Study of heat extraction and flow process by fully coupled thermal-hydro-mechanical model

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Enhanced Geothermal Systems (EGS) are widely used in the development and application of geothermal energy. They usually consist of two parallel deep boreholes, where cold water is injected into one borehole and abstracted at the second one after being heated when passing through the fractured network system. Recently, simple analytical solutions have been proposed to estimate the water pressure at the output. Nevertheless, these methods do not take into account the influences of the coupled thermal and mechanical processes. In this research study we build a fully coupled Thermal – Hydro-mechanical model (THM model) to simulate the processes of heat extraction, deformation and water flow in the nearby fractured rock formations. The influences of single thermal – hydraulic and mechanical – hydraulic effects were compared with the fully coupled and decoupled results, showing that temperature influences mostly the water pressure in the second borehole, compared with temperature. The mechanical effect alone has little influences on the water pressure. A sensitive analysis was also conducted to study which parameters affect the simulation results the most. It was shown that the initial permeability and temperature are playing the main roles in this simulation.