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High Resolution Tsunami Modelling for the Evaluation of Potential Risk Areas in Setubal

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Modeling has a relevant role in today's natural hazards mitigation planning as it can cover a wide range of natural phenomena. This is also the case for an event like a tsunami. In order to support the urban planning or prepare emergency response plans it is of major importance to be able to properly evaluate the vulnerability associated with different areas and/or equipments. The use of high resolution models can provide relevant information about the most probable inundation areas which complemented with other data such as the type of buildings, location of prioritary equipments, etc., may effectively contribute to better identify the most vulnerable zones, define rescue and escape routes and adequate the emergency plans to the constraints associated to these type of events.

In the framework of FP6 SCHEMA project these concepts are being applied to different test sites and a detailed evaluation of the vulnerability of buildings and people to a tsunami event is being evaluated. One of the sites selected it is located in Portugal, in the Atlantic coast, and it refers to Setúbal area which is located about 40 km south of Lisbon. Within this site two specific locations are being evaluated: one is the city of Setúbal (in the Sado estuary right margin) and the other is the Tróia peninsula (in the Sado estuary left margin). Setúbal city is a medium size town with about 114,000 inhabitants while Tróia is a touristic resort located in a shallow area with a high seasonal occupation and has the river Sado as one of the main sources of income to the city.

Setúbal was one of the Portuguese villages that was seriously damaged by the of 1755 earthquake event. The 1755 earthquake, also known as the Great Lisbon Earthquake, took place on 1 November 1755, the catholic holiday of All Saints, around 09:30 AM. The earthquake was followed by a tsunami and fires which caused a huge destruction of Lisboa and Setúbal

In the framework of the present study, a detailed evaluation of the site vulnerability to a tsunami event based on the consideration of the wave heights, buildings type and access routes characteristics was performed. The wave height and most probable inundation areas was made on the basis of the simulation of three earthquake potential sources with different level of impact (extreme, moderate and weak) in the Setúbal area. In the case of the extreme event the selected source for simulation corresponds to an interpretation of the origins of the 1755 earthquake proposed by Baptista et al (2003).In this study it is suggest that the 1755 tsunami event had two sources: one located in the Marques de Pombal thrust (MPTF) and a second one located in the Guadalquivir Bank. The other two sources are based on a study done by Omira et al (2009) regarding the design of a Sea-level Tsunami Detection Network for the Gulf of Cadiz. In the framework of this study there are analyzed different areas of seismic activity in the South of Portugal and proposed some possible earthquake sources and characteristics.

The tsunami propagation simulations were performed using MOHID modelling system which is an open source three-dimensional water modelling system, developed by Hidromod and MARETEC (Marine and Environmental Technology Research Center - Technical University of Lisbon).

As a result of the study detailed inundation maps associated to the different events and to different tide levels were produced. As a result of the combination of these maps with the available information of the city infrastructures (building types, roads and streets characteristics, prioritary buildings, etc.) there were also produced high scale vulnerability maps, escape routes, emergency routes maps.