Geophysical Research Abstracts
Vol. 20, EGU2018-15804, 2018
EGU General Assembly 2018

Interaction of geothermal, tectonic, and magmatic processes in the Hengill area

Halldór Geirsson (1), Thóra Árnadóttir (1), Kristín S. Vogfjord (2), Daniel Juncu (1), Hanna Blanck (1,2,3), Cécile Ducrocq (1), Bjarni Reyr Kristjánsson (4), Gunnar Gunnarsson (4), Freysteinn Sigmundsson (1), Benedikt G. Ófeigsson (2), Kristín Jónsdóttir (2), Björn Lund (5), Gunnar B. Guðmundsson (2), and Vincent Drouin (1)

(1) University of Iceland, Institute of Earth Sciences, Reykjavik, Iceland (hgeirs@hi.is), (2) Icelandic Meteorological Office, Reykjavik, Iceland, (3) ÍSOR - Iceland Geosurvey, Reykjavík, Iceland, (4) Reykjavík Energy, Reykjavík, Iceland, (5) Uppsala University, Uppsala, Sweden

High-temperature geothermal fields owe their existence to magmatic supply (i.e. intrusions) and that tectonically driven faulting provides high-permeability fluid flowpaths that are necessary for geothermal energy production. Geothermal utilization, including fluid extraction and injection, causes permanent changes in crustal stress and fluid pressure, which affects nearby seismicity and fault movements. Stress changes can in general also affect magmatic movements, such as dike propagation, dike arrest, and formation and growth of magma chambers. Here, we present the start of a project that studies stress interactions of geothermal, tectonic, and magmatic processes, with special focus on the Hengill area. Significant changes in geothermal production in the Hengill area commenced in 2016 when production started in the Hverahlíð geothermal area, giving us a chance to observe in detail changes in deformation, fluid pressures, temperature from the onset of the production in a new area. We use geodetic, seismic, and reservoir monitoring data to model deformation processes and associated stress changes; estimate in-situ stress changes from earthquakes; map faults activated using relative earthquake relocations; and plan to combine our observations with existing numerical reservoir models in the area at later stages of the project. Three new continuous GPS stations were installed in the summer of 2017 near the center of the three main geothermal production areas in Hengill, such that now the geodetic network is composed of 8 continuous stations and upwards of 100 campaign benchmarks. Preliminary analysis of SENTINEL-1 InSAR data extending into 2017 show a small subsidence in the Hverahlíð region, in a broad correspondence with the limited mass outtake in the region. A new dense microseismic monitoring network shows a mixture of anthropogenically induced seismicity near the injection areas and natural seismicity in the area relating to the plate boundary and volcanic deformation.