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Castor UGS (/content/causes-of-the-induced-earthquakes-at-the-Castor-underground-gas-storage)

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GEoREST Workshop on Induced Seismicity

- Yusuke Mukuhira (Tohoku University)
- Luis Cueto-Felgueroso (Technical University of Madrid)
- Qinghua Lei (Uppsala University)
- Silvia De Simone (CSIC)
- Mateo Acosta (CalTech)
- Alexis Sáez (EPFL)

Important dates

20th of January 2024: Abstract submission deadline

25th of January 2024: Confirmation of abstract acceptance and opening of registration

29th of February 2024: Closing of the registration

Committee

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Programme

Monday, 11th of March, 2024	
8:30-9:00	**Registration opens**
9:00-9:15	**Welcome address** **Víctor Vilarrasa (CSIC)**

Tuesday, 12th of March, 2024	
17:00-18:00	Session 4: Forecasting induced seismicity 5 oral presentations

Wednesday, 13th of March, 2024	
9:00-10:30	Session 5: Case Studies of induced seismicity Keynote lecture and 5 oral presentations
10:30-12:00	Coffee break + posters Session 5
12:00-13:00	Session 5: Case Studies of induced seismicity 5 oral presentations

For more and up-to-date information, please go to the ***workshop website (https://workshop.georest.eu/)***

A methodological approach to characterize seismicity induced by geofluids

G.M. Cipressi [1,4], A. Vuan [4,5], M.A. Romano [4], G. Lavecchia [2,3], R. de Nardis[2,3]

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The distinction between induced and natural seismicity is of great interest in scientific research, especially considering the growing importance of Underground Gas Storage (UGS) activity to reduce CO_2 and methane emissions into the atmosphere.

Currently, no single recognized methodology can discriminate induced seismicity from natural one. About that, we propose a methodological approach, aimed at analyzing the differences between the seismicity induced by the injection of geofluids and that linked purely to tectonics, through (1) the space-time analysis of the clustered seismicity, (2) the diffusivity properties of clusters associated with transient phenomena, such as fluid migration, and (3) the frequency magnitude distribution that characterized swarm-like, mainshock-aftershock or fore-mainshock sequences.

We implemented this approach in the central-southern sector of the Apennine chain, where it is hypothesized that the seismicity is triggered along fractured fault zones by the upwelling of deep fluids rich in CO_2 (Chiodini et al., 2014; Talone et al., 2023).

We analyzed 37 years of seismicity (1981-2018) contained in the CLASS catalog (Latorre et al., 2022). To improve the spatio-temporal resolution of seismicity, we applied Template-Matching techniques (Vuan et al., 2018) in the 7-year time window from 2012 to 2018, which allowed us to increase the number of earthquakes by lowering their completeness magnitude (+20,000 events with $-1.5<M<5$).

Seismicity was analyzed through an original workflow using tools to detect and classify clusters. The declustering of the catalogs was performed by the Nearest Neighbor (Zaliapin & Ben-Zion, 2020) and Windowing (Gardner & Knopoff, 1974) methods. The individual clusters' space-time definition was based on the kernel density calculation and the percentage of the seismicity rate over time (Roland et al., 2009).

We identified 29 and 26 seismic clusters for the original and improved catalogs, respectively, and classified them into swarm and seismic sequences. Diffusivity was calculated using the method of Shapiro et al. (1997) and analyzed together with the temporal duration of each cluster. The resulting diffusivity values for most of the clusters are high (>0.5 m^2/s) and associated with short temporal durations (days).

From these results, it is possible to divide the seismicity in the central-southern Apennines into clusters associated with purely tectonic phenomena that do not present diffusivity and highly diffusive clusters, which confirm the presence of permeable fault zones and the contribution of deep fluids pressurized, rich in CO_2.

11-13 March 2024

Palma de Mallorca Spain

Call for Abstracts

Until January 20th

GEOREST-WORKSHOP ON INDUCED SEISMICITY