TSUNAMI

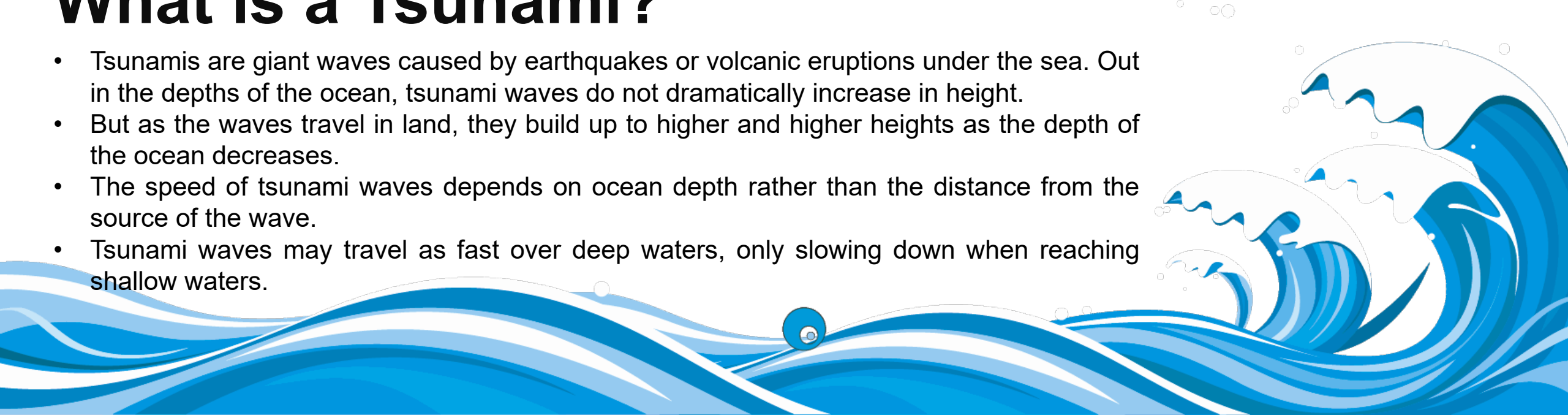
PRESENTATION

Made by Tatiana Neves

01

What is a Tsunami?

- Tsunamis are giant waves caused by earthquakes or volcanic eruptions under the sea. Out in the depths of the ocean, tsunami waves do not dramatically increase in height.
- But as the waves travel in land, they build up to higher and higher heights as the depth of the ocean decreases.
- The speed of tsunami waves depends on ocean depth rather than the distance from the source of the wave.
- Tsunami waves may travel as fast over deep waters, only slowing down when reaching shallow waters.



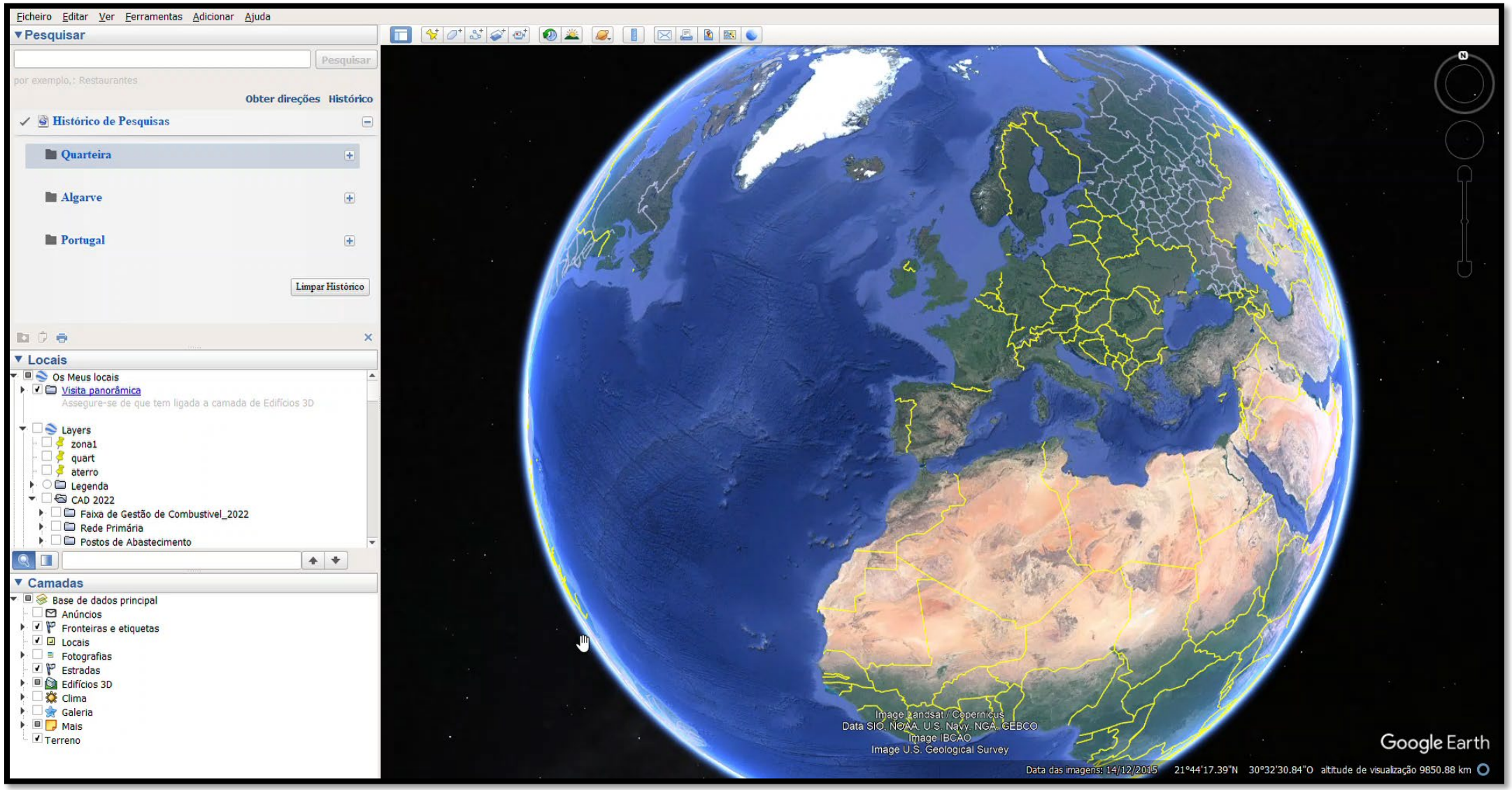
A tsunami is a **series of waves** caused by **earthquakes** or **undersea volcanic eruptions.**

02

Our Location

- Portugal is a country located on the Iberian Peninsula, in Southwestern Europe, and whose territory also includes the Macaronesian archipelagos of the **Azores** and **Madeira**.
- It features the westernmost point in **Continental Europe** its mainland west and south border with the **North Atlantic Ocean** and in the north and east, the Portugal-Spain border constitutes the longest uninterrupted border-line in the European Union.
- We are close to the Gorringe Ridge, is a **seamount** in the **Atlantic Ocean**.

Lisbon is the **capital** and largest city by population, being also the main spot for tourists alongside **Porto** and **Algarve**.

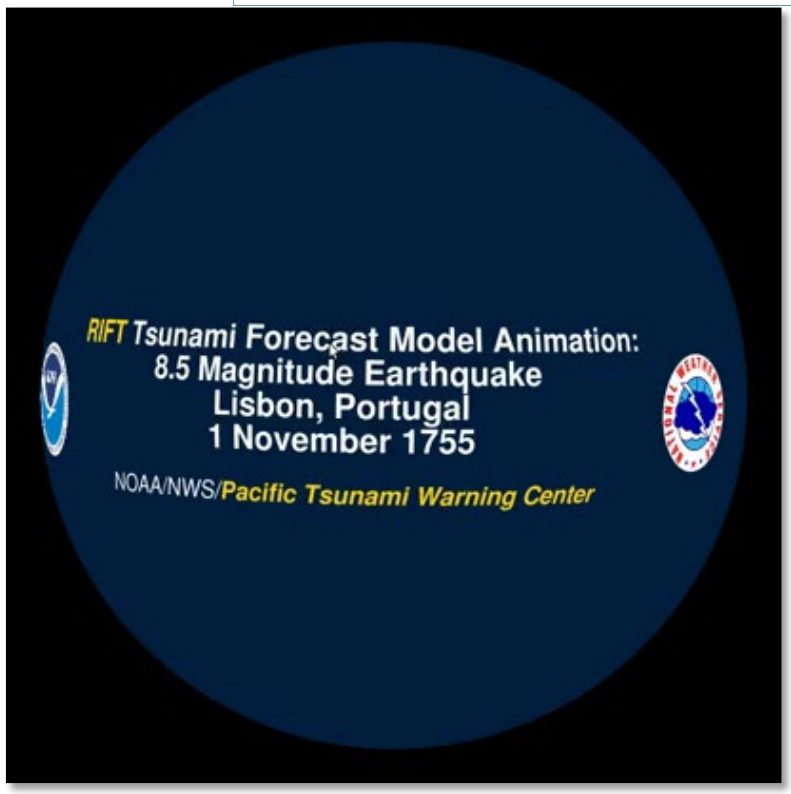


03

Tsunami Historical Series: Lisbon – 1755

- The year of a massive earthquake and tsunami which destroyed most os Lisbon as well a considerable area of the Algarve.

Tsunami Historical Series: Lisbon – 1755



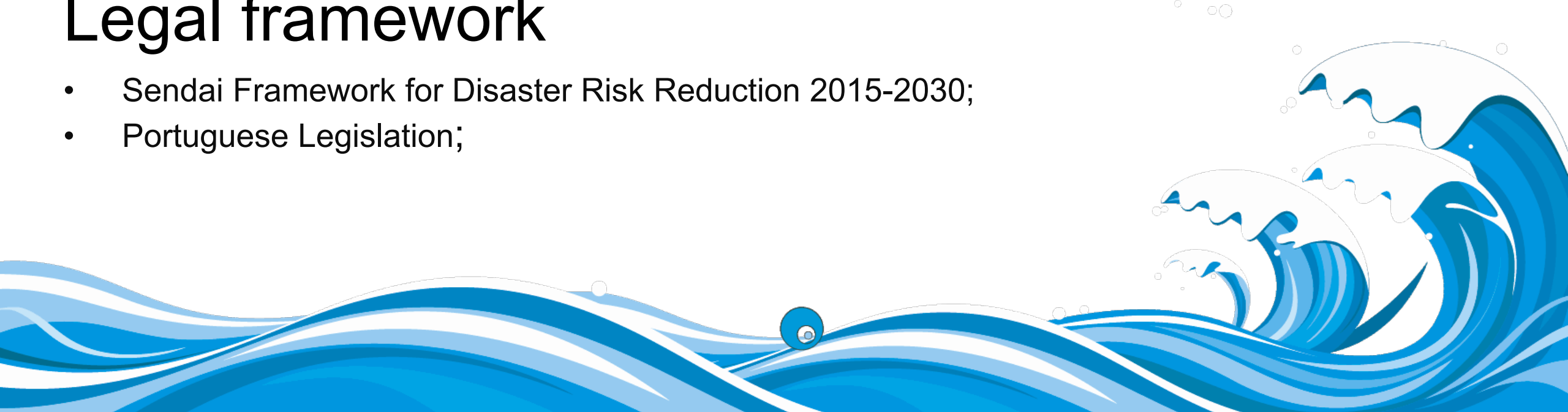
The tsunami generated by the 01.11.1755 earthquake affected mainly the coasts of the Iberian Peninsula and Northwest Morocco and was observed all over the North Atlantic coasts. The catastrophic dimensions of that phenomenon had a tremendous impact on the city of Lisbon. Lisbon was not the only Portuguese city affected by the catastrophe, the **south of the country**, in particular the **Algarve**, destruction was rampant. The tsunami destroyed some coastal fortresses in the Algarve and, at lower levels, it razed several houses. Almost all the coastal towns and villages of the Algarve were heavily damaged, except Faro, which was protected by the sandy banks of Ria Formosa. In Lagos, the waves reached the top of the city walls.

The historical documents reported waves of **15 m** height at Cape S. Vicente (Southwest Portugal).

04

Legal framework

- Sendai Framework for Disaster Risk Reduction 2015-2030;
- Portuguese Legislation;



Sendai Declaration

1

We, the Heads of State and Government, ministers and delegates participating in the Third United Nations World Conference on Disaster Risk Reduction, have gathered from 14 to 18 March 2015 in Sendai City of Miyagi Prefecture in Japan, which has demonstrated a vibrant recovery from the Great East Japan Earthquake in March 2011. Recognizing the increasing impact of disasters and their complexity in many parts of the world, we declare our determination to enhance our efforts to strengthen disaster risk reduction to reduce disaster losses of lives and assets from disasters worldwide.

2

We value the important role played by the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters during the past ten years. Having completed the assessment and review of and considered the experience gained under its implementation, we hereby adopt the Sendai Framework for Disaster Risk Reduction 2015-2030. We are strongly committed to the implementation of the new framework as the guide to enhance our efforts for the future.

3

We call all stakeholders to action, aware that the realization of the new framework depends on our unceasing and tireless collective efforts to make the world safer from the risk of disasters in the decades to come for the benefit of the present and future generations.

4

We thank the people and the Government of Japan as well as the City of Sendai for hosting the Third United Nation World Conference on Disaster Risk Reduction and extend our appreciation to Japan for its commitment to advancing disaster risk reduction in the global development agenda.

www.preventionweb.net/go/sfdrr
www.unisdr.org
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UNISDR
The United Nations Office for Disaster Risk Reduction

Sendai Framework for Disaster Risk Reduction 2015-2030

The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted by UN Member States on 18 March 2015 at the Third UN World Conference on Disaster Risk Reduction in Sendai City, Miyagi Prefecture, Japan. The Sendai Framework is the first major agreement of the post-2015 development agenda, with seven targets and four priorities for action.

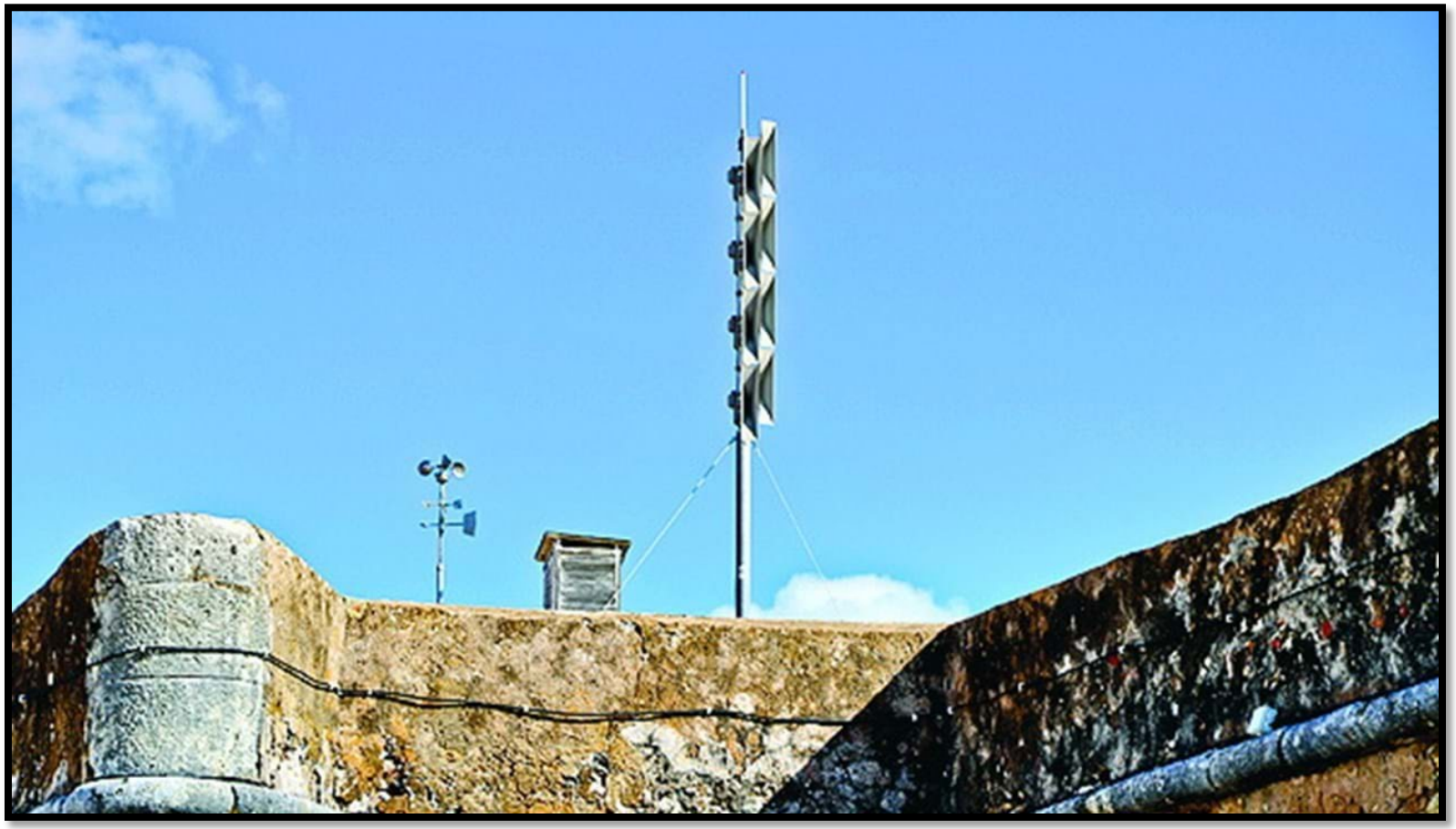
The Framework aims to achieve the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries over the next 15 years.

Portuguese Legislation

nº1/2019 of September 12th – Installation of signage in areas exposed to the risk of dam failure and areas exposed to the TSUNAMI risk and evacuation paths.

Article 4, point 6 – The need to install vertical signage for tsunami risk must be assessed on a case-by-case basis, through risk assessment, by the Municipal Civil Protection Services or another entity with jurisdiction in the area.

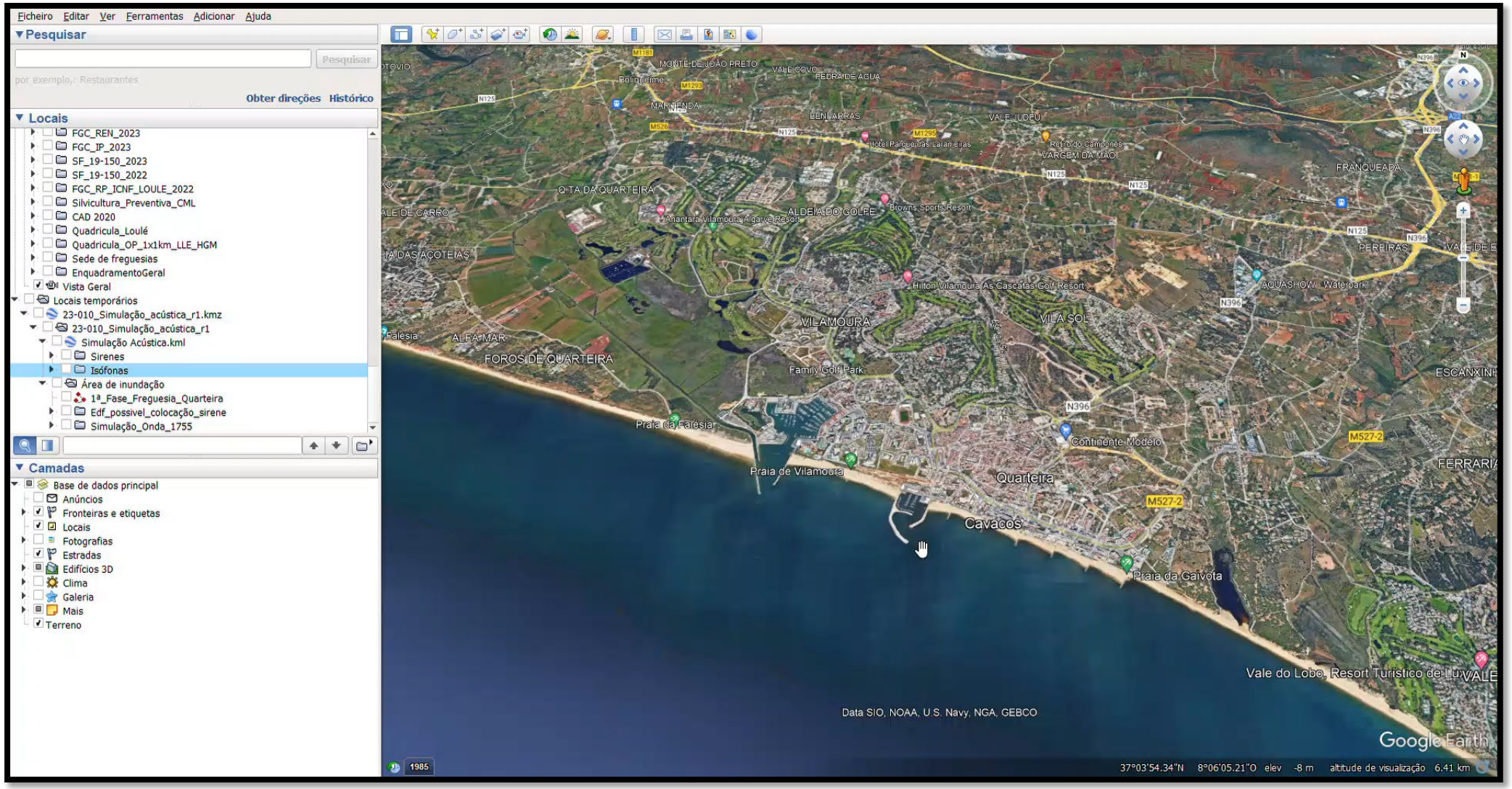
Portuguese Legislation



Resolution nº2/2019 of September 12th – Approval of the Directive on technical standards for the operationalization of Tsunami warning systems using sirens.

"Among the various means that can be used to disseminate civil protection warnings in the event of TSUNAMI, the use of sirens is one of the most used on an international scale. In this sense, it is necessary to establish guidelines for the installation of acoustic warning systems for sirens (…)."

Sound Warning Stations

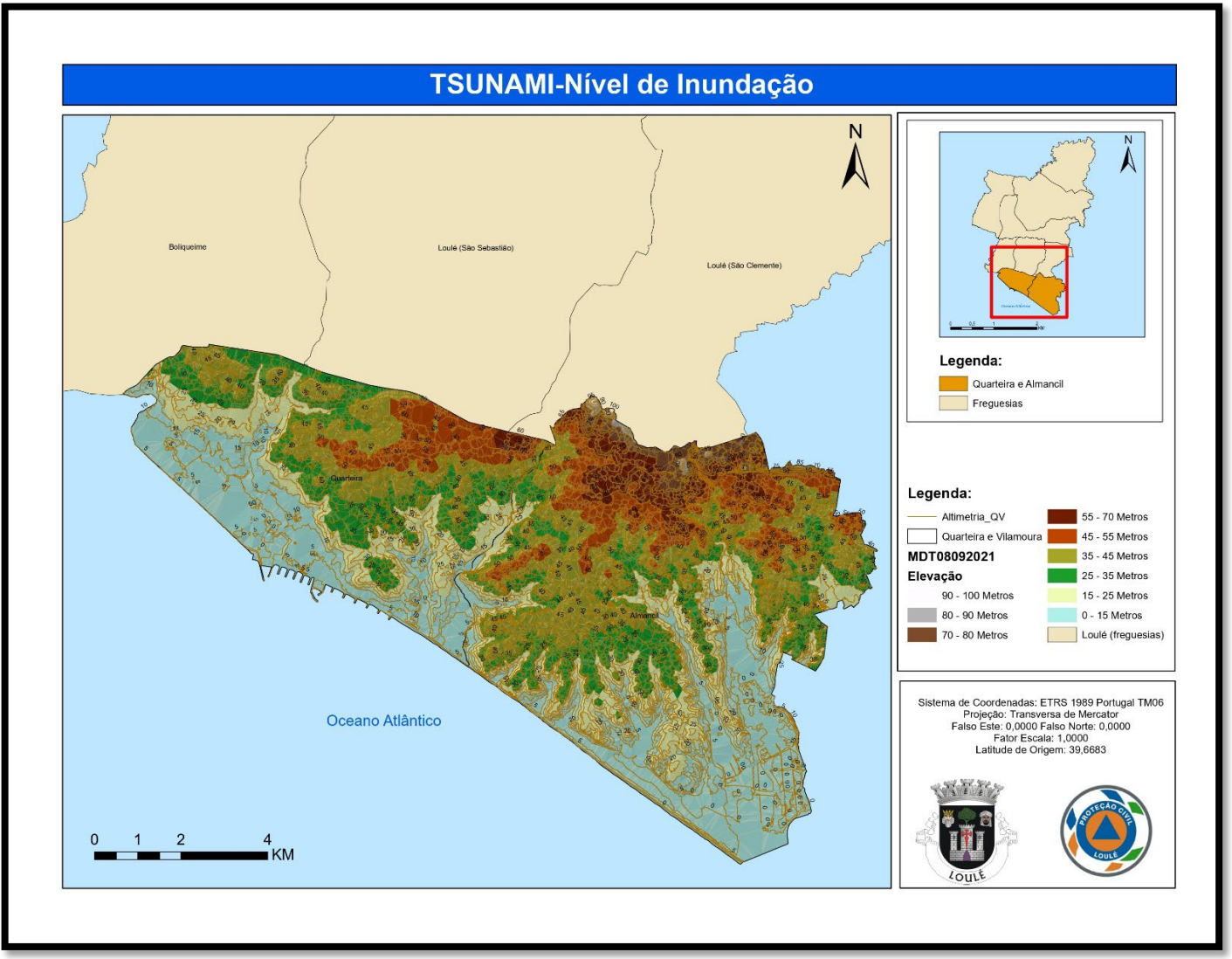


05

Methodology

1. Evacuation maps;
2. Damage to the Building;
3. Seismic and Tsunami Risk;
4. Beach population accounting;
5. Evacuation routes;

Digital Terrain Model



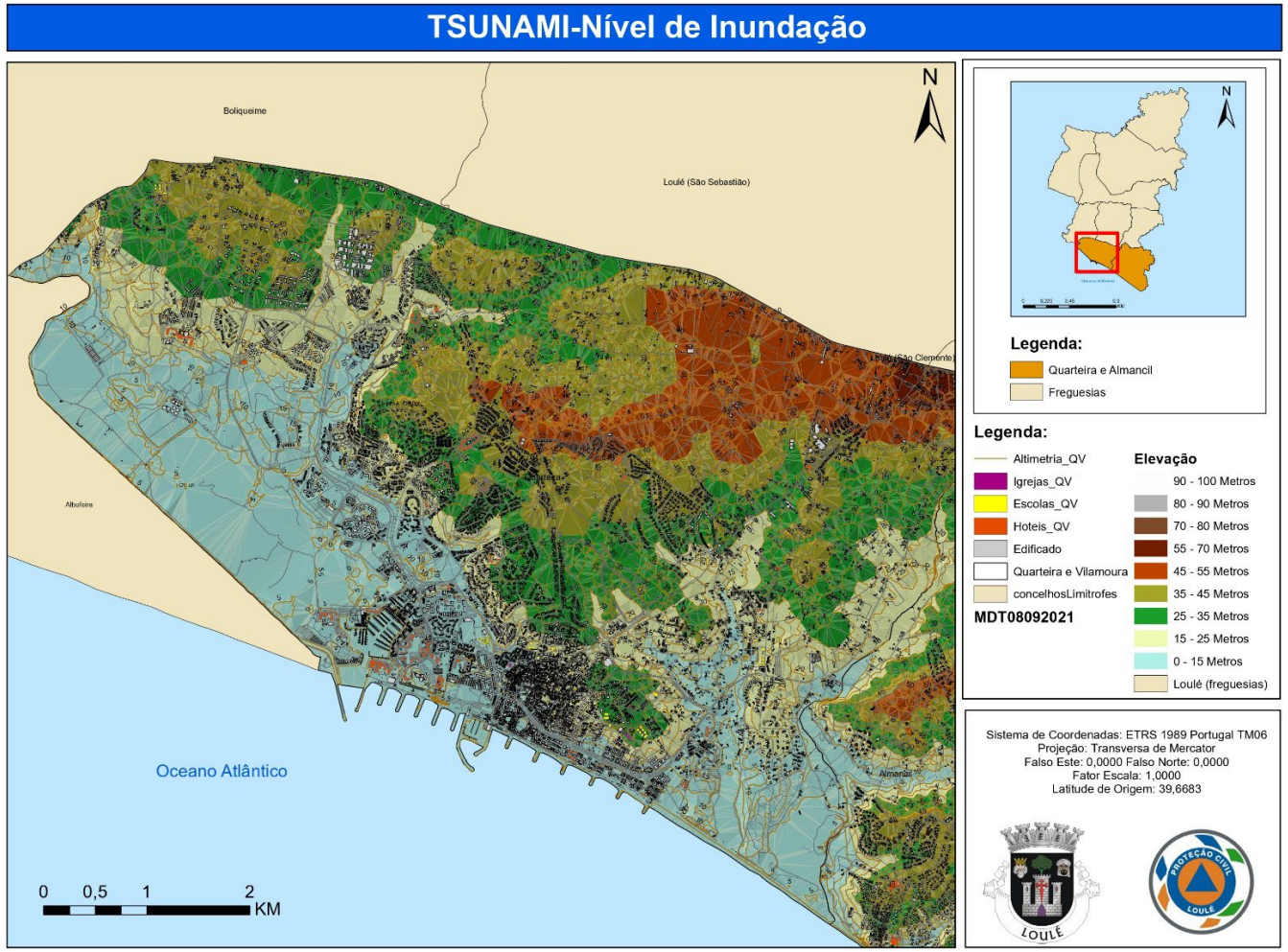
- Digital Terrain Models (DTM) sometimes called Digital Elevation Models (DEM) is a topographic model of the bare Earth that can be manipulated by computer programs.

- The data files contain the elevation data of the terrain in a digital format which relates to a rectangular grid. Vegetation, buildings and other cultural features are removed digitally - leaving just the underlying terrain. DTMs are used especially in civil engineering, geodesy & surveying, geophysics, geography and remote sensing.

- This Digital Terrain Model (MDT) is an interpolation of Contour Curves or Isolines with the same elevation value in relation to sea level, with this we could calculate the expected flooding area and consequently determine the safe zones.

- The worst-case scenario in mind, which would be a 15-metre wave, taking into account what happened in 1755.

Flood and Safe Areas Map



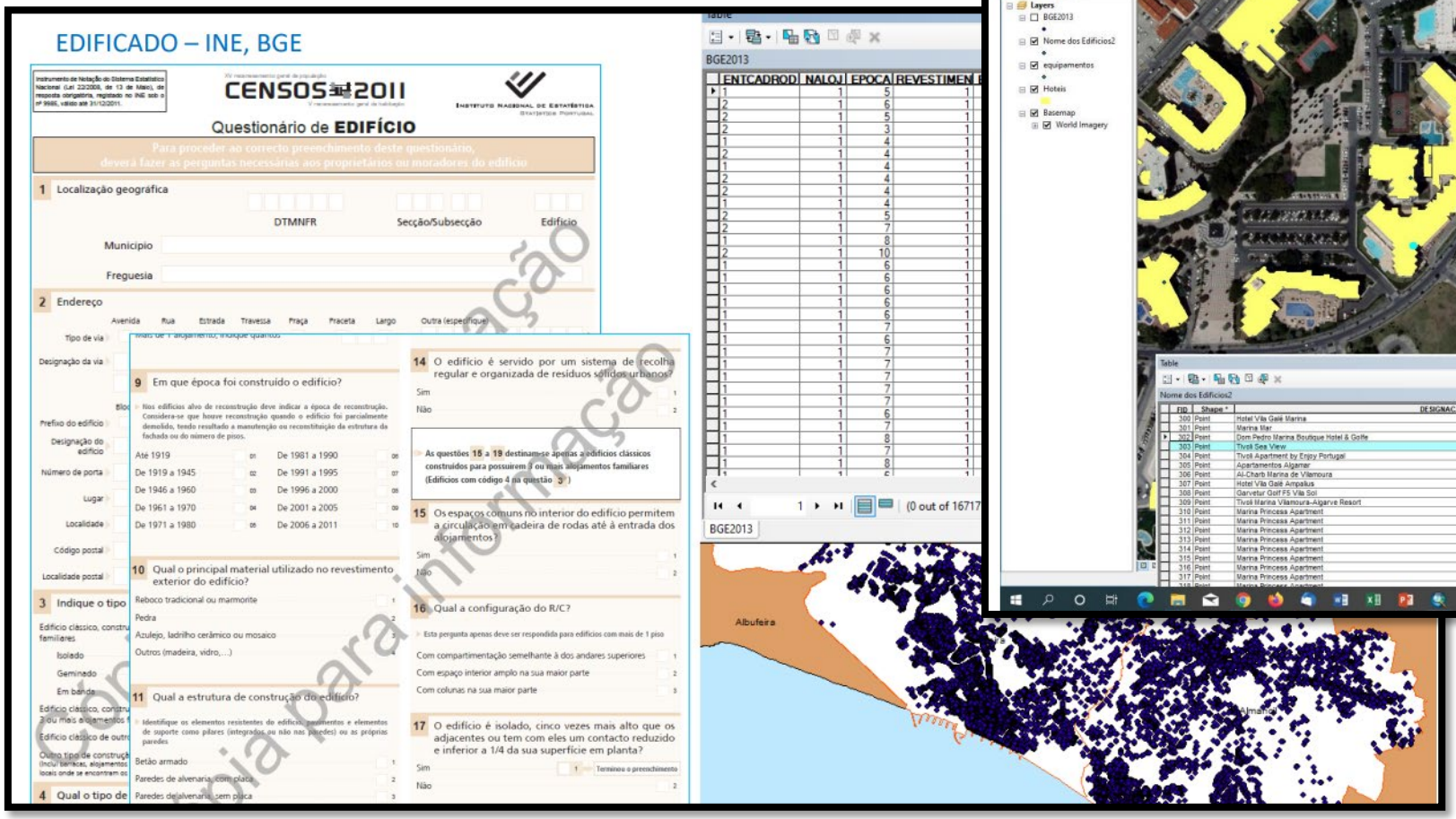
- Flood and safe areas map, the flood map is calculated by superimposing on the Digital Terrain Models (DTM):

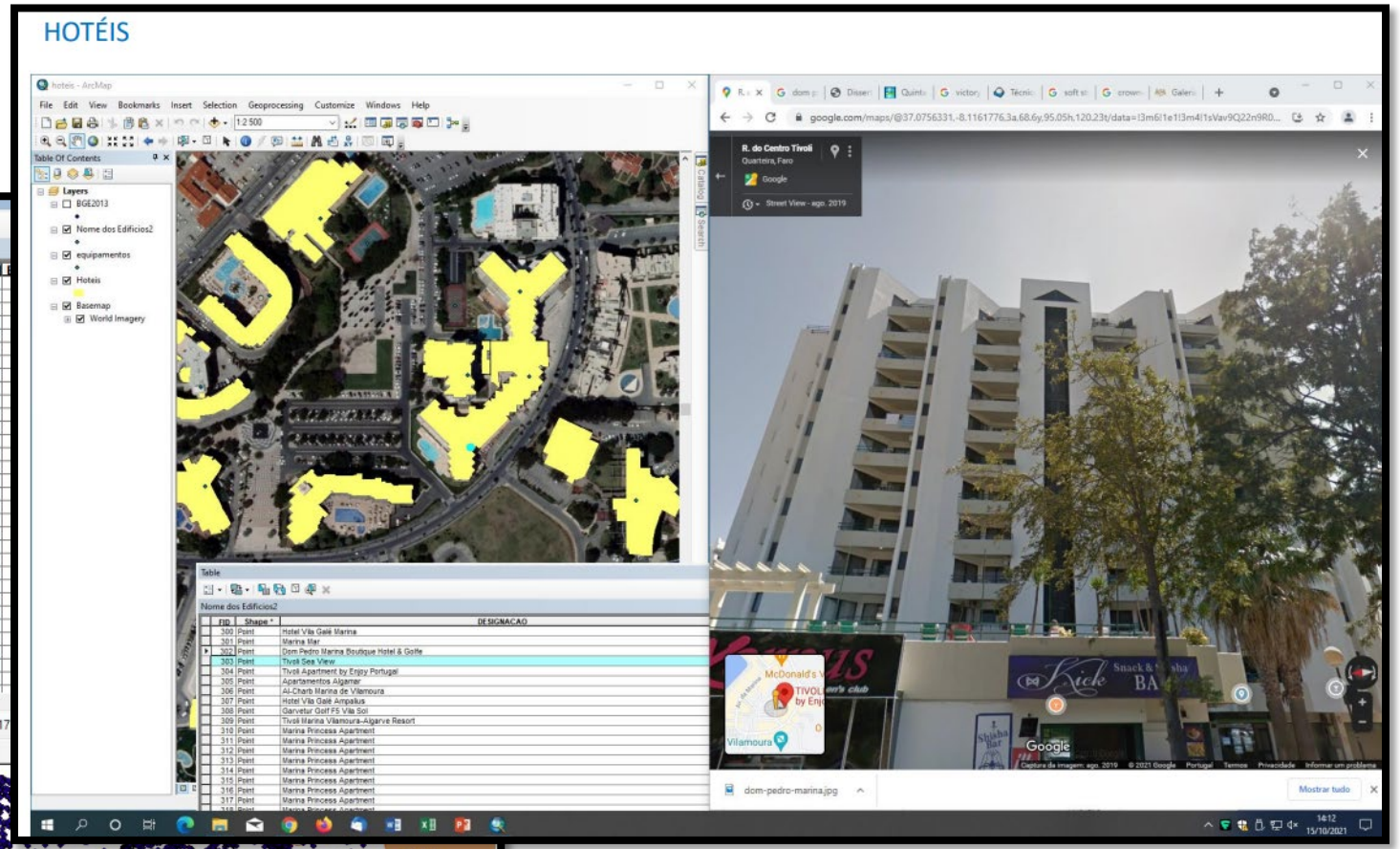
1. The expected wave height (15 m);
2. The distribution of Classified Buildings,
3. The Population
4. And cartography of the road network

- Where the estimated flood area is considered “Evacuation Zone ” and the non-flooded “Safe Zones”.

Building Damage Study

The 2011 census made it possible to analyze the age of buildings, the number of floors and the type of material used in their construction.





Assessment of damage to the building taking into account seismic action

Damage Level	Description	Marker Color
D0	No damage	
D1	Cracking of non-structural elements, such as dry walls, brick or stucco external cladding	
D2	Major damage to the non-structural elements, such as collapse of a whole masonry infill wall; minor damage to load bearing elements	
D3	Significant damage to load-bearing elements, but no collapse	
D4	Partial structural collapse (individual floor or portion of building)	
D5	Full collapse	

Vulnerabilities of construction periods, Vi

Classe	Época de construção	Vi
1	Alvenaria (<1919)	0,81
2	Alvenaria (1919-1945)	0,75
3	Betão (1946-60)	0,70
4	Betão (1961-85)	0,60
5	Betão (>1985; até 5 pisos)	0,52
6	Betão (>1985; 5-10 pisos)	0,54
7	Betão (>1985; + 10 pisos)	0,56
8	Betão > 2000	0,40

Vulnerability modifying factors

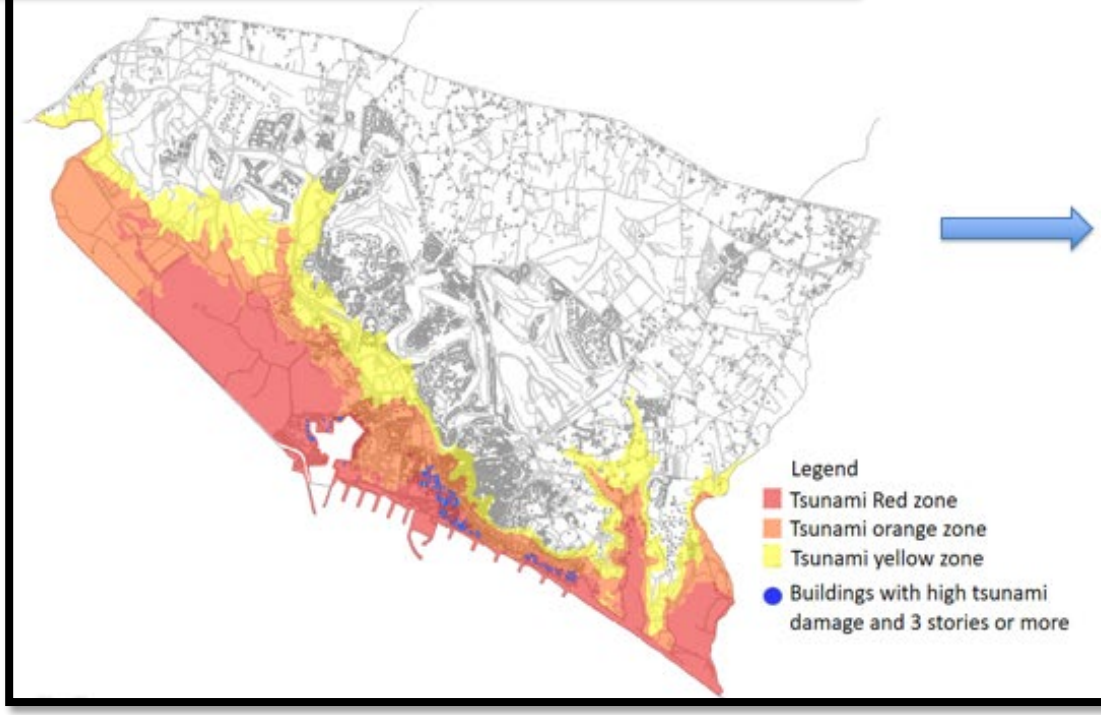
+ Número de pisos
+ Estado de Conservação
+ Regularidade em planta
+ R/C vazado (*soft-storeys*)
+ Pisos recuados

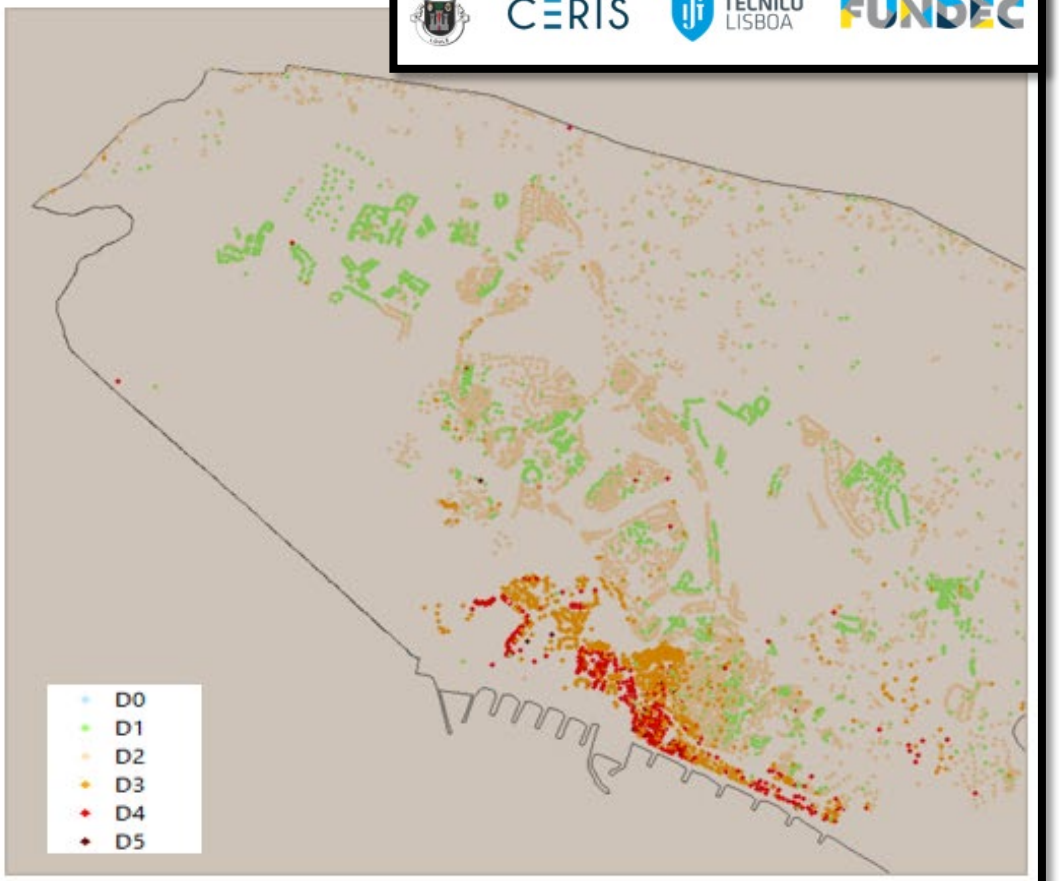
Type of soils (EC-8)

Combined earthquake and tsunami damage

Zone	Description	Aggravated Index
Red	Buildings with heights between 0m and 5m (inclusive)	+2
Orange	Buildings with heights between 5m and 10m (inclusive)	+1.25
Yellow	Buildings with heights between 10m and 15m (inclusive)	+0.5
White	Buildings with heights greater than 15m	0

Inundation zones and mid-rise buildings with high tsunami severe damage



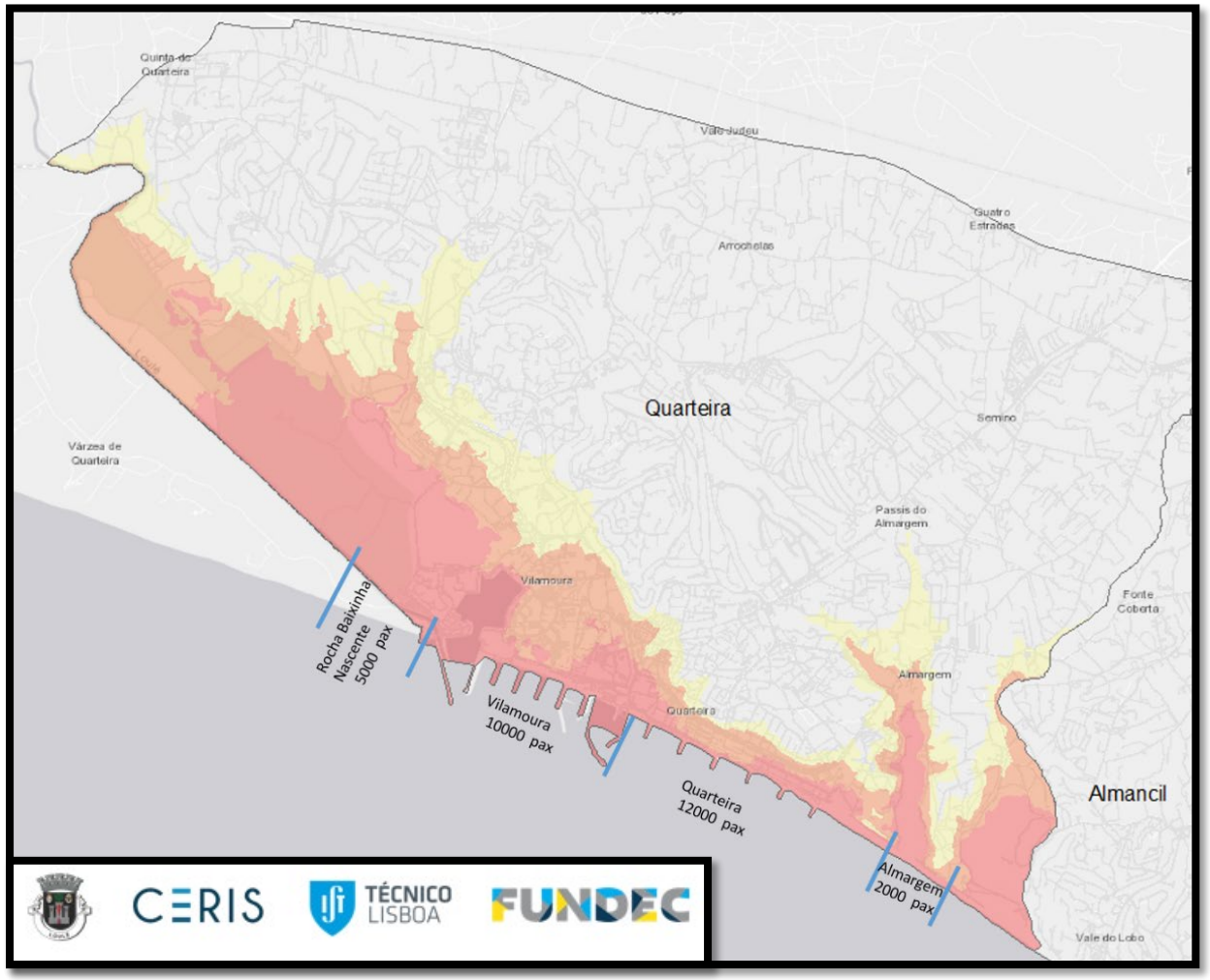


Beach population accounting

Creation of Evacuation Routes

Beach population accounting

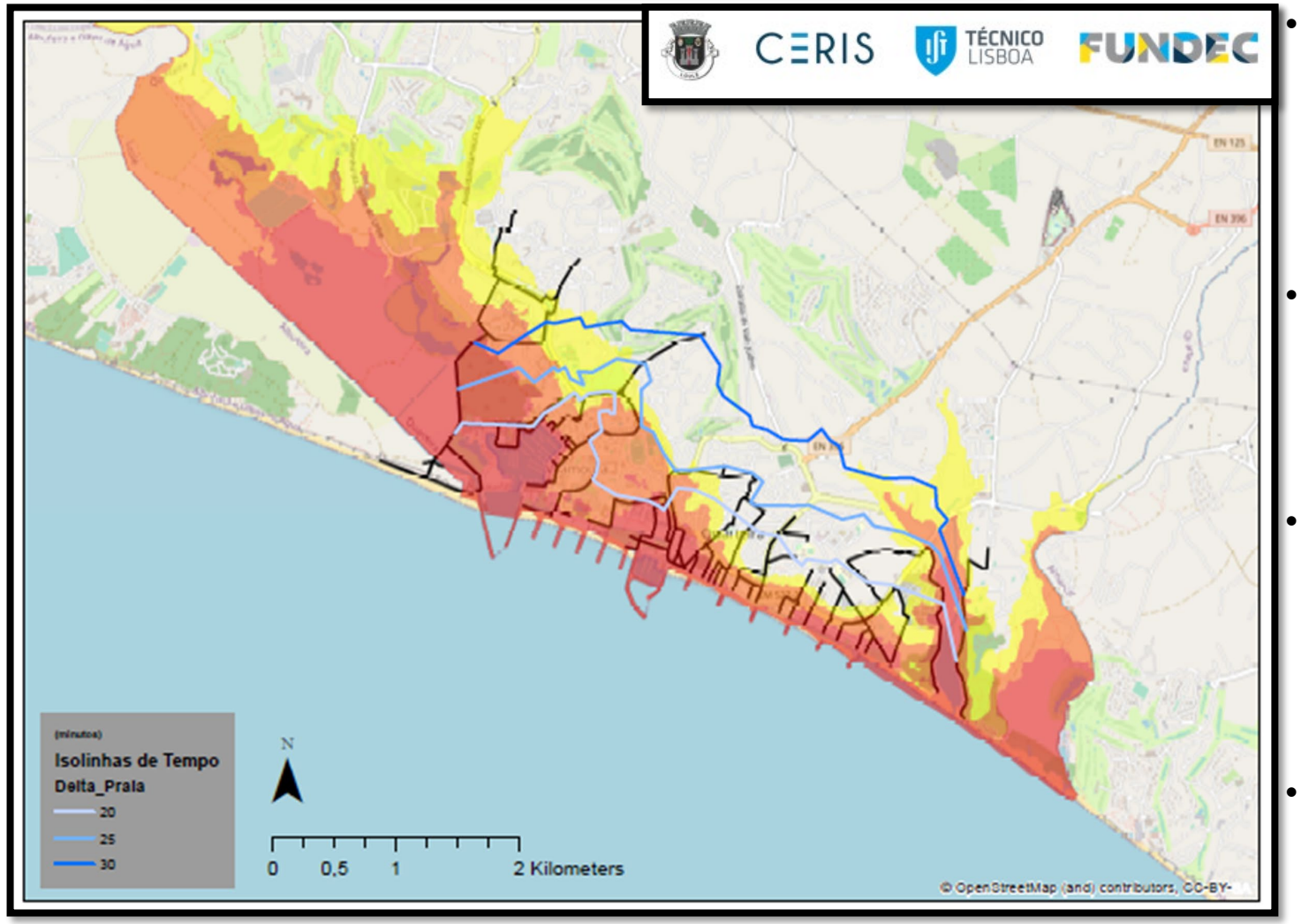
Creation of Evacuation Routes



- Tsunami arrival time in Loulé could be 30 minutes.
- However, if the alert is given after registering on the tide gauge in Sagres, we only have 15 minutes to evacuate the area.
- To define the tsunami evacuation routes, based on the assessment of the damage caused by the earthquake, it was verified which routes did not present obstruction problems due to the collapse of structures.
- The slopes of each section were calculated. It was considered that the speed, for example, of walking in the area would correspond to 1.8 km/h, that is, 0.5 m/s.

Maximum capacity on beaches, referring to the bathing season from 1/Jun to 30/Sep 2021(Source: https://apambiente.pt/apa/arh-do-algarve) (infopraia.apambiente)

For the population to be able to carry out these times, it is important that they are informed about the procedures to be carried out and the paths to follow.



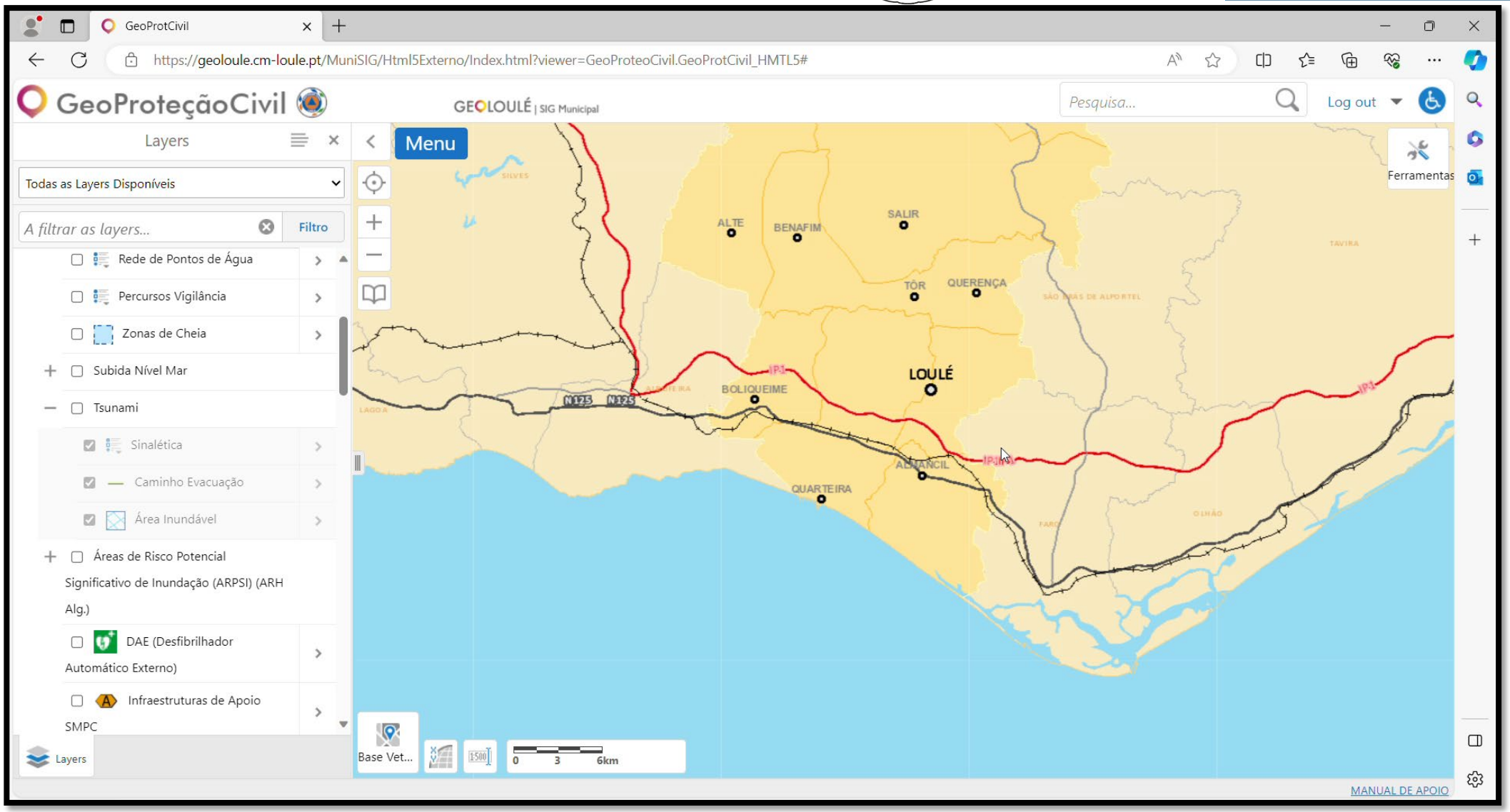
- The populations of the areas of Vilamoura and Quarteira have the possibility of reaching safe locations during the alert period, while those of Rocha Baixinha Nascente, due to the long distance to travel, may face additional problems.
- For the Almargem area we are in a mixed situation, so rapid alert and knowledge on the part of the population of what to do immediately are essential.
- To draw up the evacuation time isolines, the journey times from the beach or marina were added, calculated in order to determine the places where it would be possible to reach in 10, 15 and 20 minutes after the alert.
- A **10 minute** period was also added to take into account the reaction time and exit from the sand until the start of the evacuation routes.

06

What does "georeferenced" mean?

- Georeferencing means that the internal coordinate system of a digital map or aerial photo can be related to a ground system of geographic coordinates.
- A georeferenced digital map or image has been tied to a known Earth coordinate system, so users can determine where every point on the map or aerial photo is located on the Earth's surface.

Georeferenced Signage

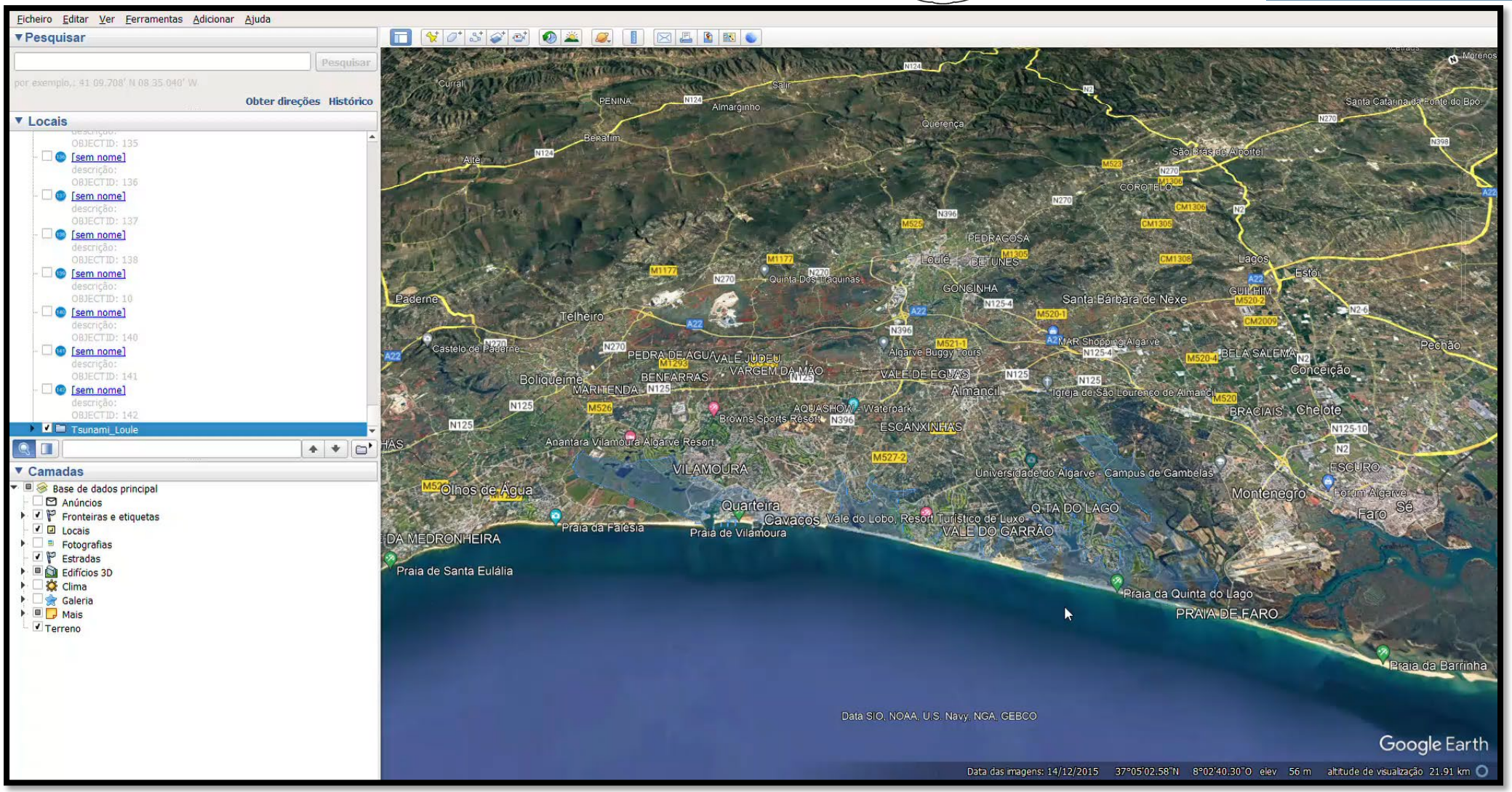


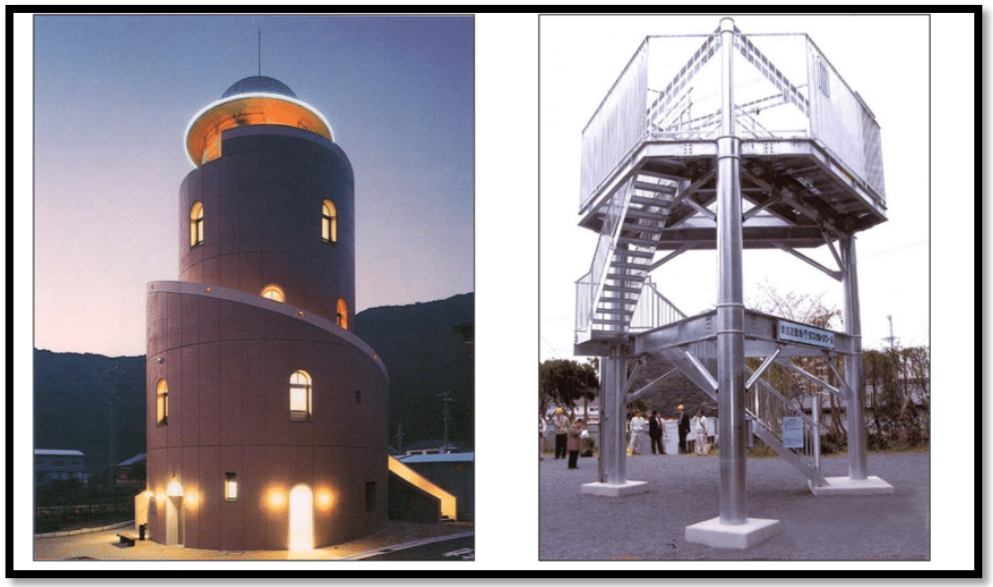
07

Solutions and Challenges

- Tall Buildings;
- Creation of Vertical Shelters;

Solutions and Challenges





Examples of vertical shelters

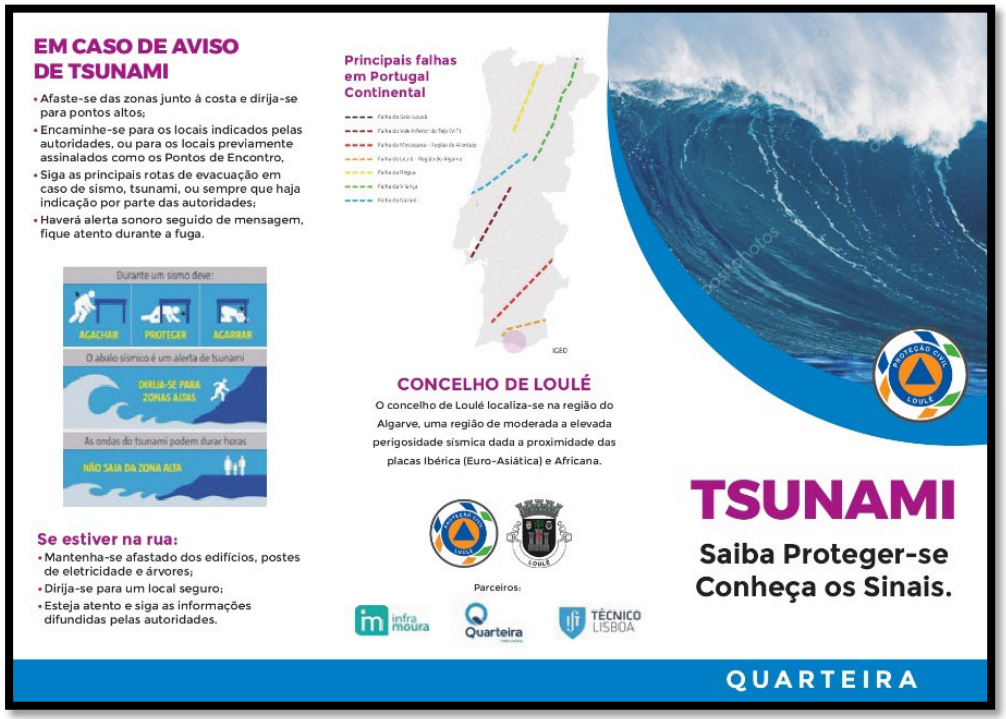
Hotel Vila Galé Marina

Hotel Tivoli Marina

08

Awareness

- Bilingual Brochure (Portuguese and English);
- Evacuation Drills;
- Awareness events;



"work in process"
and
"work in progress"


CISION
ID: 109146420
PORTUGAL resident
18-01-2024
Meio: Imprensa
País: Portugal
Área: 425,04cm²
Âmbito: Informação Geral
Period.: Semanal
Pág: 14,1

Tsunami signposting set up in Quarteira and Vilamoura

PROJECT | Around 140 signposts have been set up along the coastal areas of Quarteira and Vilamoura to help people know where to go in the event of a tsunami.

The project has also signalled 13 "safe" meeting points which are located in higher altitude areas, such as the church of São Pedro do Mar, the Dr. Francisca de Aragão and Dr. Laura Ayres schools and Avenida Papa Francisco.

Six sound warning stations have also been set up that will be "heard in the case of an alert", Loulé Municipal Council announced in a statement to the press.

The signposts include the distances between the several points of the network and were created to be as easy to understand as possible.

The evacuation routes "aren't always the shortest, but instead the safest," the local council added.

Tatiana Neves from Loulé's Civil Protection Service explained that the project was developed with the "worst-case scenario in mind, which would be a 15-metre wave, taking into account what happened in 1755" – the year of a massive earthquake which destroyed most of Lisbon as well as a considerable area of the Algarve.

Shelters elevated from the ground are due to be built in Vilamoura, where the terrain is mostly flat, particularly near Praia da Falésia.

Now that the signposting has been set up, the next step will involve raising awareness about the possibility of tsunamis and what should be done in the event of one. According to the local council, a bilingual brochure available in Portuguese and English is being created, while awareness events are being planned.

"It's not enough to just do something. The last step is getting all this information across to the population. People have to know how to behave (in these situations). Fieldwork is fundamental, at schools for example, in order for people to know how the signposts work," said professor Carlos Oliveira from Lisbon's Instituto Superior Técnico, who led the project alongside the municipal civil protection team.

As he explained, these kinds of signposting projects already exist in towns and cities such as Portimão, Cascais and Lisbon, although in Quarteira some "innovations" were made.

A second phase of the project is due to be carried out in Almancil, which also has a 14km-long coastline.

Loulé Mayor Vítor Aleixo has highlighted the importance of making sure communities are prepared for these potentially life-threatening events.

"The safety of human communities is one of the first responsibilities of public authorities. The majority of the population lives on the coast, and Portugal is no exception. In recent years, we have systematically worked to prepare ourselves for an unexpected and tragic event, be it an earthquake, a tsunami, a storm, or a drought with potentially disastrous consequences. Our first commitment is to life," the mayor said. ■■■


LOULÉ
PROTEÇÃO CIVIL
LOULÉ
unesco
Intergovernmental
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Commission
Tsunami Ready
THANKS!
Made by Tatiana Neves