



**The Ebro delta coastal response during 2001-2004:
a proxy of the potential effects
of an increase in storminess?**

José A. Jiménez, Vicenç Gracia & Herminia I. Valdemoro

Universitat Politècnica de Catalunya
Barcelona, Spain

jose.jimenez@upc.edu

Motivation & objective

Under a climatic **scenario of increase in storminess**

Which should be ...

the most **likely coastal response?**

the **implications?**

Usually

model-based approach

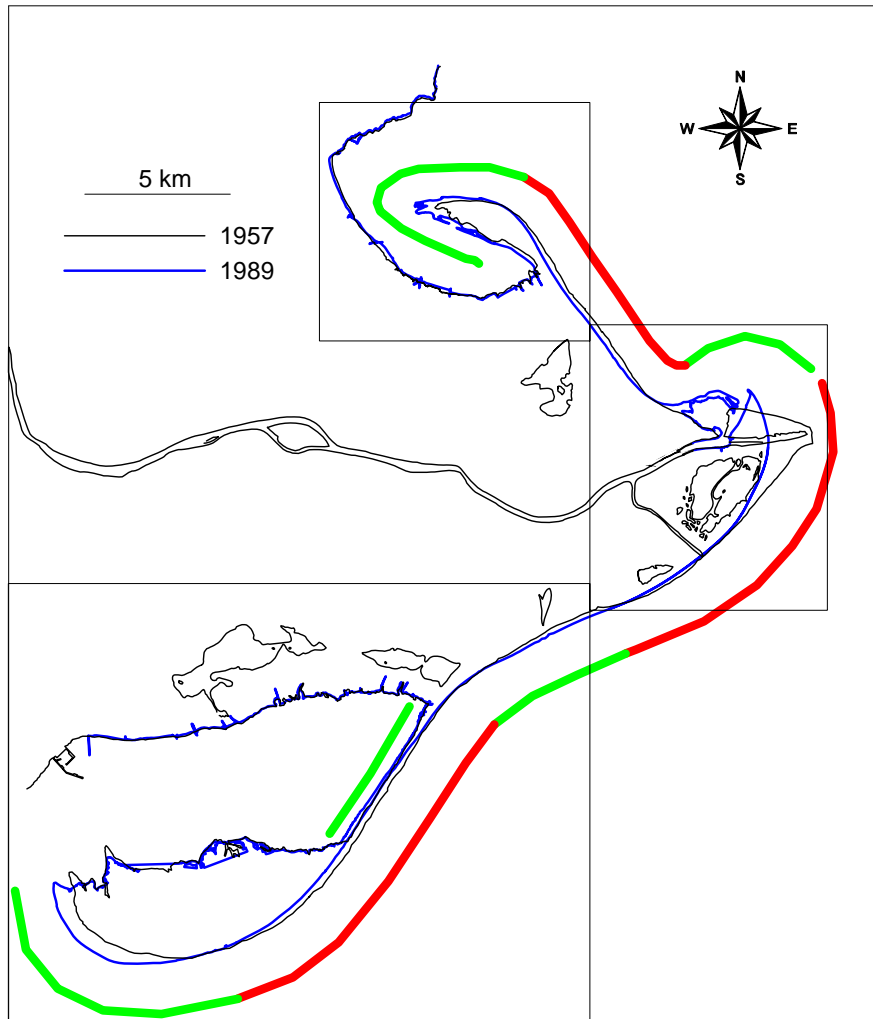
Here

data-based approach



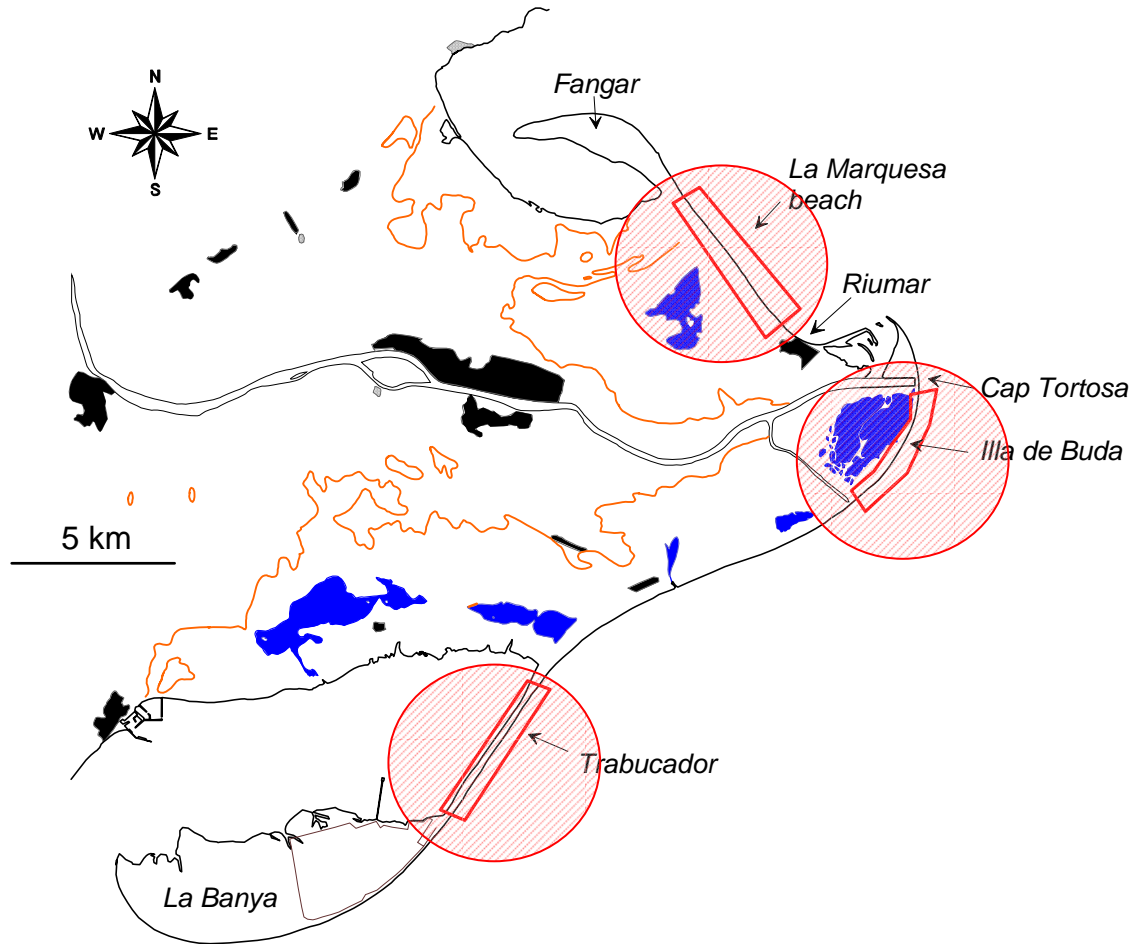
- Low-lying coast ($\sim 50\%$ with $z \leq +0.50$ m).**
- Exposed sandy coast without obstacles.**
- Highly dynamic coastline.**
- High natural values (geo- & bio- diversity).**
- Strategic zone in Catalonia (land-planning).**



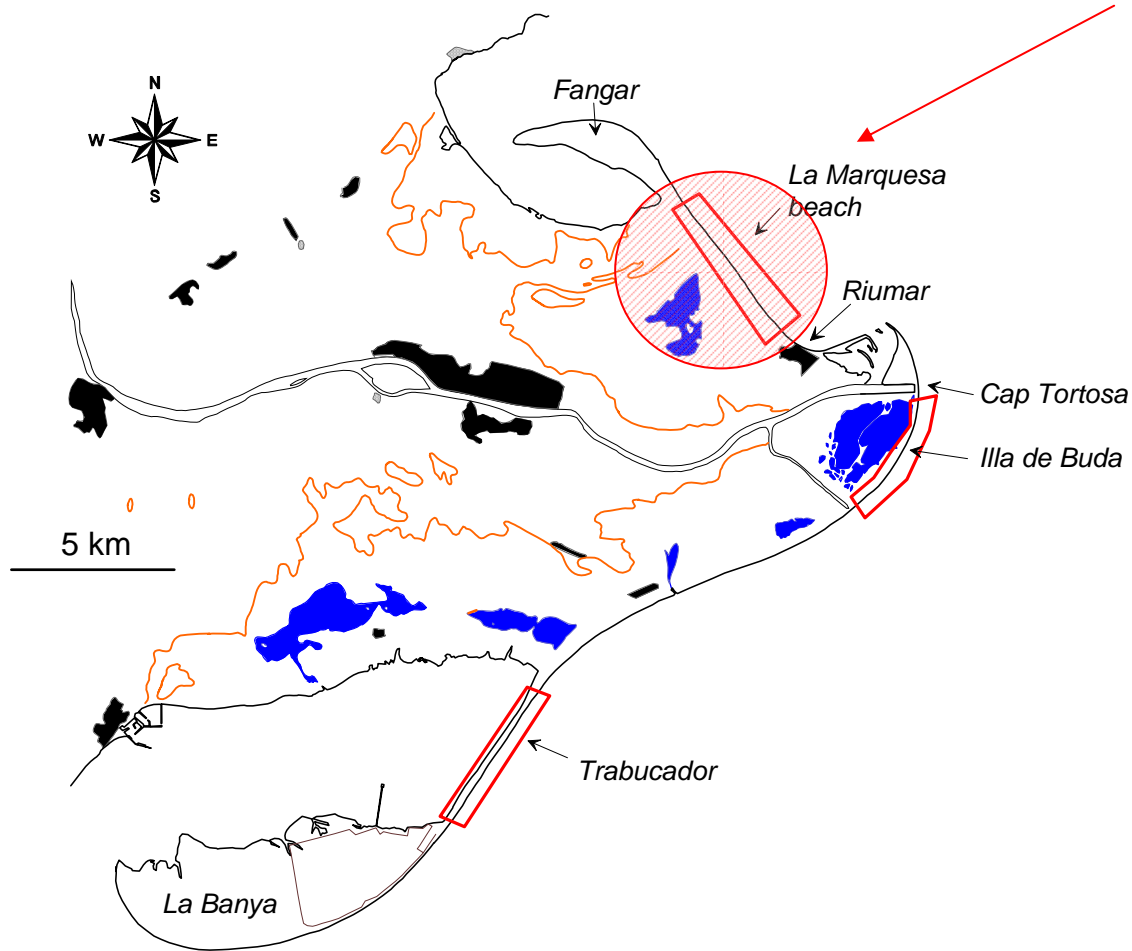


**Max erosion (Cap Tortosa)
retreat > 1750 m in 43 yrs (1957-2000)**

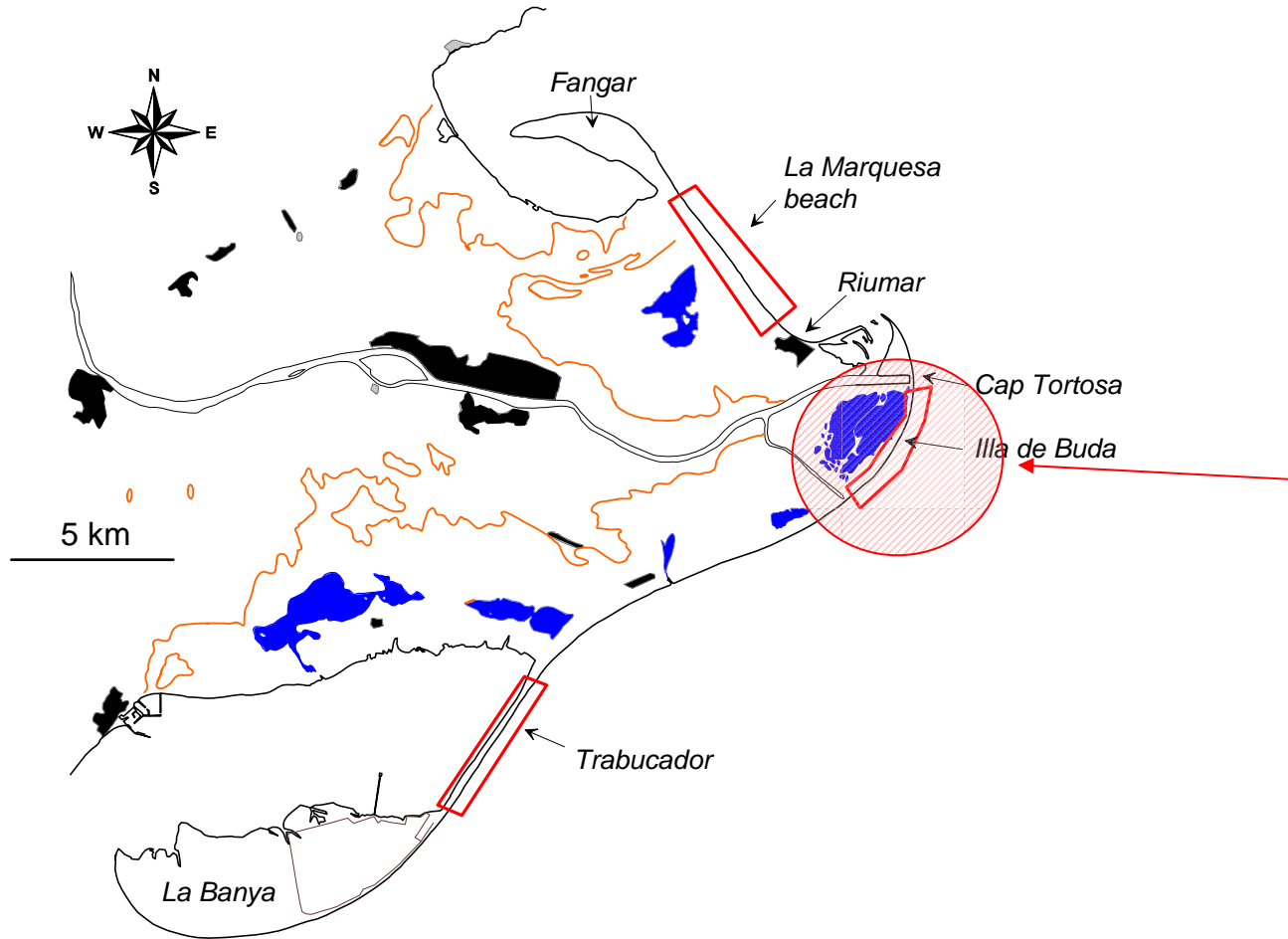
Sensitive areas to storm impacts



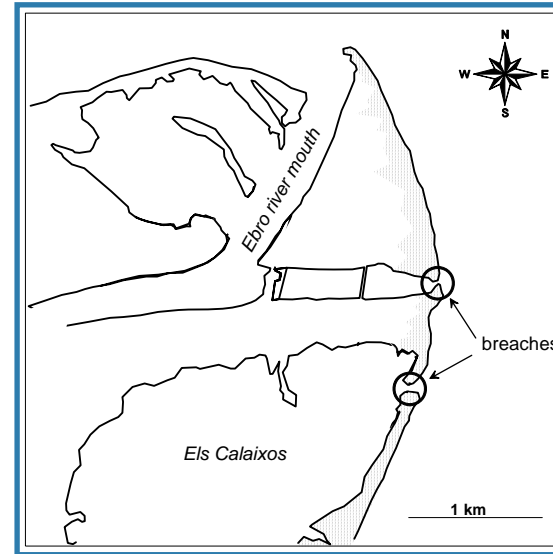
La Marquesa
dune/beach erosion
overwash
hinterland inundation

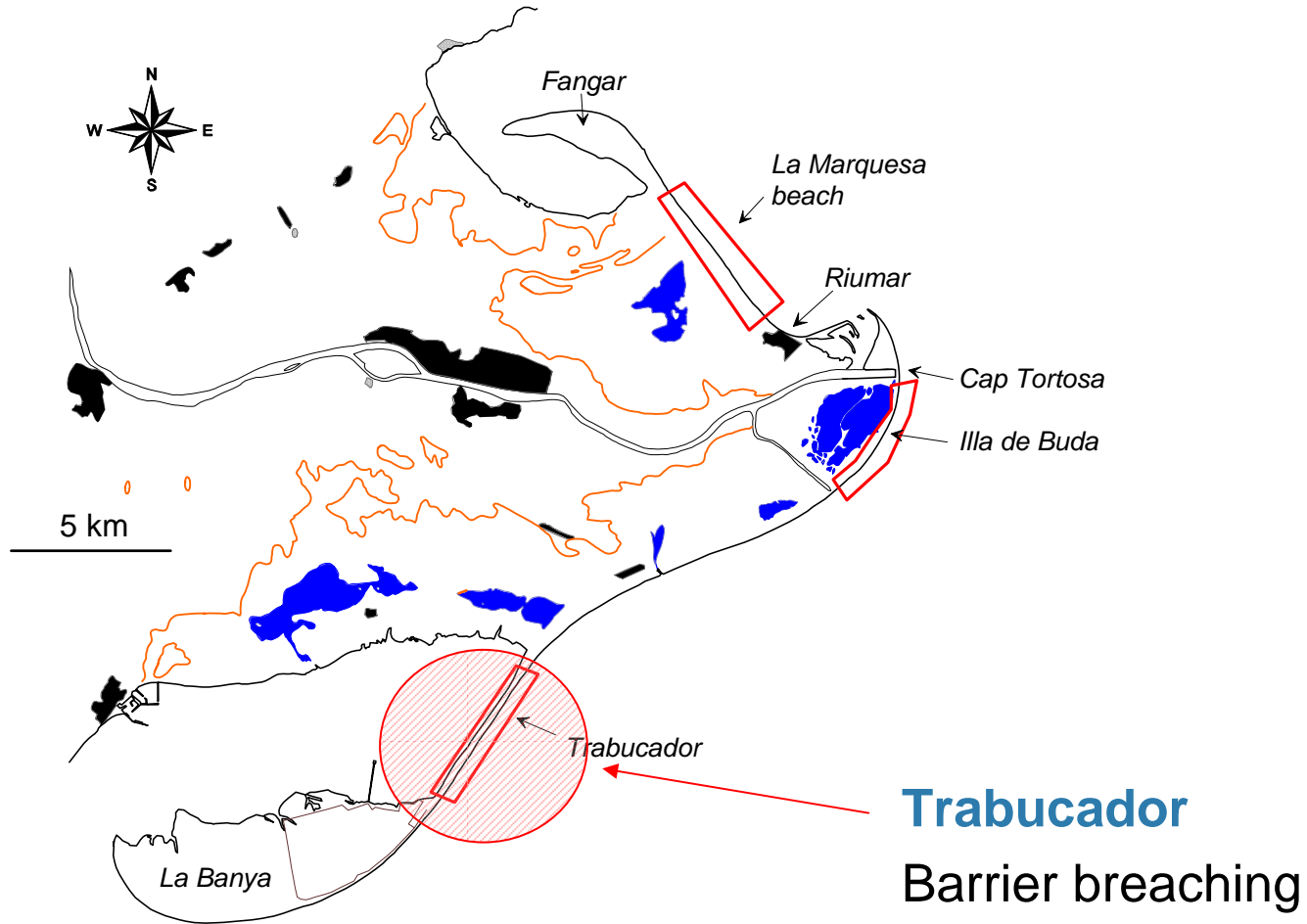




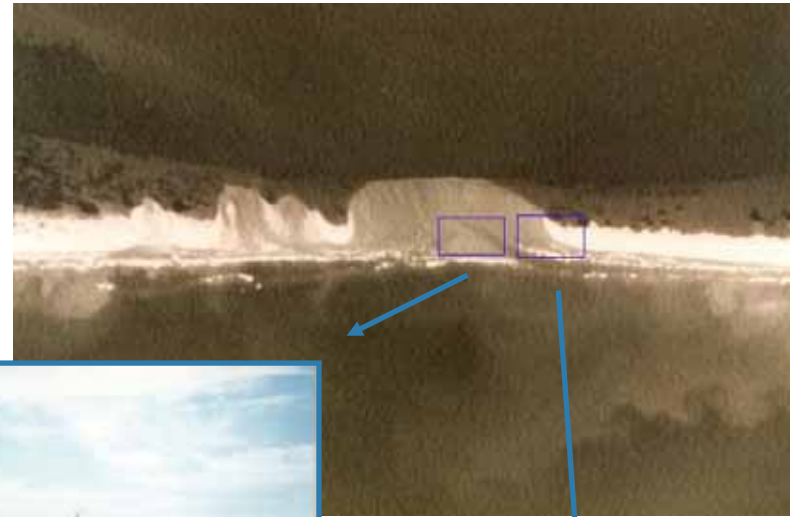


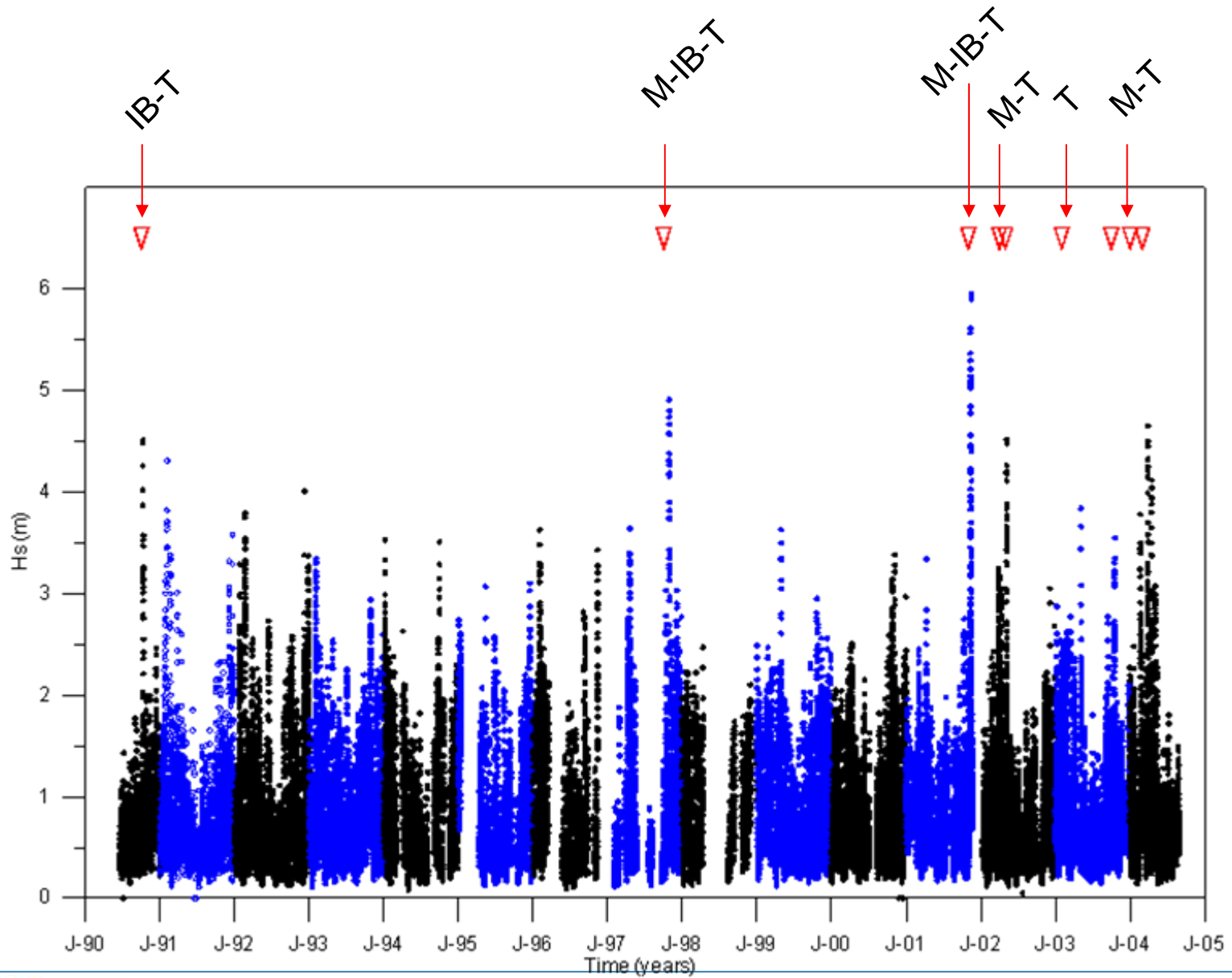
Illa de Buda
Breaching
Inundation



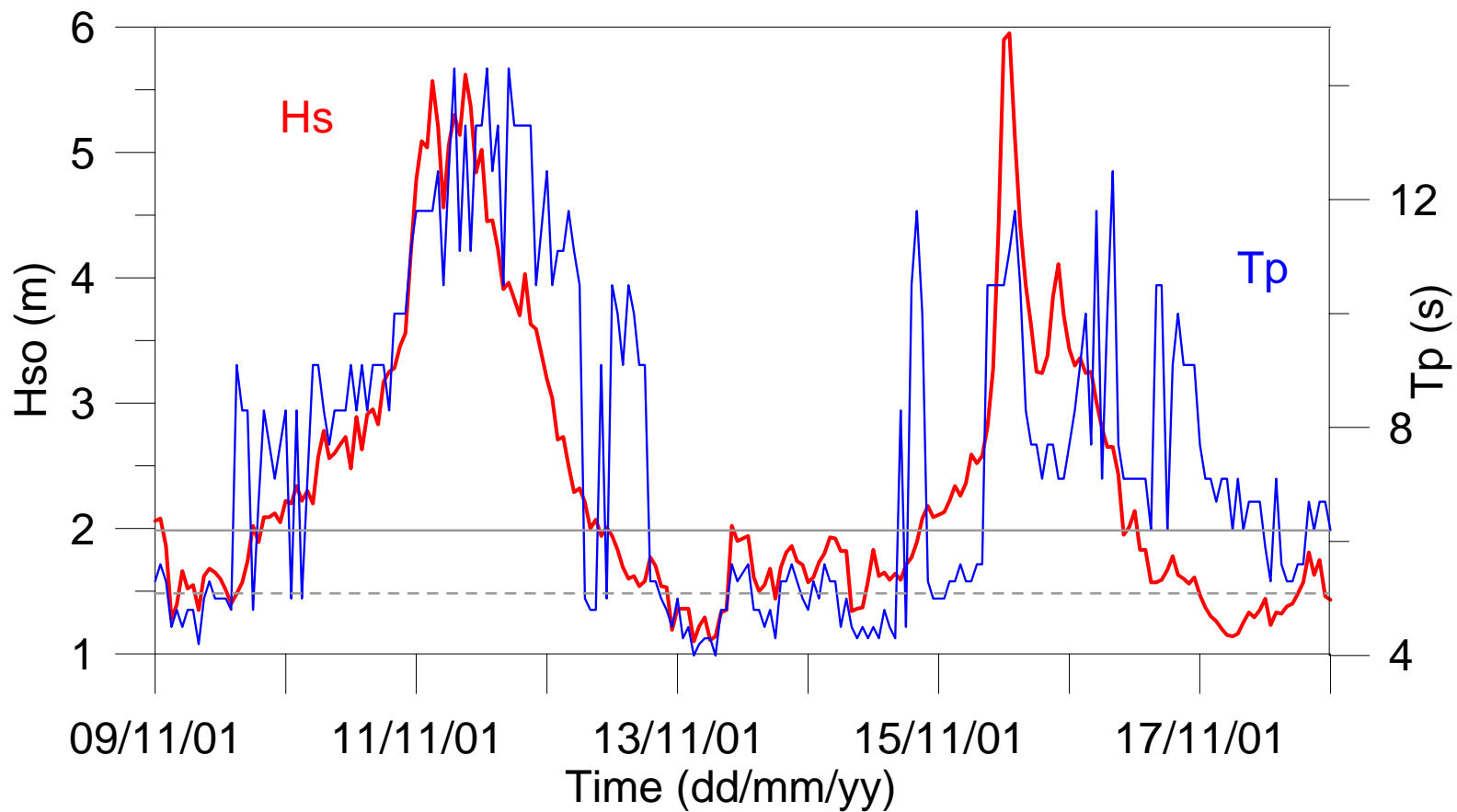


Trabucador
Barrier breaching

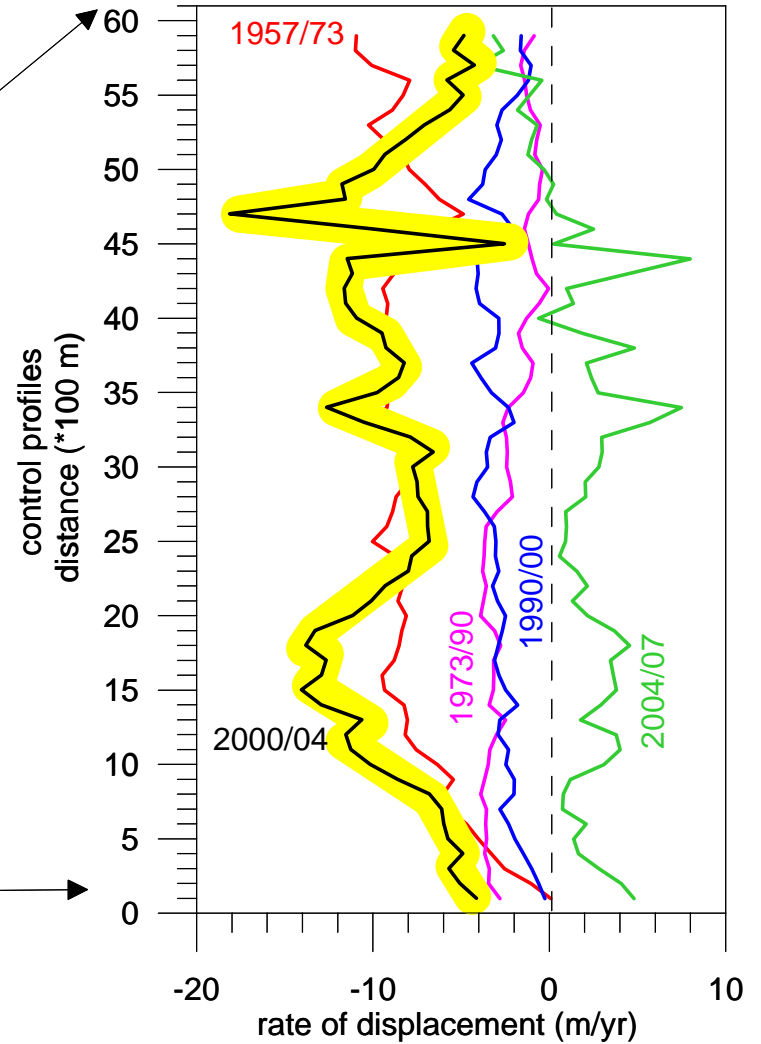
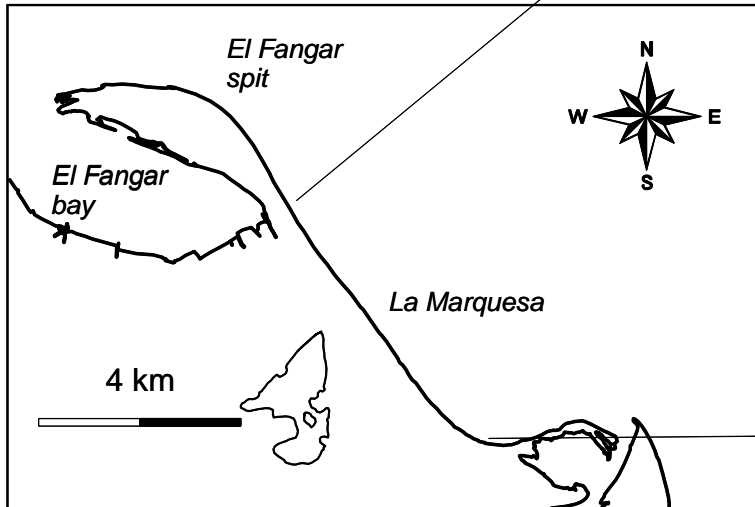




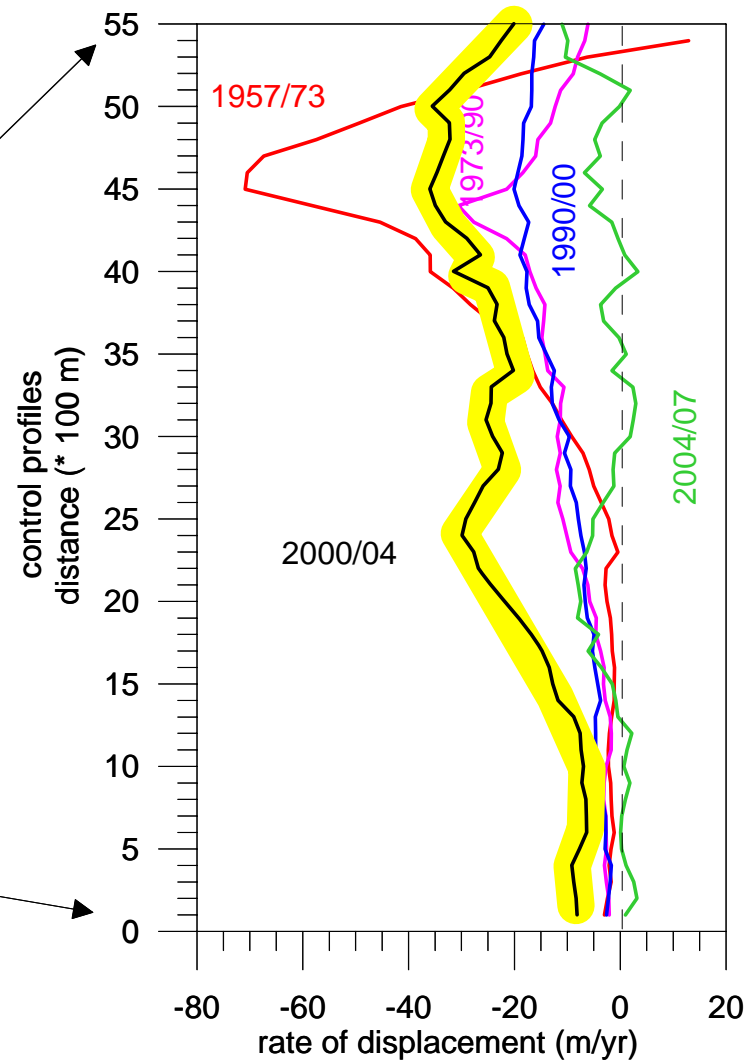
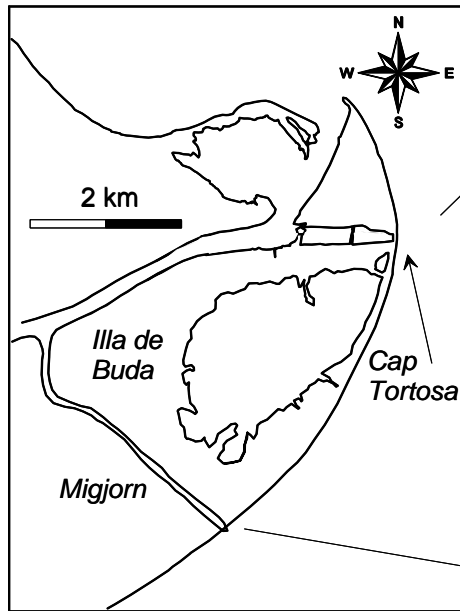
storm	Hs (m)	Tp (s)	θ	t (hours)	Tr (years)
§ Oct-1990-1	4.51	10	73	18	9
§ Oct-1990-2	3.57	10	78	28	2
Oct-1997	4.91	12.5	76	39.5	15
§ Nov-2001-1	5.62	13.3	78	63	71
§ Nov-2001-2	5.95	11.1	81	38	117
§ Apr-2002-1	3.25	8.3	90	43	1
§ Apr-2002-2	3.17	8.3	87	48	< 1
§ Apr-2002-3	3.05	10.5	68	20	< 1
May-2002	4.52	9.1	82	65	9
Feb-2003	2.90	9	98	51	< 1
Oct-2003	4.20	8.6	76	94	6
Mar-2004	4.65	9.1	79	63	11
Apr-2004	4.12	9.1	80	37	5



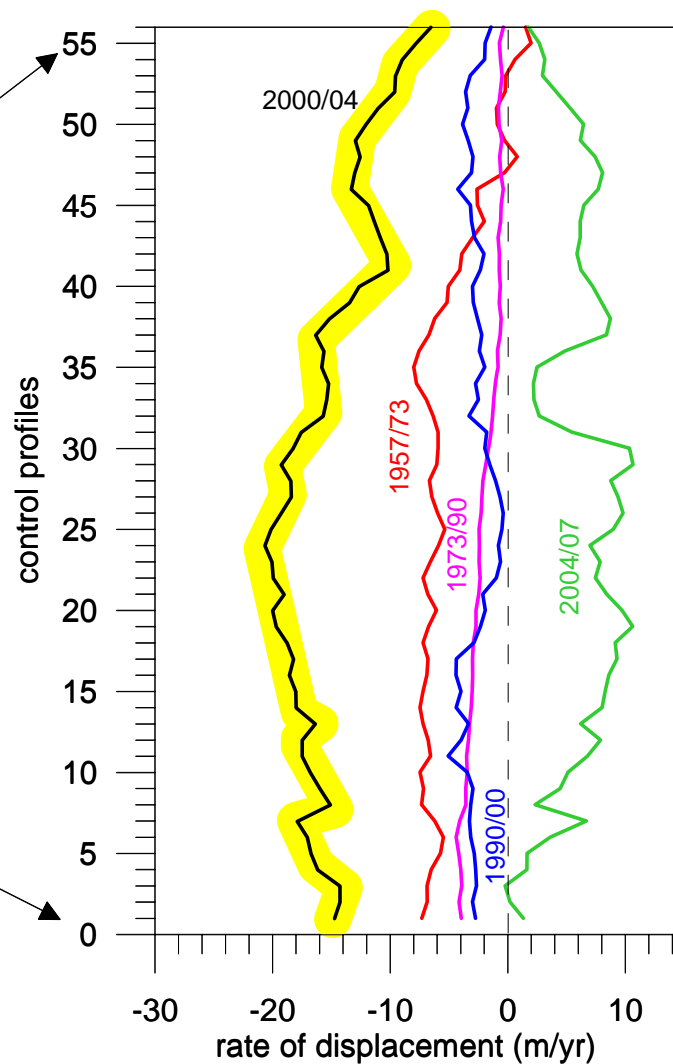
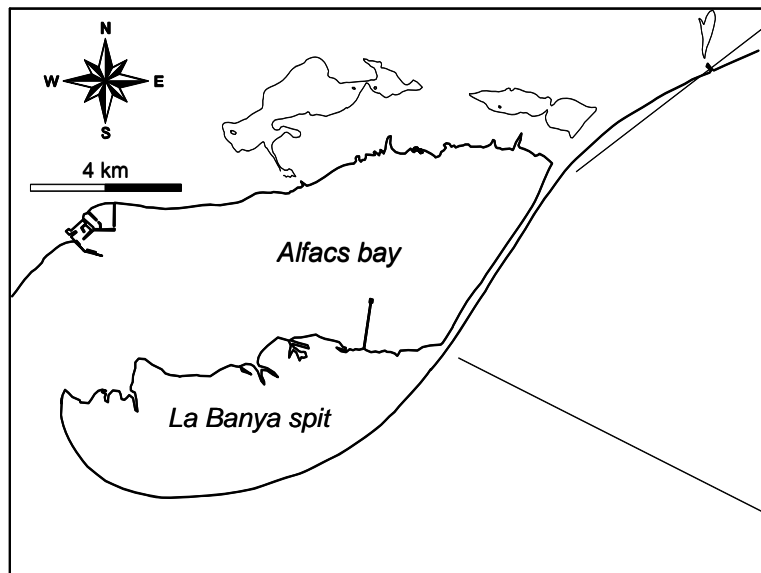
Av increase: 330 %





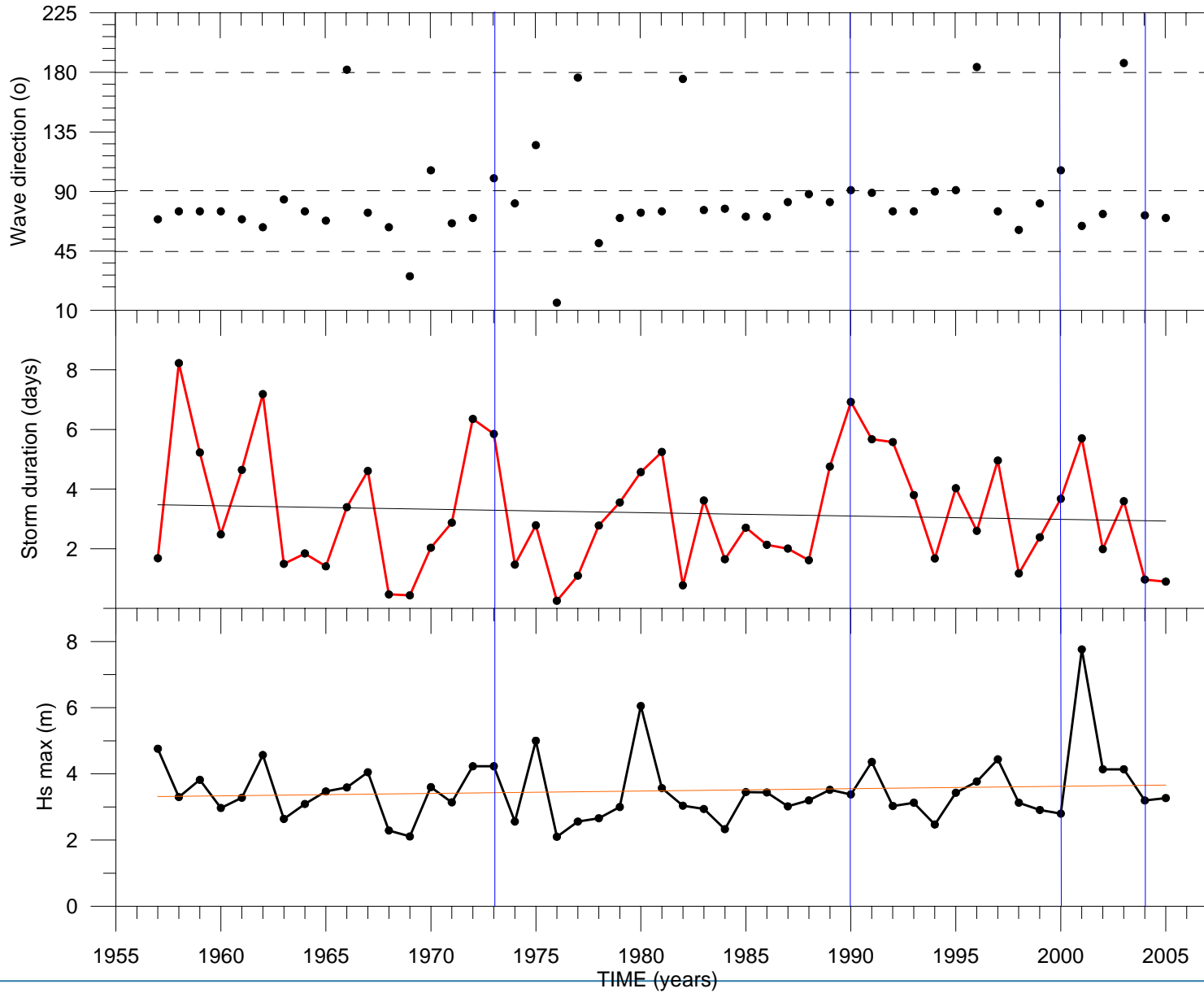


Av increase: 240 %

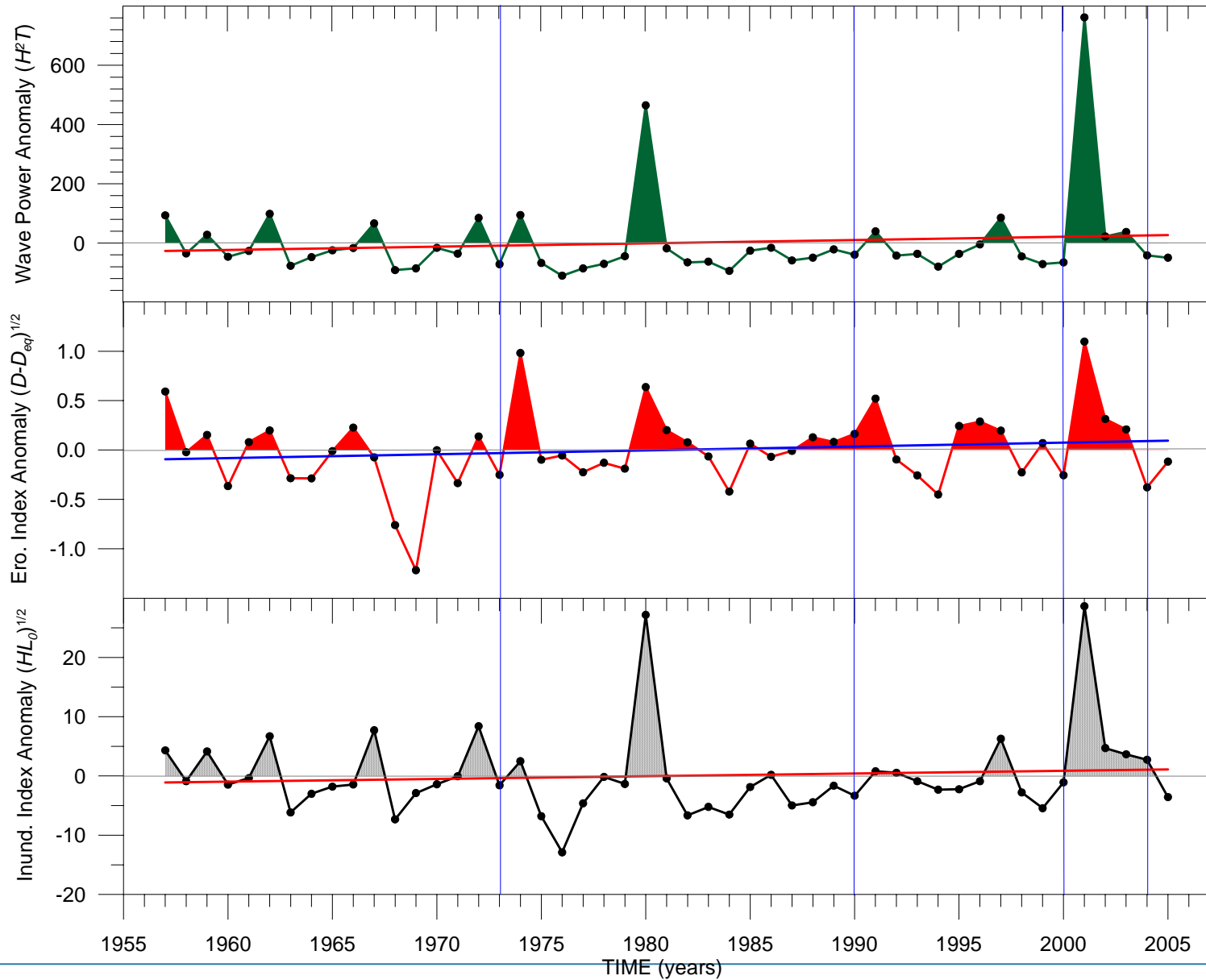


Av increase: 800 %

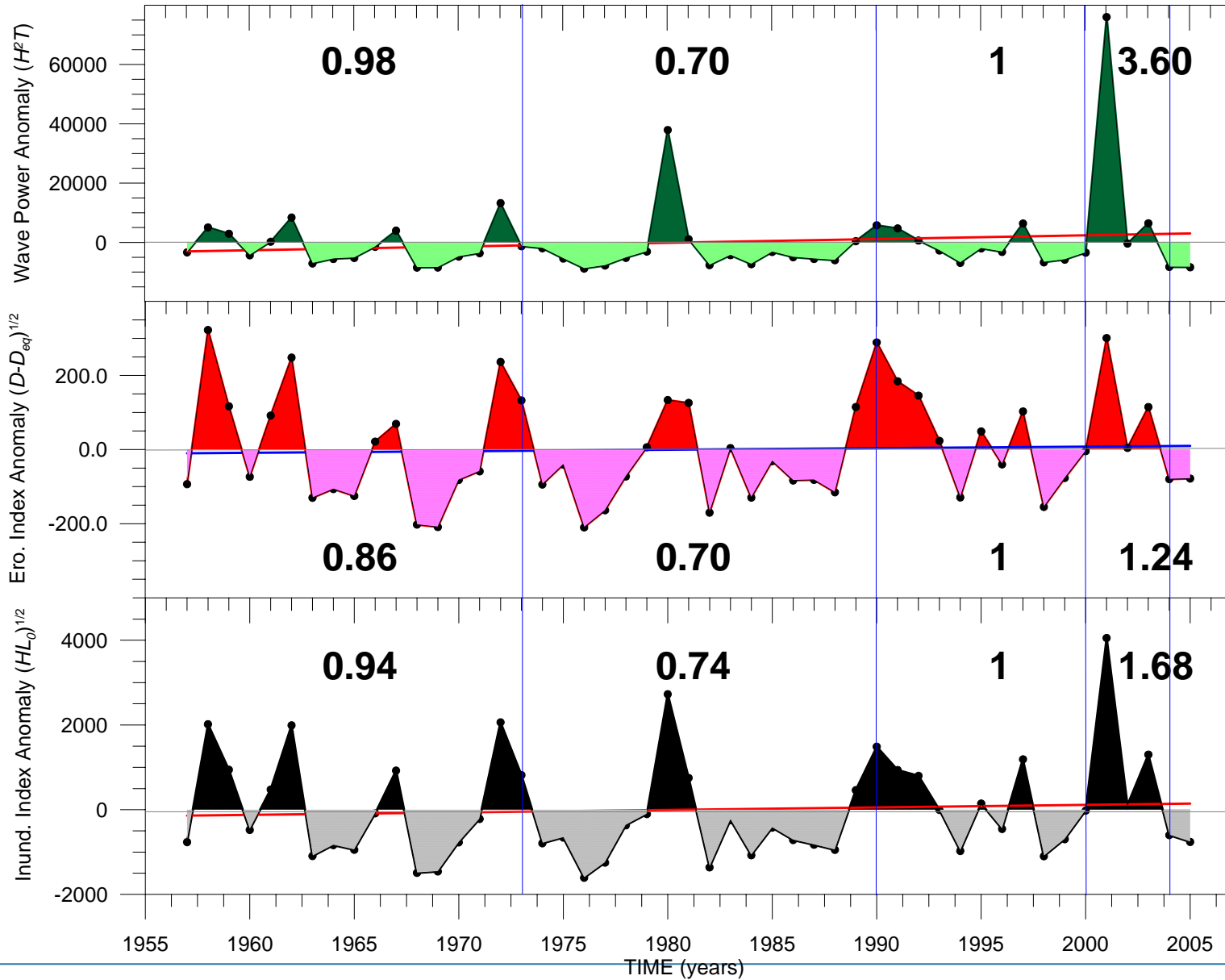
Yearly maximum wave events



Anomalies of yearly maximum values



Anomalies of yearly integrated values

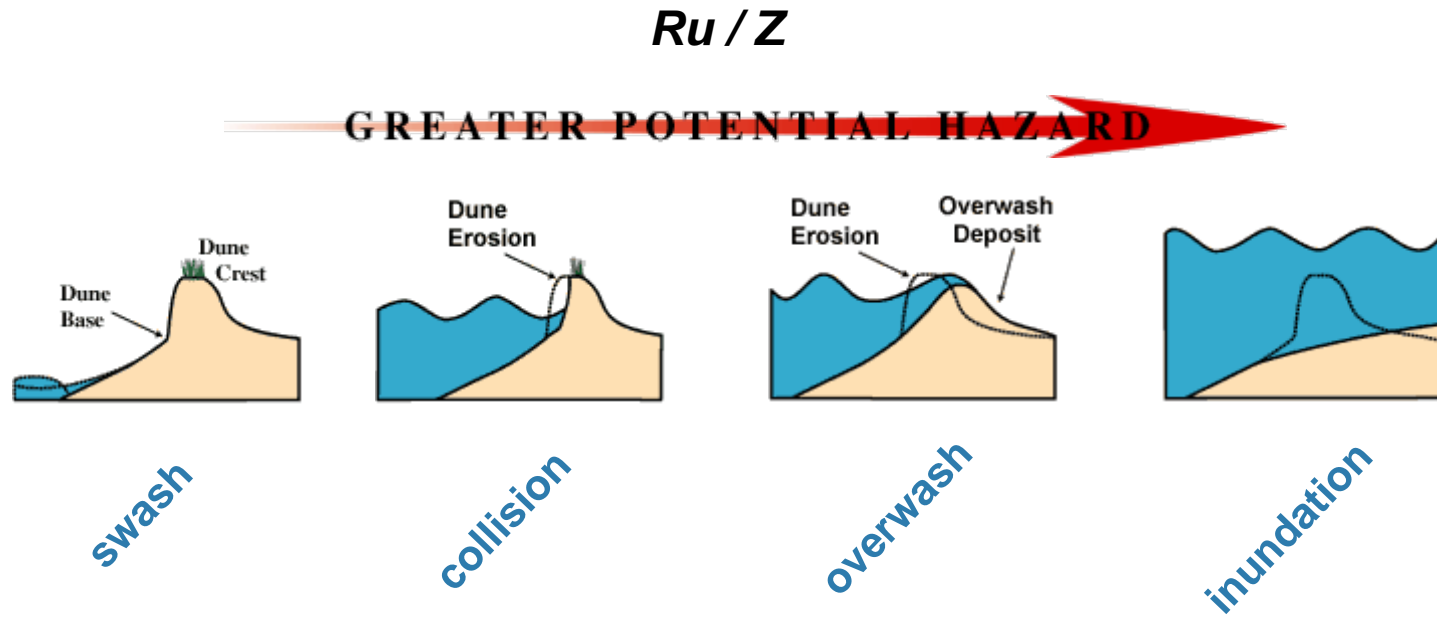


Numbers : yearly av. value period / value 1990/2000

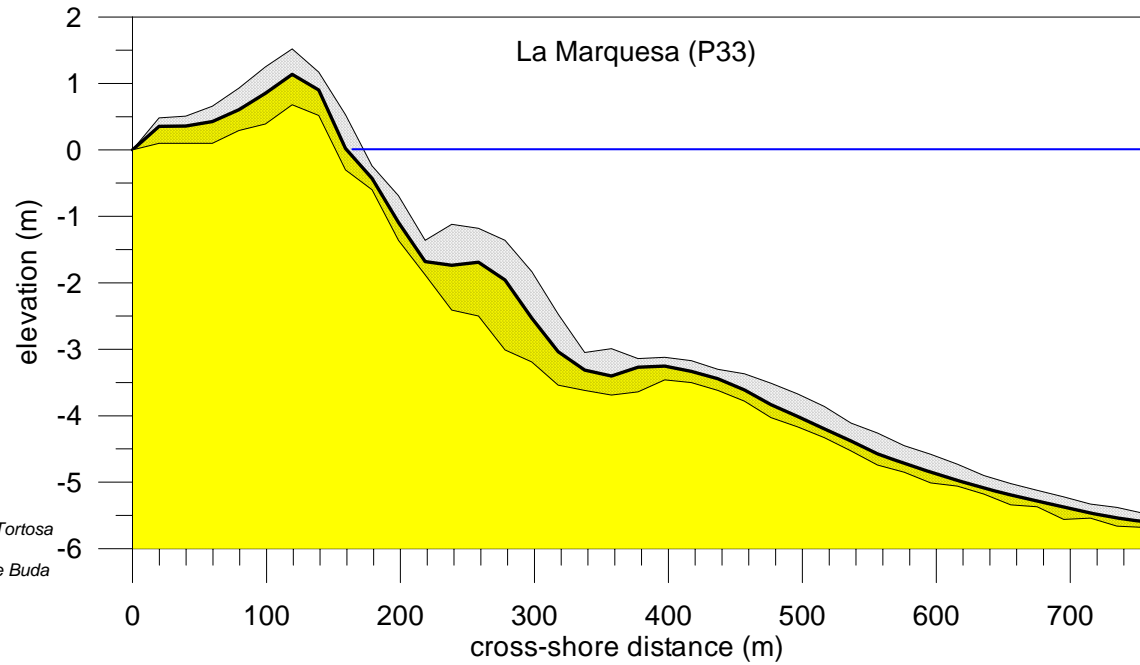
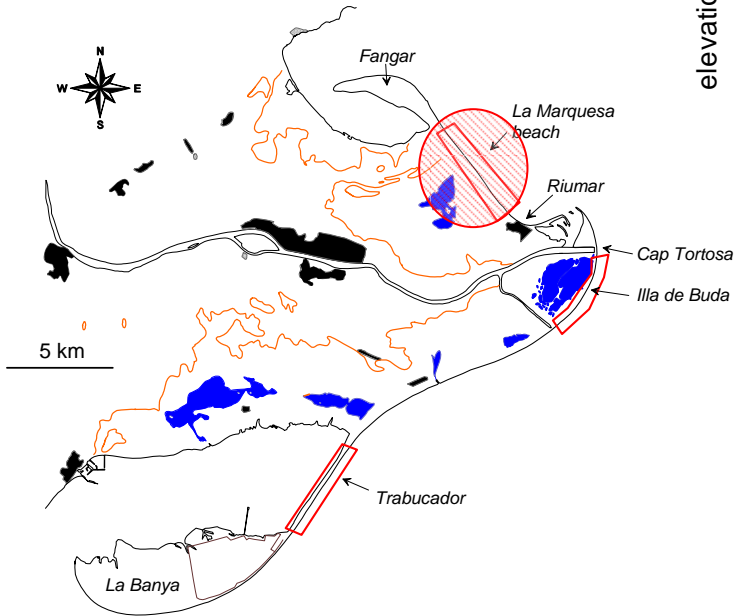
Coastal Change Hazard Scale for low-lying coasts

Conceptual model of coastal response to storm impacts (Sallenger, 2000).

Basic parameters: Coast – **Z** (beach/dune height)
 Storm – **Ru** (runup / water level)



La Marquesa



$$Z_{max} = 1.5 \text{ m}$$

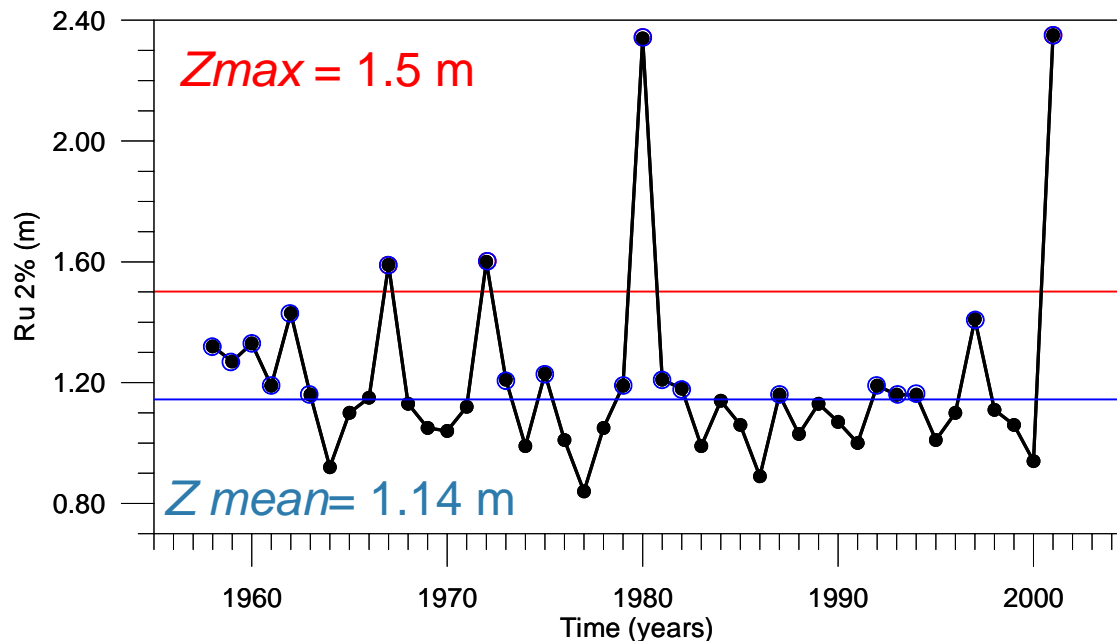
$$Z_{min} = 0.7 \text{ m}$$

$$Z_{mean} = 1.14 \text{ m}$$

$$\tan \beta = 0.019$$

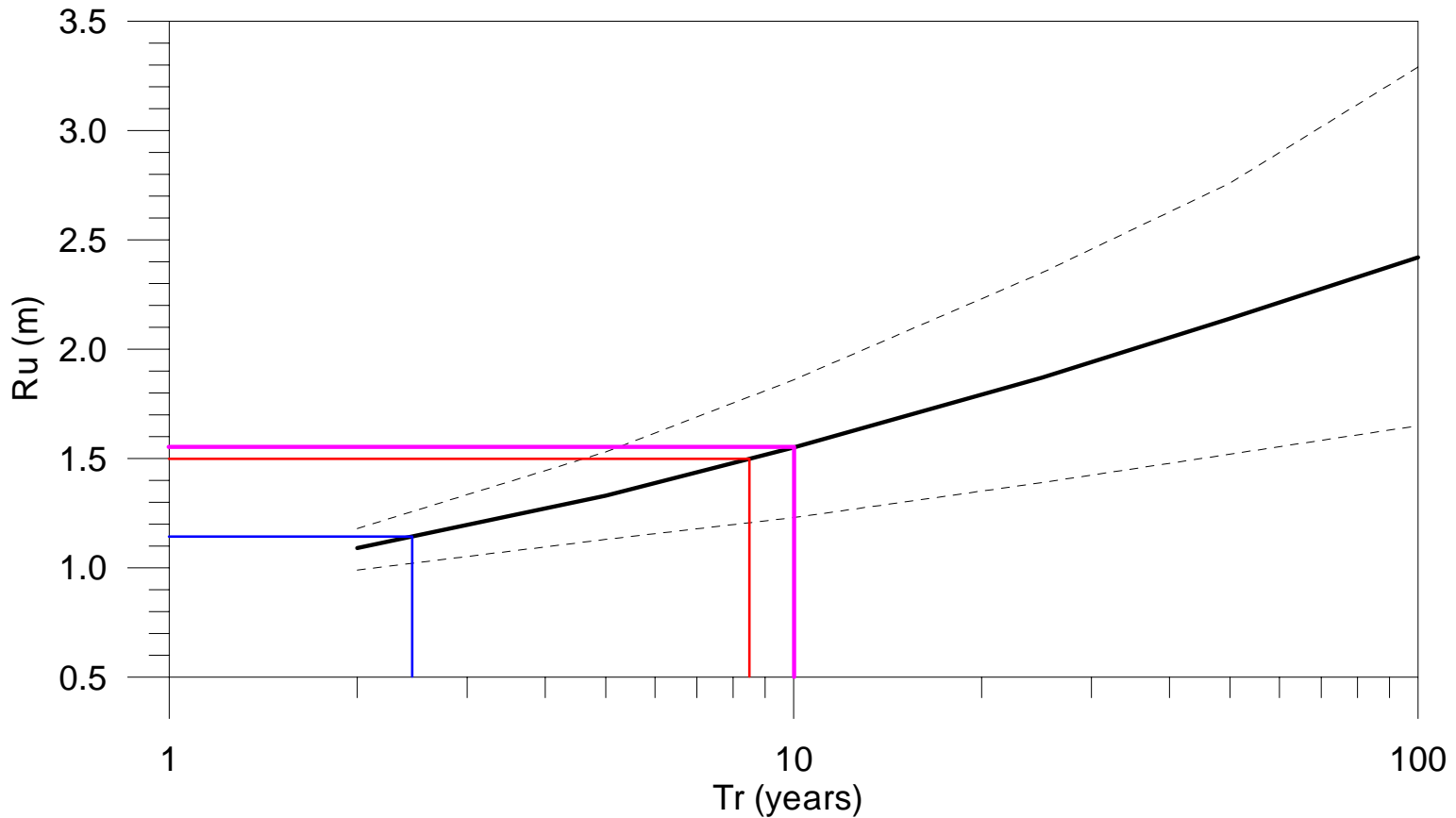
La Marquesa

Estimated change in coastal inundation due morphodynamic variability
(year per year basis – observed variability)



La Marquesa

$$F(Ru) = 1 - \exp(-((Ru-0.971)/0.189)^{0.75})$$



Summary & Conclusions (I)

Driving terms

- Energetic period with the largest recorded storm (~ 100 y).
- No detected change in storminess.
- Largest values inund. & transp. potential (↑68% & ↑360 %).

Coastal Response

- Largest erosion rates (↑250% & ↑800 %).
- Large overwash deposits (~ 17 Ha).
- Concentrated in narrow (≤ 150 m), lowlying & erosive areas

Summary & Conclusions (II)

Implications

- Cumulative effects.
- Snapshot of a period of accelerated coastal retreat.
- Useful to better define a buffer area.
- Need to be considered for long-term land-planning.