The impact of the 2019 Ridgecrest earthquake sequence on time-dependent earthquake probabilities for the Garlock fault, California, USA

Sara Carena¹, Alessandro Verdecchia², Alessandro Valentini³, and Bruno Pace³
¹Department of Earth and Environmental Sciences, Ludwig-Maximilians University, Munich, Germany (scarena@iaag.geo.uni-muenchen.de)
²Department of Earth and Planetary Sciences, McGill University, Montreal, Canada (alessandro.verdecchia@rub.de)
³DiSPUTer, Università G. d’Annunzio di Chieti-Pescara, Chieti, Italy

The 2019 M 6.4 Searles Valley and the M 7.1 Ridgecrest earthquakes occurred in the Eastern California Shear Zone (ECSZ) between the southern tip of the Owens Valley fault and the central segment of the Garlock fault. This earthquake sequence, as shown by recent studies based on cumulative (coseismic plus postseismic) Coulomb stress (ΔCFS) modeling, is likely to have been influenced by previous earthquakes in the ECSZ, reinforcing the hypothesis that the spatial and temporal distribution of major earthquakes in this region is controlled by the location and timing of past events. In turn, the 2019 Ridgecrest sequence has likely reshaped the state of stress on neighbouring faults, and as a consequence modified the probability of occurrence of future events in the region.

Here, focusing on the Garlock fault, we calculate the cumulative ΔCFS due to several major (M ≥ 7) earthquakes which occurred in the ECSZ and surrounding areas (e.g. San Andreas fault) following the most recent event on the Garlock fault (A.D. 1450-1640), and up to and including the Ridgecrest sequence. We then use these results to evaluate the influence of stress changes due to past earthquakes on a probabilistic seismic hazard model for the Garlock fault.

In our first probabilistic model, we calculate BPT (Brownian Passage Time) curves of occurrence of a M ≥ 7 event on the central segment of the Garlock fault in the next 30 years, using recurrence time and coefficient of variation values calculated from palaeoseismological data. Preliminary results show a probability of occurrence in 30 years of up to 10% when we do not consider the effect of ΔCFS. This increases to about 15% when ΔCFS effects are introduced in the model.

As a next step, we will implement a more complex segmented model for the Garlock fault, where probability calculations take into account multiple possible rupture combinations.