

Continuous gravity in a volcanic geothermal field: contribution to understand mass changes

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The exploitation of geothermal systems modifies mass and stress distributions in and around the reservoirs. Continuous monitoring of gravity field and ground motion allows a better understanding of processes and mechanisms, that produce short term gravity changes and local seismic activity. In the project "MicroGraviMoTiS Geothermal Technologies: continuous microgravity monitoring for integrated mass and stress balance analysis in a volcanic geothermal field - contribution for exploitation sustainability" (BMBF, 03G0858A) we aim to identify and quantify links between the external anthropogenic forcing (exploitation) and the natural forcing (earth tides, earthquakes ...) as well as the response of the geothermal system within the natural tectonic and volcanic environment. In autumn 2017 we have setup a multi-parameter station network in and around the Theistareykir geothermal field in North East Iceland. The site chosen for this unique experiment is at the very beginning of its exploitation and after being used for power production (started in November 2017) all extracted fluids are re-injected at a single location. The 5 gravity monitoring positions are set up close to the geothermal production and injection wells and one site is located outside the geothermal field, for reference measurements that are unaffected by exploitation activities. The network deployed consists of 3 iGrav superconducting gravimeters and 2 gPhone spring gravimeters, supplemented with additional instruments, such as broadband seismic stations, tiltmeters, GNSS receivers, hydro-meteorological stations, snow height observation instruments etc. Absolute gravity measurements (FG5) were performed at each location in January and July 2018 to monitor and remove the instrumental drift and calibrate each relative gravimeter. In order to increase the spatial coverage of the gravity changes, a repetition gravity network was set-up in summer 2017 that has been measured twice since. We present here the site, the infrastructure, the instruments deployed as well as first results and an outlook.