Space-Time Evolution of Seismicity in The North-Western Geysers Geothermal Field and its Connection to Stimulation Processes

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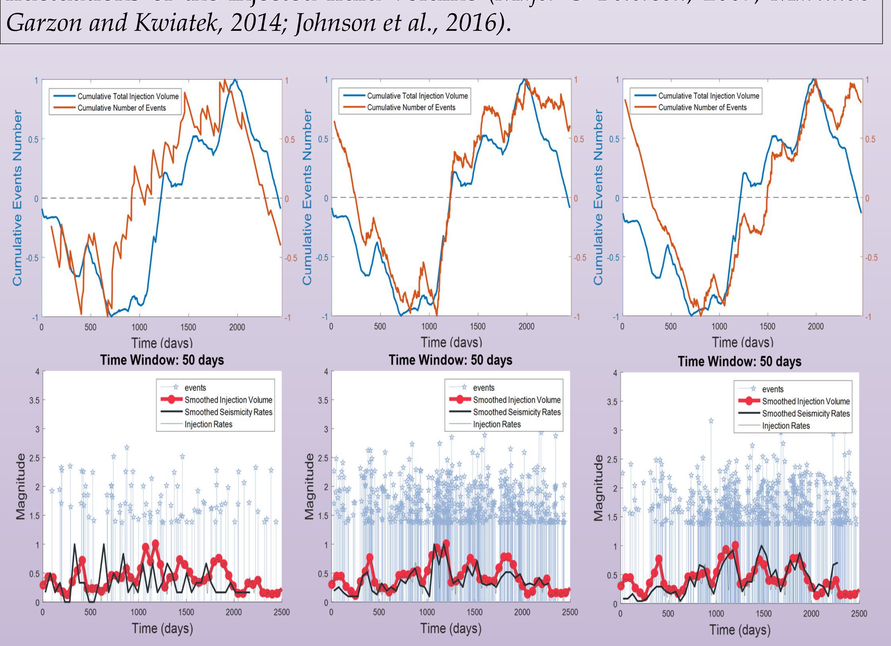
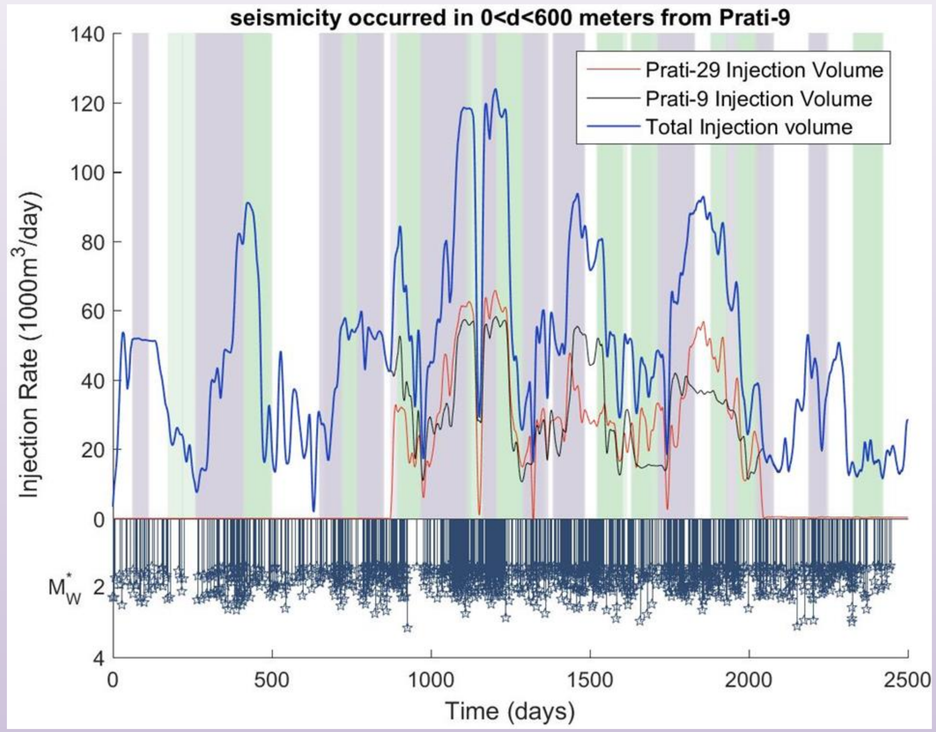
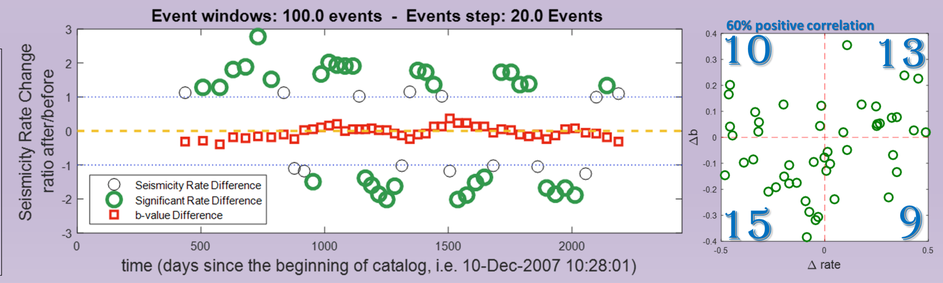
Introduction: Hydraulic fracturing that has been carried out during the last decades is occasionally connected with triggered and induced seismicity worldwide. Data from geothermal fields can be used as a proxy for shale gas exploitation associated seismicity since they are both tightly connected to hydraulic fracturing. The Geysers (California, USA) is the largest producing geothermal field in the world and has been sufficiently monitored and studied since the last decades. Seismic and technological data gathered during the past 40 years indicate a connection of seismic activity with the fluctuations of the injected fluid volume *(Majer & Peterson, 2007; Martinez-Garzon and Kwiatek, 2014; Johnson et al., 2016)*.

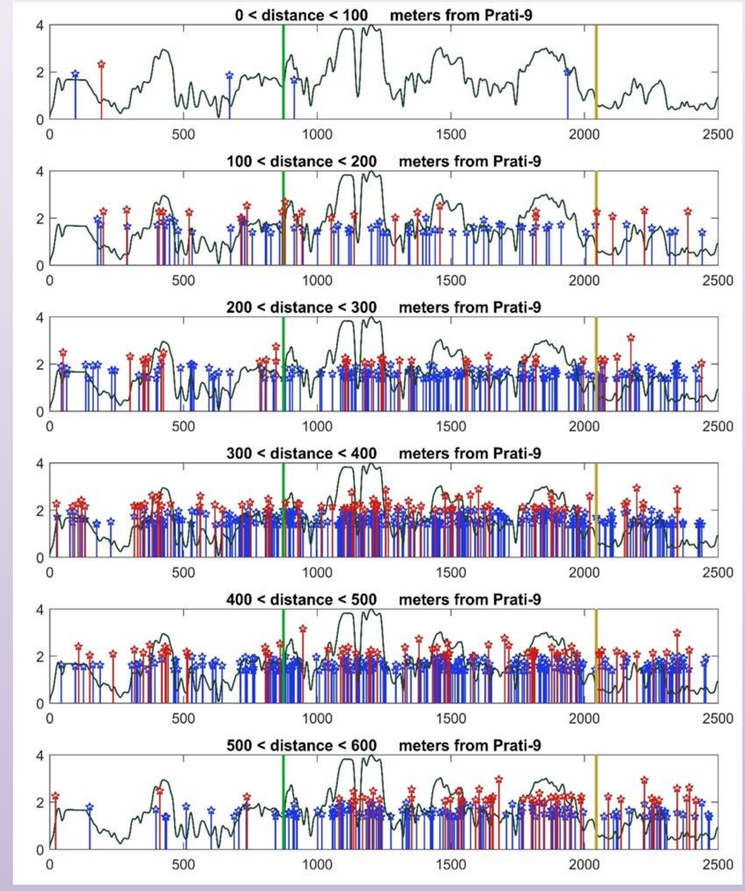


Data: We utilize 'The Geysers' seismic and water injection data from the compiled SHEER (Shale Gas Exploration and Exploitation Induced Risks) database. In this study we verify and quantify this correlation by analyzing the data associated with 2 injection wells (Prati-9 and Prati-29) which covers a time period of approximately 7 years (1154 events with M≥1.4, occurred from November 2007 to August 2014), as they were relocated by *Kwiatek et al., 2015*.



Methods: The correlation between spatio-temporal seismicity evolution and variation of the injection data is performed by elaboration of original and smoothed time-series through specified statistical tools (cross correlation, binomial test to investigate significant rate changes, b-value variation).





Results: Our analysis indicate a short time delay of seismicity occurrence at distances larger than 200m from the injection well, whereas no evidence of significant correlation between injection rates and b-values was discovered. The obtained results are expected to contribute to a better comprehension of the role of hydraulic fracturing and the physical processes that control seismogenesis in fluid injection sites *(Leptokaropoulos et al., submitted manuscript)*.

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