The MICORE Review of Historical Changes in Storminess in Europe

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The MICORE Project

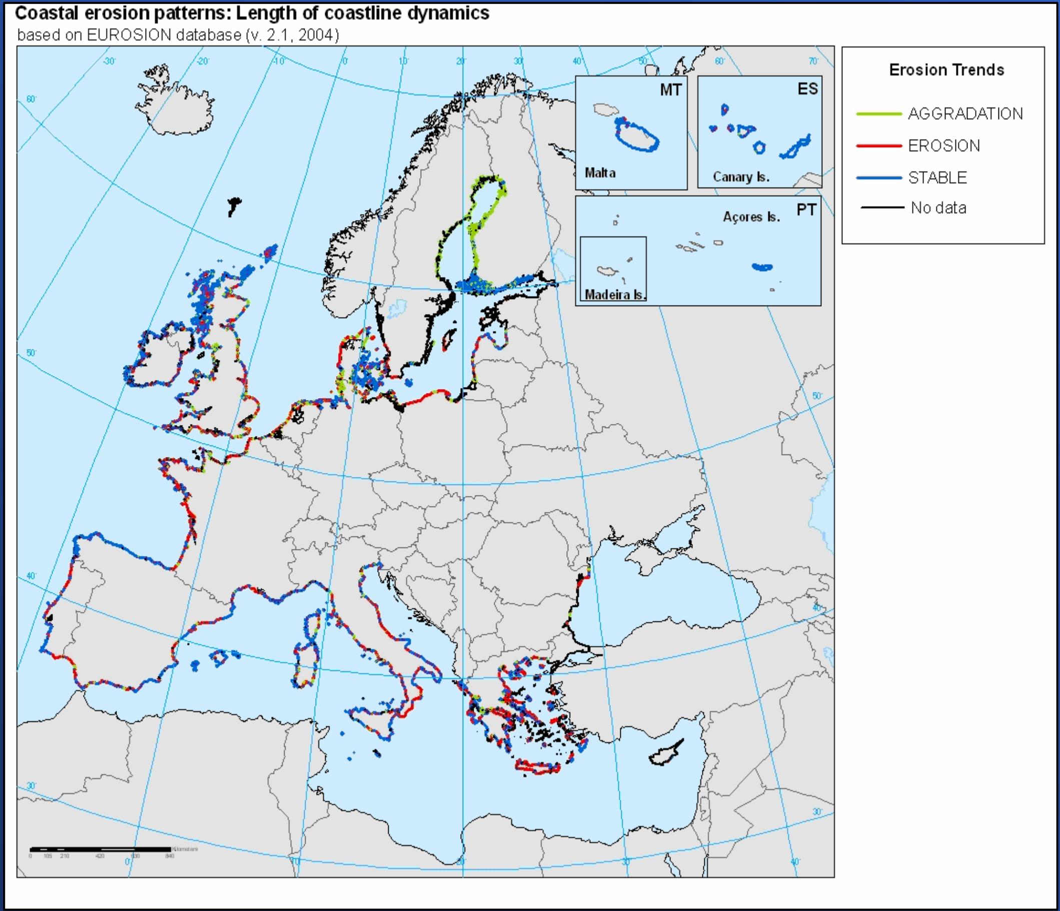
MICORE

Morphological Impacts and COastal Risks induced by Extreme storm events

FP7-contract n. 202798

Started June 2008-duration 3 years

Vulnerability of coastal systems in the EU



Eurosion Project: annual sediment deficit of European coasts 100 Mt

EU-Joint Research Centre: 19% of total EU-25 population (86 million inhabitants) live in 0-10 km coastal zone

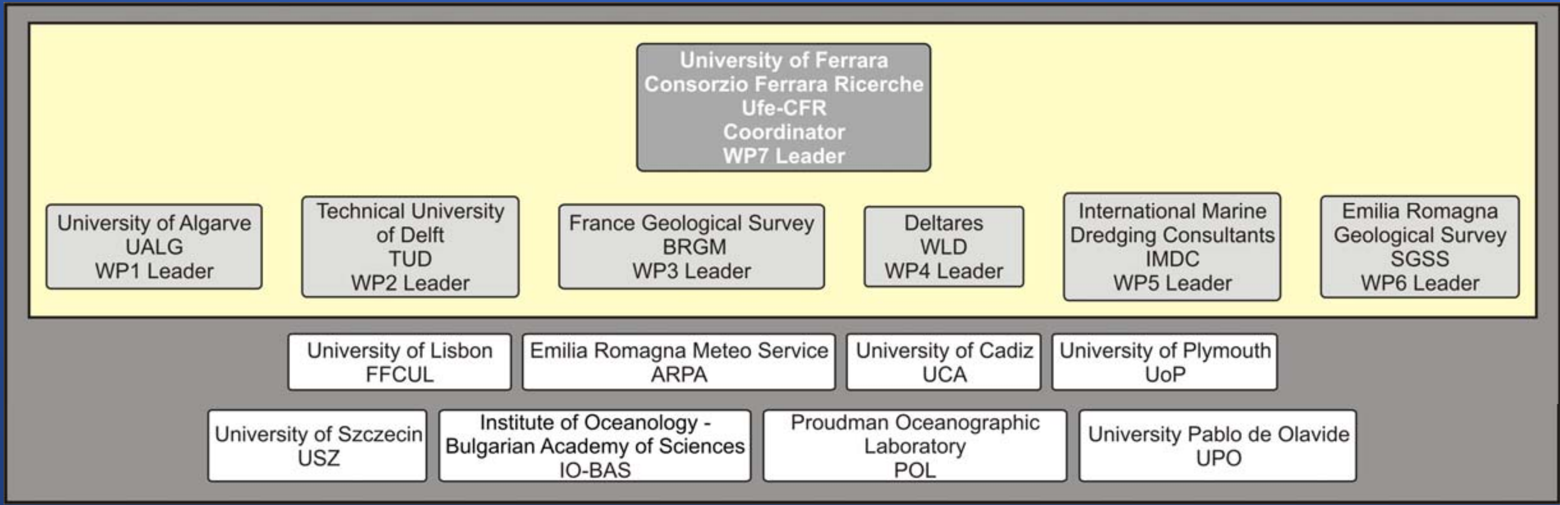
European Environment Agency: 12% of all EU coastal zones is lying below 5 m elevation and are potentially vulnerable for sea level rise and related inundations

Project's topics and today's talks

Research objectives:

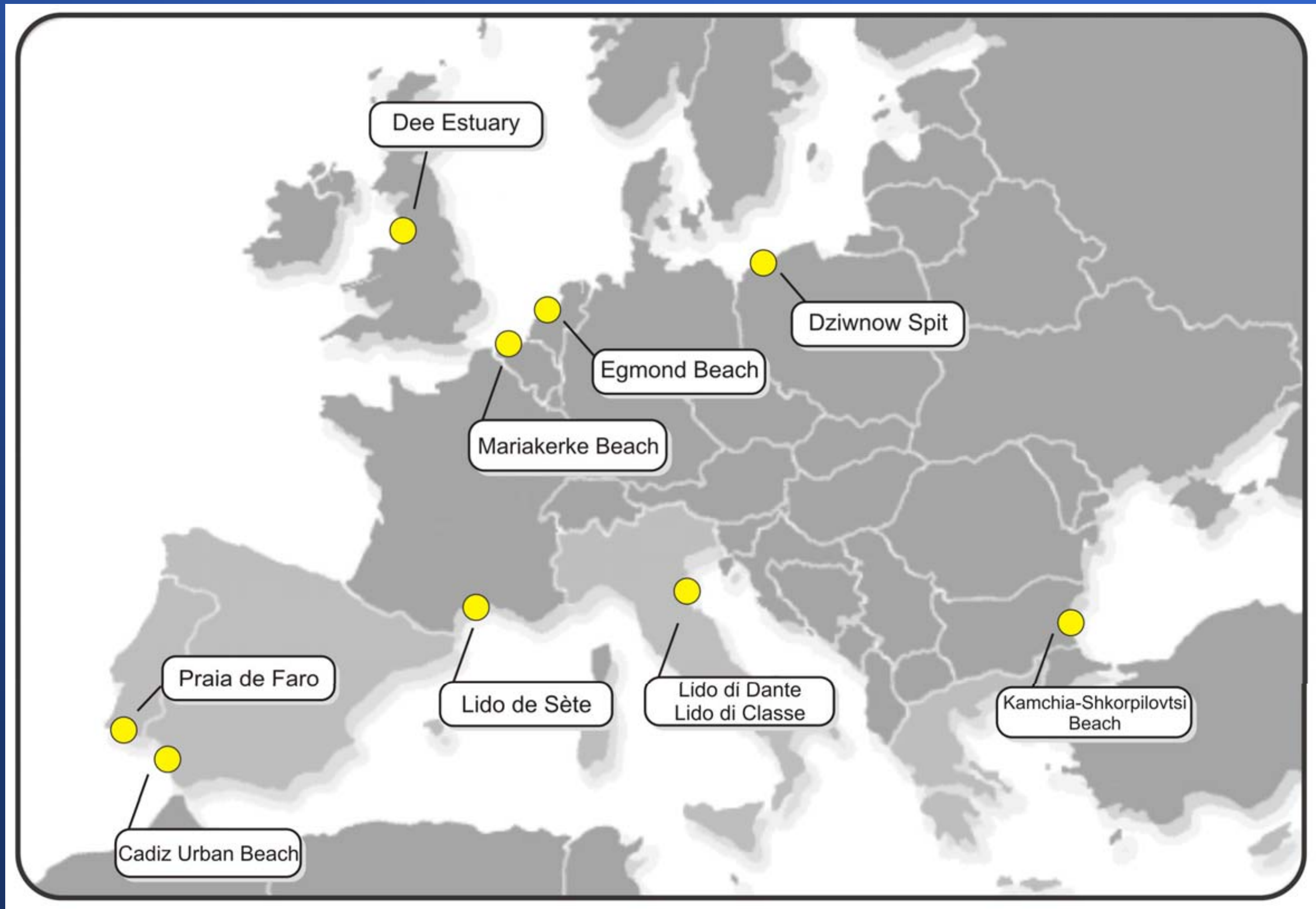
- Past European Marine Storms (homogeneous database, socio-economic damages)-This talk
- Change in dangerous storm occurrence)-This talk
- Map storm related risks: intensity, spatial extent, duration, hazard interaction. Special attention is devoted to the morphological impact)-J. Jimenez et al., C. Armaroli et al.
- Early warning and information system)-A. Van Dongeren et al.
- Multiple risks (e.g. tide+surge+wave action) J. Jimenez et al., C. Armaroli et al.
- Timely relief operations

MICORE Consortium and Project Structure



Workpackage	Leader
1. Historical Storms	UALG
2. Data Standards	TUD
3. Site Monitoring	BRGM
4. Modelling	WLD
5. Warning System Development	IMCD
6. Dissemination and Exploitation	SGSS
7. Project Management	CFR-Unife

Regional Coastlines and Case Studies



Historical Marine Storm Analysis

Goals

To undertake an analysis of change in storm occurrence and to consider future variability in the context of climate change.

To Include the study of trends in meteorological data (e.g. changes in storminess proxies) and to provide guidance for the understanding of the response of coastlines to potential changes in forcing agents.

The storminess analysis was made for all study areas of MICORE and three additional areas (Aquitaine-France, Catalonia Spain, and Portuguese West Coast).

Proxies of storminess

The driving factors included storm waves, wave energy, winds and surge levels, depending on data availability and on the specific conditions of each coastline.

A main limiting factor was the unavailability of representative (mostly measured) data sets for the last 40 years or more. Measured data rarely allowed a comprehensive analysis of storminess changes when used alone. It was necessary to incorporate model predictions (e.g. hindcast models such HIPOCAS) that were previously validated to assure a quality control.

Focus the study mainly on the last decades (generally 40 to 50 years datasets) where the available data was found to have good quality standards.

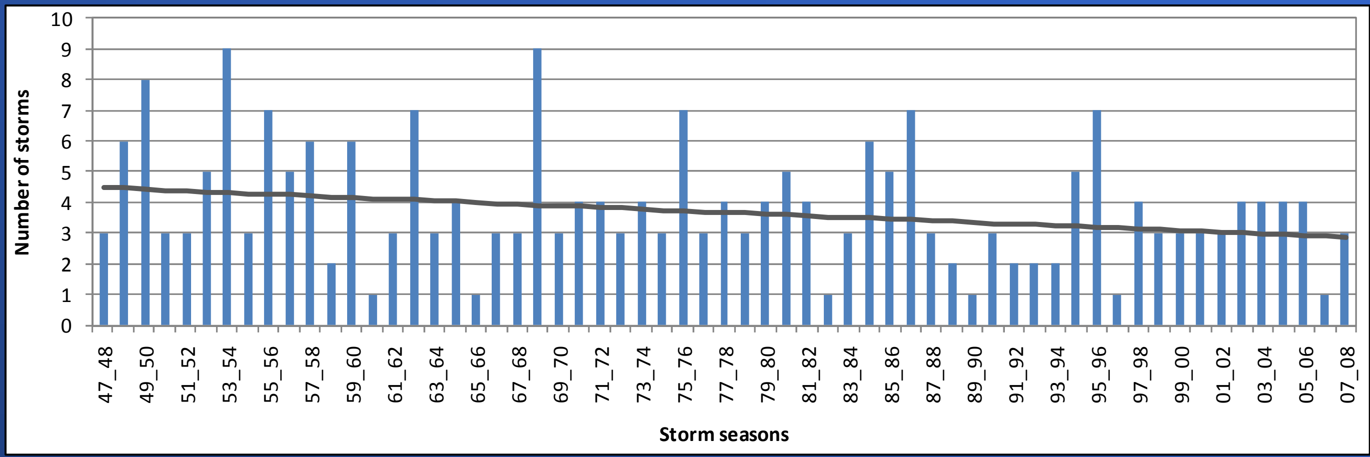
Temporal continuity

Existing databases of measured data were extended in time by integration of results from hindcast models (mainly for waves). Alternatively, hindcast results alone were used. Datasets with less than 30 years were not considered as indicators of climatic trends.

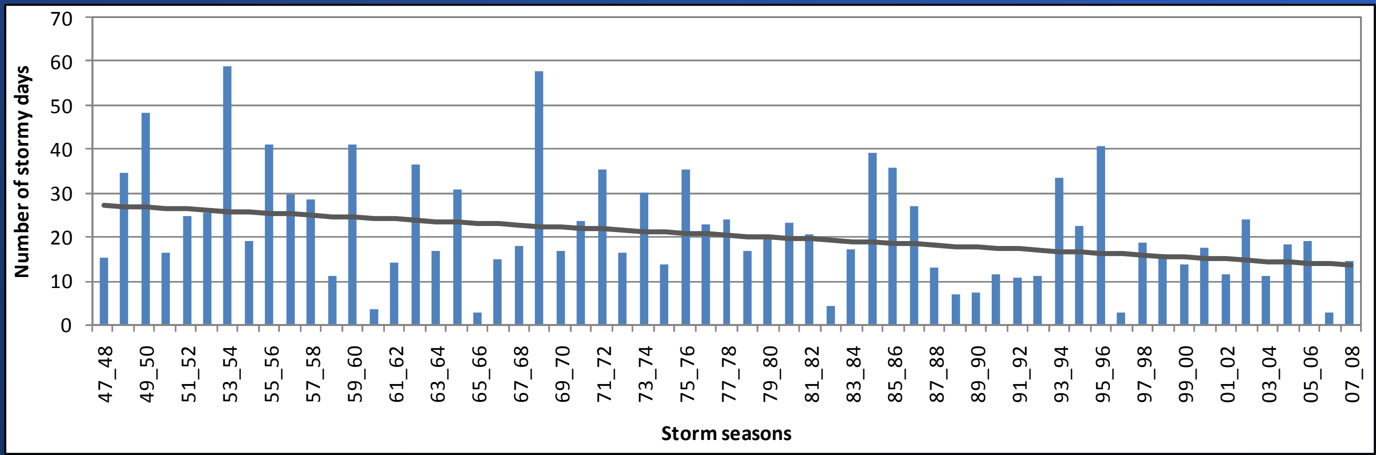
Almost all wind analyses were based on measured data; a surge and water level analysis were based on measured data. Wave analysis for datasets > 30 years was mainly based on hindcasting.

The periods considered for wind analysis ranged between 46 years (Netherlands) to 105 years (Andalusia – Spain), for surge from 45 years (Poland) to 100 years (Netherlands), for wave from 30 years (Belgium) up to 60 years (Bulgaria).

Examples of storminess decrease

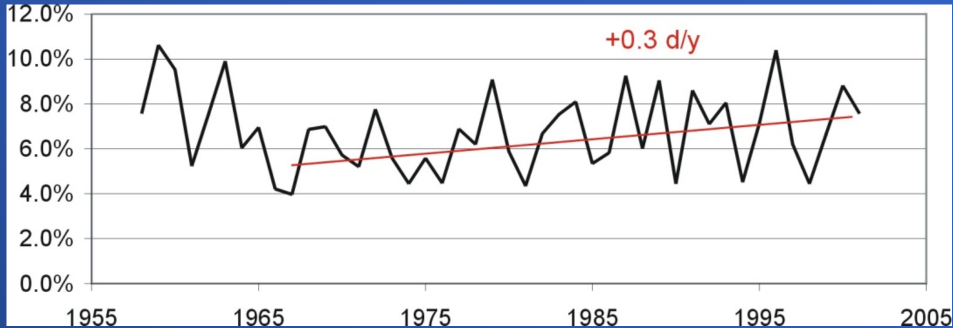


Number of storms during 1948-2008 in the Black Sea (Bulgaria)

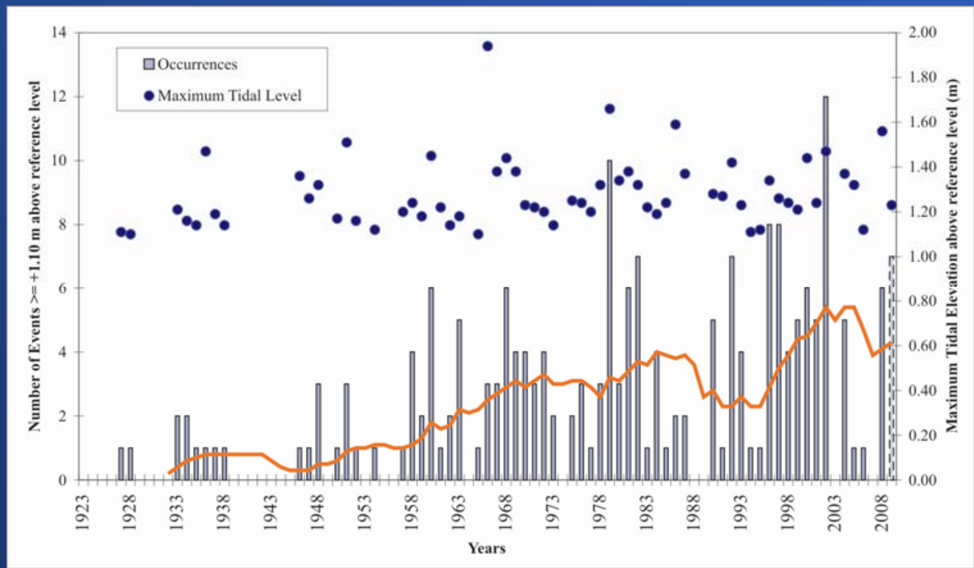


Number of stormy days during 1948-2008 in the Black Sea (Bulgaria)

Examples of storminess increase



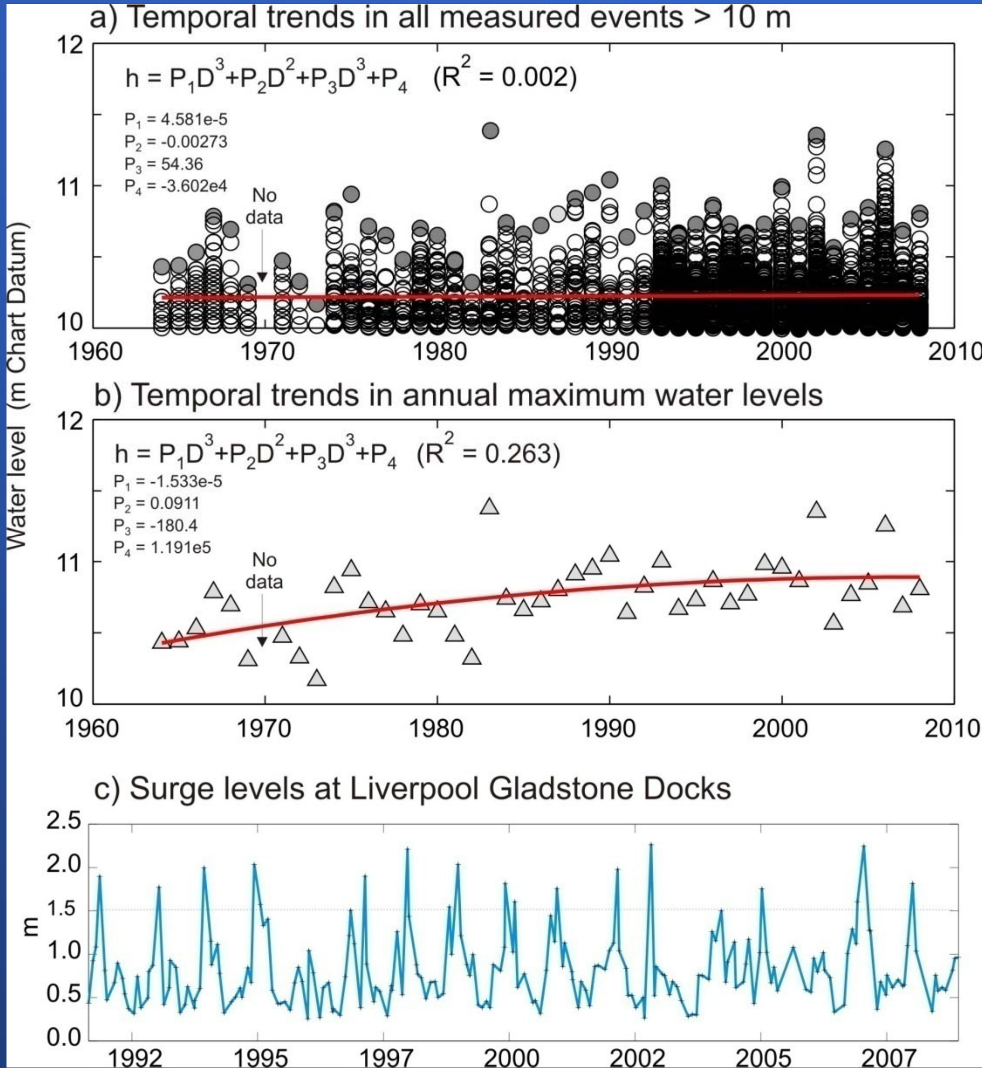
Cumulative frequency of storms classes from 1958 to 2001 in Mediterranean France

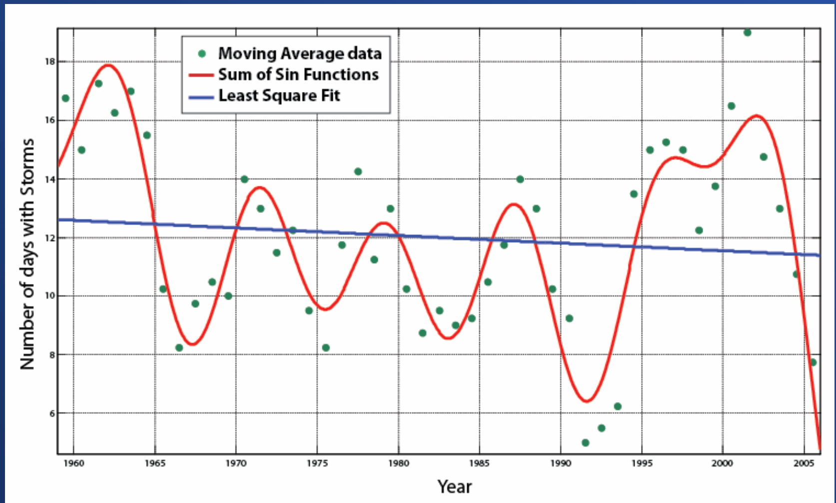


Characteristics of the storm surges in Venice during the period 1923-2008 (Italy)

Examples of “weak” trends

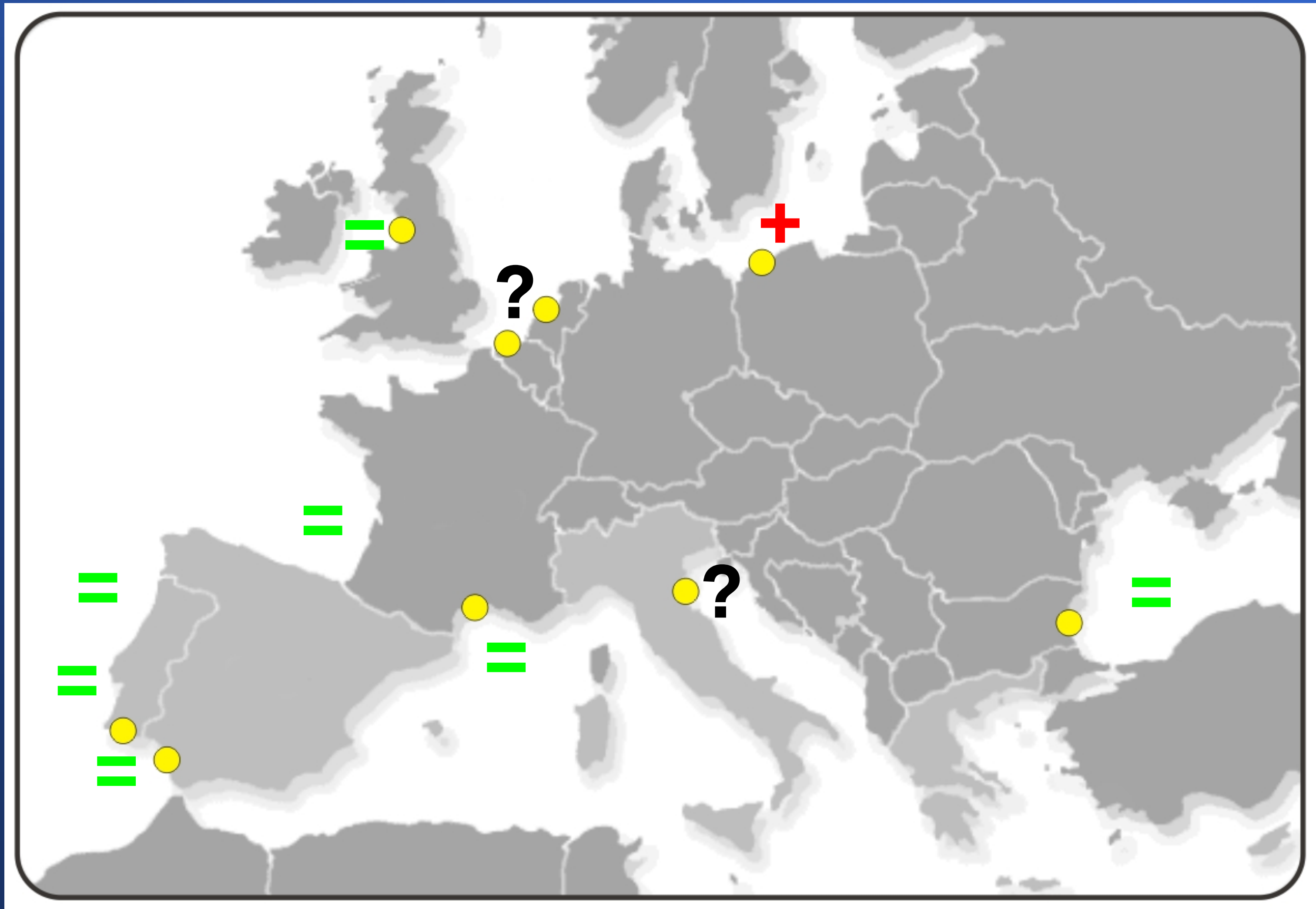
Data from the Irish Sea: water levels above 10 m (Chart Datum) at Heysham (UK) in (a) and (b). Surge levels at Liverpool Gladstone Docks (c).





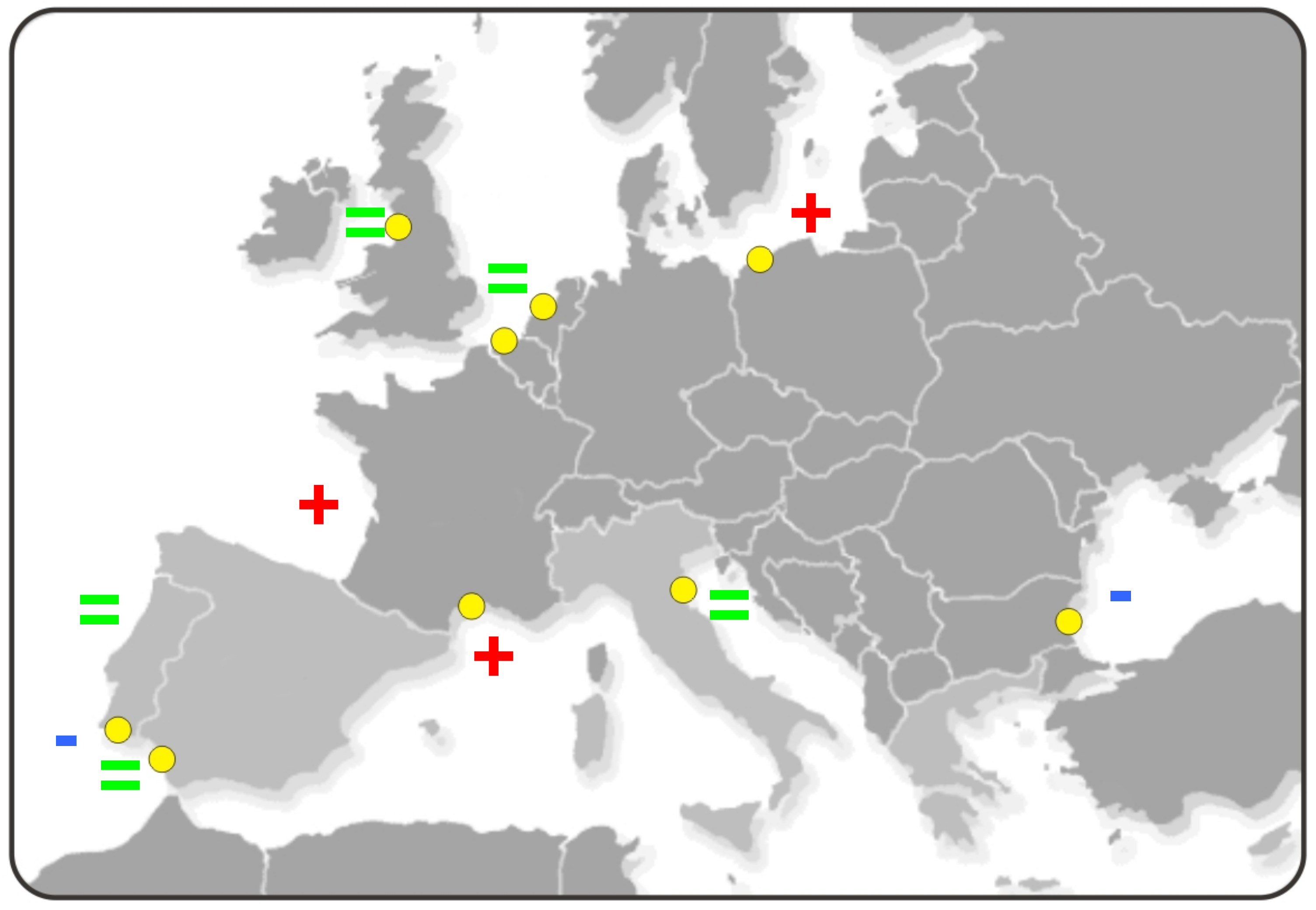
Moving average of days with storms\year, in southern Portugal

Variability: Storm Duration



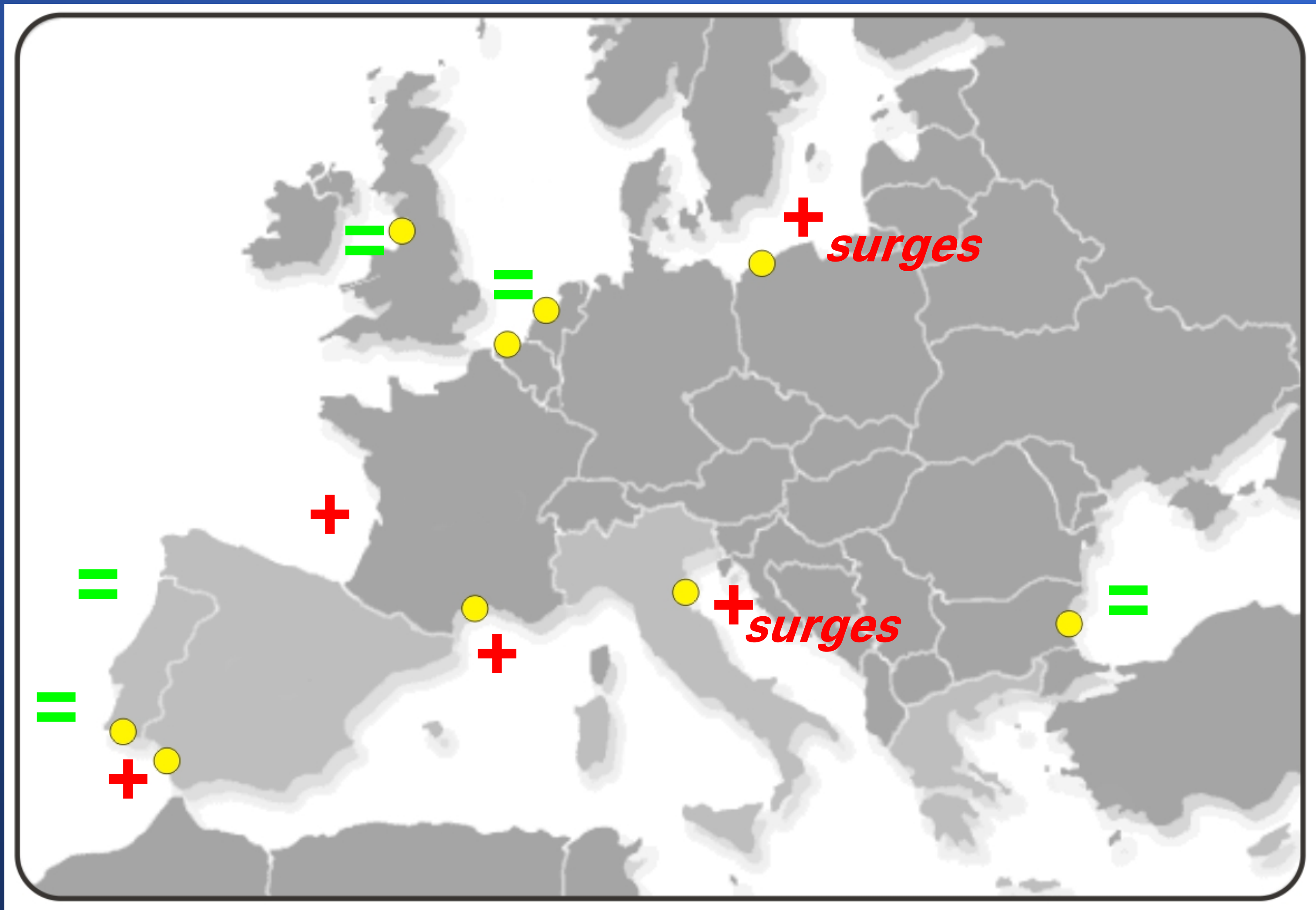
"=" – No trend, "+" Increasing storminess, "-" Decreasing storminess

Variability: Storm Intensity



"=" – No trend, "+" Increasing storminess, "-" Decreasing storminess

Variability: Storm Frequency



"=" – No trend, "+" Increasing storminess, "-" Decreasing storminess

Conclusions

- Large variability of trends from coastal region to coastal region. The dominant result is the absence of a trend, with most of the used proxies (62) showing “no trends”.
- Storminess variability is much higher than the observed trends at the time scale of the performed analysis (more than 3 decades records).
- For the existing and available data sets, the relationship between global climate change and storminess variability was not detected at European level.
- Need of making available into the public domain all European data sets on storminess indicators, as well as to establish monitoring networks for storminess proxies that should be kept active for decades, integrating both new and historical data.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