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CAN SINGLE POROSITY MODELS ADEQUATELY REPRESENT HEAT FLOW IN FRACTURED POROUS MEDIA?

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Understanding of heat transfer processes in subsurface fractured rocks is critical for the development of geothermal resources. One of the challenging tasks is to build models that can adequately represent the complexity of the formation geometry and subsurface processes without the extensive computation cost. Single porosity models with effective parameters are commonly used for this purpose. However, these models are often too simplistic and inadequate to represent complex fractured rocks. The aim of this study is to evaluate when a single porosity model can adequately represent heat flow in fractured rocks. Our study uses numerical modelling to simulate heat flow and upscale hydraulic and thermal properties. We then use thermal breakthrough curves generated from the simulation results to evaluate the performance of the upscaling. Embedded discrete fracture model (EDFM) with explicit fracture and rock properties provides the base solution with which we evaluate the performance of the single porosity model. Our sensitivity analysis includes fracture density, connectivity, fracture lengths as well as the permeability contrast with the background matrix. The results indicate that single porosity models are mostly inadequate to reproduce the thermal breakthrough of fractured rocks except for cases where the permeability contrast between the fractures and the matrix is less than three order of magnitude. Overall, this study demonstrates when a single porosity model can be useful to represent heat flow in fractured rocks.

Participation

In-Person

References

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