



Induced surface deformation and seismicity during 2011-2012 at the Húsmúli reinjection site, Iceland

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While induced seismicity related to fluid injection is a common occurrence, deformation due to injection is rarely observed. At the Hellisheidi power plant in SW Iceland we detect both induced seismicity and deformation during the initial phase of geothermal wastewater reinjection. The largest seismic events in the sequence were two earthquakes of M3.8 and M4.0 on 15 October 2011, after reinjection was started in September 2011 with a flow rate of around 550 l/s. After the intense induced seismicity started, a few GNSS sites in the area were operated semi-continuously, as there was no continuous station nearby. The GNSS data reveal a transient signal which indicates that most of the deformation occurred in the first months after the injection started. Surface deformation is also evident in SAR interferograms in the time interval of June 2011 to May 2012. We use an inverse modeling approach and simulate the geodetic data (InSAR and GNSS) to find the most plausible source for the deformation signal. We test whether the deformation was caused by co-seismic motion on N-S right-lateral strike slip faults due to the largest events in October 2011. We also examine other source models that may explain the deformation. Finally, we estimate Coulomb stress changes in the area to test what processes could have activated slip on pre-existing faults to examine the causal relationship between the deformation and the induced seismicity.