Contribution ID: **238** Type: **Oral Presentation**

Understanding induced seismicity for a safe use of porous media to reach carbon neutrality: the case of the Underground Gas Storage of Castor, Spain

Tuesday, 31 May 2022 11:45 (15 minutes)

The use of the subsurface for low-carbon energy-related activities, such as geothermal energy, geologic carbon storage and underground energy storage, will intensify during the transition towards a carbon-neutral society. Such intensification requires managing induced seismicity to avoid the cancellation of projects like the Underground Gas Storage (UGS) project of Castor, Spain, which implied a cost of 4.73 billion euros of public money. Castor has been the case with the largest induced earthquakes among the more than 640 UGS facilities around the world, with three earthquakes with magnitude around 4. The typically assumed triggering mechanism of pore pressure buildup was not the cause of the induced seismicity at Castor because the focal depth is located several kilometers below the storage formation and because the earthquakes were induced 20 days after the stop of injection, when pore pressure buildup had already attenuated. Instead, we have found that buoyancy of the gas, which has a permanent effect, aseismically destabilized the Amposta fault, which bounds the storage formation. The progressive accumulation of aseismic slip at the Amposta fault caused an increasing stress transfer that eventually destabilized a critically stressed fault located in the crystalline basement. Then, several patches of this deep fault were reactivated due to shear slip stress transfer and slip-driven pore pressure changes, inducing the sequence of felt earthquakes. We conclude that a thorough characterization of the site would have avoided the large earthquakes because a detailed analysis of the initially performed surveys would have served to highlight the high risk of inducing seismicity at Castor.

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Spain

References

Vilarrasa, V., De Simone, S., Carrera, J. and Villaseñor, A., 2021. Unravelling the causes of the seismicity induced by underground gas storage at Castor, Spain. Geophysical Research Letters, 48, e2020GL092038

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

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