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A Thermo-Hydro-Mechanical coupled Numerical modeling of Injection-induced seismicity on a pre-existing fault

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In terms of energy development (oil, gas and geothermal field) and environmental improvement (carbon dioxide sequestration), fluid injection into subsurface has been dramatically increased. As a side effect of these operations, a number of injection-induced seismic activities have also significantly risen. It is known that the main causes of induced seismicity are changes in local shear and normal stresses and pore pressure as well. This mechanism leads to increase in the probability of earthquake occurrence on permeable pre-existing fault zones predominantly. In this 2D fully coupled THM geothermal reservoir numerical simulation of injection-induced seismicity, we investigate the thermal, hydraulic and mechanical behavior of the fracture zone, considering a variety of 1) fault permeability, 2) injection rate and 3) injection temperature to identify major contributing parameters to induced seismic activity. We also calculate spatiotemporal variation of the Coulomb stress which is a combination of shear stress, normal stress and pore pressure and lastly forecast the seismicity rate on the fault zone by computing the seismic prediction model of Dieterich (1994).