Euro-Mediterranean Centre on
Insular Coastal Dynamics (ICoD)

Institute of Earth Systems
University of Malta

EUR-OPA MAJOR HAZARDS AGREEMENT
ACCORD EUR-OPA RISQUES MAJEURS

EUR-OPA Major Hazards Agreement

Committee of Permanent Correspondents / Directors of Centres

3 - 4 November 2020

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UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

ICoD
Euro-Mediterranean Centre on Insular Coastal Dynamics

EUROPEAN CENTRE FOR GEOMORPHOLOGICAL HAZARDS

EUR-OPA project on

Coastal Risk Assessment and Mapping

- *2016 initiative for a stepped approach to the identification & mapping of coastal risk;*

- *2016-17 development of geomorphological mapping skills;*

- *2018/19 coastal hazard susceptibility / vulnerability mapping;*

(Coordination : Anton Micallef, ICOD)

Coastal Risk Assessment and Mapping

2020 Deliverables (Outputs)

<u>Coordinator Centre</u>: ICoD, University of Malta, Malta:

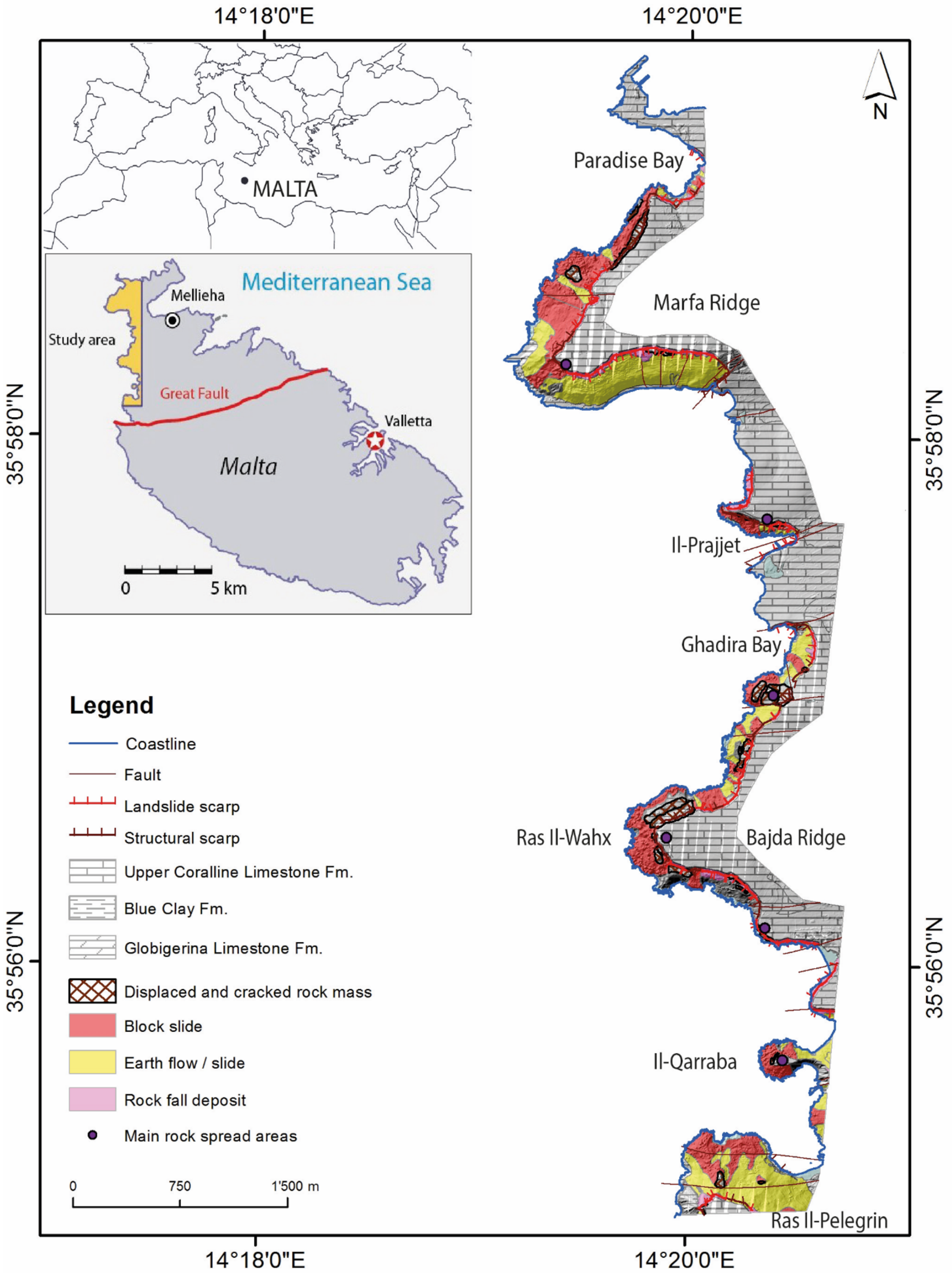
- Organisation/report on workshop on coastal risk assessment;
- identifying chosen methodology(ies) & providing guidelines & recommendations for field data collection & risk mapping.

<u>Partner 1:</u> CERG with the support of University of Caen, Normandy:

<u>Partner 2:</u> UNIMORE, University of Modena and Reggio Emilia, Italy:

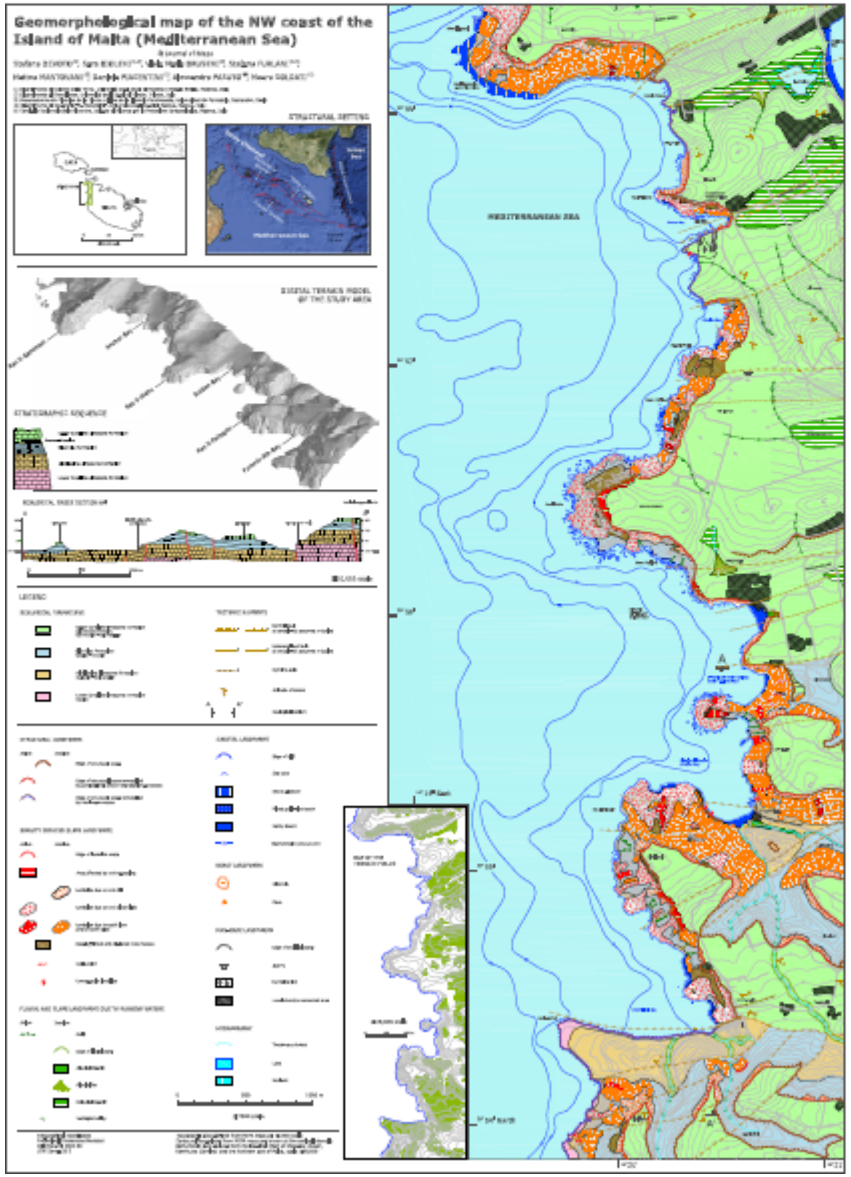
- *Contribution and participation to the above*

NW Malta



Geological-geomorphological sketch of NW of Malta (*Piacentini et al., 2015*)

Toward coastal risk mapping (NW Malta)



Geomorphological map (*Devoto et al., 2012*)

Available maps

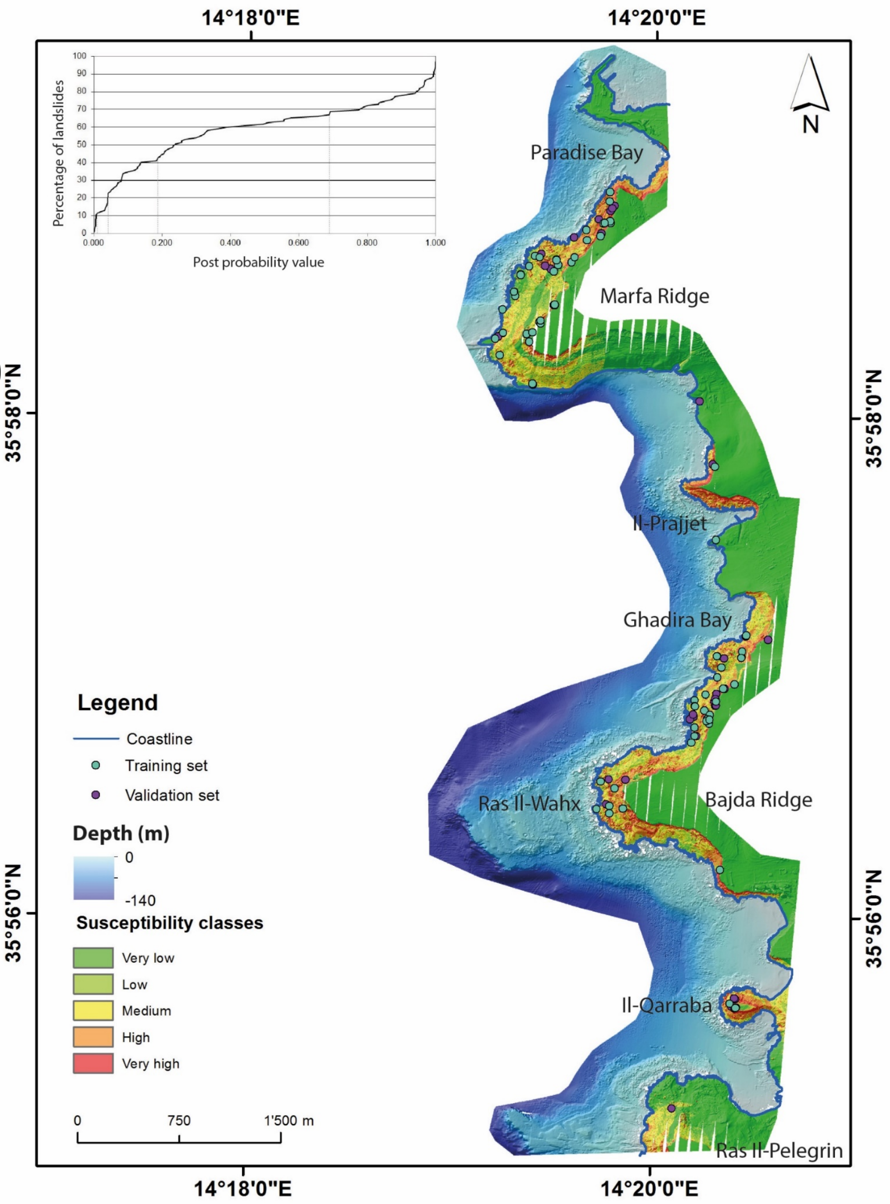
Geomorphological map (left)

Susceptibility map (right)

Missing maps

Hazard map

Vulnerability map



Landslide susceptibility map (*Piacentini et al., 2015*)

NE Gozo

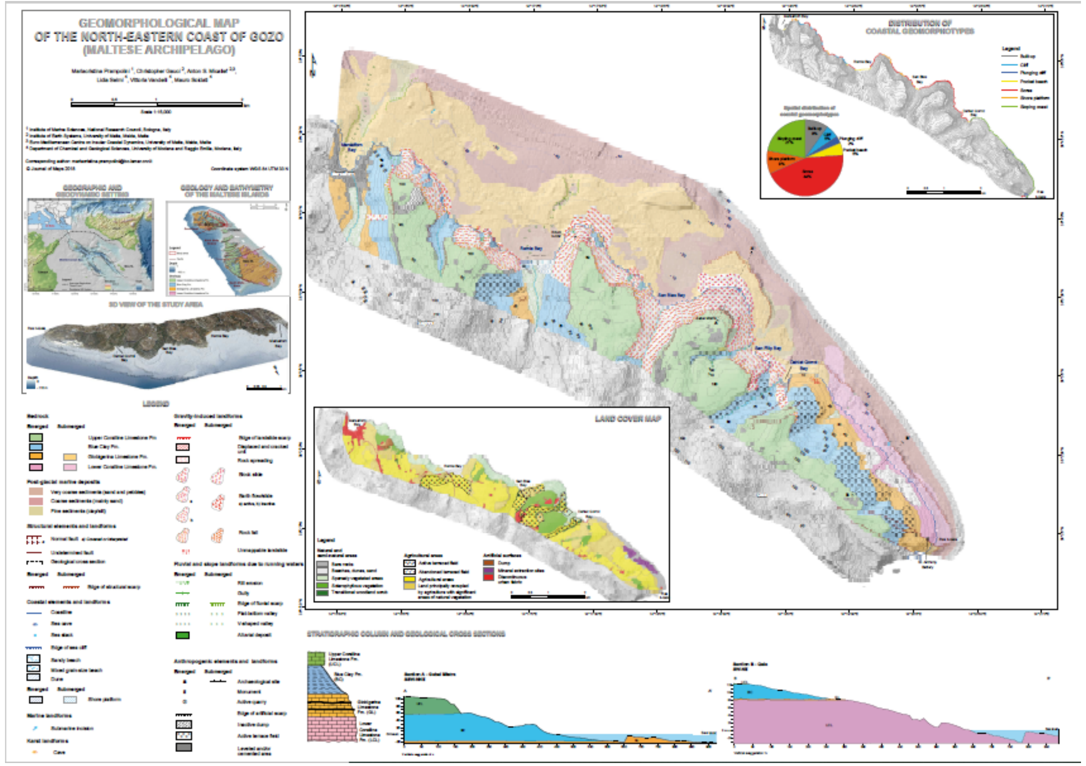
Figure 3. Coastal geomorphotypes: (a) built-up coast (Marsalforn Bay); (b) cliff shaped in Blue Clay (east of Marsalforn Bay); (c) sloping coast (between Dahlet Qorrot Bay and Ras il-Qala); (d) plunging cliff (between Dahlet Qorrot Bay and Ras il-Qala); (e) scree (Gebel Mistra); (f) shore platform (east of Marsalforn Bay); (g) pocket beach (Ramla Bay).

(Prampolini et al., 2018)

Figure 5. Landslides: (a) block slides (west of Dahlet Qorrot Bay); (b) earth flow and block slide (between San Blas Bay and Dahlet Qorrot Bay); (c) rock fall at the bottom of a limestone plateau and earth flow/slide affecting the underlying clayey terrain (between San Blas Bay and Dahlet Qorrot Bay).

(Prampolini et al., 2018)

Toward coastal risk mapping (NE Gozo)



Geomorphological map *(Prampolini et al., 2018)*

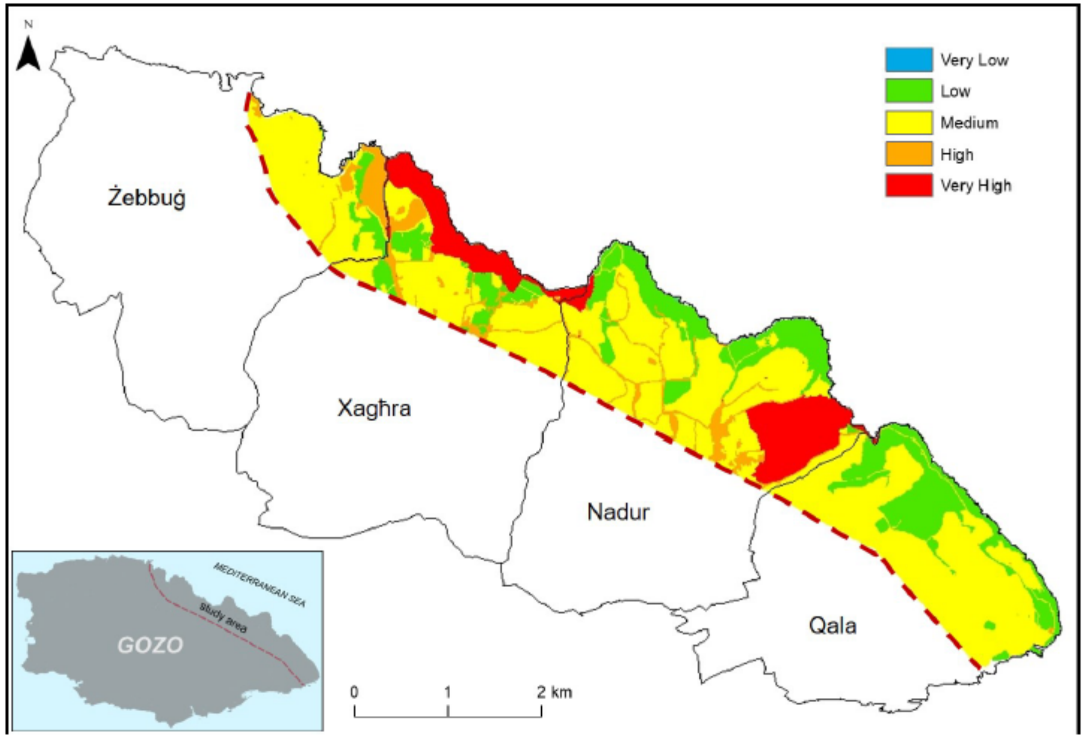


Figure 8. Overall vulnerability map resulting from the spatial aggregation of the physical vulnerability levels and the social vulnerability levels over the area. The red dashed line indicates the inland boundary of the study area.

(Rizzo et al., 2020)

Available maps

Geomorphological map (left)
Vulnerability map (right)

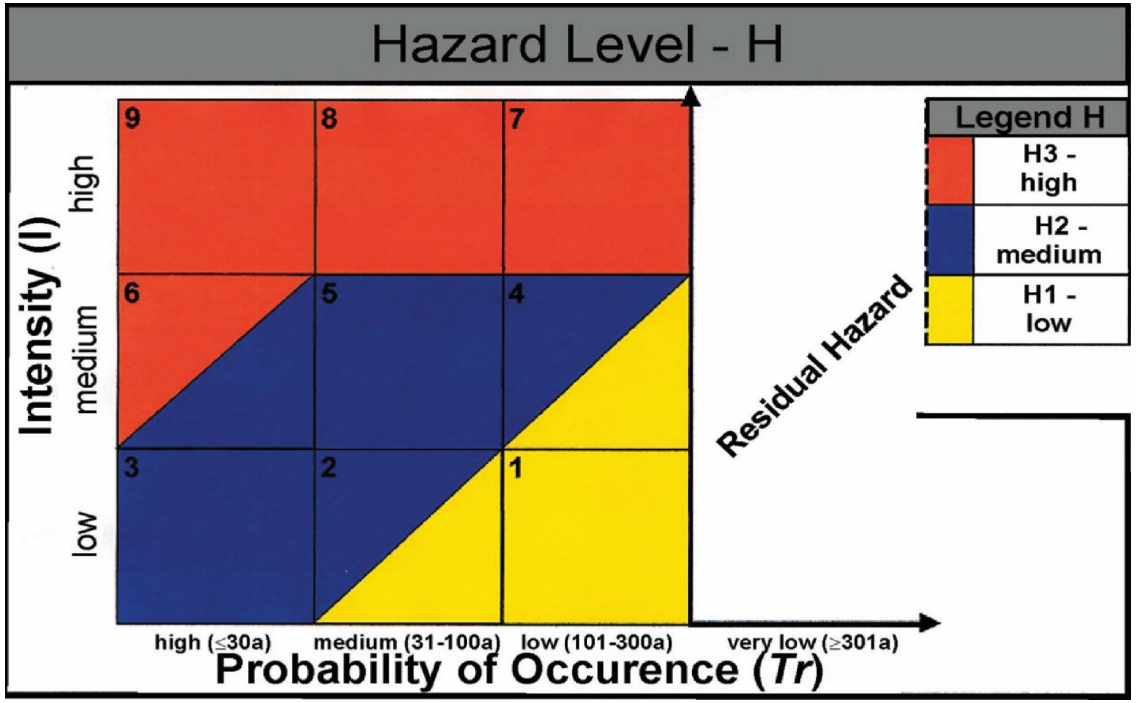
Missing maps

Susceptibility Map
Hazard map

Methodology for risk mapping

The BUWAL hazard matrix *(Heinimann et al., 1998).*

- effective for implementation of hazard maps;
- used in alpine areas but with potential for coast;
- combines intensity (velocity x thickness for landslides) with their return time;
- useful / comprehensible tool for local authorities;



Way Forward

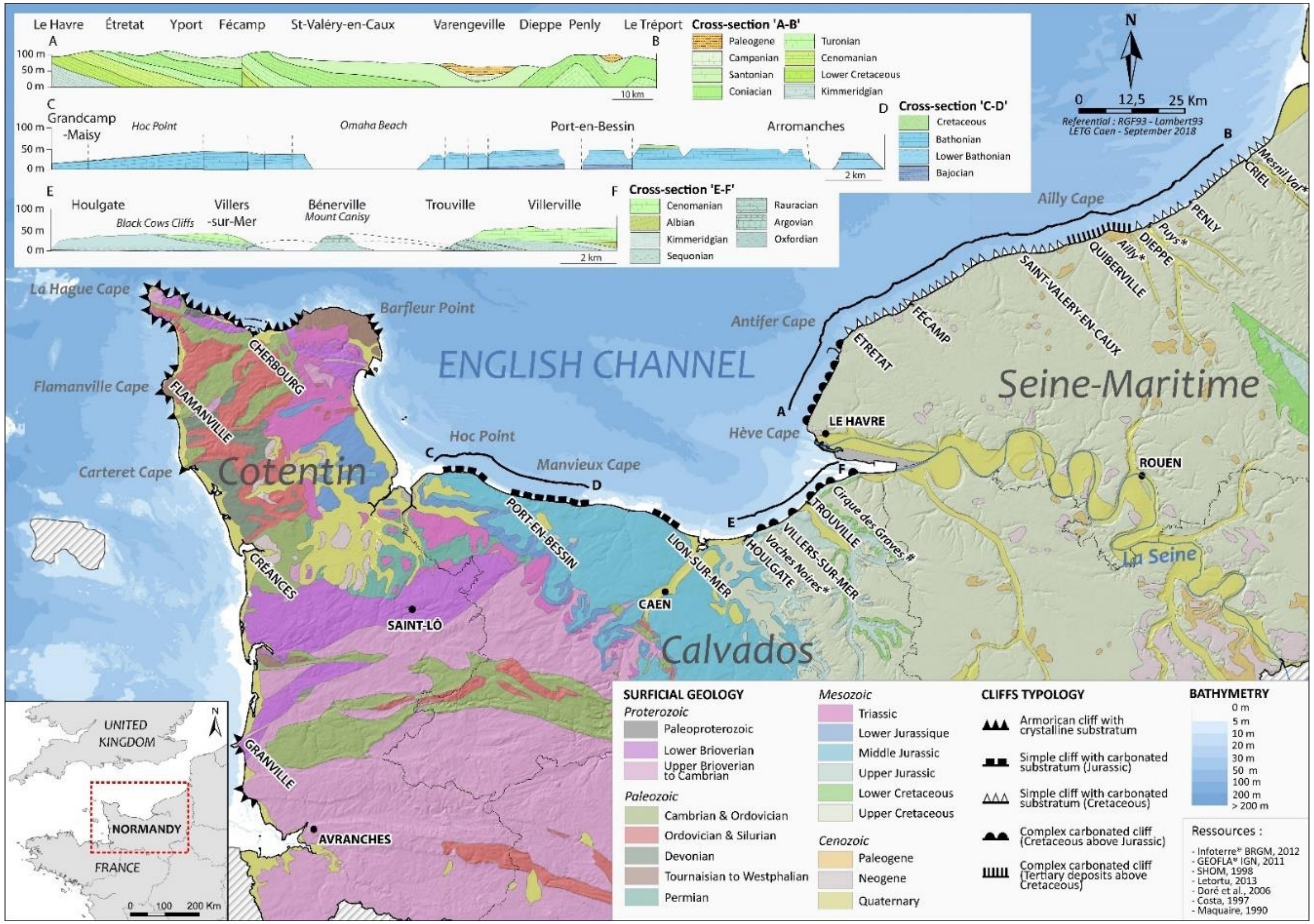
- focus on NE Gozo landslides, coastal and precipitation flooding hazards;
- evaluate storm-related factors (return-time, intensity etc);
- produce matrix for individual (accumulated) factors;
- define hazard levels;
- define Risk levels from above and previously defined vulnerability levels;
- produce Risk Maps

UNIVERSITÉ CAEN NORMANDIE

UMR 6554 CNRS LETG

RICOCHET multi-risk assessment on coastal territory in a global change context ANR-16-CE03-0008

UBO Université de Bretagne Occidentale

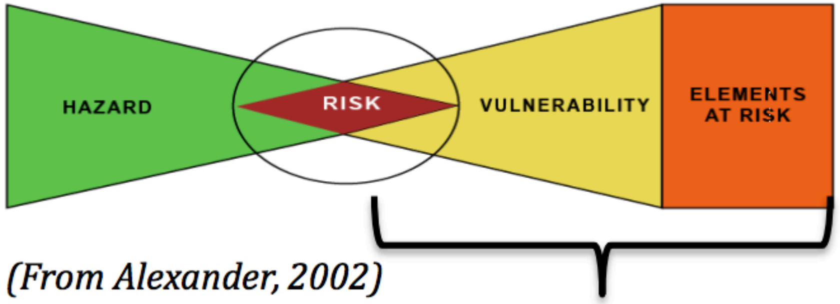


geological map & lithostratigraphic profiles of cliffs

Based on French National coastal risk mapping methodology with adaptation of several criteria.

Risk = f (hazard; consequences)

Consequences = f(Element at Risk; vulnerability)

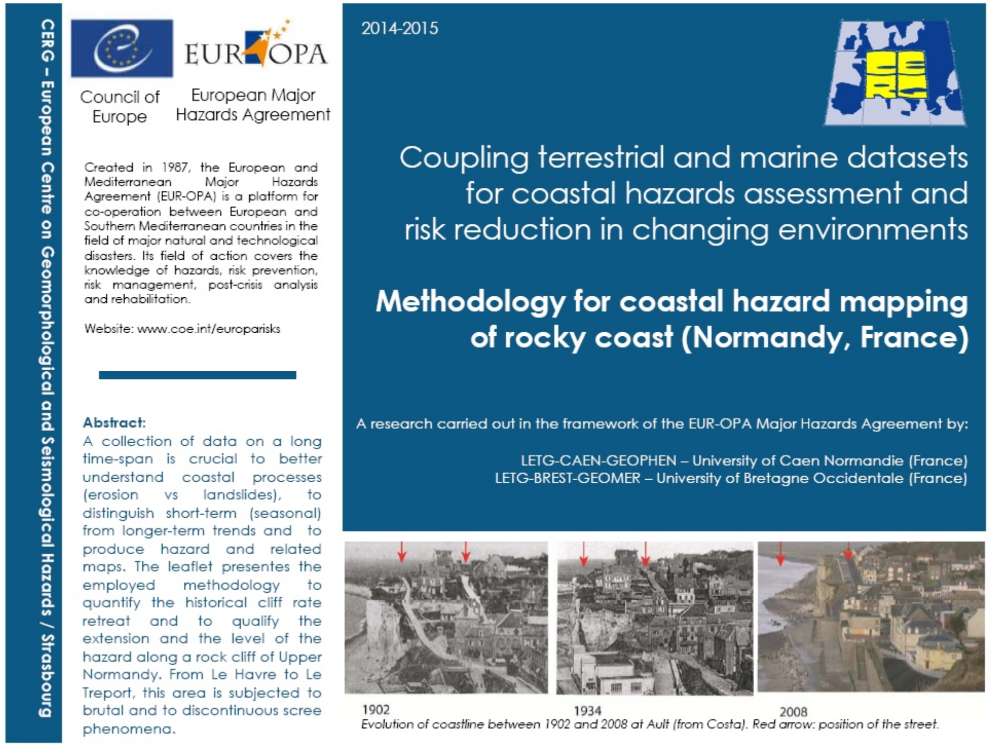


(From Alexander, 2002)

Consequences

1. Methodology for coastal Hazard mapping of rocky coast (Normandy, France)

- updated from 2015 work



CERG – European Centre on Geomorphological and Seismological Hazards / Strasbourg

Council of Europe

EUR-OPA European Major Hazards Agreement

Created in 1987, the European and Mediterranean Major Hazards Agreement (EUR-OPA) is a platform for co-operation between European and Southern Mediterranean countries in the field of major natural and technological disasters. Its field of action covers the knowledge of hazards, risk prevention, risk management, post-crisis analysis and rehabilitation.

Website: www.coe.int/europarisks

Abstract:
A collection of data on a long time-span is crucial to better understand coastal processes (erosion vs landslides), to distinguish short-term (seasonal) from longer-term trends and to produce hazard and related maps. The leaflet presentes the employed methodology to quantify the historical cliff rate retreat and to qualify the extension and the level of the hazard along a rock cliff of Upper Normandy. From Le Havre to Le Treport, this area is subjected to brutal and to discontinuous scree phenomena.

2014-2015

Coupling terrestrial and marine datasets for coastal hazards assessment and risk reduction in changing environments

Methodology for coastal hazard mapping of rocky coast (Normandy, France)

A research carried out in the framework of the EUR-OPA Major Hazards Agreement by:

LETG-CAEN-GEOPHEN – University of Caen Normandie (France)
LETG-BREST-GEOMER – University of Bretagne Occidentale (France)

1902 1934 2008

Evolution of coastline between 1902 and 2008 at Ault (from Costa). Red arrow: position of the street.

Four successive main steps:

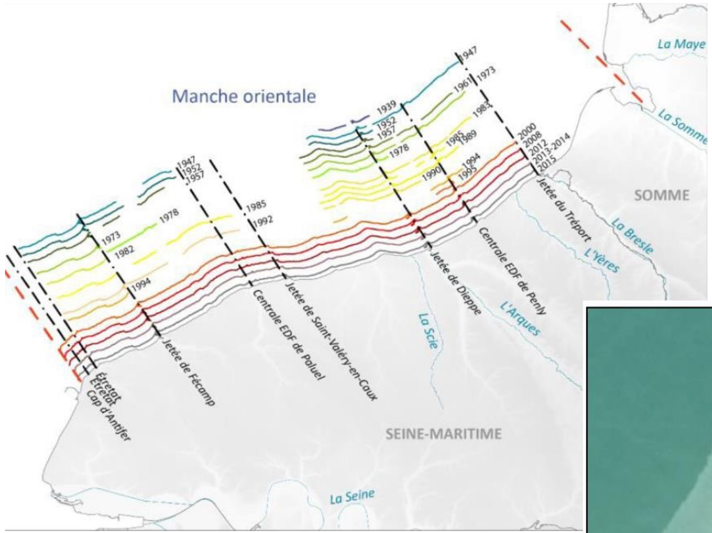
a. quantification of historical cliff rate retreat;

b. definition of the rhythm of retreat;

c. definition of the erosion map (position of coastline in 100 yrs),

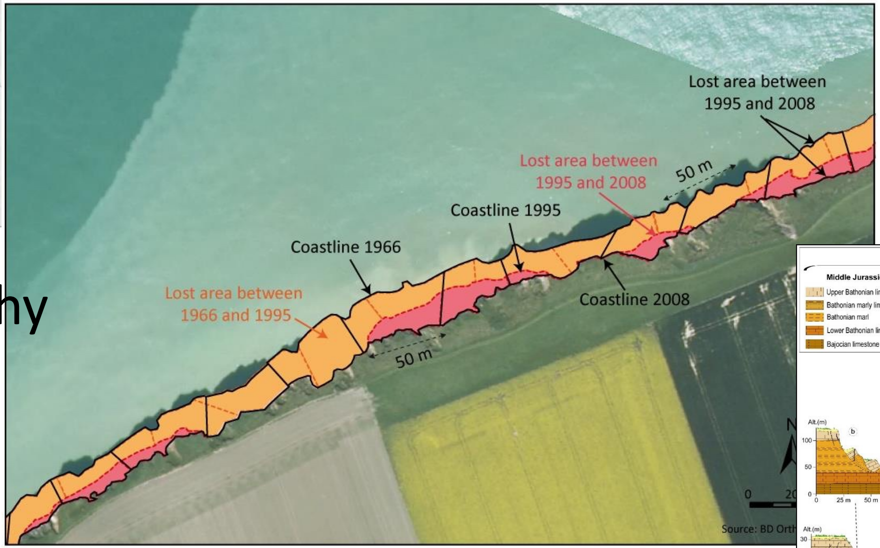
d. definition of hazard classes & hazard mapping;

a. Quantification of historical cliff rate retreat (temporal reconstruction of the evolution).

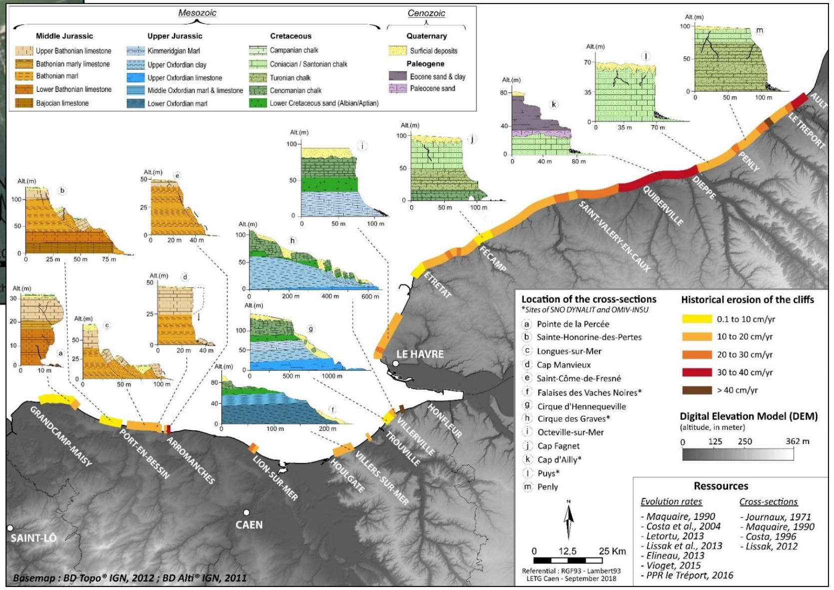


Mean retreat rate of the entire shoreline was approximately 6 m between 1966 and 1995, (0.21 m/yr).

Vertical aerial photography



lost area approach



Analysis highlighted three distinct areas indicating a litho-dependent retreat rate

historical cliff retreat rates (cm/yr)

b. Rhythm of retreat – use of geomorphological markers

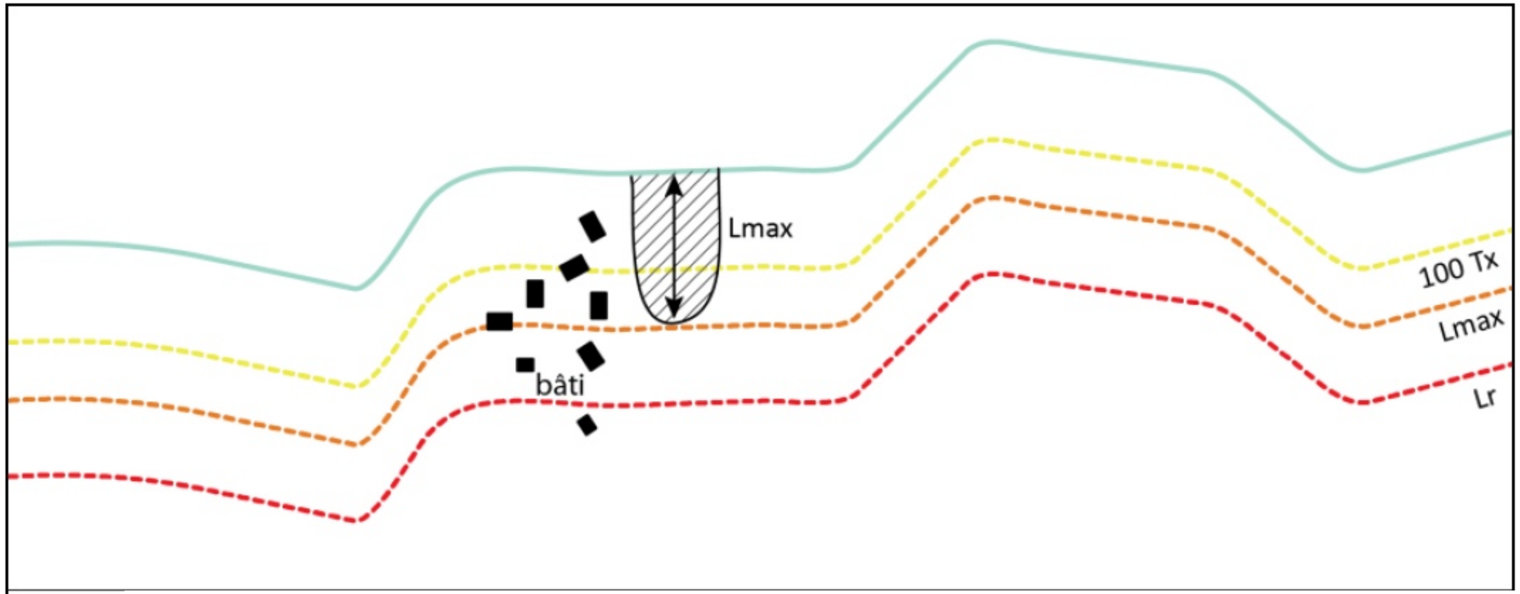
- possible changes in time & space, intensity or the frequency of events;
- retreat rhythm of falls.

c. Definition of the erosion map (100yr scenario)

- average rate of retreat +/- 50 yrs may be used to estimate coastline position for next 100 yrs (100 Tx) by 'simple' extrapolation;
- above smooths impacts of brutal phenomena that may have spatial influences (Lmax) exceeding average retreat;

c. Definition of the erosion map (100yr scenario)

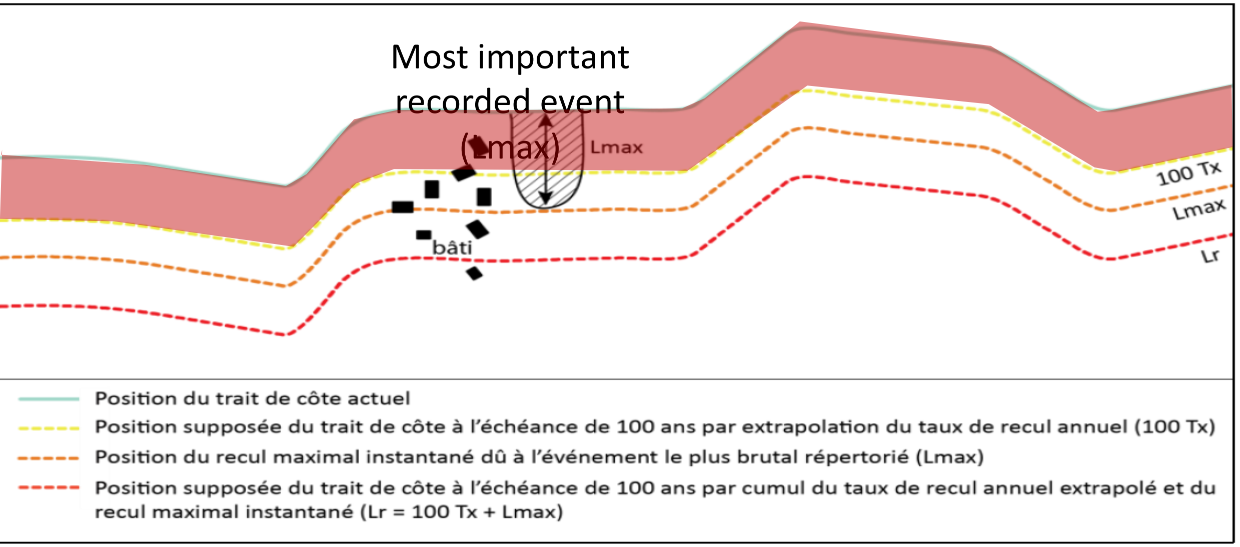
- Need to take into account another scenario, and draw a position of supposed coastline (red line) which corresponds to: Lr = 100 Tx + Lmax



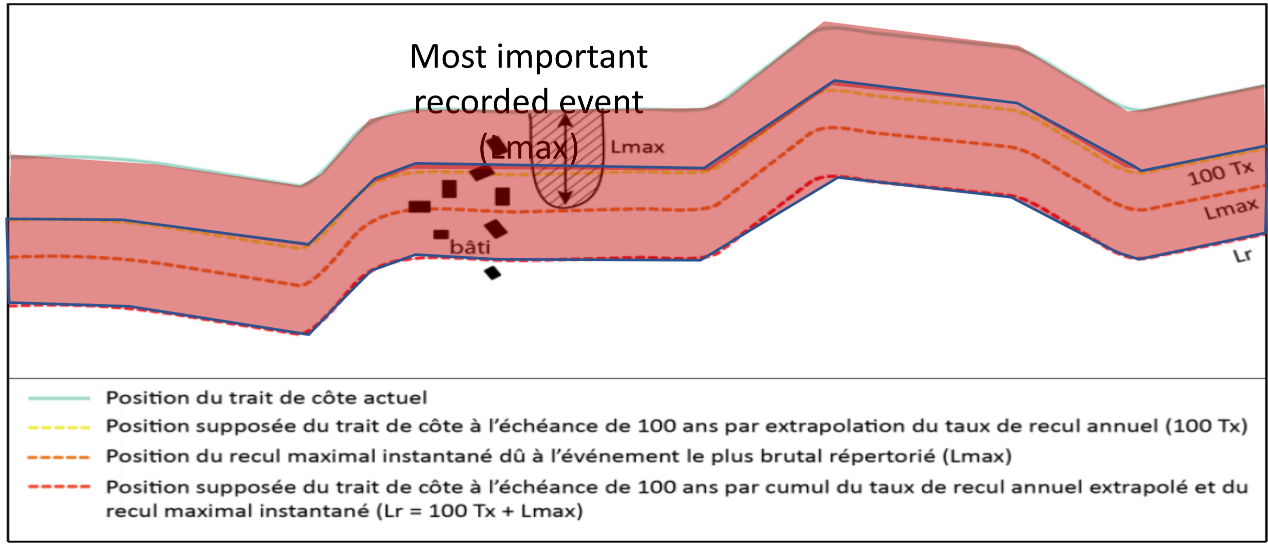
Position of the actual coastline
Estimated position of coastline in 100 years by extrapolation of average retreat (100 Tx)
Position of the instantaneous retreat consecutive to the most important recorded event (Lmax)
Position of supposed coastline over 100 years and instantaneous retreat consecutive to the most important recorded event (Lr = 100 Tx + Lmax)

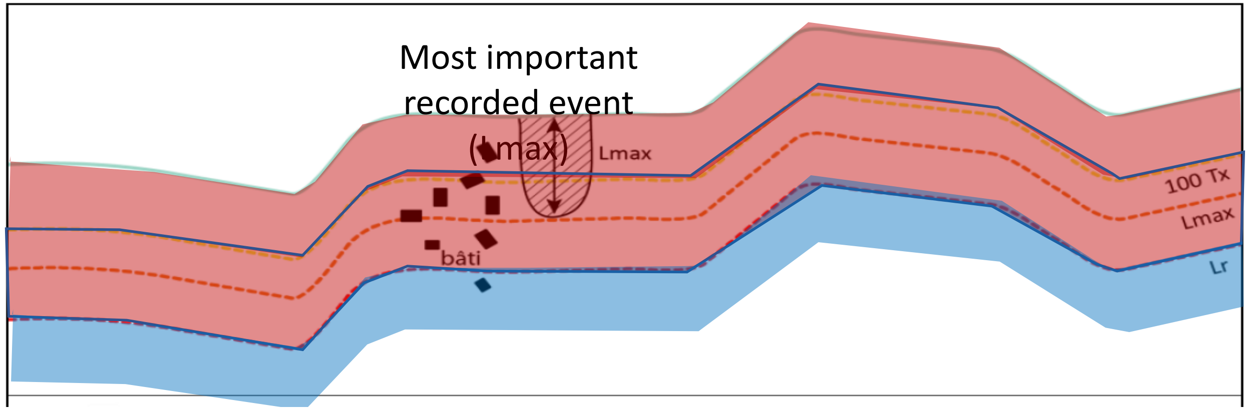
d. Definition of hazard classes & hazard mapping

High hazard (red zone) currently limited by estimated position of coastline in 100 years (100 Tx)



Position of 100yr estimated coastline + potential impacts of brutal phenomena (100 Tx + Lmax) = Lr (high hazard) to account for people / building safety.



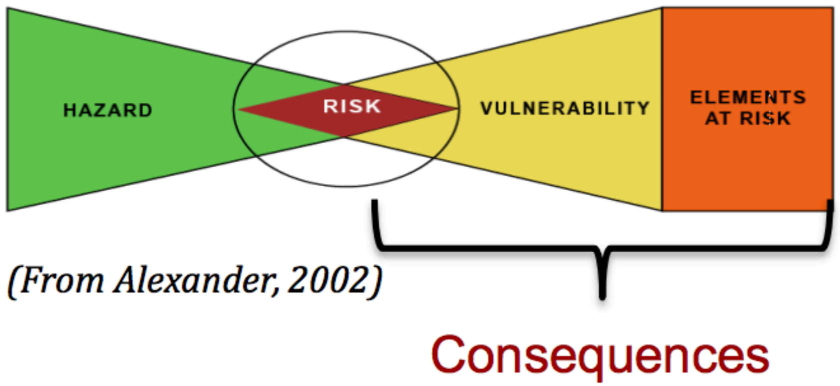


Proposed "buffer" zone (medium hazard) bet. high hazard & area not affected by retreat over100 yrs to account for uncertainties of retreat rate, important recorded events, SLR & CC.

2. Methodology for quantification of potential consequences in coastal context

Risk = f (hazard; consequences)

Consequences = f(Element at Risk; vulnerability)



(From Alexander, 2002)

Two ways to identify the stakes & to quantify the potential consequences:

- ❑ Inventory of exposed elements & major stakes on the concerned territory.
- ❑ Using multi-criteria approach that consist of semi-quantitative assessment through the use of an index.

3. Methodology for risk assessment and mapping for cliff retreat

Use of Hazard vs Consequences matrix to define three classes of risk.

Hazard	Potential consequences			
	Low	Average	High	Very high
High (H3) Lr = 100 Tx + Lmax	R3	R3	R3	R3
Medium (H2) 100 Tx	R3	R2	R2	R2
Low or null (H1)	R2	R1	R1	R1

R1: Area without specific restriction **(low).**

R2: Area with low restriction **(medium).**

R3: Area with specific restrictions **(high).**

2021 application of the different proposed methodologies for several test sites in Normandy

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EUR-OPA

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EUR-OPA project

Developing proposals to reflect in the modern Constitutions, the human & civic rights for secured safe life activities and protection of life, health & property against emergencies

Co-ordination: Educational Centre for Major Risk Management (ECRM), Armenia.

(**Project Partner:** Anton Micallef, ICOD)

- Analyse Malta Constitution reference to human & civic rights for secured safe life activities & protection of life, health and property against emergencies.
- Develop proposals to reflect above.

Principles that could be included into the Malta Constitution

- *the rights of children, including the right to grow up in a safe, protective & healthy environment;*
- *the rights of the elderly, including the right to an environment to encourage healthy ageing;*
- *the rights of the vulnerable, disabled & disadvantaged;*
- *the right to a healthy environment;*
- *the recognition & enforcement of the rights of future generations;*
- *the (general) right to a secure and safe life;*
- *the right to protection of life, health & property in times of emergencies.*

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EUR-OPA project

Protect yourself from hazards (BeSafeNet)

Co-ordination: European Centre on Disaster Awareness Cyprus

(**Project Partner:** Anton Micallef, ICOD)

- Dissemination of the Olympiad Competition.
- Re-write web content & add new information.
- Essays evaluation