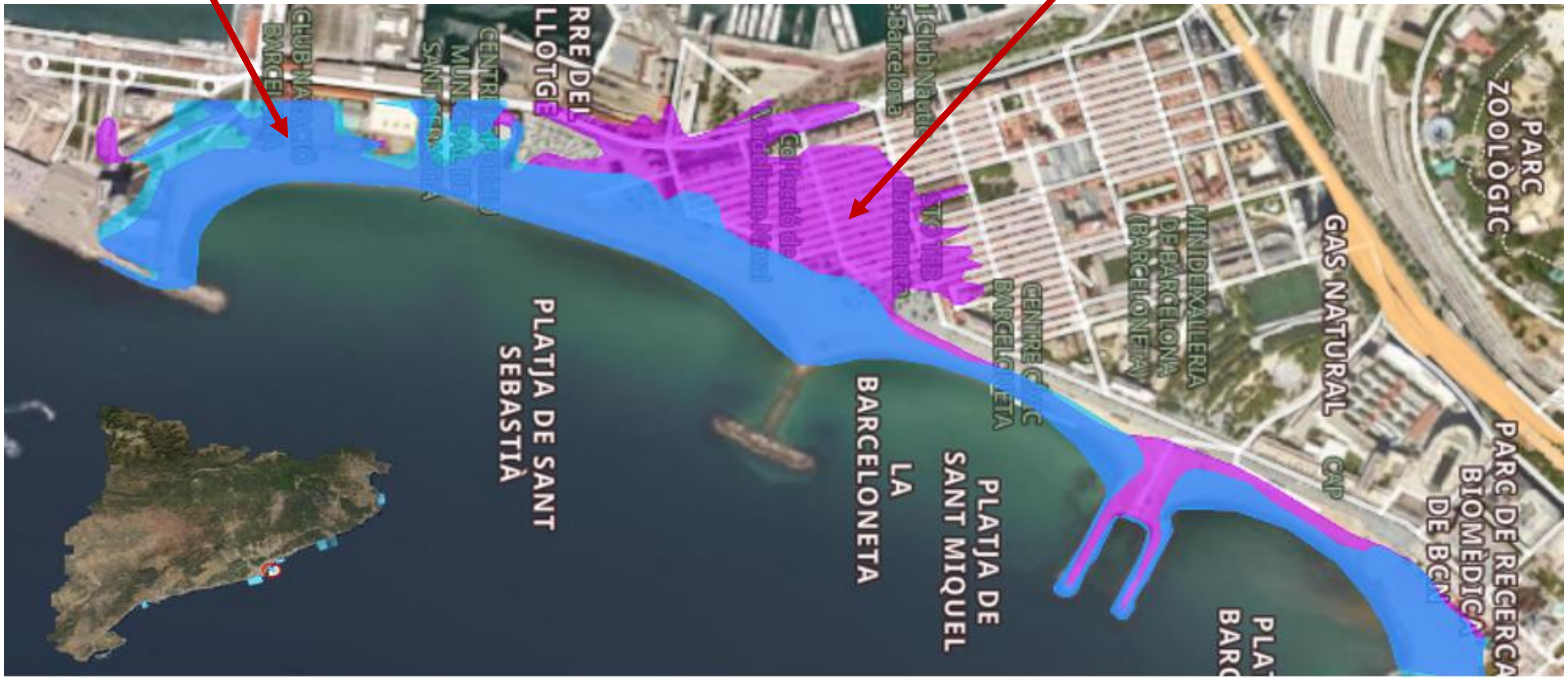
STEP V. Visualization

· Results can be seen in the viewer developed by ICGC (https://visors.icgc.cat/PIMA-AdaptaCostas/)

RESULTS AND DISCUSSION (FLOODING)

Beach completely flooded, even some part of the promenade.

Water intrusion into the city, high flood.



Present MWL and500 years wave return period

MWL RCP8.5 and 500 years wave return period

RESULTS AND DISCUSSION (FLOODING)

Channel of sea water entering the stream.

Channel of sea entering the lagoon.

- Present MWL and500 years wave return period
- MWL RCP8.5 and 500 years wave return period

RESULTS AND DISCUSSION (FLOODING)

Channel of sea water entering the stream.

Beach completely flooded, even some part of the fields.

Present MWL and500 years wave return period

MWL RCP8.5 and 500 years wave return period

RESULTS AND DISCUSSION (EROSION)

- Present MWL and 500 years wave return period
- RCP4.5 and 500 years wave return period
- RCP8.5 and 500 years wave return period

Only changes in MWL affect the coastline retreat significantly.

The inclusion of other cases in the Figure only would just add more confusion without giving any relevant information.

RESULTS AND DISCUSSION (EROSION)

Other examples where in this case, even with the increasing of the MWL, the changes are not significant.

Explained with the morphology of the beach, the the morphology dominates the dynamics.

RCP4.5 and 500 years wave return period

RCP8.5 and 500 years wave return period

CONCLUSIONS

· Climate change will have huge importance in the beach dynamics of the future.

· It is necessary to create mitigation strategies as soon as possible, especially for the lowest slope areas.

· The characterisation of some parts of the Catalan coast using morphodynamical models has resulted an interesting tool to predict the possible consequences in terms of flooding and erosion impacts.

· The definition of flooding impacts as polygons and coast retreat as lines would help the administration to understand and situate the problem, facilitating to decide which actions they would implement.

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