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# Induced seismicity in EGS reservoir : analysis of persistent multiplets at Soultz-sous-Forêts, France

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Abundant seismicity is generally observed during the exploitation of geothermal reservoirs, especially during phases of hydraulic stimulations.
At the Enhanced Geothermal System of Soultz-Sous-Forêts in France, the induced seismicity has been thoroughly studied over the years of exploitation and the mechanism at its origin has been related to both fluid pressure increase during stimulation and aseismic creeping movements.
The fluid-induced seismic events often exhibit a high degree of similarity and the mechanism at the origin of these repeated events is thought to be associated with slow slip process where asperities on the rupture zone act several times.
In order to improve our knowledge on the mechanisms associated with such events and on the damaged zones involved during the hydraulic stimulations, we investigate the behaviour of the multiplets and their persistent nature, if it prevails, over several water injection intervals.
For this purpose, we analysed large datasets recorded from a downhole seismic network for several water injection periods (1993, 2000, ...). For each stimulation interval, thousands of events are recorded at depth. We detected the events using the continuous kurtosis-based migration method and classified them into families of comparable waveforms using an approach based on cross-correlation analysis. We obtain precise relative locations of the multiplets using differential arrival times obtained through cross-correlation of similar waveforms. Finally, the properties of the similar fluid-induced seismic events are derived (magnitude, spectral content) and examined over the several hydraulic tests.
Hopefully these steps will lead to a better understanding of the repetitive nature of these events and the investigation of their persistence will outline the heterogeneities of the structures (temperatures anomalies, regional stress perturbations, fluid flow channelling) regularly involved during the different stimulations.