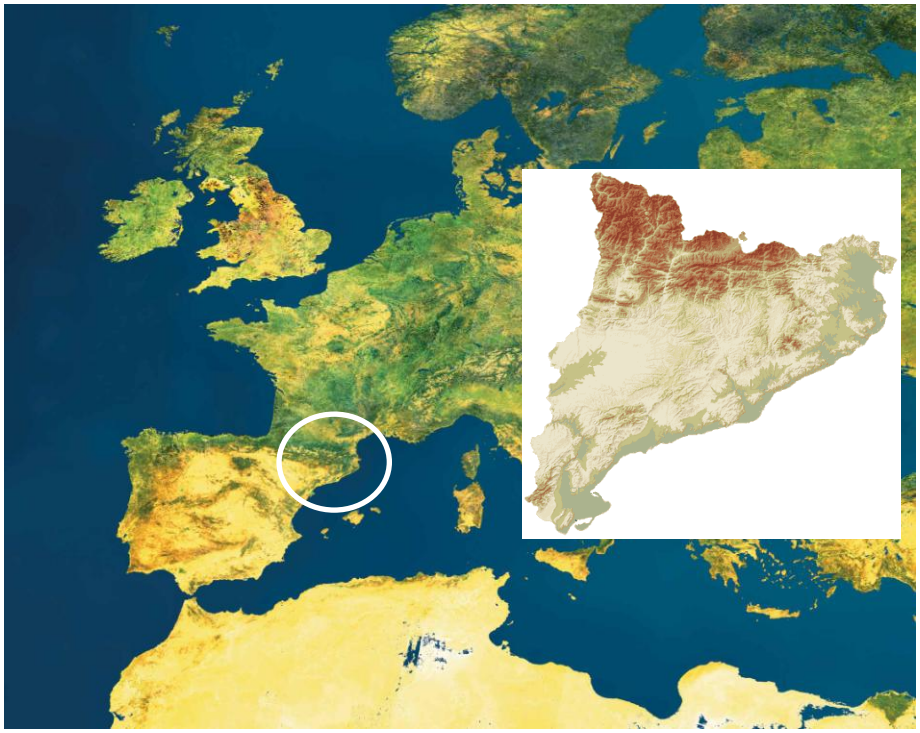
La variabilitat climàtica i la costa catalana

A. Sánchez-Arcilla, C. Mösso, J. P. Sierra, M. Casas Prat

Laboratori d'Enginyeria Marítima, UPC

Centre Intern. d'Investigació dels Recursos Costaners

Catalonia coastline length: ~ 700 km



High geodiversity

500 m fringe
6.9% total area
48% population

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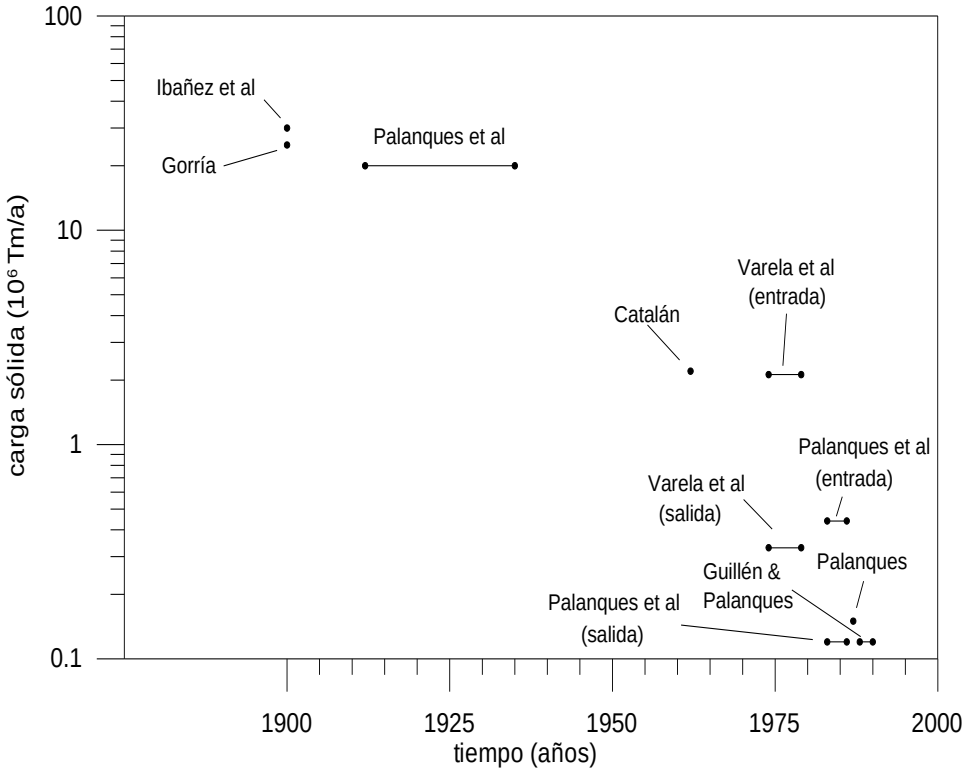
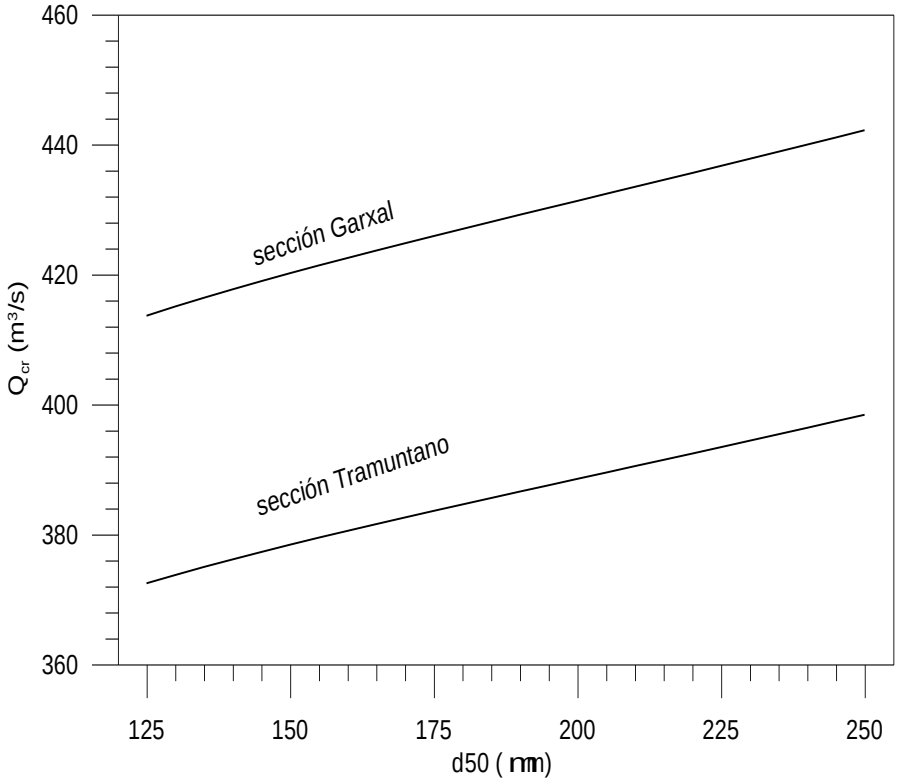
HAZARDS UNDER PRESENT CLIMATE.
WIND – WAVES + STORM SURGES

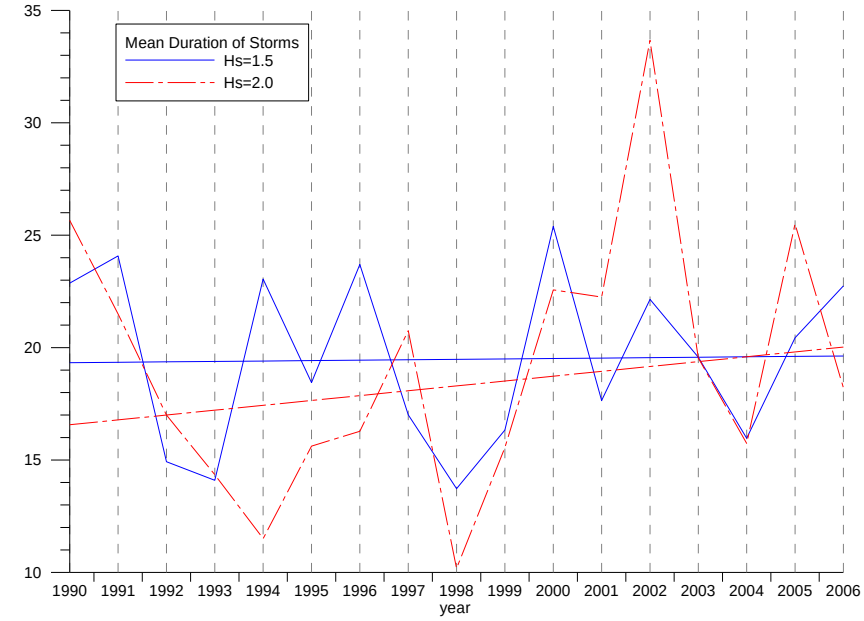
26 Dec 2008 storms

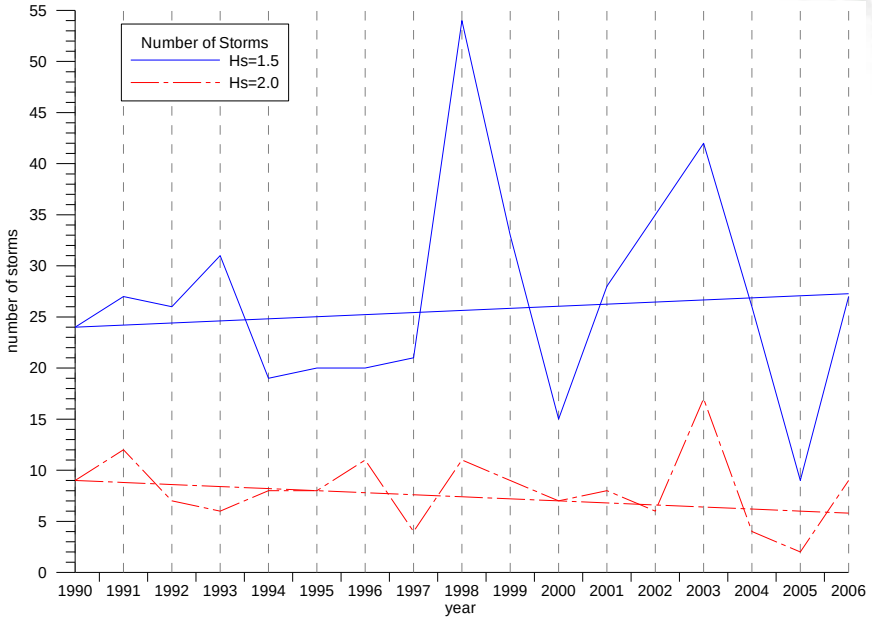
The solid discharge reduction in the last century is of ≈ 1% of that in 1900, much more than for the liquid discharge



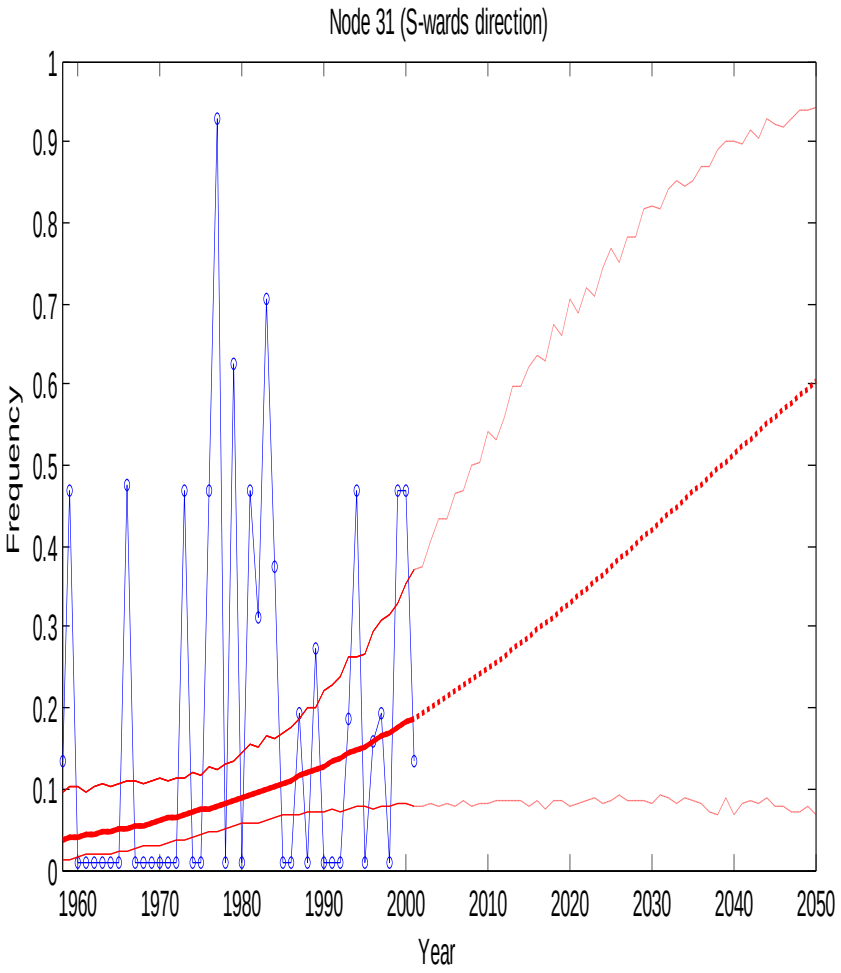
Critical QI to transport the sand fraction at different sections down river

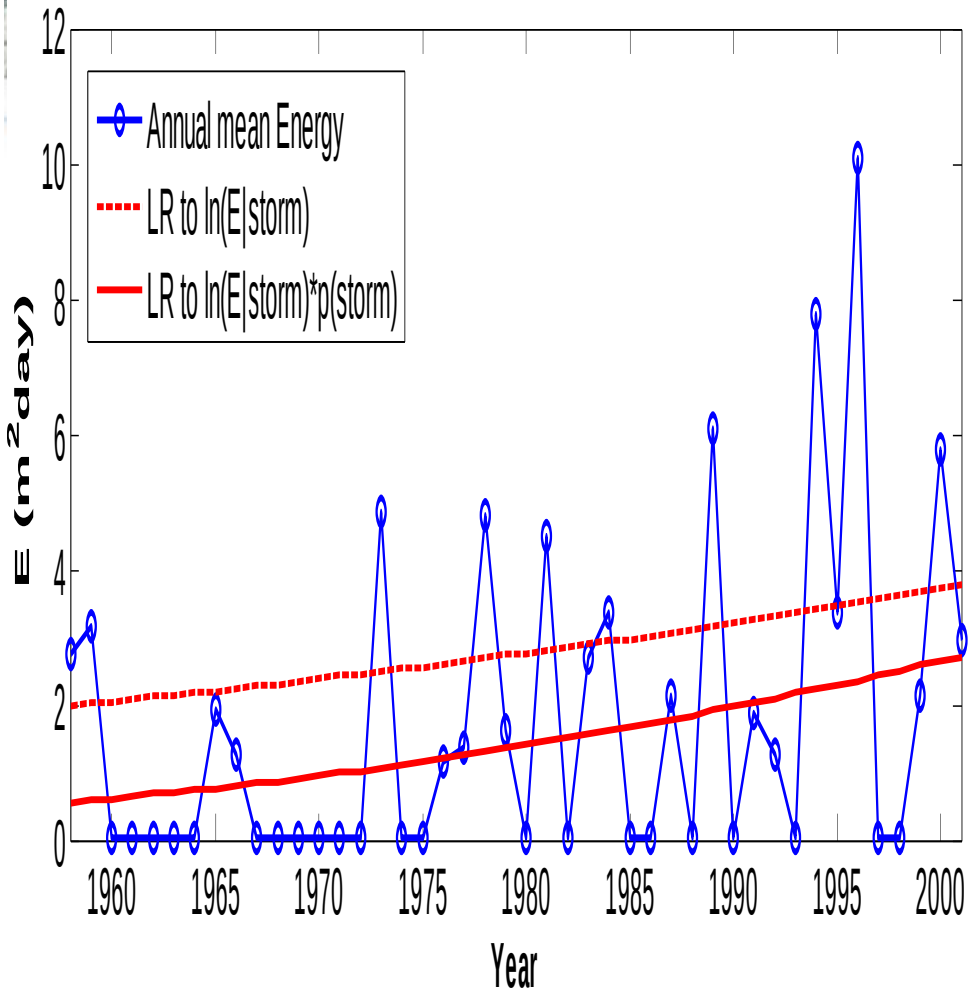






Mean duration of moderate (Hs ≥ 1.5m) and severe (Hs ≥ 2.0m) storms (left) and number of storms (right) for the same two event types. Both panels correspond to observed wave series off the Ebro Delta coast





Evolució temporal de la freq. anual de les tempestes del S. Extrap. al 2050 amb interv. de conf. del 95%.

Tendència de l'energia de tempestes d'onatge provinents de S per a la costa catalana

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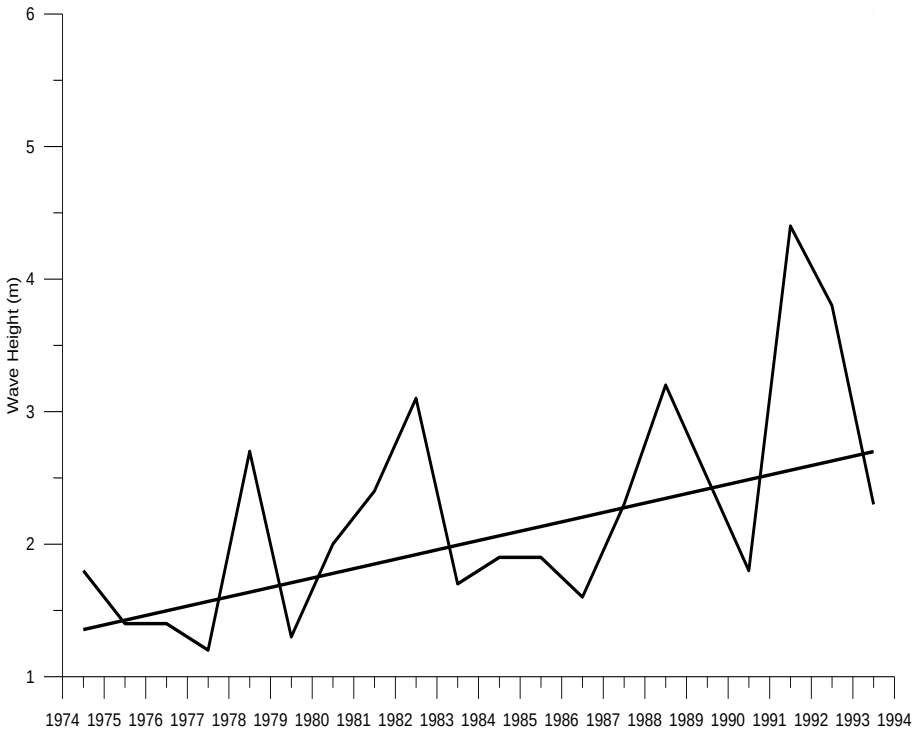
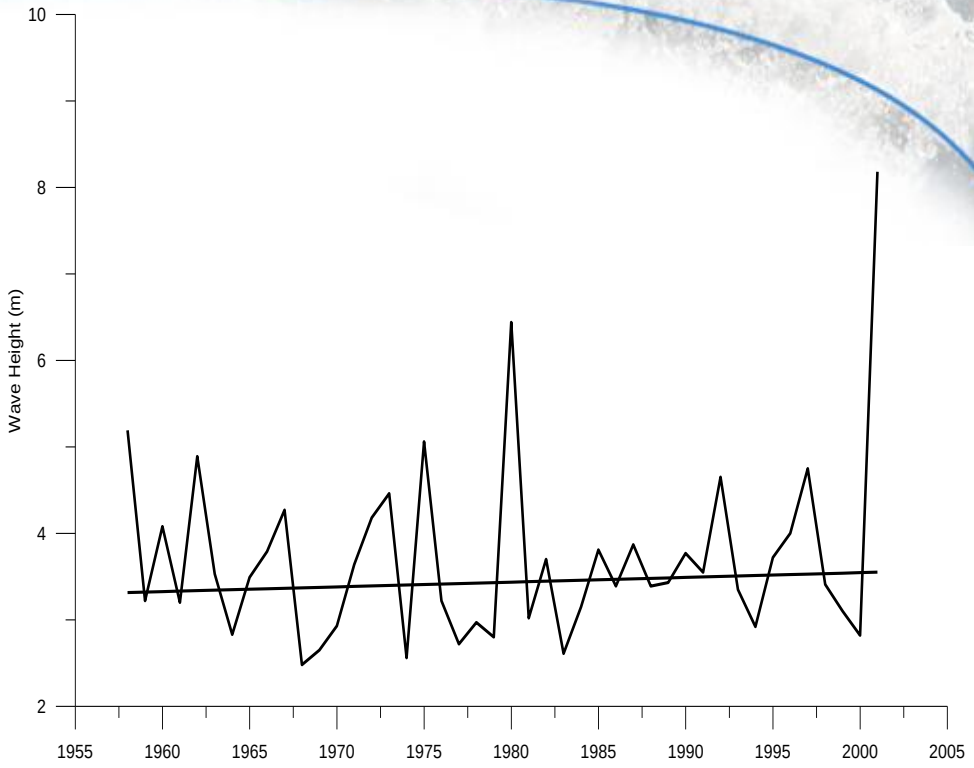
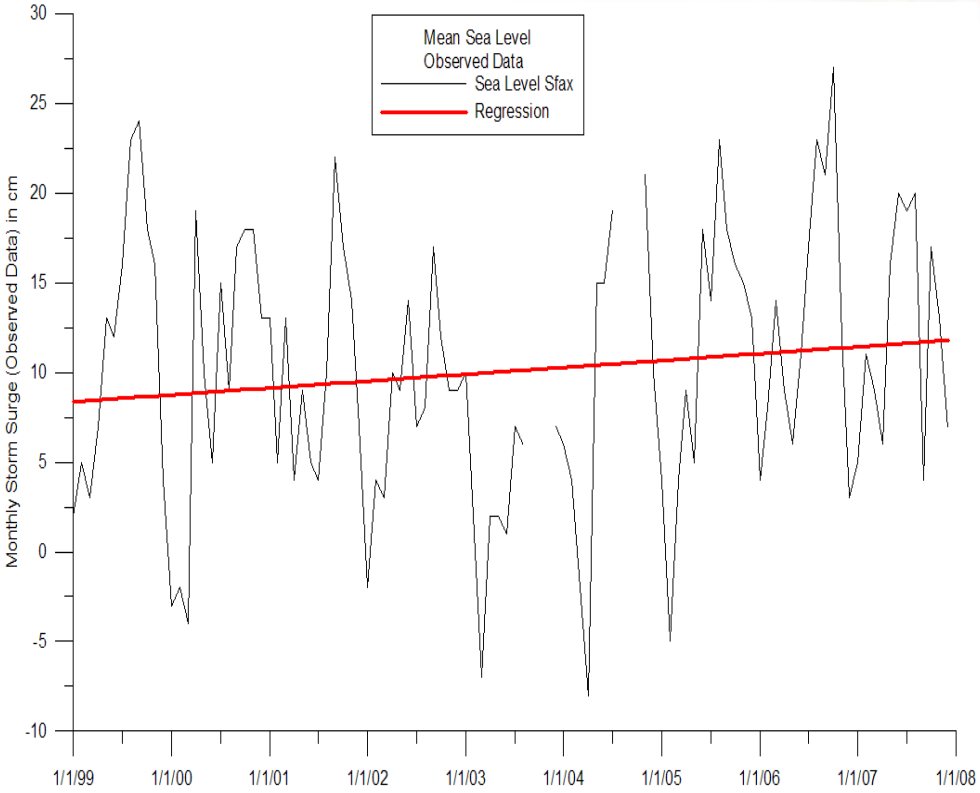
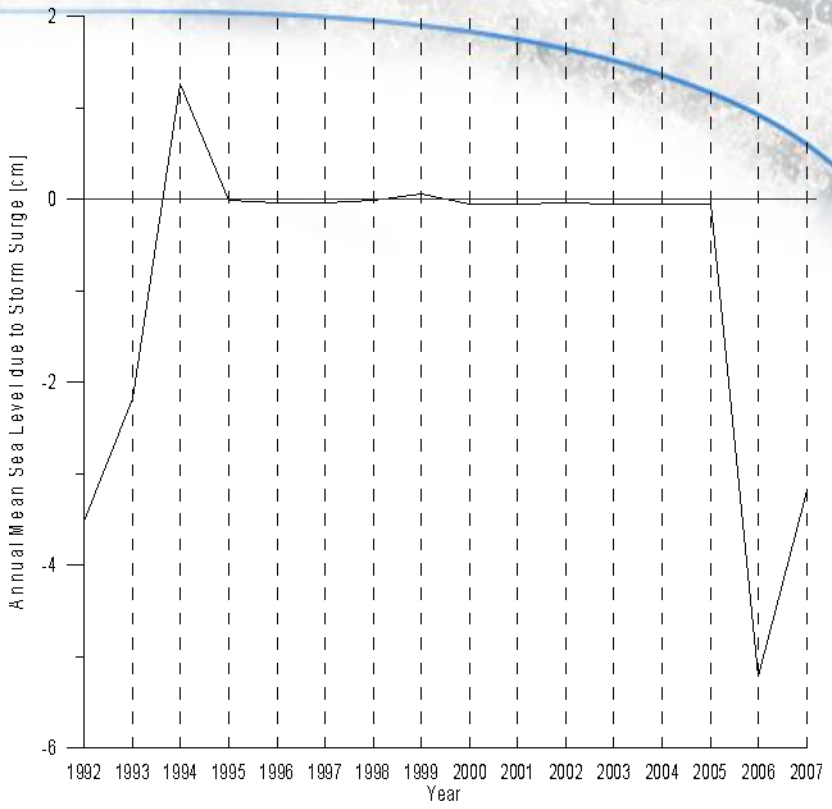


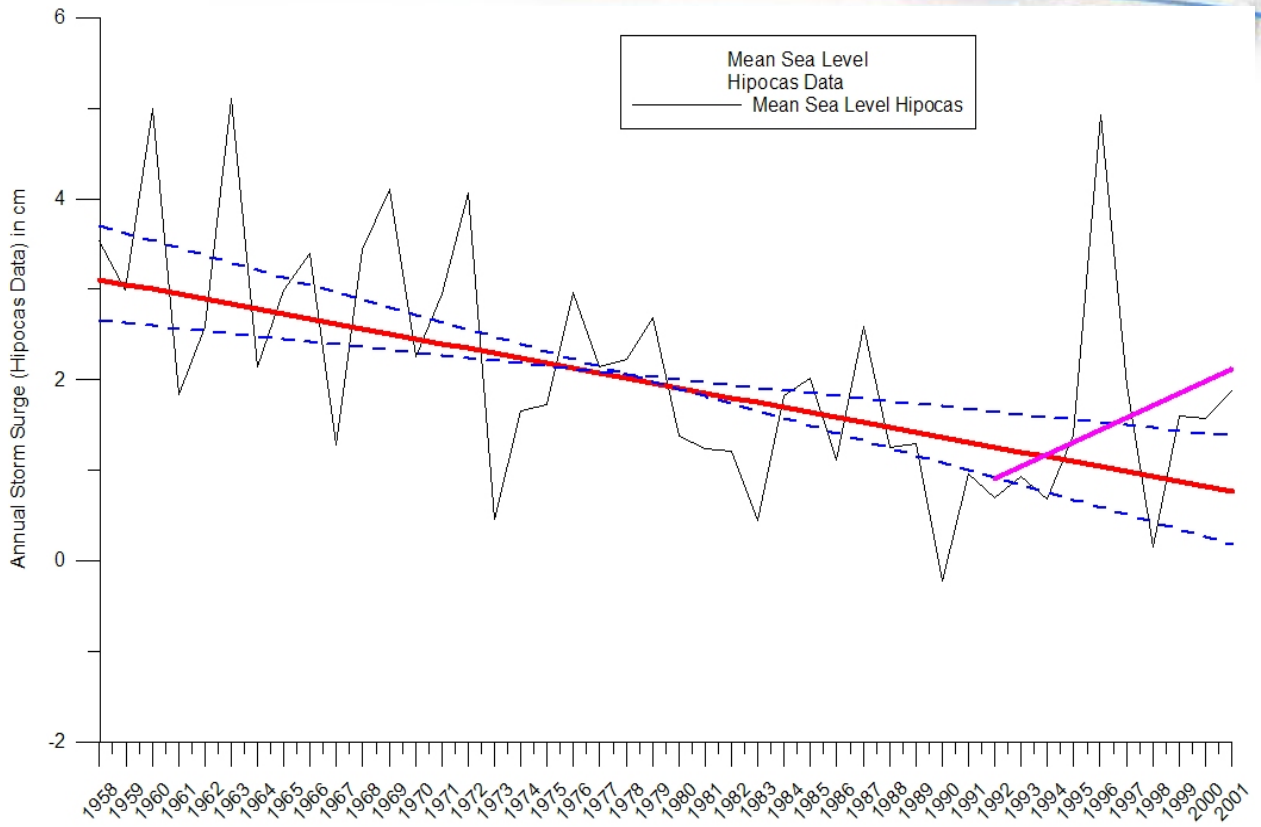


Yearly mean hind-cast Hs values for the Gabès (left) and Catalan (right) coasts. Data provided by the Ministère de l'Equipement et l'Habitat for Tunisia and by the Ministry of Public Works for Spain



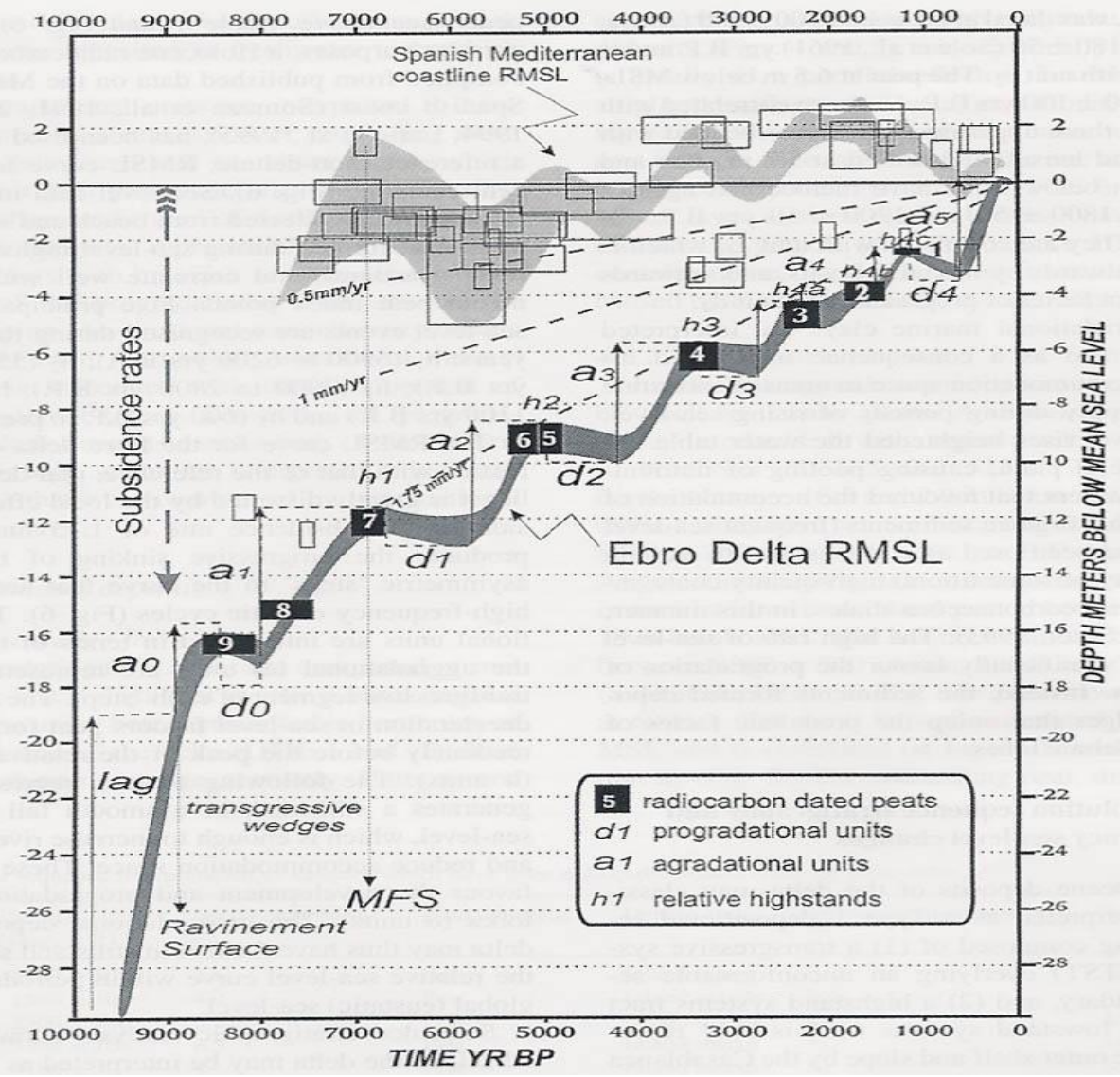


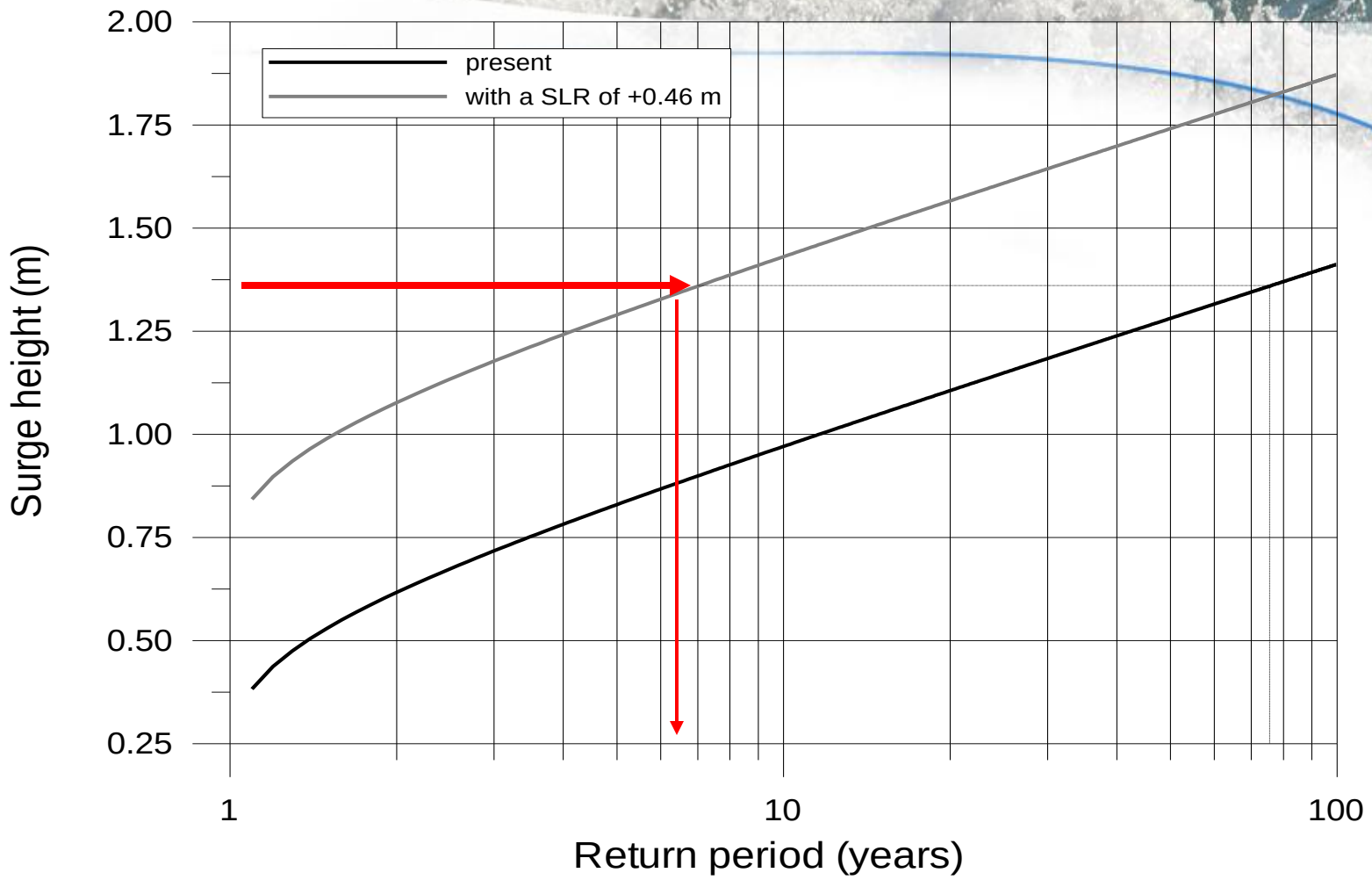
Measured MSL – storm surges – (without astronomic tidal component) at the the Gabès Gulf (left, **monthly mean**, 1999 - 2008) and at the Barcelona harbour (right, **yearly mean**, 1992 - 2007)



Storm surges at the Ebro coast in Spain. Hindcast time series (1958-2001) showing a slight decreasing trend, while for the last decade there is an increasing trend.

Holocene MSL for the Ebre delta and adjacent spanish coast (Somoza et al., 1998)

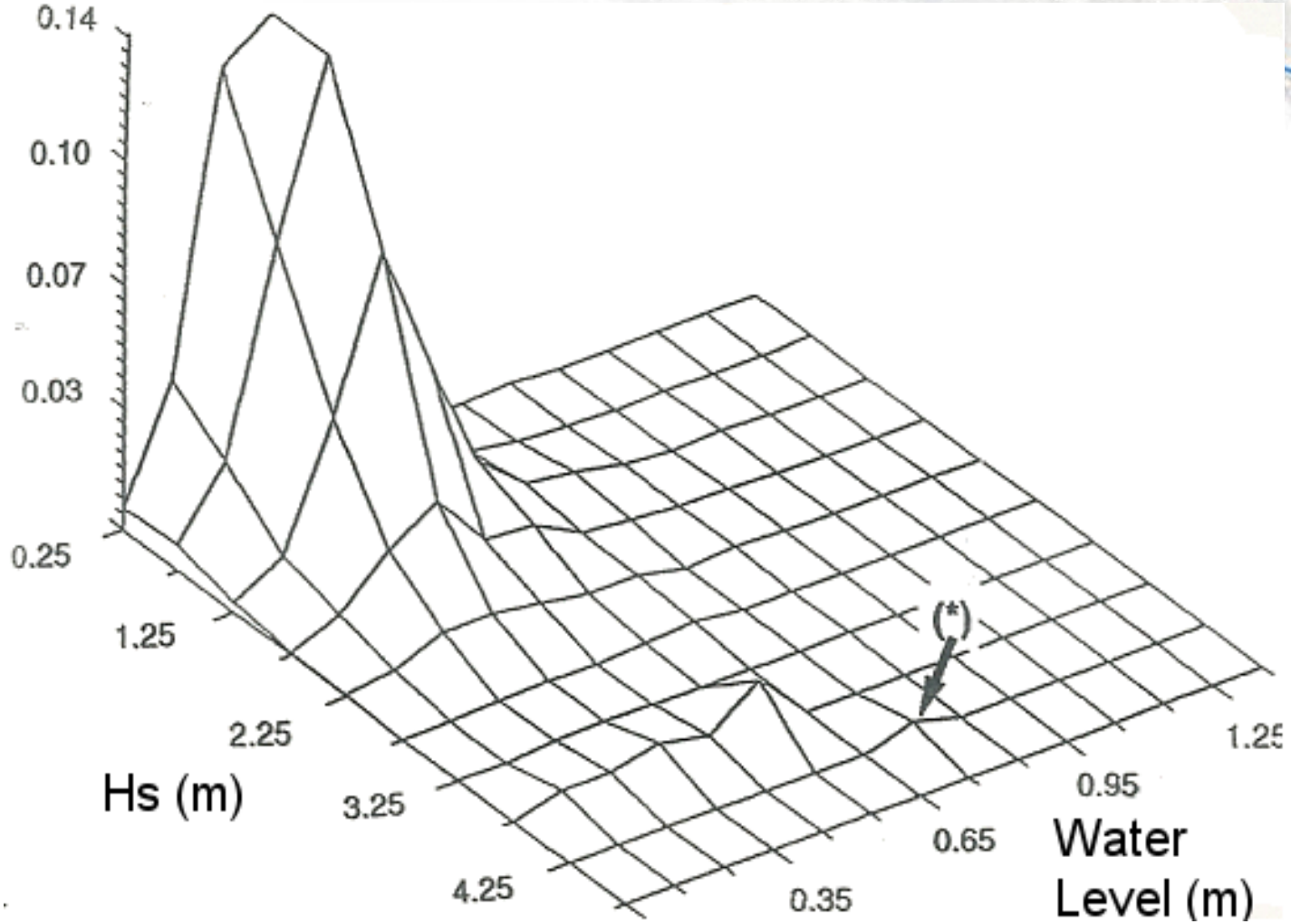




Storm surge PDF off the Ebre delta under present conditions and for a RSLR of 0.46 m corresponding to year 2100. For a surge of **1.40 m**, goes **from 77 years down to 6.5 years**

Coastal rigidity (no retreat) + over-wash deposits after storm impact (“marine” flooding) in November 2001

Coastal retreat + overwash deposits after storm impact ("marine" flooding) in November 2001



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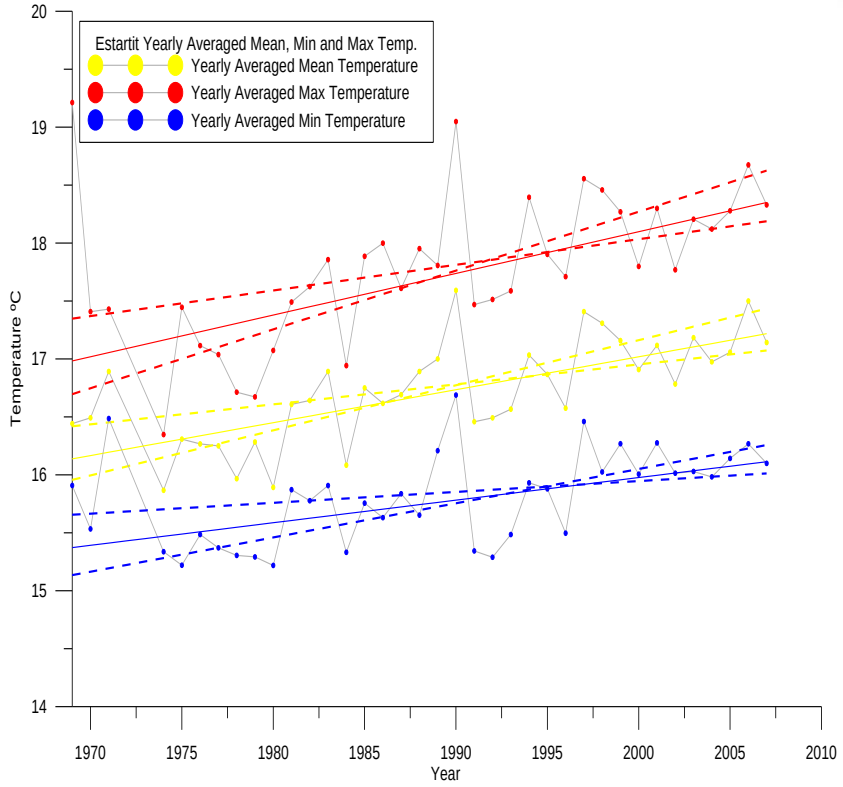
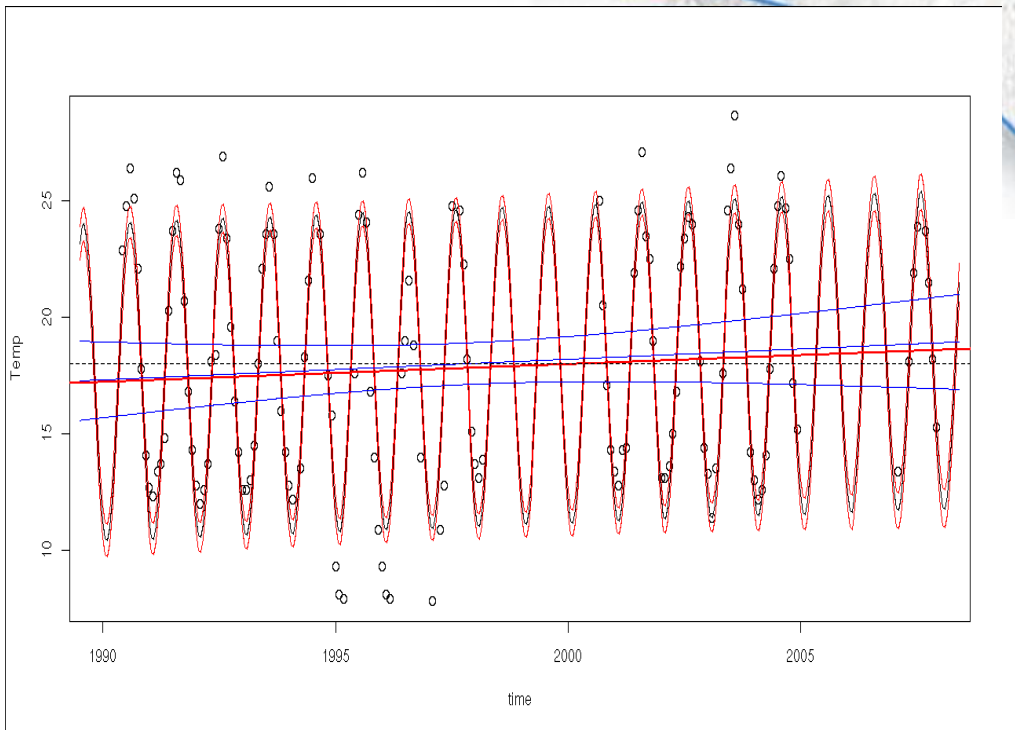
Storm impact in the Trabucador bar (left). Breaching after the impact of the Oct/1990 storm (middle) & breaching after the Nov/ 2001 storm (right).





Annual mean (yellow), maximum (red) and minimum (blue) SST at the Northern Catalan Coast (Estartit), 1969-2008 (left) and monthly SST in front of the Ebro delta, 1990-2008 (right). Data from Servei Meteo. de Catalunya & J. Pascual.

Consequences/Impacts

	Recent	Past	Present		Near Future	
Site	No Sub	Sub	No Sub	Sub	No Sub	Sub
Valencia	0		10		70	
Delta Ebro		25		35		95
Oran	25		35		95	
Gabès	25		35		75	
Nile		40		50		110

Erosion (horizontal meters of shore-line retreat) due to **SLR + storm** effects for the **last century** (Recent Past), **present** conditions (Present) and by the year **2100** (Near Future). Sites without subsidence (No Sub) and with subsidence (Sub). Uncertainty in the estimates should be considered.

Consequences/Impacts

	Present Rates	Near Future	
Spanish Coast	+ 3.3ºC / -20%	+5.0ºC / -40%	
Oran gulf	+4ºC / -30%	+2ºC / -10%	+6ºC / -50%
Gabès gulf	+4ºC / -30%	+2ºC / -10%	+6ºC / -50%
Nile coast	+4ºC / -30%	+2ºC / -10%	+6ºC / -50%
		Winter	Summer
	Present	Near Future	

Percentual variation in water quality (**WQ**) driven **by temperature** (T) changes for **present** conditions and by the year **2100** (denoted as Near Future). Values of average **variation** (100 years interval) **in SST** and WQ are shown simultaneously (**SST / WQ**) for the present conditions and the accelerated rate due to climate change . The uncertainty in the estimates should be always

HAZARDS UNDER FUTURE & PRESENT CLIMATE. FLOODING + SUBSIDENCE (NEW INFRASTRUCT.)

Llobregat Delta

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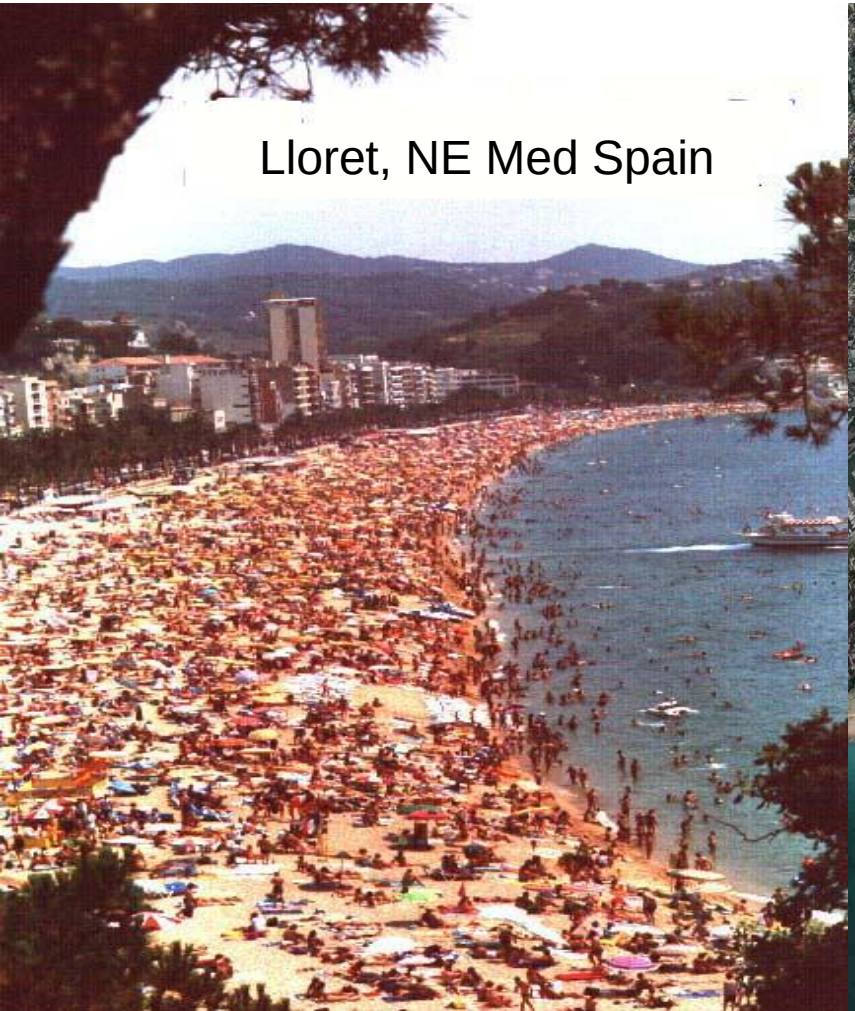
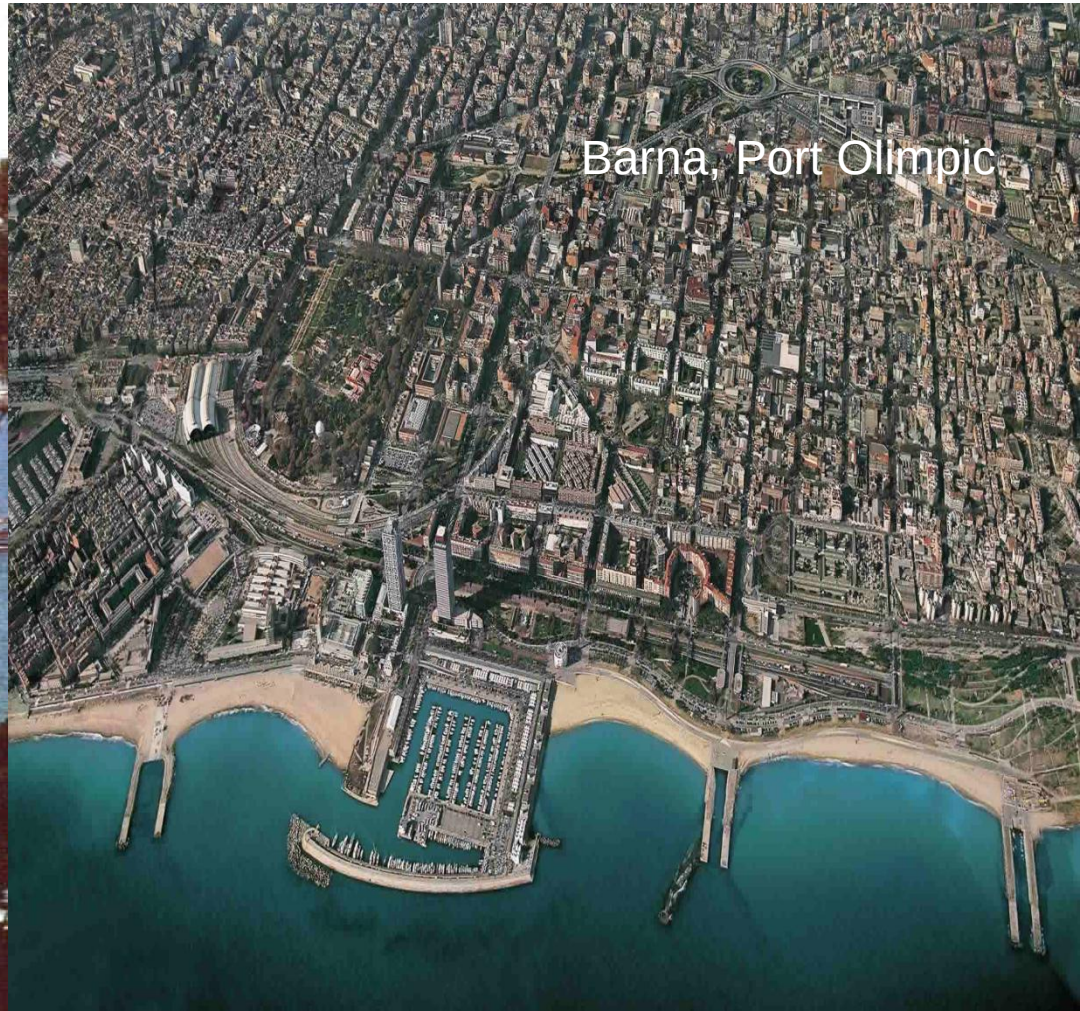
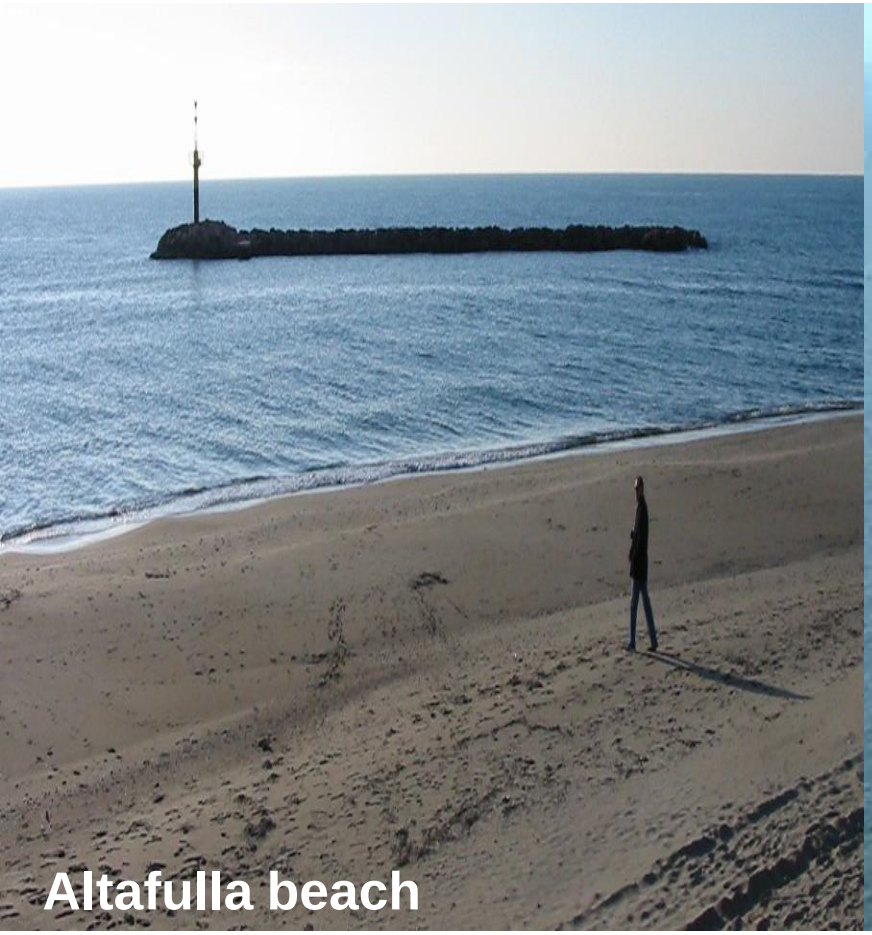
HAZARDS UNDER FUTURE & PRESENT CLIMATE. NARROW POCKET BEACHES (URBAN)





HAZARDS UNDER FUTURE CLIMATE. NARROW ARTIFICIAL BEACHES (+ LCS)



Altafulla beach

Barceloneta beach

CONCLUSIONS

Indicadors robustes – Estat ZC

- Erosió
- Inundació

⟷ NMM (+ Subsidència)

⟷ Onatge (H_S, D, θ, freq.)

- WQ ⟷ T_w,

⟷ Pluviometria (freq, D, Vol)

“Darrers” anys (≈ 20 anys)

a) - No tempestes onatge sever ↑
   - Erosió, Inundació ↑

CONCLUSIONS

Futur proper (≈ 50 anys)

b) - H_S ↓
- Tempestes onatge del S ↑
- Canvi de θ (trajectòries temp. cap al N)
- Reorientació costa ↑ (costes “rígides” + erosió) (e.g. Maresme)
-- Agitació ports

c) - NMM (storm surge) ↑
- Erosió, Inundació ↑
- Zones baixes i amb subsidència (e.g. Deltes)