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Variations of the earthquake diffusion rates in the Western Gulf of Corinth (Greece)

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Earthquake diffusion is frequently observed in the spatiotemporal evolution of seismic clusters and regional seismicity, a characteristic that is attributed to a triggering mechanism, such as fluid flow, aseismic creep and/or stress transfer effects. In this work, we study the earthquake diffusion properties in the Western Gulf of Corinth (central Greece), an area that presents high extension rates, moderate to large magnitude earthquakes, intense microseismicity and frequent seismic swarms. We focus on the period 2013–2014 that is characterized by intense background microseismic activity along with significant seismic sequences. More specifically, the latter include the 2013 Helike swarm, the 2014 seismic sequence between Nafpaktos and Psathopyrgos, which culminated with an Mw 4.9 event on 21 September 2014, as well as moderate magnitude events that were followed by aftershock sequences. In the herein analysis, we employ a relocated earthquake catalogue of ~9000 events which delineates the activated areas during the study period in high-resolution. We consider the most significant seismic sequences and calculate their respective spatial correlation histograms and the evolution of the mean squared distance of the hypocenters with time, in order to study the earthquake diffusion rates and possible variations that might be related to the triggering mechanisms of seismicity. Our results demonstrate a weak earthquake diffusion process, analogous to subdiffusion within a stochastic framework, for the seismic sequences under consideration, providing further evidence for slow earthquake diffusion in regional and global seismicity. In addition, the earthquake diffusion rates exhibit variations that can be associated with the triggering mechanism. In particular, seismic sequences which are related with pore-fluid pressure diffusion present considerably higher diffusion rates than mainshock/aftershock sequences or the background activity. Such results may provide novel constraints on the triggering mechanisms of clustered seismic activity based on the study of the earthquake diffusion rates.

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