Geophysical Research Abstracts,
Vol. 11, EGU2009-4672-3, 2009
EGU General Assembly 2009

Generation of deterministic tsunami hazard maps in the Bay of Cadiz, south-west Spain

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The bay of Cádiz is a densely populated and industrialized area, and an important centre of tourism which multiplies its population in the summer months. This bay is situated in the Gulf of Cádiz, the south-west Atlantic margin of the Iberian Peninsula.
From a tectonic point of view this area can be defined as a diffuse plate boundary, comprising the eastern edge of the Gloria and Tydeman transforms (where the deformation is mainly concentrated in these shear corridors), the Gorringe Bank, the Horseshoe Abyssal plain, the Portimao and Guadalquivir banks, and the western termination of the arcuated Gibraltar Arc. This deformation zone is the eastern edge of the Azores – Gibraltar seismic zone, being the present day boundary between the Eurasian and African plates. The motion between the plates is mainly convergent in the Gulf of Cádiz, but gradually changes to almost pure transcurrent along the Gloria Fault. The relative motion between the two plates is of the order of 4-5 mm/yr. In order to define the different tsunamigenic zones and to characterize its worst tsunamigenic source we have used seismic, structural and geological data.
The numerical model used to simulate the wave propagation and coastal inundation is the C3 (Cantabria, COMCOT and Tsunami-Claw) model. C3 is a hybrid finite difference-finite volume method which balances between efficiency and accuracy. For offshore domain in deep waters the model applies an explicit finite difference scheme (FD), which is computationally fast and accurate in large grids. For near coast domains in coastal areas, it applies a finite volume scheme (VOF). It solves correctly the bore formation and the bore propagation. It is very effective solving the run-up and the run down.
A set of five worst case tsunamigenic sources has been used with four different sea levels (minimum tide, most probable low tide, most probable high tide and maximum tide), in order to produce the following thematic maps with the C3 model: maximum free surface elevation, maximum water depth, maximum current speed, maximum Froude number and maximum impact forces (hydrostatic and dynamic forces). The fault rupture and sea bottom displacement has been computed by means of the Okada equations.
As result, a set of more than 100 deterministic thematic maps have been created in a GIS environment incorporating geographical data and high resolution orthorectified satellite images. These thematic maps form an atlas of inundation maps that will be distributed to different government authorities and civil protection and emergency agencies.
The authors gratefully acknowledge the financial support provided by the EU under the frame of the European Project TRANSFER (Tsunami Risk And Strategies For the European Region), 6th Framework Programme.