Geophysical Research Abstracts
Vol. 19, EGU2017-11945, 2017
EGU General Assembly 2017

Coupled thermo-hydro-mechanical modeling of heat extraction from the Tattapani geothermal field, India

Sachchida Nand Pandey and Vikram Vishal

Computational and Experimental Geomechanics Laboratory, Department of Earth Sciences, IIT Bombay, Mumbai - 400076, India (snpiitm@gmail.com; v.vishal@iitb.ac.in))

Modeling of coupled thermo-hydro-mechanical processes in enhanced geothermal systems is presented using the finite element method of modeling for a 3-D domain. The reservoir consists of a single horizontal fracture surrounded by low permeable rock matrix. The flow is imposed on a fracture plane, consisting of a doublet system. The reservoir rock mechanical properties were taken from the field data of the Tattapani geothermal field, India. We investigate the effects of injection temperature and mass flow rate on the energy output. The results indicate that temperature and pressure changes within the reservoirs occur due to injection of cold water. The temperature drop and fluid overpressure inside the reservoirs/fracture affect the transport properties of the fracture. The spatial-temporal variations of fracture aperture inside the reservoir greatly impact the thermal drawdown and therefore net energy output. The results showed that maximum aperture evolution occurs near the injection zone than the production zone. The fracture aperture evolution is a result of combined effects of thermal stress and fluid overpressure inside the fracture. The fracture opening reduces the injection pressure required to circulate the fixed volume of water. The effects of the injection temperature on heat extraction were also analyzed under different reservoir formations. The results indicate that reservoir permeability plays a significant role on heat extraction, highlighting the important effect of water losses. For each factor, it is concluded that thermal breakthrough primarily depends on injection temperate, mass flow rate, reservoir permeability and well distances. The results of this study can help in choosing the operational parameters for successful operation of geothermal system. The study will also be helpful to optimize the EGS performance under varying reservoir conditions.