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Short-term forecasting of aftershock sequences, microseismicity and swarms inside the Corinth Gulf continental rift

Margarita Segou
GeoAzur-CNRS, Valbonne, France (segou@geoazur.unice.fr)

Corinth Gulf (Central Greece) is the fastest continental rift in the world with extension rates 11-15 mm/yr with diverse seismic deformation including earthquakes with M greater than 6.0, several periods of increased microseismic activity, usually lasting few months and possibly related with fluid diffusion, and swarm episodes lasting few days. In this study I perform a retrospective forecast experiment between 1995-2012, focusing on the comparison between physics-based and statistical models for short term time classes. Even though Corinth gulf has been studied extensively in the past there is still today a debate whether earthquake activity is related with the existence of either a shallow dipping structure or steeply dipping normal faults. In the light of the above statement, two CRS realization are based on resolving Coulomb stress changes on specified receiver faults, expressing the aforementioned structural models, whereas the third CRS model uses optimally-oriented for failure planes. The CRS implementation accounts for stress changes following all major ruptures with M greater than 4.5 within the testing phase. I also estimate fault constitutive parameters from modeling the response to major earthquakes at the vicinity of the gulf (Aσ=0.2, stressing rate app. 0.02 bar/yr). The generic ETAS parameters are taken as the maximum likelihood estimates derived from the stochastic declustering of the modern seismicity catalog (1995-2012) with minimum triggering magnitude M2.5. I test whether the generic ETAS can efficiently describe the aftershock spatio-temporal clustering but also the evolution of swarm episodes and microseismicity. For the reason above, I implement likelihood tests to evaluate the forecasts for their spatial consistency and for the total amount of predicted versus observed events with M greater than 3.0 in 10-day time windows during three distinct evaluation phases; the first evaluation phase focuses on the Aigio 1995 aftershock sequence (15/06/1995, M6.4), the second covers the period between September 2006-May 2007, characterized for its intense microseismicity, and the third is related with the May 2013 swarm. The conclusions support that (1) geology based CRS models are preferred over optimally oriented planes (2) CRS models are consistent forecasters (60-70%) of transient seismicity, having in most cases comparable performance with ETAS models (3) microseismicity and swarms are not triggered by static stress changes of preceding local events with magnitude M greater than 4.5 and (4) the generic ETAS model can efficiently describe the recent swarm episode. The findings of this study have a number of important implications for future short-term forecasting and time-dependent hazard within Corinth Gulf.