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A tsunami induced by a coastal uplift during the 2003 Zemmouri earthquake (Mw=6.9, algeria): Modelling and results

P. J. Alasset (1), H. Hébert (2), V. Calbini (1), S. Maouche (3), & M. **Meghraoui** (1)

(1) EOST-IPG Strasbourg, UMR 7516, France, (2) LDG, CEA, Bruyères le Châtel, France, (3) CRAAG, Algiers, Algeria

A strong tsunami with sea disturbances observed along the Algerian coast, but with significant damage mainly in the Balearic Islands (Spain) harbors, affected the western Mediterranean during the 2003 Zemmouri earthquake (Mw 6.9, Algeria). An average regional uplift of 0.55m was measured along the shoreline in the epicentral area. Field observations, mainshock and aftershocks studies and characteristics concur for a ˜ 55-km-long trending rupture, NE-SW trending, dipping SE and with thrust mechanism. The seismotectonic parameters indicate a surface deformation with 7 to 8-km-deep hypocenter and a possible fault outcrop offshore between 5 and 15 km from the shoreline. Several tide gauges located in the western Mediterranean Coast indicate an average of 0.4 m of sea level change with a maximum of 2 m in the Balearic Islands. We generated high resolution bathymetry grids from the Algerian coasts to the Balearic Islands coasts in order to test different seismic sources (with different fault rupture location, strike and dip) and model the tsunami initiation and propagation. We use a Crank-Nicolson numerical schema with a finite difference method and the modelling is supported to fit the Okada Elastic model. We also highlight the different factors responsible of waves amplification around the Balearic coasts. The best fit between synthetic and real data (tide gauges, GPS levelling and coastal uplift as compared to run-up values) is obtained for a thrust rupture comparable with the earthquake fault inferred from seismotectonic studies and located within 15 km offshore. This study presents the results and modelling of a major tsunami recorded in the western Mediterranean Sea.