Analysis of seismicity caused by fluid injection

Vasily Riga¹ and Sergey Turuntaev¹,²,³

¹All-Russia Research Institute of Automatics, The Centre for Fundamental and Applied Research, Moscow, Russian Federation (rigavu92@gmail.com)
²Institute of Geosphere Dynamics, Russian Academy of Sciences, Moscow, Russian Federation (s.turuntaev@gmail.com)
³Moscow Institute of Physics and Technology, Moscow, Russian Federation

Induced seismicity associated with fluid injection into the subsurface is an important issue worldwide. Sometimes the fluid injection into a fault leads to aseismic creep of the fault or to microseismic events, but other times it results in more significant seismicity. In our work, we analyze the influence of various parameters of the fault and the rock, as well as the geometry of the model on induced seismicity. A case of well injecting water near a single fault was considered. To describe the slip process, several versions of the rate-and-state friction law was used. It was analyzed, how the model parameters, such as the position of the well relative to the fault, the permeability of the rock, the frictional properties of the fault affect the fault displacements. The problem of the poroelastic effect influence on the fault motion was also considered. Conditions that are favorable for the occurrence of noticeable seismicity were obtained. Difference in the fault behavior with one-parameter and two-parameter rate-and-state friction law were also considered.