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Seismic and tectonic implications of an intersegment rupture. The damaging May 11th 2011 M_W 5.2 Lorca, Spain, earthquake.

J.J. Martínez-Díaz (1), M. Béjar-Pizarro (2), J.A. Álvarez-Gómez (3,1), F.L. Mancilla (4,5), D. Stich (4,5), G. Herrera (2), J. Morales (4,5)

(1) Dep. Geodynamics, Fac. Geology, Universidad Complutense de Madrid, (2) InSARlab Geohazards InSAR laboratory Geohazards group Geoscience Research department, Geological Survey of Spain, (3) Environmental Hydraulics Institute "IH Cantabria", Santander, Spain, (4) Instituto Andaluz de Geofísica. Campus Universitario de Cartuja. Universidad de Granada, Granada, Spain., (5) Departamento de Física Teorica y del Cosmos. Universidad de Granada, Granada, Spain

On May 11th 2011 an Mw 5.2 earthquake stroke the city of Lorca in the SE Spain. This caused 9 fatalities, 300 injuries, serious damage on the city and surrounding area. The Lorca earthquake occurred in the vicinity of a region bounding two well-known segments of a large active fault, the Alhama de Murcia fault (AMF). The Lorca earthquake offers a unique opportunity to study how strain is accommodated in an intersegment region of a large strike slip fault. We map recent tectonic structures in the epicentral region and we use radar interferometry to analyze the coseismic deformation. Combining these data with seismological data of the seismic sequence of Lorca we model the source of the earthquake and we analyze the influence of our preferred model in the adjacent segments by Coulomb failure stress modeling. We finally compare our results with topography and fault structure close to the rupture area and discuss the implications for strain accommodation, fault behavior and seismic hazard in the region.

The proposed source model of the Lorca earthquake suggest that this event ruptured an area of $\sim$ 4 x 3 km within the complex structure that limits the Goñar-Lorca and Lorca-Totana segments of the AMF. The influence of this earthquake in the stress state of the surrounding segments indicate that the Goñar – Lorca segment is charged at its northern tip and the Lorca - Totana segment is charged at its southern tip. Considering the low slip rate of these faults (between 0.1 and 0.6 mm / yr) the stress change calculated represents a seismic cycle advance equivalent to 200 to 1000 years of tectonic loading. From our results, we propose a hypothesis for the long-term seismogenic behavior of the Lorca intersegment zone in which it behaves like a structural barrier capable of arresting earthquakes that rupture the adjacent segments.