Geophysical Research Abstracts
Vol. 21, EGU2019-18643-1, 2019
EGU General Assembly 2019

Seismic velocity changes during reinjection of wasterwater in Hellisheidi geothermal field, SW Iceland

Sigridur Kristjansdottir (4), Kristin Jonsdottir (2), Thomas Lecocq (3), Olafur Gudmundsson (4), Ari Tryggvason (4), and Michael Fehler (5)

(4) Uppsala University, Sweden, (2) Icelandic Meterological Office, Iceland, (3) Royal Observatory of Belgium, Belgium, (5) Massachusetts Institute of Technology, USA

Ambient noise has been used successfully to measure changes in seismic velocity in volcanic and geothermal areas in various locations. The source of the ambient noise is the coupling between atmosphere, ocean, and seafloor. The ambient noise travels from the source to the area of interest and is scattered in the subsurface. Therefore a large volume is sampled. Physical changes in the subsurface, e.g. due to intrusion of magma can lead to either an increase or a decrease in seismic velocity. By using cross correlation and time delay measurments in the coda of the correlogram we can monitor these changes. Our reasearch is focused on whether reinjection of waste water in a geothermal field produces an observable change in seismic velocity or not.
Our research area is the Hellisheidi geothermal field in southwest Iceland. Electrical and thermal power production started there in 2006. The field is located in the Hengill volcanic system and is both tectonically and seismically active due to the influence of the nearby triple junction of an oblique rift, a normal rift, and a transform zone. The operators of the geothermal power plant are legally obligated to reinject wastewater from the plant back into the ground below the ground water table. The original injection site was located to the southwest of the power plant. A second injection site, to the northeast, was taken into use in September 2011. Seismicity increased in the vicinity of these injection wells immediately following the start of injection. During this time a dense temporary network, run by Uppsala University, Reykjavik University, Massachusetts Institute of Technology, and the Iceland GeoSurvey, was in operation in the Hengill area. Additionally, data from the Icelandic Meteorological Office′s regional network is included in the data set.
For calculating the velocity changes we use the MSNoise software. We observe a significant decrease in velocity in the months following the onset of injection. This could be explained by the increased volume of water in the rock matrix. However, seasonal effects as well as changes in the source of the ambient noise must be considered.
This work is a part of the IS-NOISE project, a project funded by the Icelandic Centre for Research, which aims to investigate velocity changes in three different geological settings: a geothermal field, volcanic systems, and in a transform zone prior to a large earthquake.