

Preliminary Evaluation of a Surface DAS Array to Monitor Seismic Activity at the FORGE Geothermal Facility in April 2022

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Enhanced geothermal systems (EGS) are engineered reservoirs that enable the production of geothermal electricity where natural hydrothermal resources are absent. The Frontier Observatory for Research in Geothermal Energy (FORGE) in Utah is an underground field laboratory sponsored by the Department of Energy where pioneering EGS technology is being tested and developed. EGS works by injecting cold water into hot dry rock to create fractures, where it can permeate and be heated up by the surrounding rock volume before returning to the surface as a source of geothermal energy. This process of inducing fractures in the rock leads to the generation of small magnitude earthquakes. As a result, robust seismic monitoring is needed to locate those fractures, track reservoir development, and mitigate seismic risk.

The use of horizontal (surface) distributed acoustic sensing (DAS) arrays is proving to be a powerful tool for seismological purposes due to its dense, meter-level sensor spacing and scalable aperture. For this reason, in April 2022 we deployed an 1800-m horizontal DAS array at FORGE to monitor seismicity that occurred during a 2-week series of hydraulic stimulations. The motivation for this experiment is three-fold, that is: (1) to exploit the capabilities of a horizontal DAS array and evaluate its potential for investigating induced seismicity in general; (2) to compare the performance of surface DAS to borehole DAS, borehole geophones, and surface geophones; and (3) to explore its value in guiding future EGS operations and research, complementary to traditional seismic networks. Here, we introduce the logistical and scientific background of this experiment in context of the FORGE mission, showcase preliminary observations, and discuss lessons learned and future directions.