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Type: Oral Presentation

Thermo-hydraulic-Mechanical Modeling Studies of Cryogenic Effects in the Near-wellbore Region of Geothermal Formations

Wednesday, 15 May 2024 14:00 (15 minutes)

We developed a parallel thermo-hydraulic-mechanical (THM) model of fully coupled multiphase fluid and heat flow and geomechanics as well as associated fracturing processes in porous and fractured media to simulate cryogenic fracturing with liquid nitrogen in hot reservoirs. This included enhancing our THM simulator and developing a physical property module for nitrogen-water systems and formulating fracture initiation and extension criteria.

We used cryogenic fracturing experiments on small concrete blocks to verify the simulator modifications. Then, we simulated two field cases, one with an injector-producer pair with cryogenic fracturing that enhanced the permeability in a vertical plane around the wellbore and extending in the direction of the producer. The second case was cryogenic fracturing and cooling of the near-wellbore region in a shallow, heated reservoir. The induced fractures were horizontal but their lengths were non-uniform due to the pressure and temperature gradients.

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References

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Primary authors: Dr WINTERFELD, Philip H. (Colorado School of Mines); YAO, Bowen (China University of Petroleum - Beijing); Dr WU, Yu-Shu (Colorado School of Mines)

Presenter: Dr WU, Yu-Shu (Colorado School of Mines)

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