



Basel Induced Seismicity - A Never Ending Story?

Toni Kraft, Marcus Herrmann, Thessa Tormann, Dimitrios Karvounis, Nicholas Deichamnn, and Stefan Wiemer
SED @ ETH Zurich, Swiss Seismological Service, Zurich, Switzerland (t.kraft@sed.ethz.ch)

The Deep Heat Mining Basel project drilled a 5km deep borehole into the granitic basement below the city in 2006. The goal was to create an artificial reservoir at this depth using hydraulic stimulation, to extract heat from the 200°C hot rock mass, and to provide heating and electricity for the local communities. Unfortunately, a magnitude ML3.4 earthquake was induced after six days of hydraulic stimulation and the project had to be stopped. A subsequent risk study concluded that further earthquakes of similar or larger magnitudes would be likely when continuing the project, and the authorities and the operator decided to terminate the project.

Between 2007 and 2011 the Basel borehole was mainly open and one-third of the water injected during stimulation was flowing back to the surface. In April 2011 the well was closed, and wellhead pressure began to slowly rise again. In January 2017 the pressure had reached nearly 9 bar. Between February and March 2017 seismicity in the reservoir increased significantly and earthquakes up to ML1.8 were recorded by the Swiss Seismological Service (SED). An analysis of the SED concluded, that the increase in seismicity is likely linked to the pressure increase in the borehole and reservoir, and the authorities, subsequently, ordered the opening of the well. The opening was performed between July and October 2017 by weekly, stepwise reductions of the wellhead pressure. The SED has intensified the seismic monitoring of the reservoir and additionally started recording high-resolution, hydraulic wellhead parameters since April 2017.

In this presentation, we discuss the seismic analysis and hydro-mechanical modeling that led the Canton to demand the reopening of the well. We will describe the pressure-reduction procedure, as well as the monitoring and alarming system the SED operated for the Canton and the owner of the borehole. Finally, we will have a look at the behavior of the hydraulic parameters and the seismicity since the opening of the well.