Geophysical Research Abstracts
Vol. 20, EGU2018-14556, 2018
EGU General Assembly 2018

Analysis of hazard and efficiency associated with the stimulation strategy for Enhanced Geothermal Systems

Vanille A. Ritz, Antonio P. Rinaldi, and Stefan Wiemer
Swiss Seismological Service, ETH Zürich, Switzerland (ritzv@student.ethz.ch)

Stimulation operations at geothermal sites often cause induced earthquakes that are susceptible of being felt by local populations. Such injection-induced sequences often present specific earthquake-size distributions, presenting both spatial and temporal features ; an example of which being the Basel deep heat mining experiment. Previous studies have already replicated these observations with simplified assumptions. Here, we propose an improvement to these model accounting for a full 3D configuration for stress and fluid flow, and more complex physics based mechanisms (e.g. permeability enhancement, static stress transfer). Our model of a hot dry rock system and its stimulation phase is achieved using a hydro-geomechanical-stochastic simulator: TOUGH2-Seed. We successfully model a seismic cloud comparable to the one observed in Basel, including similar spatio-temporal evolutions of the b-value.
Based on this synthetic modelling, we focus on assessing the efficiency of the reservoir creation, introducing a stimulation factor built on permeability enhancement in the stimulated volume. Furthermore, we assess the seismic hazard associated with the fluid injection, estimating the probability of exceeding a certain magnitude event during and after stimulation. The comparison of these factors representing seismic hazard and efficiency allow us to envision a unique tool aiming at a simpler evaluation of injection strategies, reconciling the engineering successfulness goal of a geothermal project and the potentially damaging seismicity resulting from stimulation operations.