The role of fluids in the seismicity of the Western Gulf of Corinth (Greece)

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The present study focuses on the Western Gulf of Corinth (WGoC), which is one of the most seismically active sites in Europe and also the region where the Corinth Rift Laboratory (CRL) Near Fault Observatory (NFO) has been installed. The WGoC exhibits high extension rates and intense microseismicity, with frequent occurrence of clustered seismicity, as in the cases of the 2001 Agios Ioannis swarm, the seismic sequences of 2003-2004 and 2006-2007 in the central part of the Gulf and the 2013 Helike swarm. These outbreaks of seismicity, lasting a few days to months, are characterized by a high frequency and density of earthquakes, with magnitudes generally not exceeding 4.5, with the strongest ones usually occurring in the middle or towards the end of the sequence. These short-lived seismic crises often exhibit patterns of spatio-temporal migration in their hypocentral distribution, which has been associated with the effects of diffusion and circulation of fluids to the seismogenic crust of the WGoC. Fluids appear to play an important role in both triggering and evolving seismic sequences. In the framework of the present study, earthquake hypocenters, relocated with high resolution by employing waveform cross-correlation and the double difference-method, are used to perform an upper crust Shear-Wave Splitting (SWS) study at the WGoC area. The temporal variation of the SWS is investigated, in relation with the temporal evolution of seismicity, to possibly identify patterns related to changes of the stress-field due to fluid migration, or before the occurrence of moderate to strong earthquakes. In addition, the relocated catalogue is analyzed using nonlinear statistical physics for the definition of the spatio-temporal scaling properties of clustered seismicity, as well as for the quantification and modeling of seismic diffusion phenomena associated with fluid circulation at the upper crust of the WGoC.

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