

CONFERENCE ON COASTAL RISKS
Rabat, 23-24 April 2019



Human impact on mixed sand and gravel Mediterranean deltas: insights from the Guadalfeo case study (Southern Spain)

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ScolaMAR
Erasmus+ Capacity building 

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Motivation

Transition between fluvial & maritime environments

Rapid response to natural and human-induced changes



River damming



Coastal erosion

Massive developments



Motivation





Objective / Study site

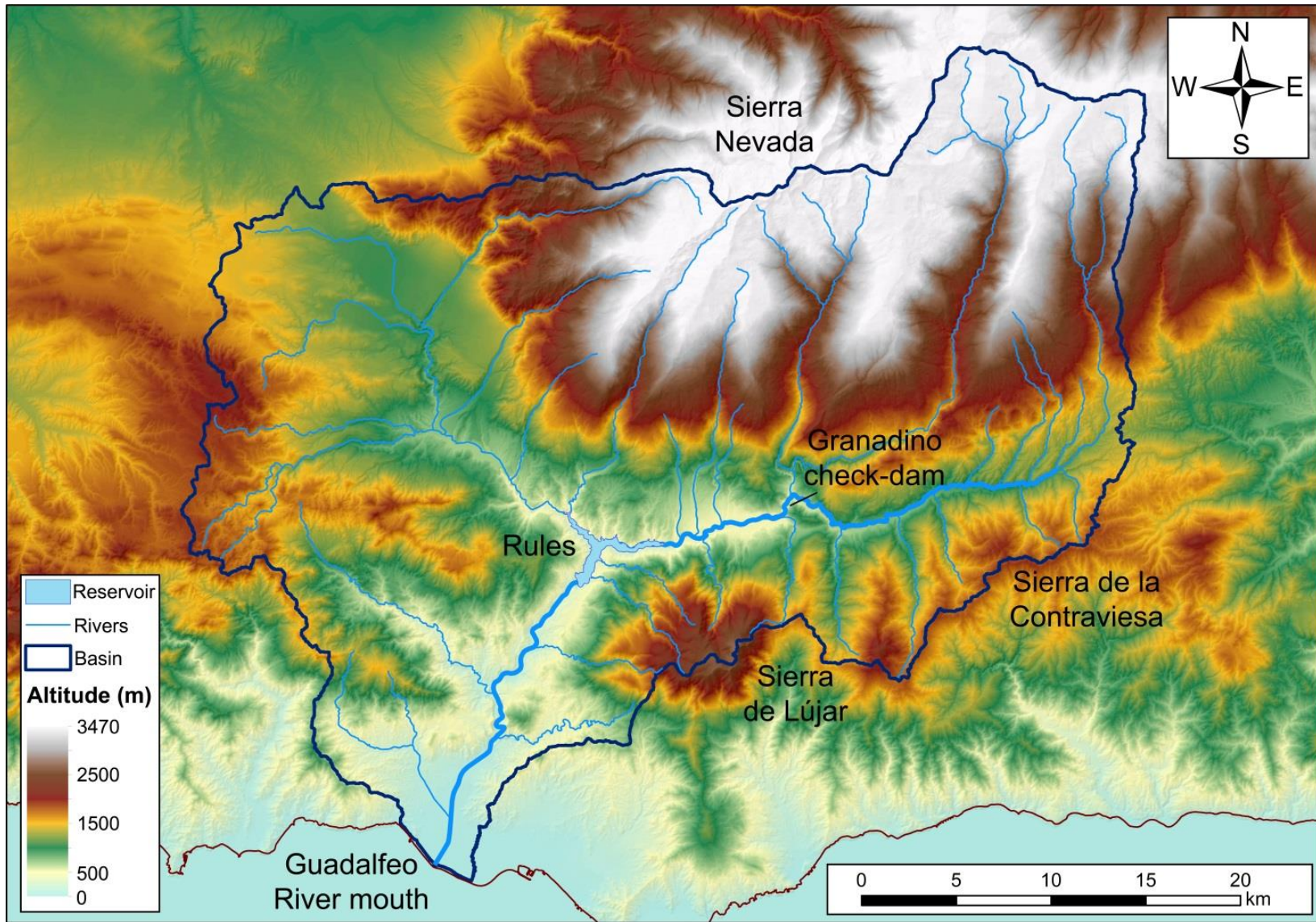
Morphological & urban evolution of Guadalfeo Delta (southern Spain)

Impact of river damming

Diagnosis of the situation & consequences



Objective / Study site



AERIAL IMAGES

DATA

MEASUREMENTS

1956

1977

1984

1997

1999

2002

2004

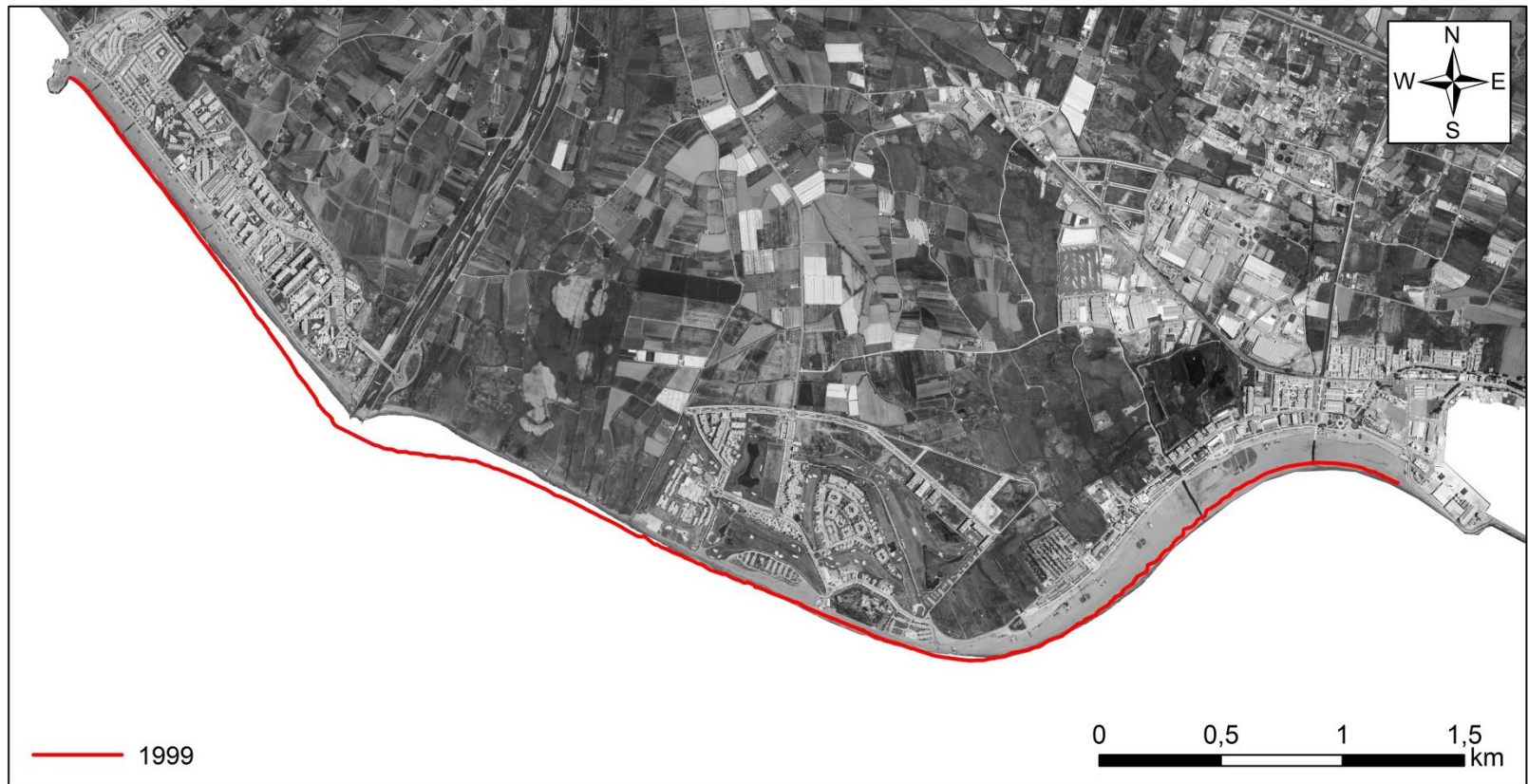
2006

2007

2008

2010

2013



Resolution: 0.5 m/pixel

Evolution of the coastline position and the built area

AERIAL IMAGES

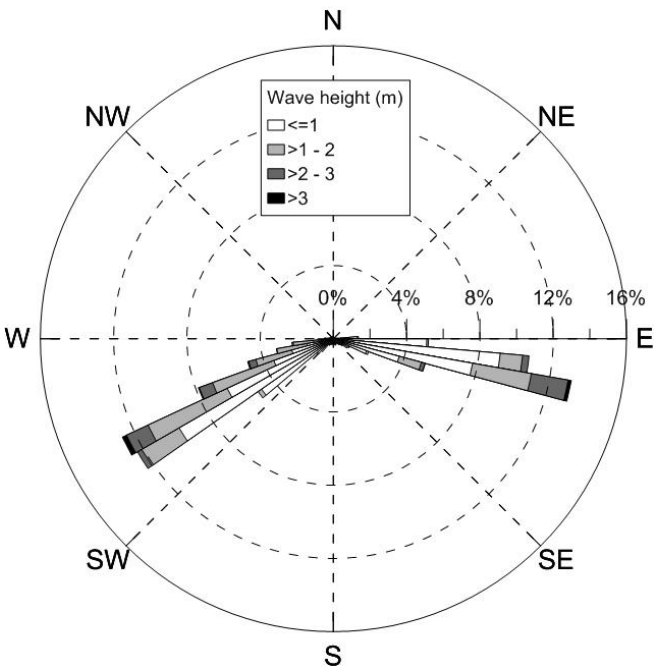
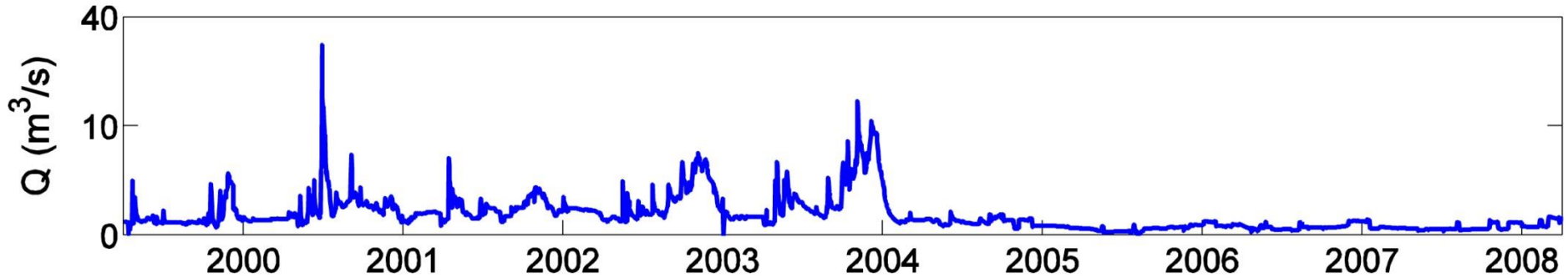
DATA

MEASUREMENTS

Precipitation & Flow

1999-2008

Wave climate



From 5 years before the entry into operation of the dam to 4 years afterwards.

Wave climate: Significant deep-water wave height, peak wave period and wave direction.

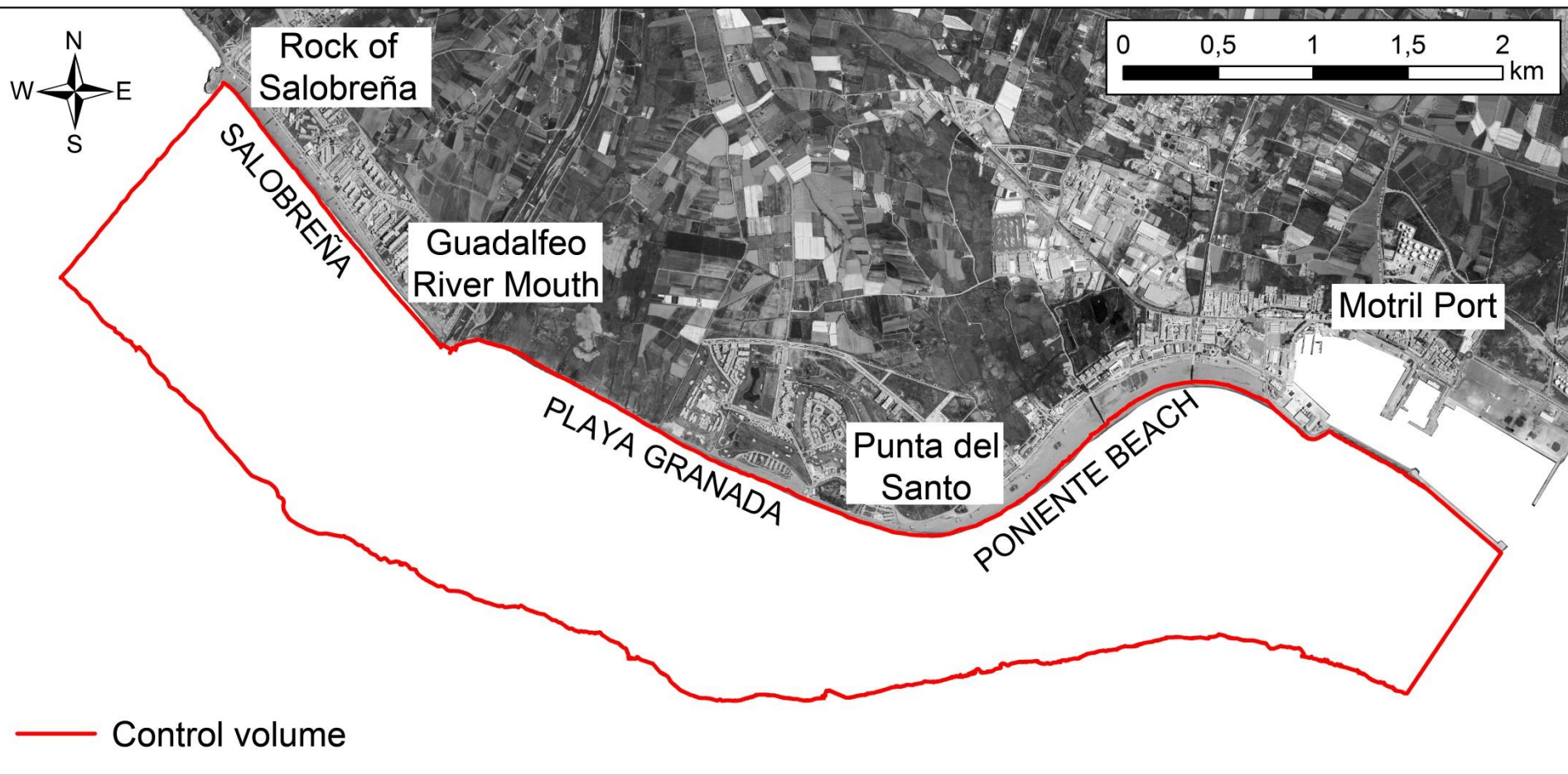
AERIAL IMAGES

DATA

MEASUREMENTS

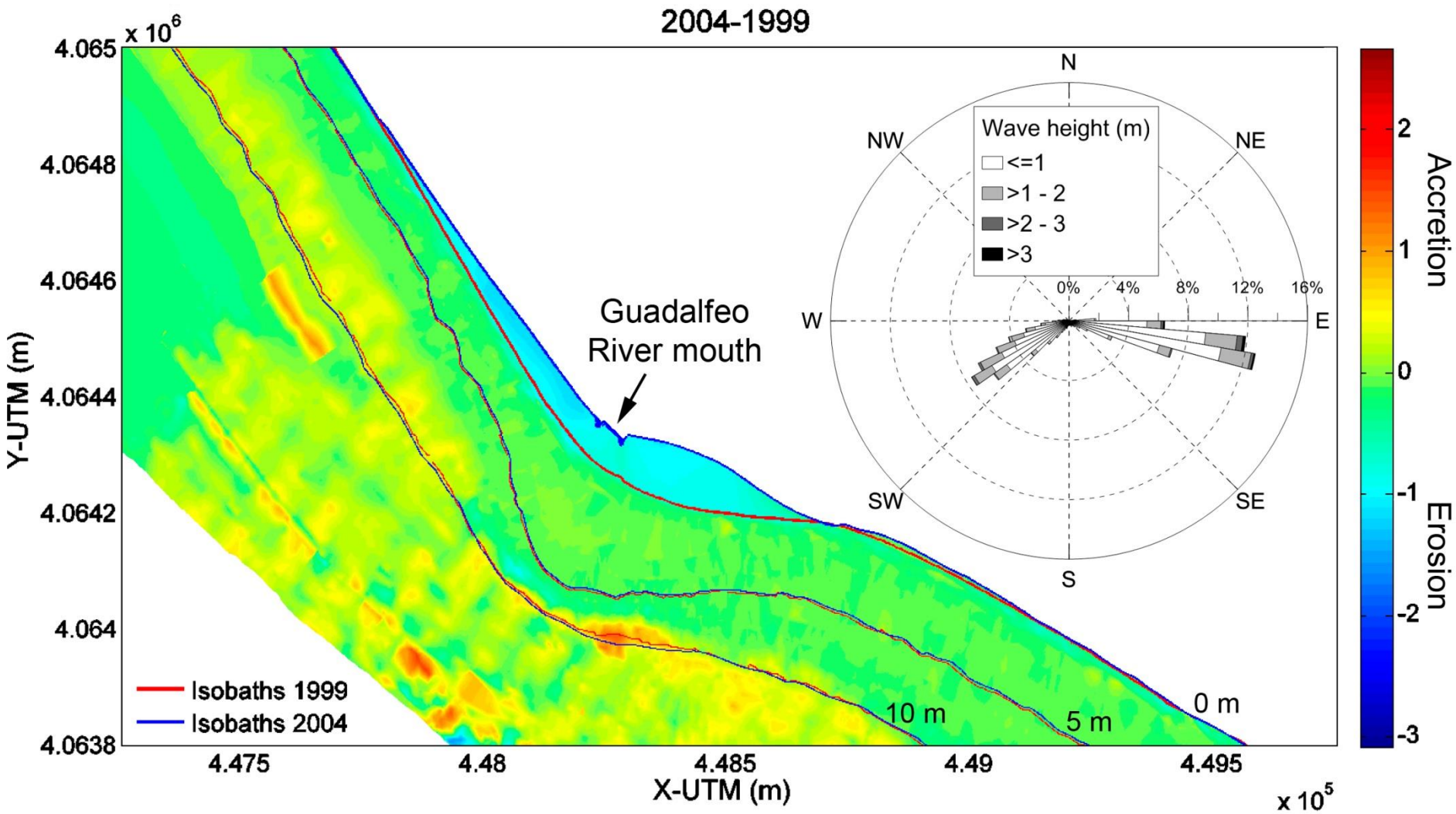
Bathymetries + Topographies (1999, 2004, 2008, 2014)

Changes in sediment volume - evaluate impact of river damming on the coast



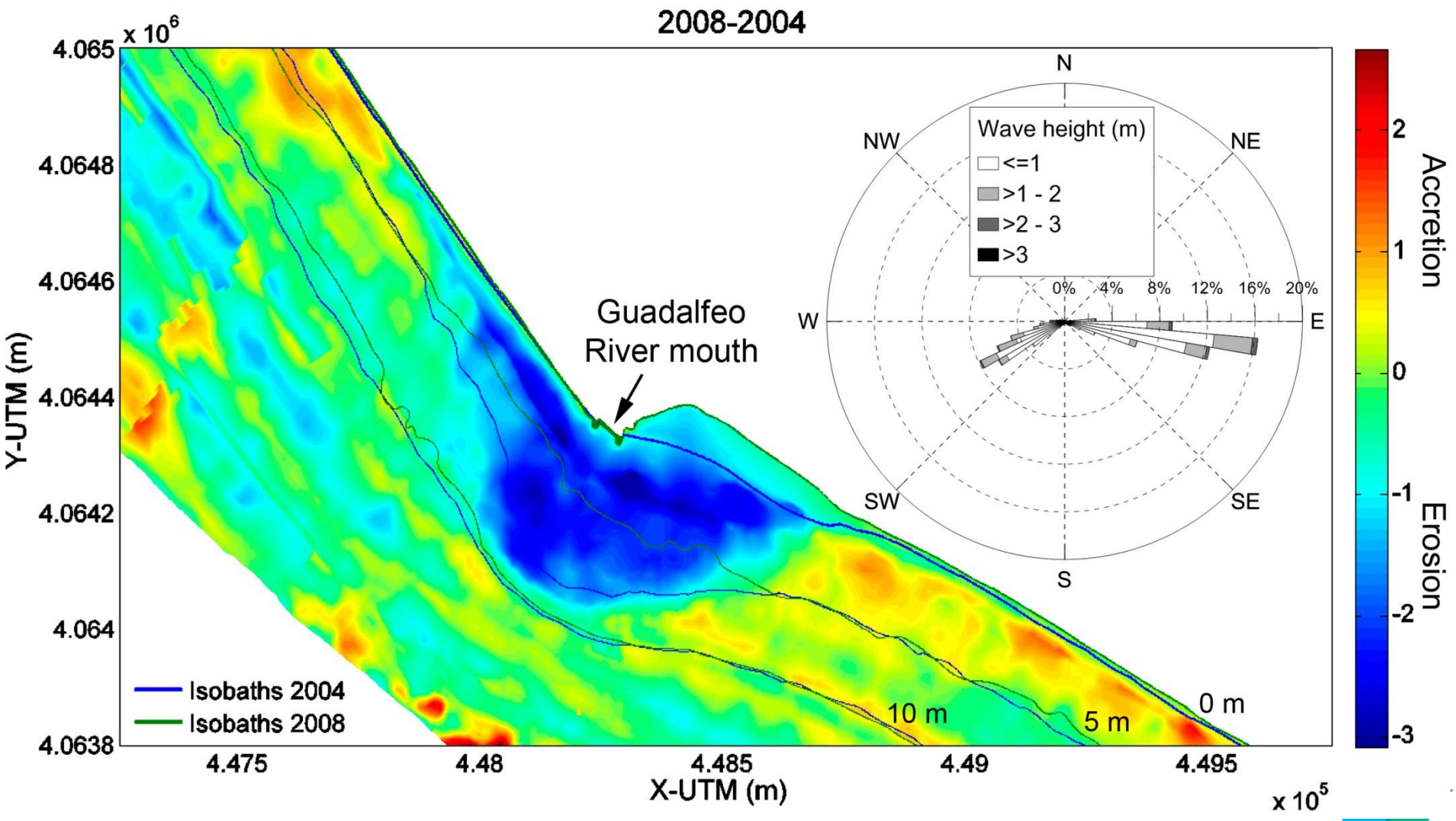
Evolution of the delta

Before the dam: small changes



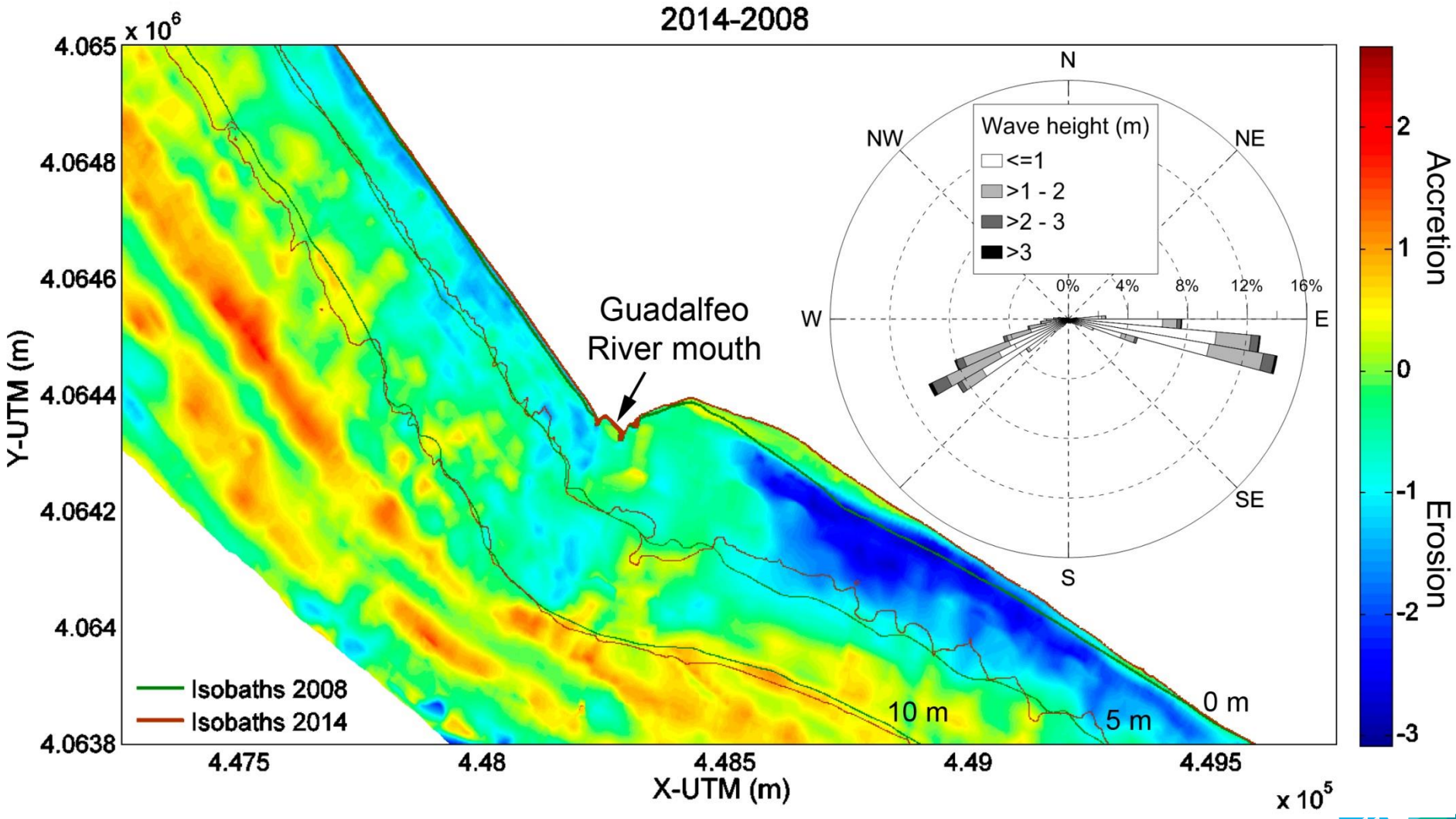
Evolution of the delta

After the dam: massive erosion around the mouth

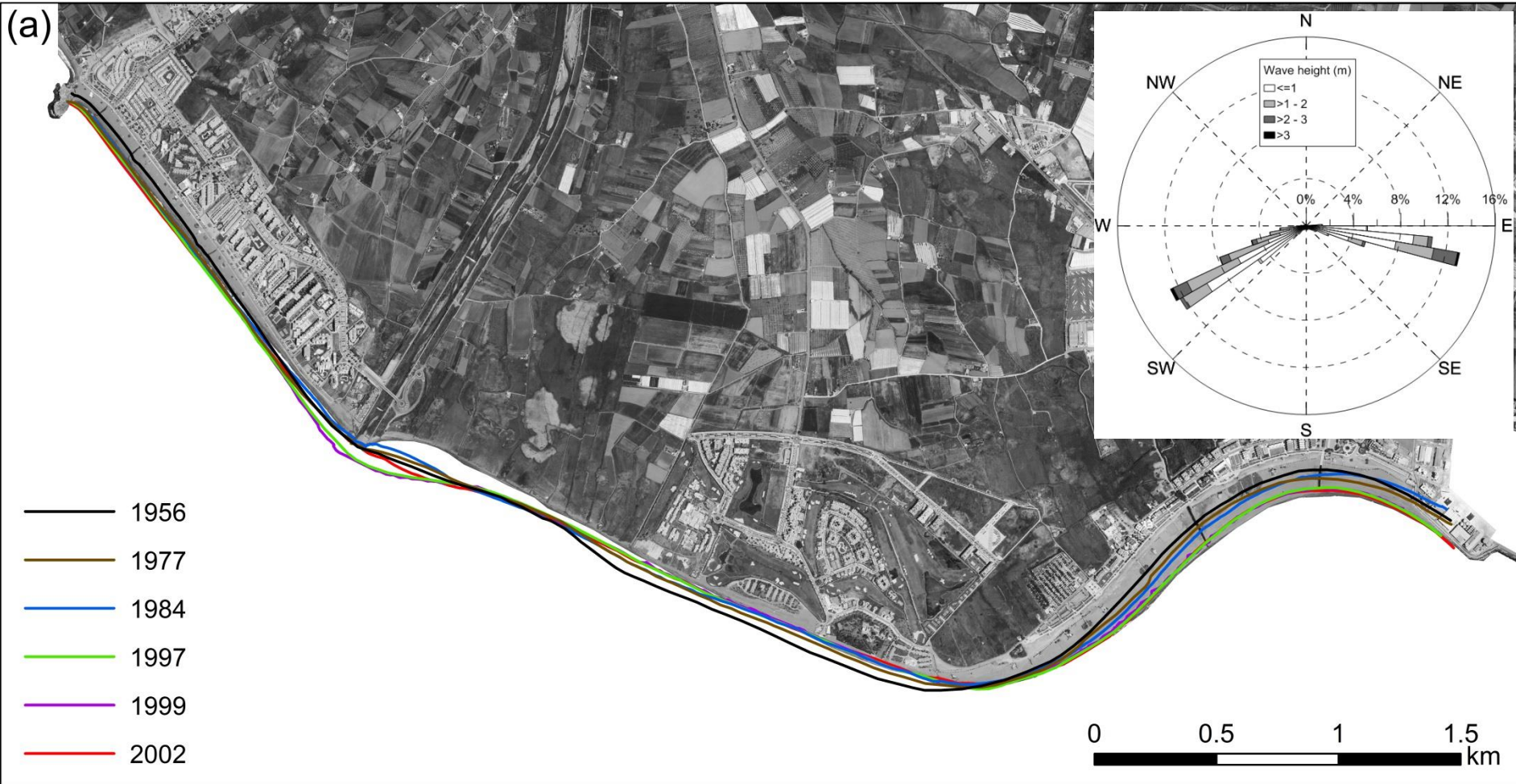


Evolution of the delta

After the dam: progradation of the erosion towards the east



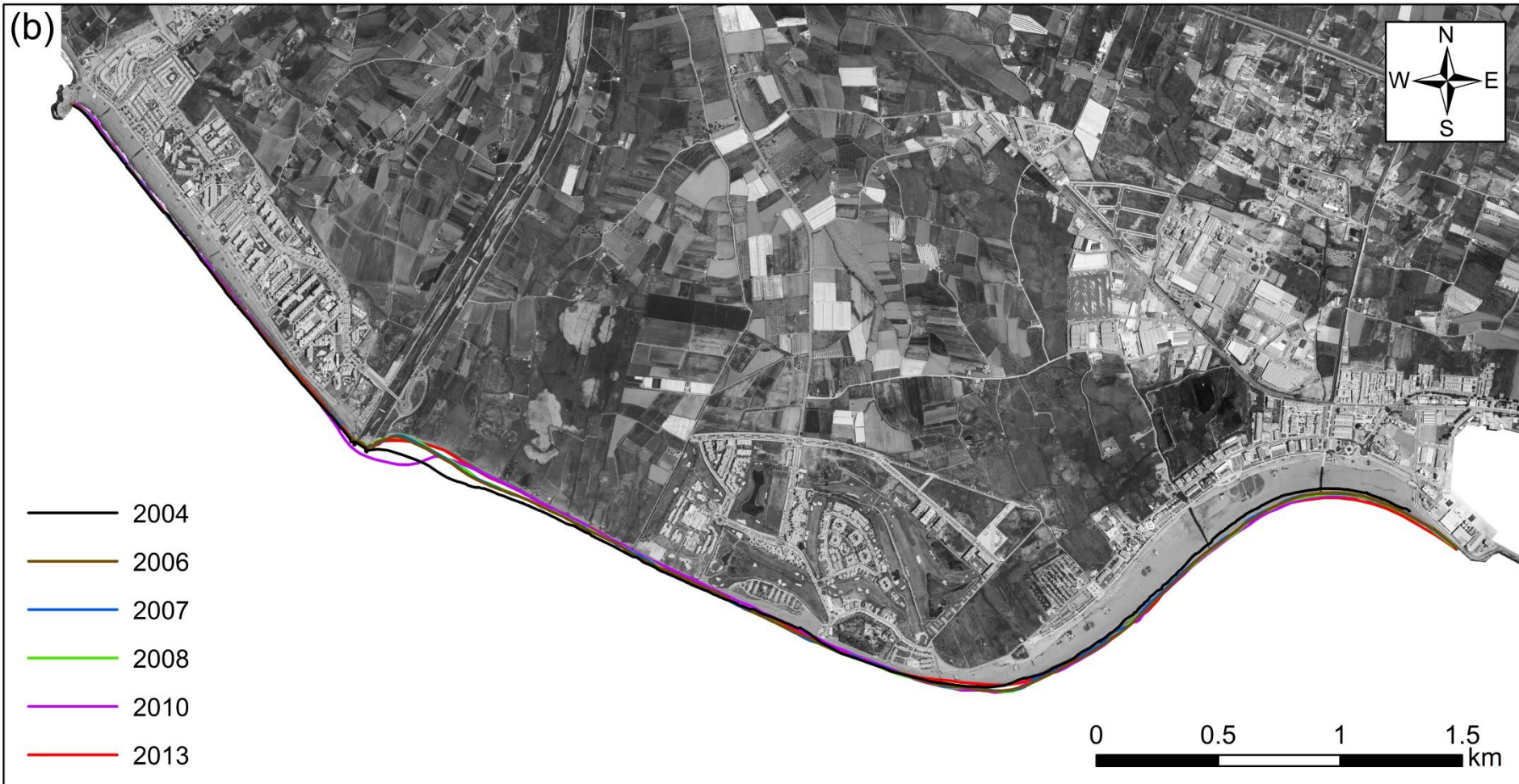
Coastline evolution



Erosion in the western section Vs accretion in the eastern section

Beach extension increased about 150000 m² between 1956 and 2004

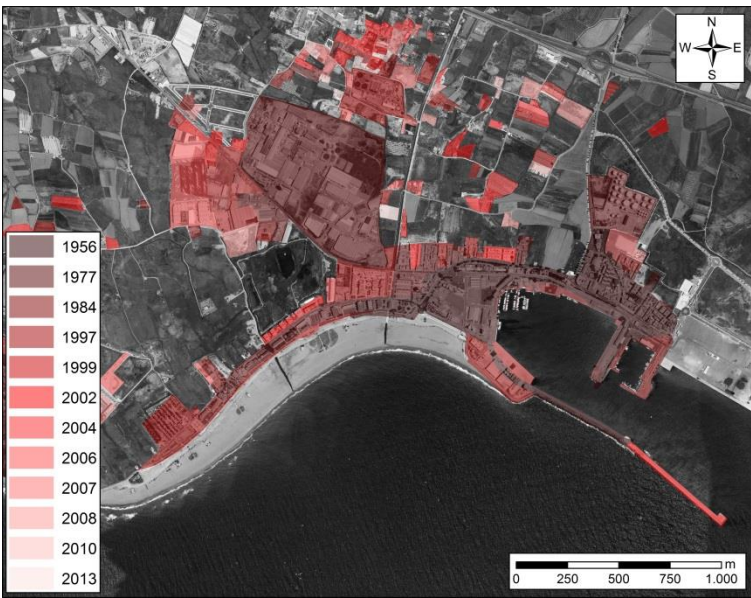
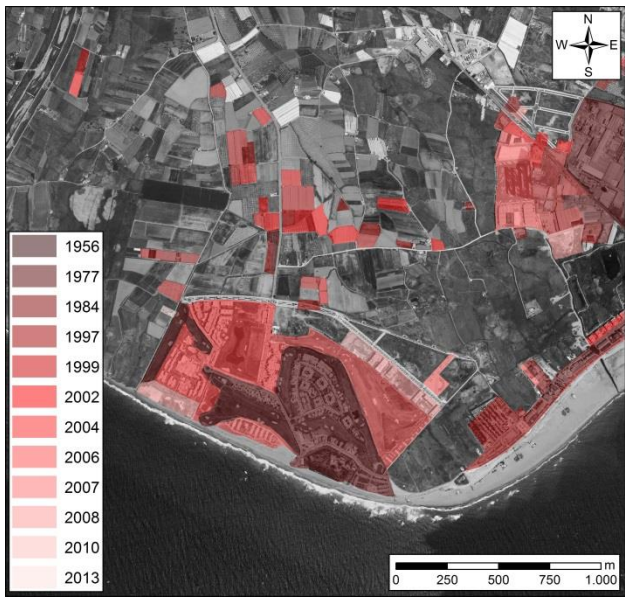
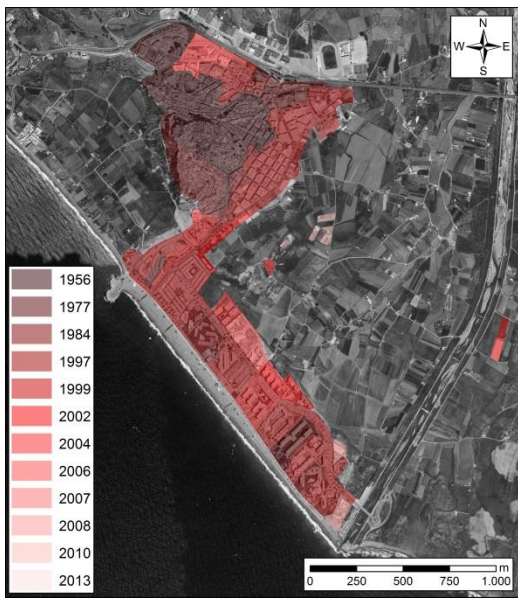
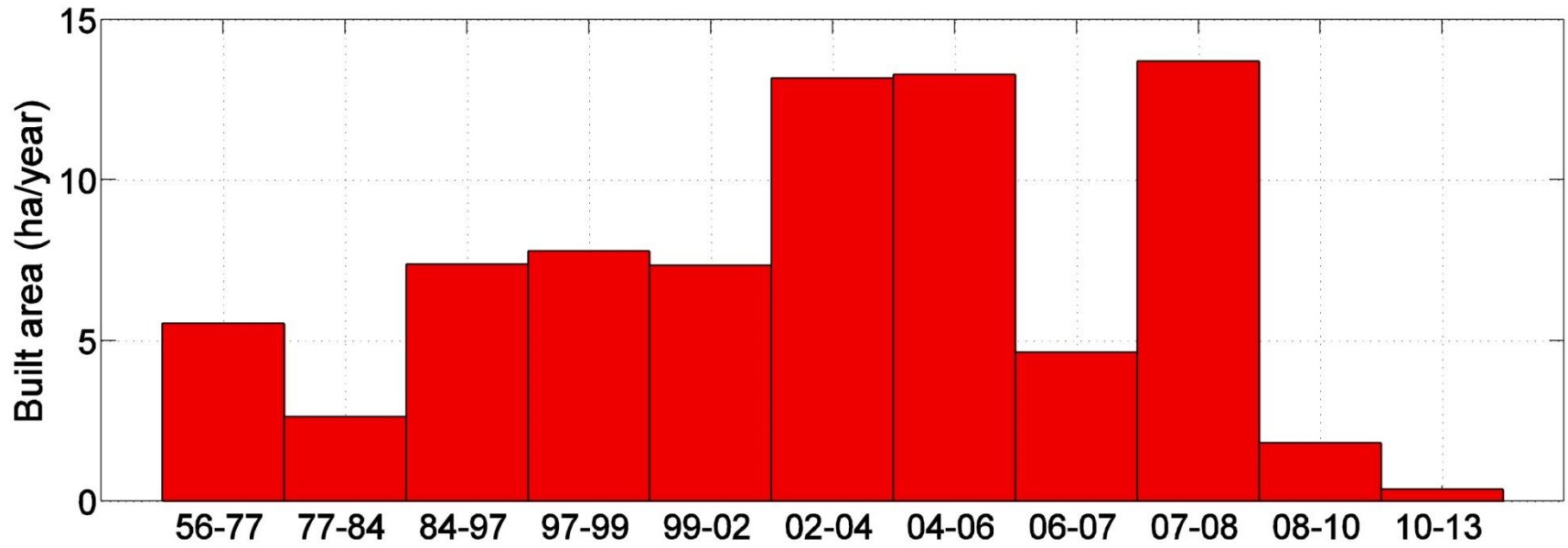
Coastline evolution



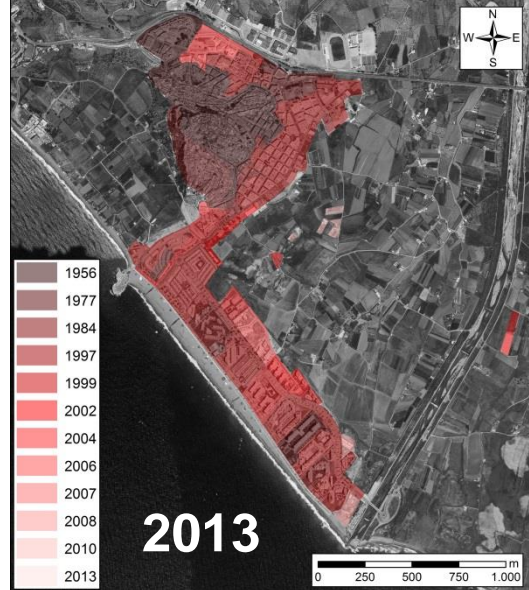
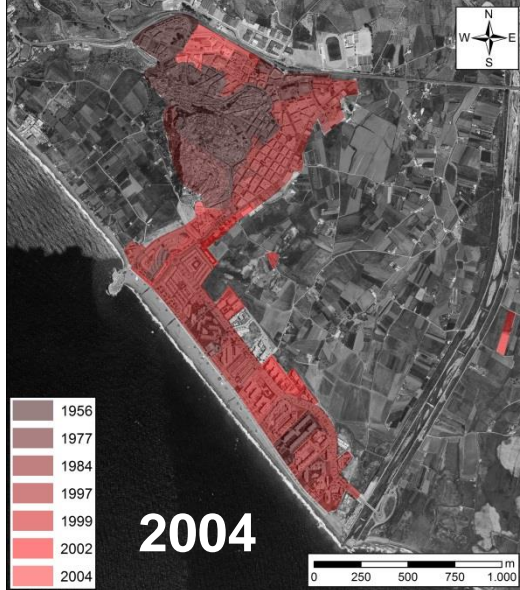
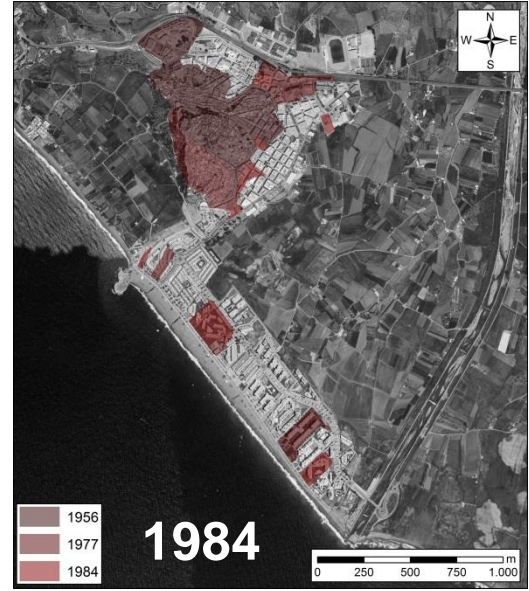
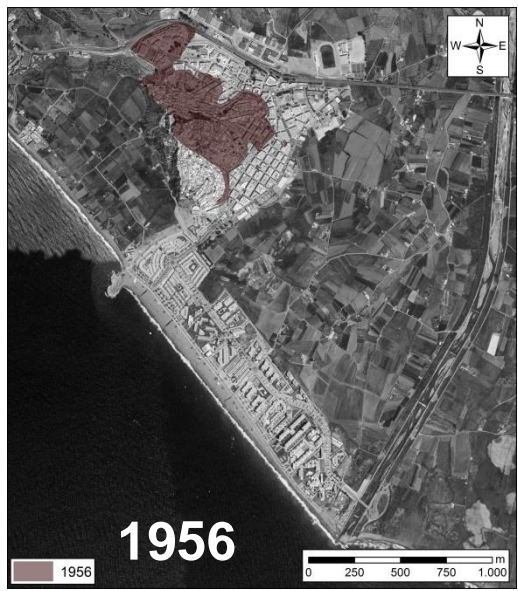
Beach extension decreased about 43000 m^2 after 2004

Average retreat = 6 m // Maximum retreat = 87 m (92%)

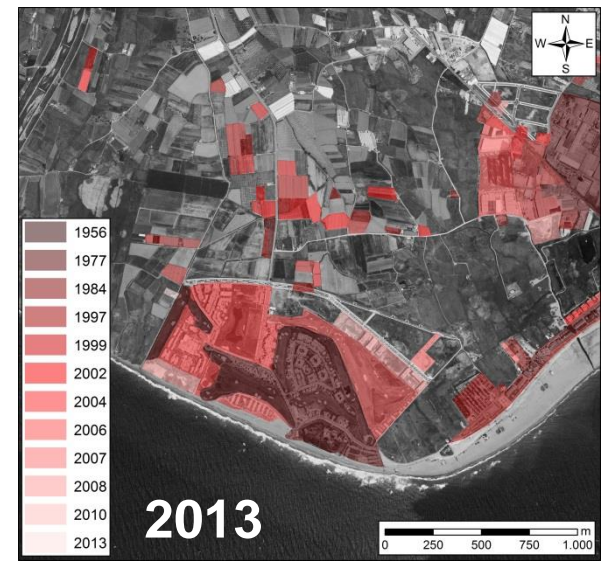
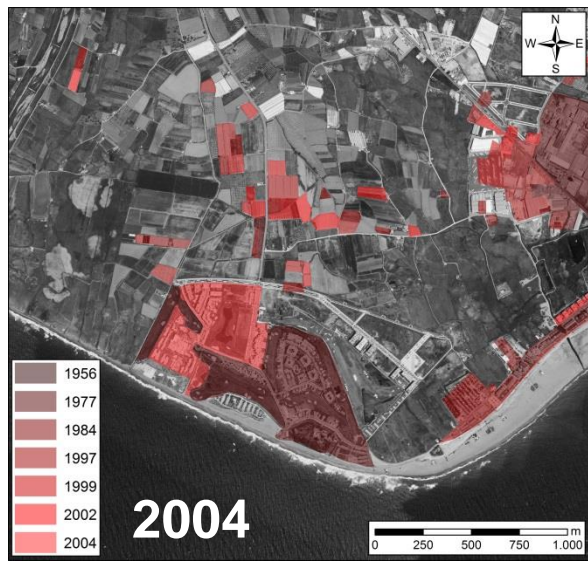
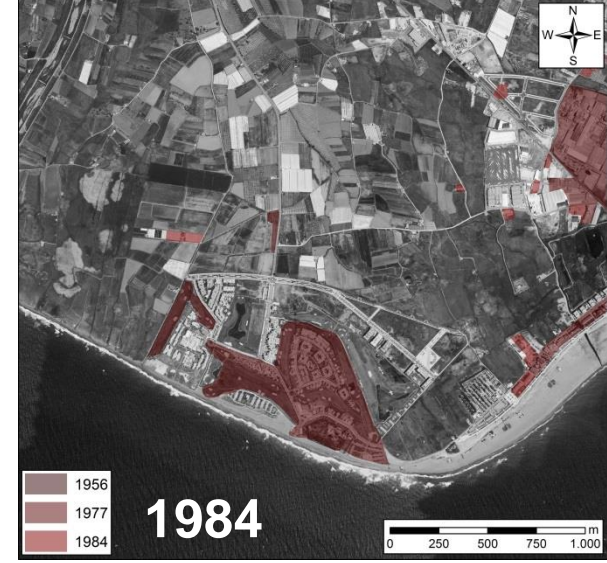
Urban evolution – Total built area



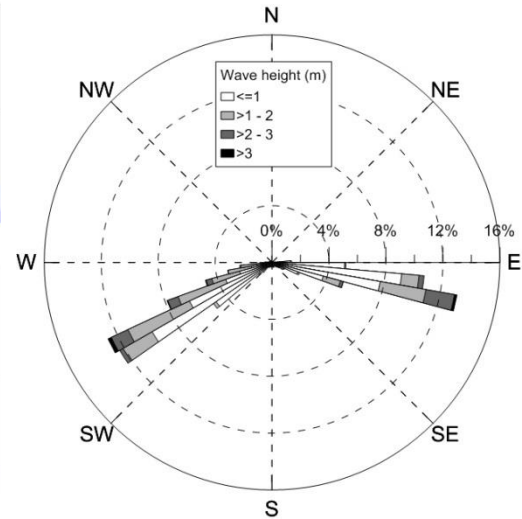
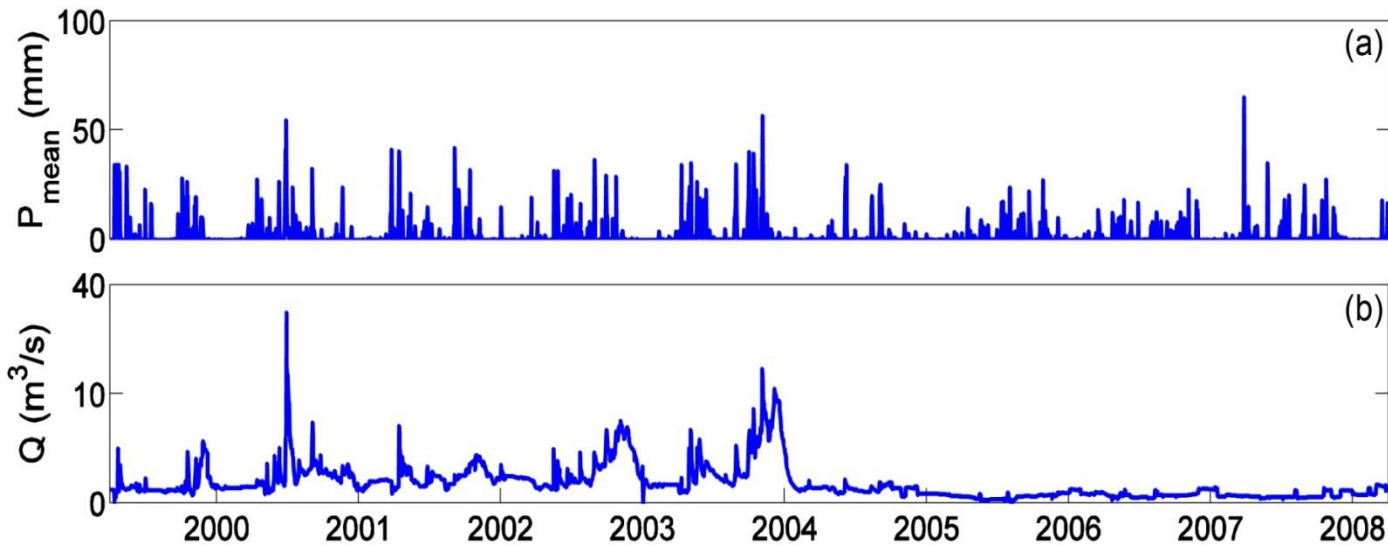
Urban evolution – Salobreña



Urban evolution – Playa Granada



Management interventions in the basin – River damming



Storm events – Flow regulated

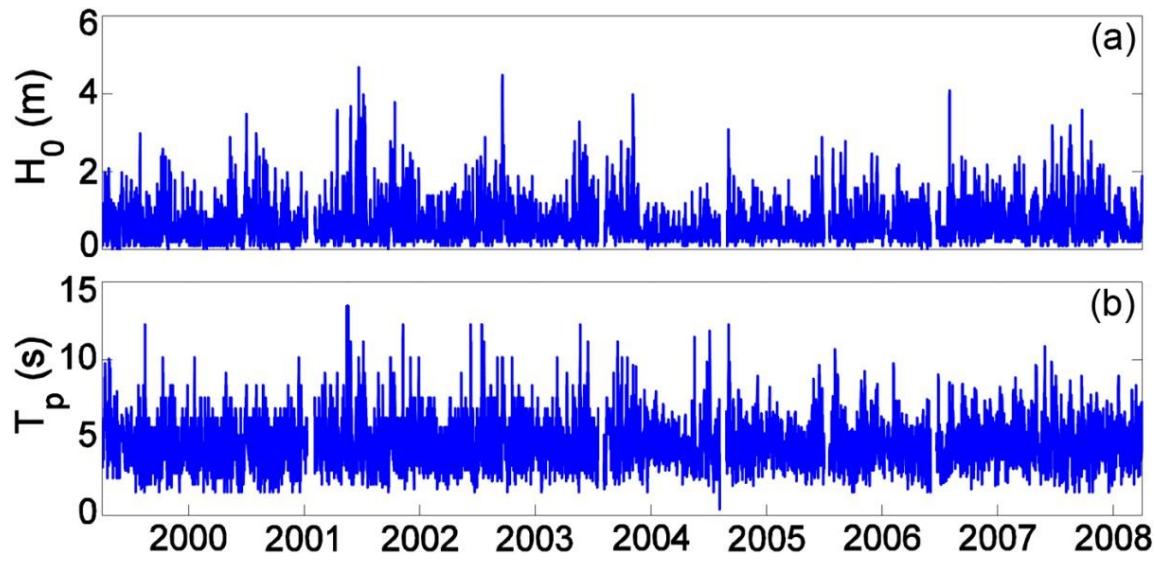
Sediment volumes differences

1999-2004: $+1968 \text{ m}^3$

2004-2008: -394892 m^3

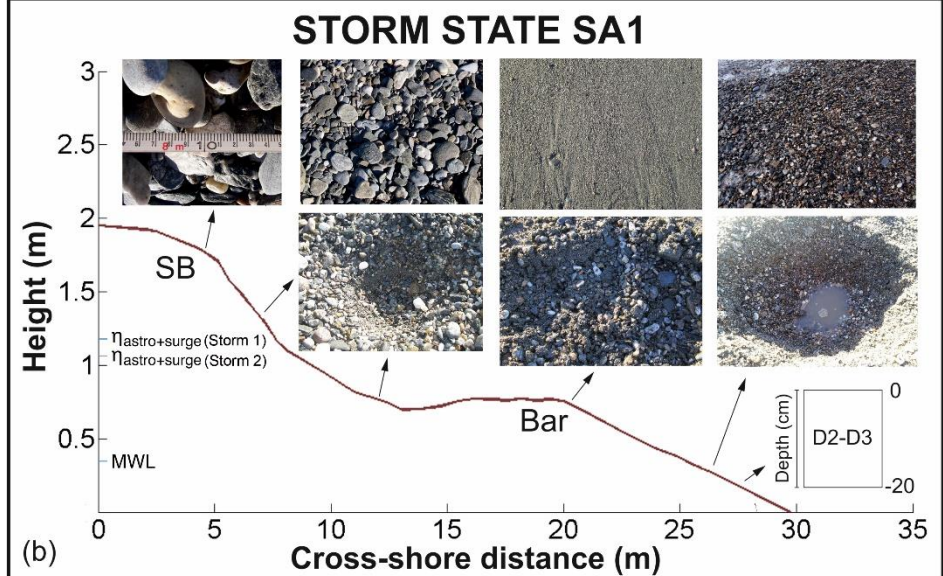
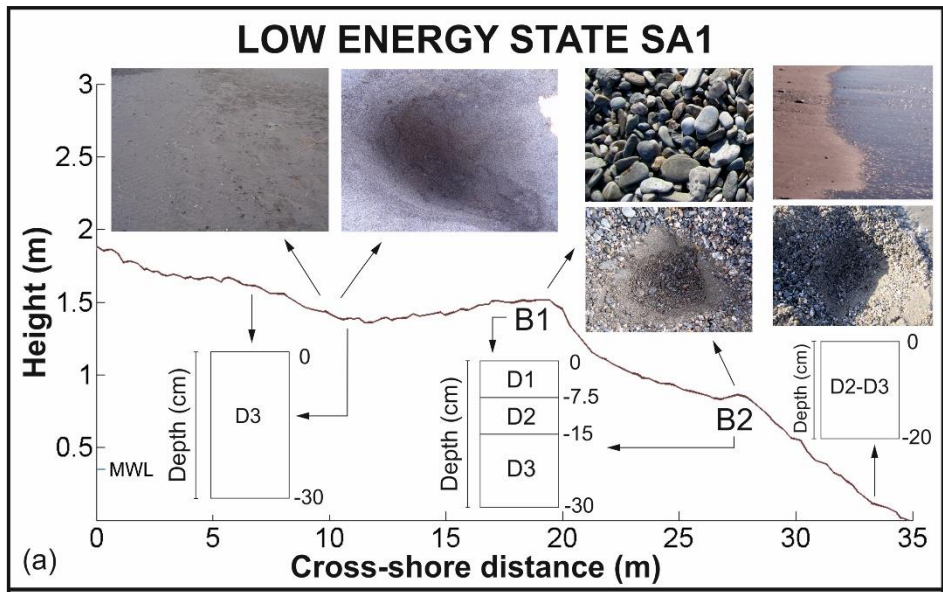
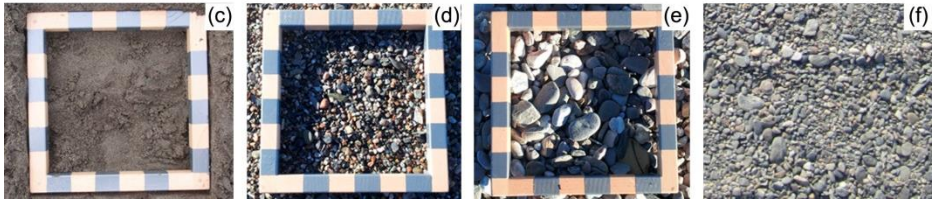
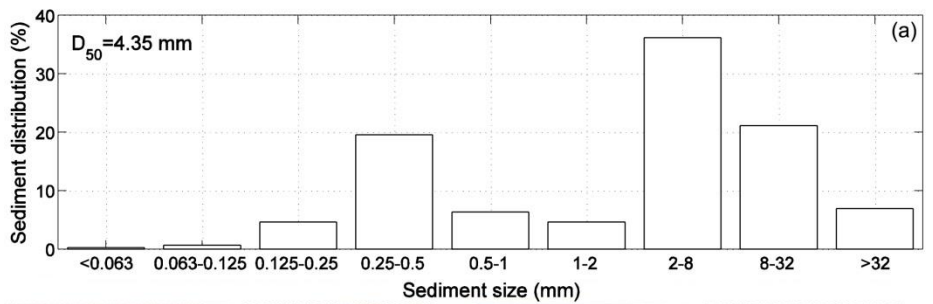
Wave direction:

- Longshore transport
- Coastline shape changes

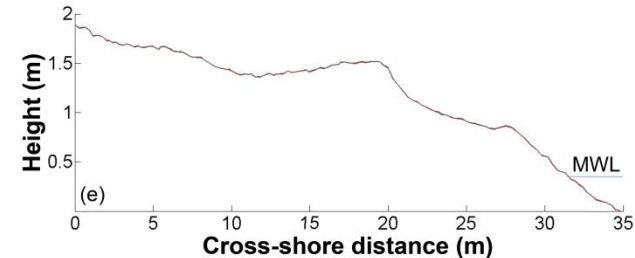
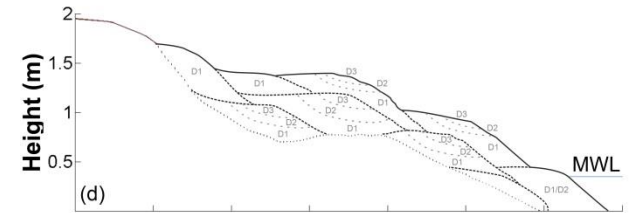
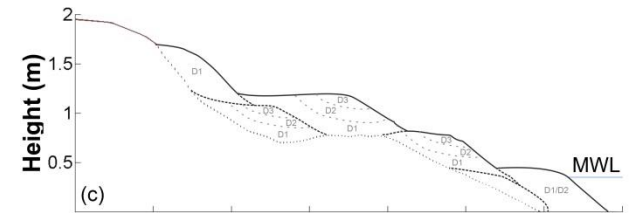
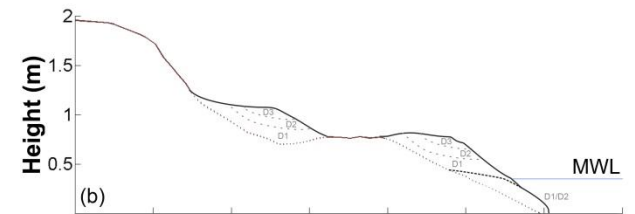
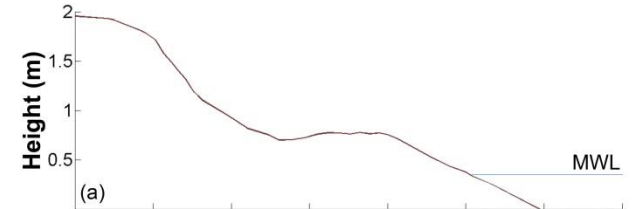
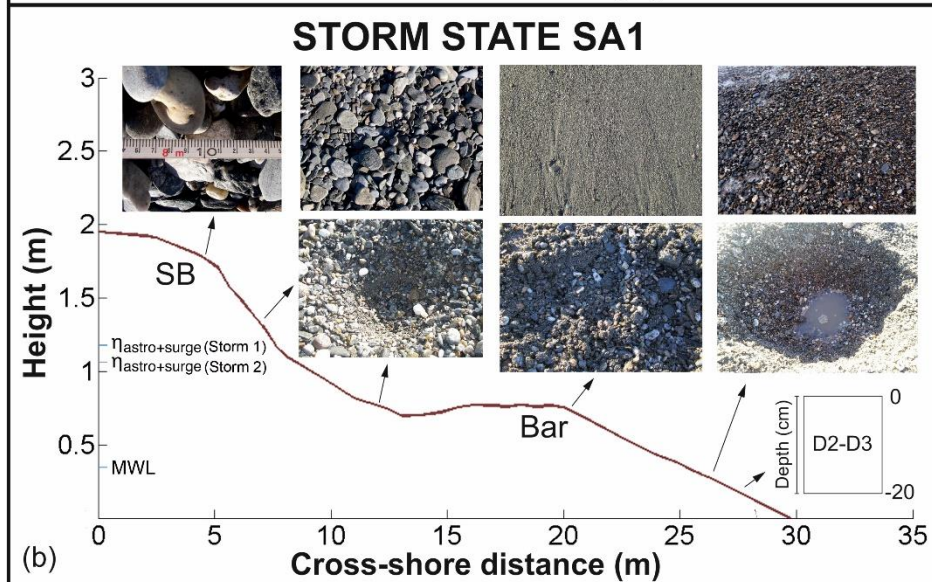
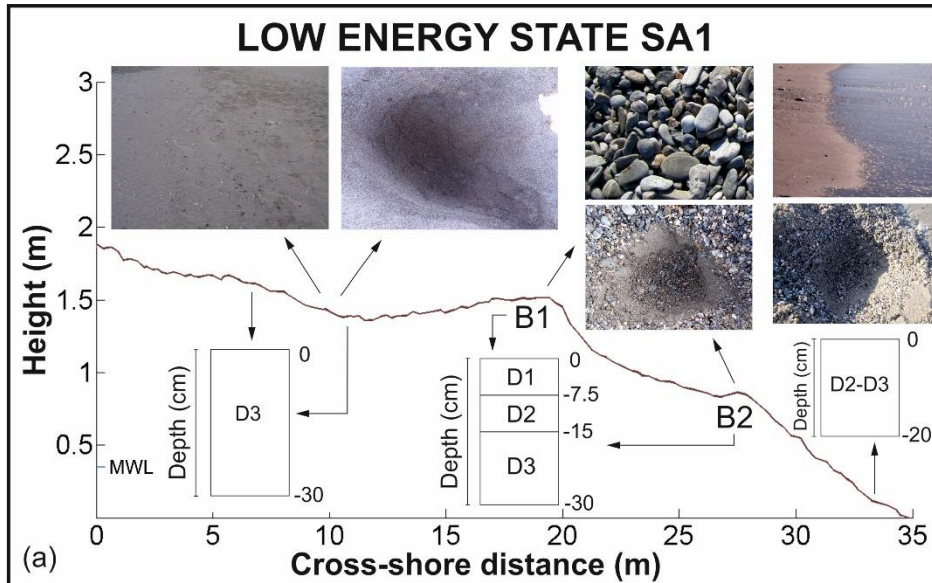


Response of the beach

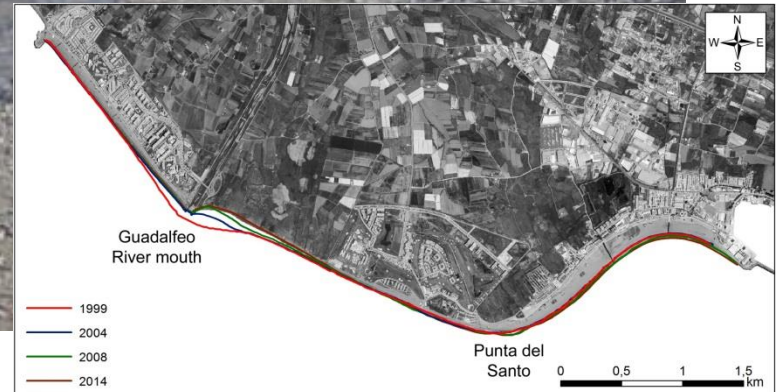
- Sand, fine gravel & coarse gravel
- **Low energy:** convex with multiple berms
- **Storm:** concave/reflective with a single storm berm
- **Storm:** higher percentage of gravel



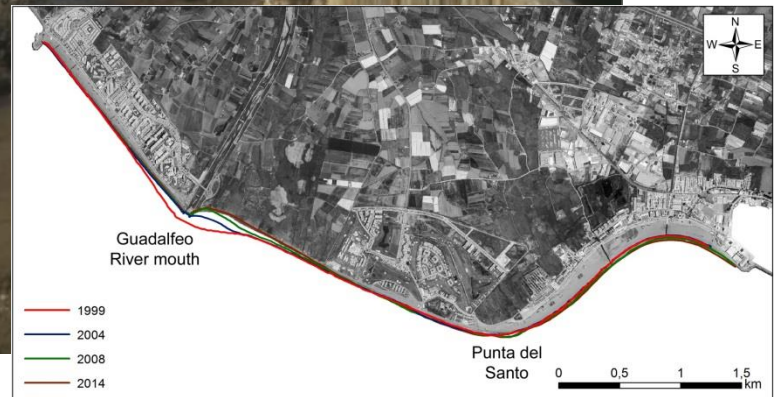
Response of the beach



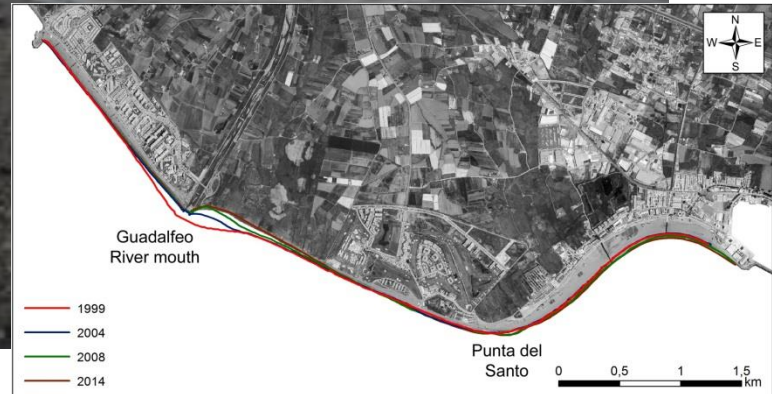
What is happening now?



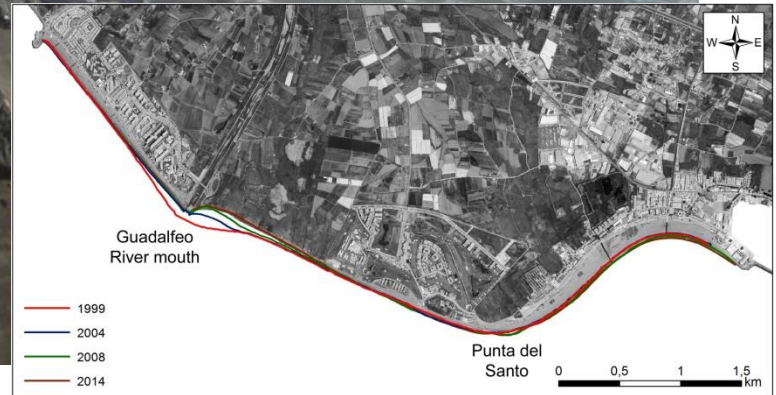
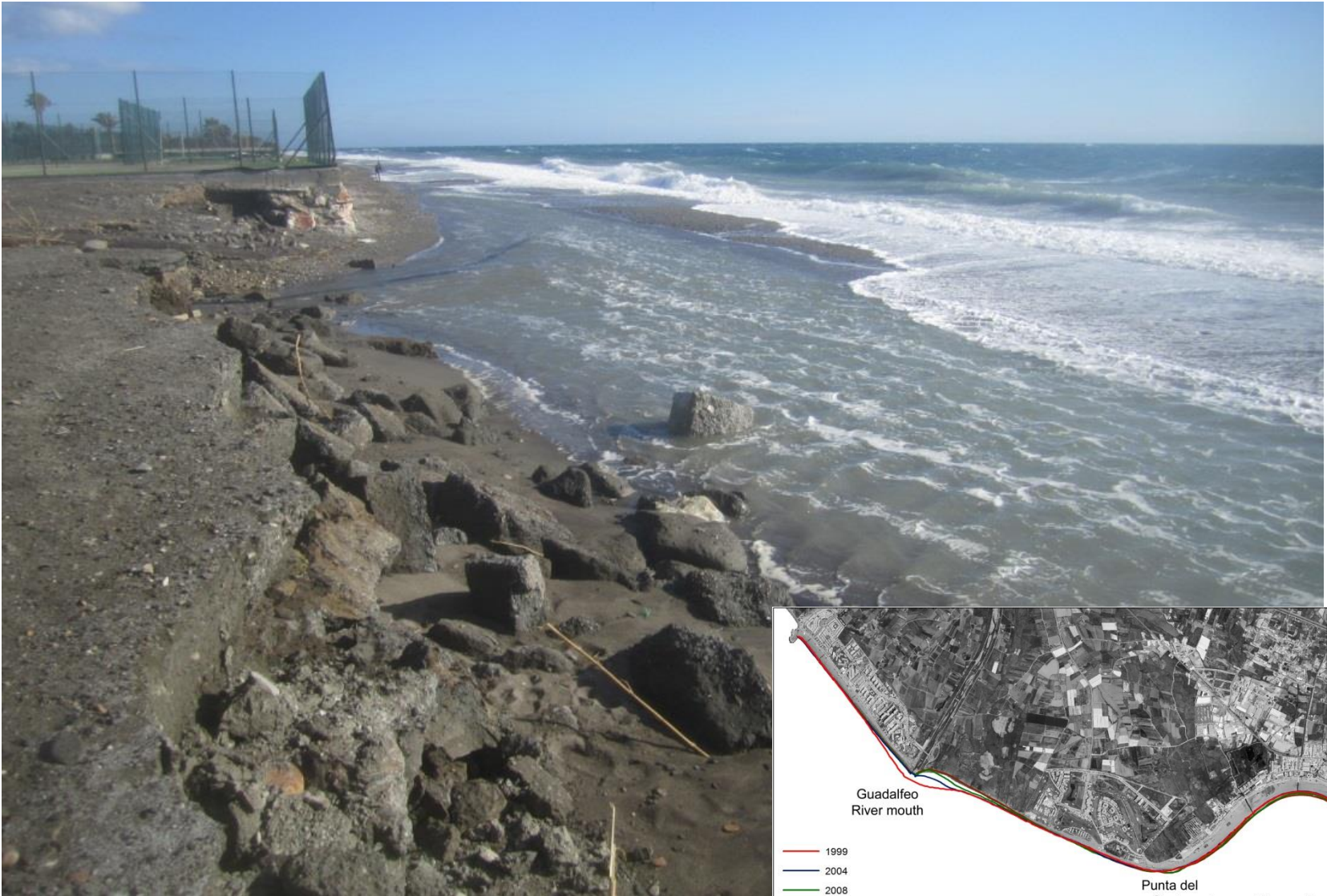
What is happening now?



What is happening now?



What is happening now?



What is happening now?



Solutions?

Costas trabajará en la regeneración de Playa Granada hasta la próxima semana

Las labores de adecuación de esta ribera motrileña arrancaron y se interrumpirán durante el fin de semana para evitar molestias a bañistas y negocios



11 junio 2014
12:20



La alcaldesa de Motril, Luisa García Chamorro, ha anunciado que tras las



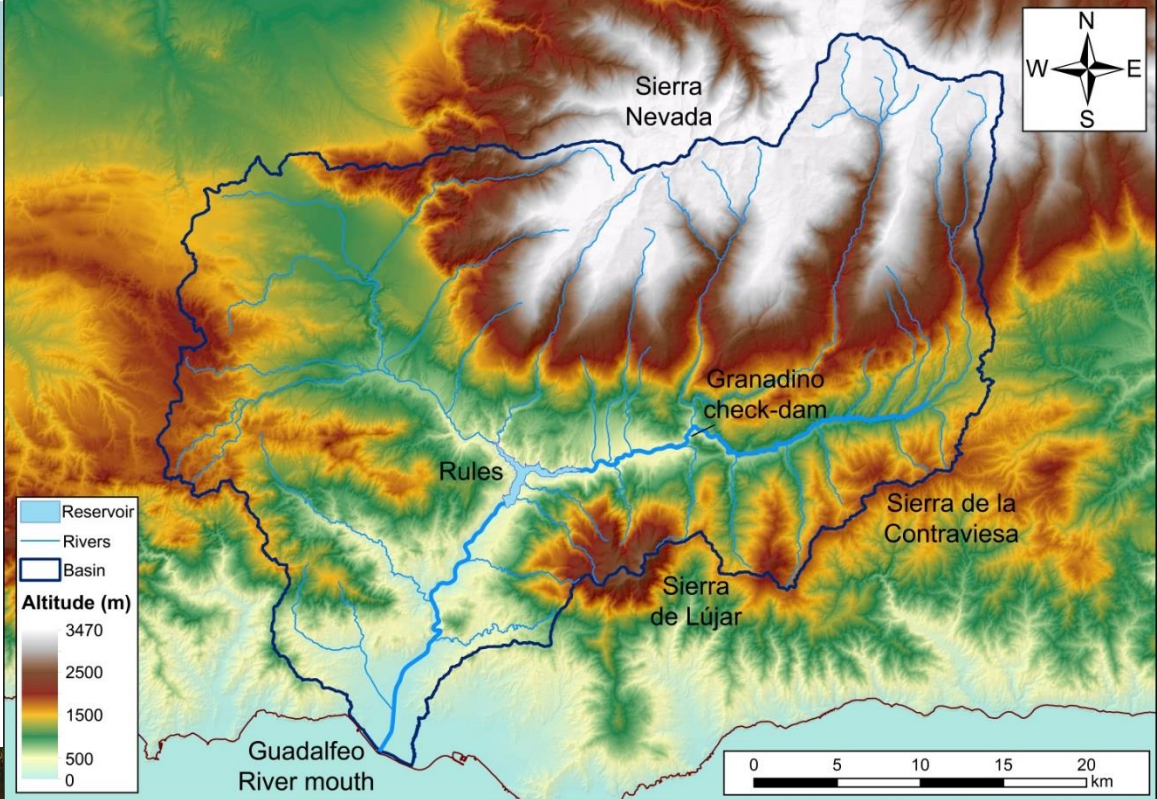
Solutions?



Solutions?



Solutions?



Other cases along the Mediterranean coast of Southern Spain



Jabaloy-Sánchez et al. (2010)

García et al. (2013)

Bergillos et al. (2015)



Urban development on beachfront areas threatened by coastline retreat and coastal flooding – River damming & sea-level rise.

The model of economic planning and growth of many Mediterranean coasts needs to be less chaotic and more coherently organized.

Management strategies should harmonize socioeconomic and environmental considerations instead of prioritizing one over the other

Public funds to restore the coast to the way it used to be and to regenerate it so that its natural processes can be activated once more

Quality of life and social well-being in a context of environmental sustainability: The future of many worldwide deltas is in our hands