Seismic hazard scenarios through different modeling of the Carboneras fault and its impact on the expected ground motion in the city of Almeria

Benito Oterino, M.B., Rivas Medina, A., Gaspar–Escribano, J., Staller, A. y Martínez Cuevas, S.

Abstract

The Carboneras Fault, located in the Southeast Iberian Peninsula, is one of those with the highest slip rate (0.1 g), among the active faults in Spain, and is also one of the longest (L), which also makes it one of the highest potential seismc, in terms of the scalar seismic moment that could be released (M0). According to [Zolud64] (Zolud, 2016), its I = 1.1 km / year and L = 110.5 km, which would make possible an earthquake of magnitude Mw = 7.4. (Using the eq. W & CMF empirical relationship) with a recurrence interval of TR = 1130 years. The fault is strike slip and plane seismic is in point to point of minimum of 5-6 events since the late-Pliocene observed in trenching along La Serena (Molina, 2010, Arnao et al., 2008) and an estimated time for Mw 7.4 of 1176 years. On the other hand, the last major event reported historically in the fault is the one that occurred in 1522, with M (550)-M = 6.5, which allows estimating an elapsed time of about 300 years for that magnitude. With the available data, hazard estimates have been developed from different fault modeling: 1) TS (time series characteristic earthquakes), 2) Renewal model of temporal independence, 3) Renewal model and 4) Poisson model. The sensitivity of the results to the different source modeling is analyzed, and these are compared in turn with the PGA values of the latest seismic hazard map of Spain (PAHM, 2010). Finally, we analyze the impact of the results in the city of Almeria, which is one of the most vulnerable in southern Spain, which makes the impact spread to the seismic risk scenarios that can be expected due to future earthquakes.

Conclusions

Different approaches have been followed for characterizing the seismic hazard in Southern Spain, giving the next results:

- Hybrid method with source model composed by zones and faults, and Poissonian models of seismic maximum PGA in Carboneras fault
- PGA 0.10 g in Almeria City
- Hazard curves for different developing in the Carboneras Fault, give maximum PGA values 0.35 g at the beginning of the seismic cycle (50% PGA in Almeria city), 0.4 g at the end of seismic cycle (95% PGA in Almeria city) and 0.6 g considering the time elapsed since the last event (99.5% PGA in Almeria city).

Seismic hazard assessment using a time dependent model

Rupture segments: CF1, CF2, CF3

Data from Gomez Novelo et al. (in preparation)

Hazard curves in Almeria City

Hazard results (Poissonian model)

Desaggregation results: control earthquakes

PGA with probability of exceedance 10% in the next 50 years

q=0 starting of seismic cycle

q = elapsed time derived from the catalogue

Summary of results with time dependent

Magnitude expected value of PGA in Southern Spain, with 10% of exceedance probability in 50 years, in different states of change in Carboneras Fault

New hazard map of Spain for the relocation of the building code

Discussion

Hazard results obtained in the study with time dependent models in the Carboneras Fault provide a significant PGA values (in 50 years) of 0.6 g. Describing an average time elapsed in a seismic cycle.

Activity models of zones and faults give maximum PGA values of 0.9 g around the Carboneras fault. In the future, results obtained in the study could be useful for the seismic hazard map of Spain (PAHM 2010) or even the new seismic hazard code of Spain (REHAB 2010).

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