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TSUNAMI HAZARD ASSESSEMENT IN PORTUGAL

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1. Introduction

The 1755 Lisbon Earthquake and Tsunami is the worst natural disaster that occurred in Portugal.

Although several researches have been studying this historical event, many features remain unknown.

Therefore, the aim of this paper is to present and discuss the state-of-art of the 1755 Lisbon Tsunami in Portugal mainland, by conducting a comprehensive analysis of it.

With this research the author hopes to provide more realistic details about the historical facts of the event, as well as scenarios which could be useful tools to emergency management for civil protection and spatial planning agents.

2. Methodology

To fully understand this historical event it is necessary to combine several methodologies:

1. The summary of the historical accounts;
2. Review of the seismo-tectonics offshore the southwest of the country - determination of tsunami source area;
3. Tsunami numerical model - obtain maximum water level and travel times;
4. Criterion to classify the tsunami hazard.

3. Results

3.1. Historical accounts

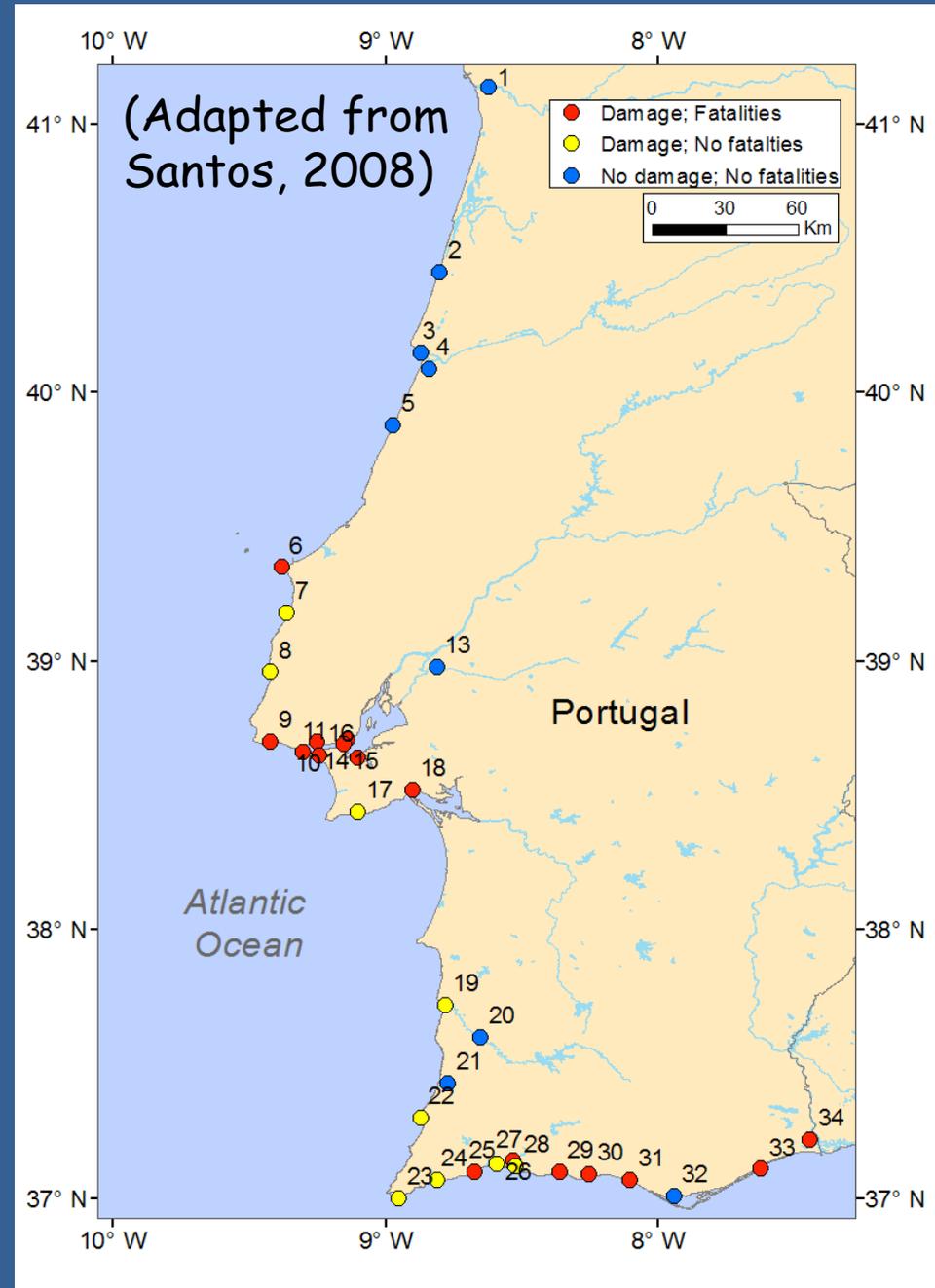
Time of the earthquake

The earthquake started most likely at 10:15 -10:16 UTC, hitting Lisbon from 10:16.8 UTC and Cadiz from 10:17.2 UTC (Santos et al., 2011).

Earthquake duration

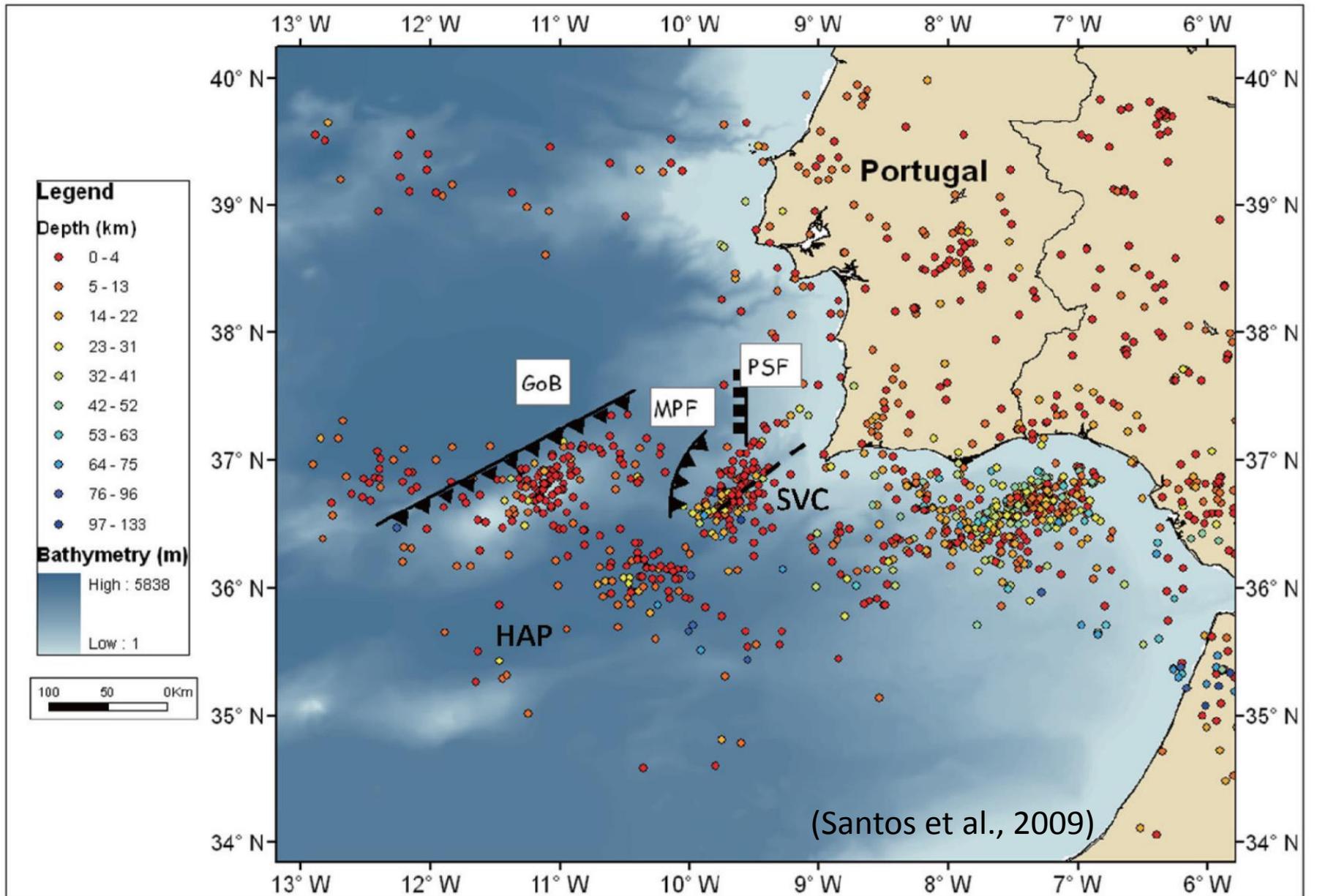
1st aprox 2 min, with magnitude 8.7, followed by 2 aftershocks; 3 shakes between 8 and 15 minutes (Santos, 2008)

The combination of earthquake, fire and tsunami (Lisbon and Setubal) caused more than 12 000 fatalities (Santos and Koshimura, 2015).



3. Results

3.2. Sismo-tectónica ao largo do SW de Portugal



3. Results

3.3. Numerical model

Travel time (minutes)

16 : Sao Vincent Cape

23-30: Cruz Quebrada and Lagos

30 : Bugio light house

78 : Cadiz

90 : Funchal

Subsidence: Safi and Cadiz
(wave trough arrives first)

4 waves: Cornwall
St. Agnes Islands (Sediments)

Tsurima Project

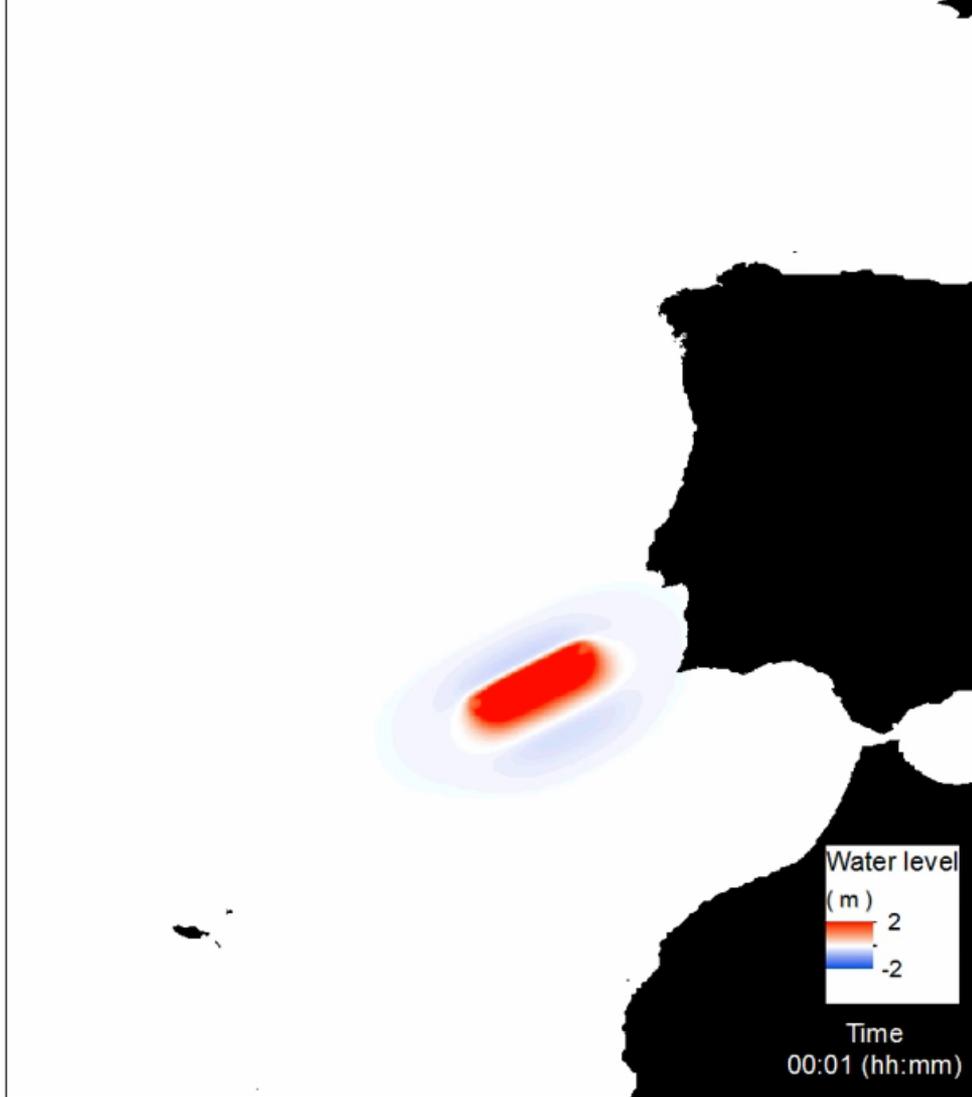
<https://sites.google.com/a/campus.ul.pt/tsurima/home>

The 1755 Lisbon Tsunami

Tsunami numerical model and animation
by Angela Santos, Universidade de Lisboa

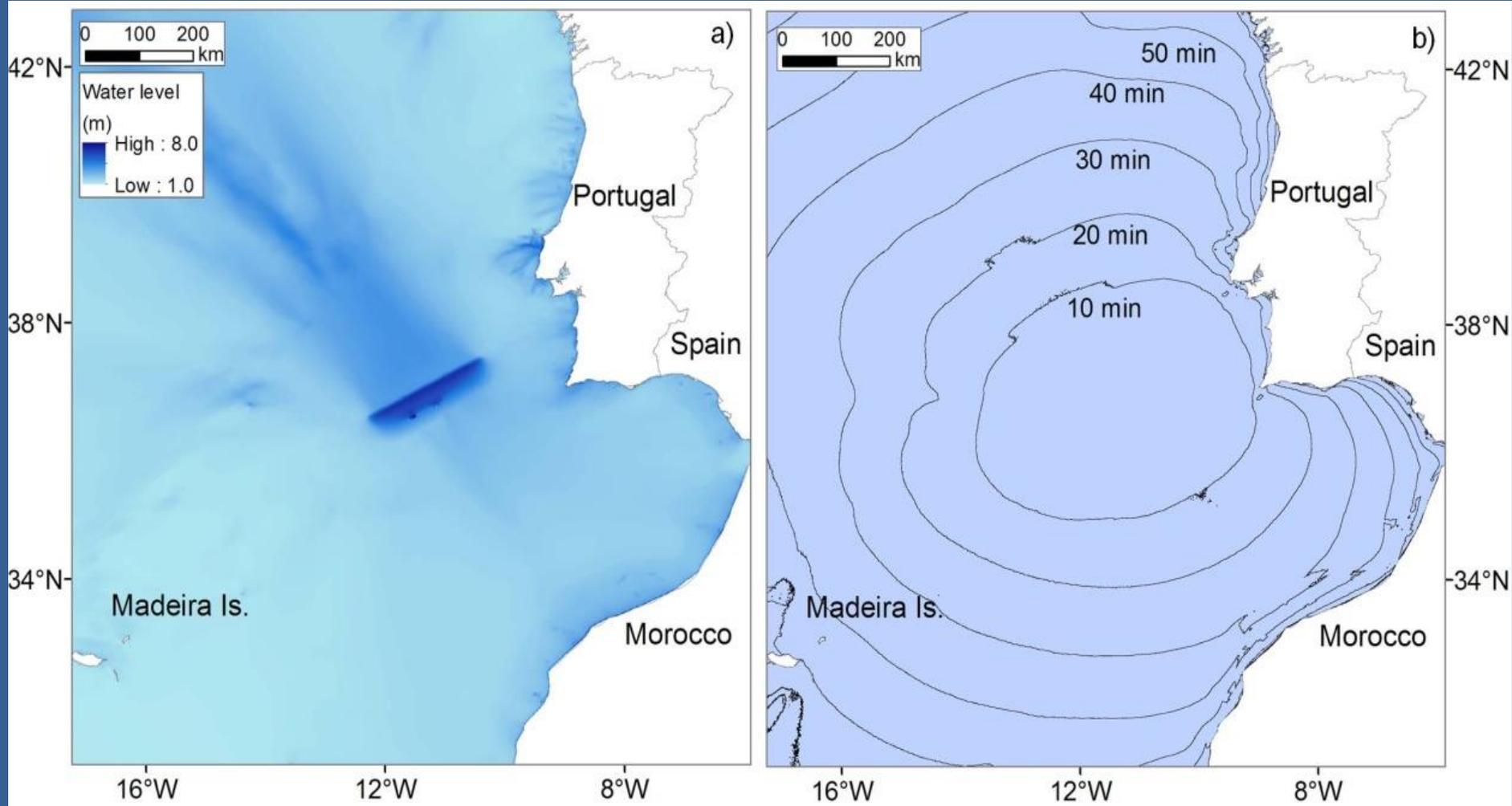
More details in:

Santos, A., Koshimura, S., Imamura, F.,
The 1755 Lisbon Tsunami: Tsunami
source determination and its validation,
Jour. Dis. Res., 4:1, 41-52, 2009



3. Results

3.3. Numerical model



3. Results

3.3. Tsunami hazard criterion

Criterion of Tsunami Hazard (Santos and Koshimura, 2015)

Water level height (m)	Classification	Travel time (min)	Classification
0 - 2	Very low	0 - 20	Critical
2 - 5	Low	20 - 30	High
5 - 10	Moderate	30 - 40	Moderate
10 - 15	High	40 - 50	Low
More than 15	Critical	More than 50	Very low

Tsunami Hazard Matrix

W. L. height \ T. Time	Very low	Low	Moderate	High	Critical
Critical	Moderate	High	High	Critical	Critical
High	Moderate	Moderate	High	High	Critical
Moderate	Low	Moderate	Moderate	High	High
Low	Low	Low	Moderate	Moderate	High
Very low	Very low	Low	Low	Moderate	Moderate

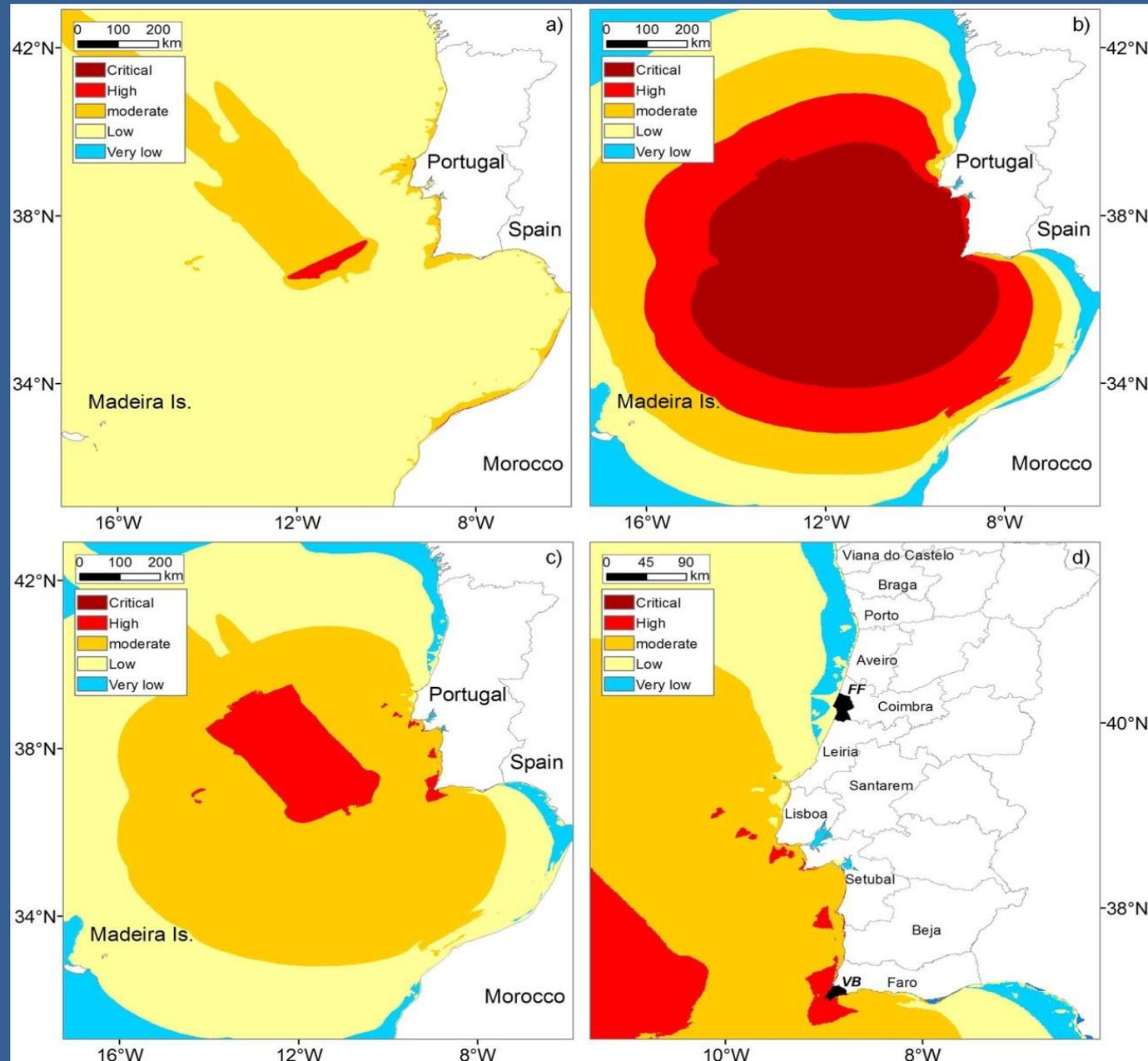
3. Results

3.4. Tsunami hazard criterion

Tsunami hazard is classified as:
High on some areas offshore Lisbon, Setubal, Beja and at the west of Faro districts,

Low from Coimbra district northward.

However, if the next tsunami occurs during summer there will be unknown number of fatalities...



4. Conclusion

This study shows that although earthquakes and tsunamis are rare in Portugal mainland, the impact of this kind of natural disaster could cause many fatalities and severe damage.

Therefore, it is necessary that both Academia and Authorities (national and local) work together in order to mitigate these type of disasters, especially on the Portuguese coastline and low ground areas.