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The EGS Collab Project –Stimulating Crystalline Rock at 1.25 and 1.5 km Depth

The EGS Collab project, funded by the US Department of Energy Geothermal Technologies Office, is performing intensively monitored rock stimulation and flow tests at the 10-m scale at the Sanford Underground Research Laboratory to inform challenges in implementing enhanced geothermal systems (EGS). We are gathering data and observations from the field tests and comparing to models to understand processes and to build confidence in numerical modeling of the processes.

Experiment 1 examined hydraulic fracturing at a depth of approximately 1.5 km (4850 level). We installed many types of geophysical monitoring instrumentation in six of eight sub-horizontal boreholes in well-characterized phyllite to allow careful monitoring of stimulation events and flow tests. The other two boreholes were also instrumented to perform and carefully measure water injection and production. We performed more than a dozen hydraulic stimulations and nearly one year of flow tests in the testbed and collected and analyzed detailed observations and numerous data sets of processes occurring during stimulation and dynamic flow tests. Data from these tests are generally openly available. Ambient temperature and chilled water flow tests were performed with many tracer tests to examine changing system behavior. We achieved adaptive control of the tests using close monitoring of rapidly disseminated data and near-real-time simulation. Numerical simulation was used to answer key experimental design questions, to forecast fracture propagation trajectories and extents, and to analyze and evaluate results. Many simulations were performed in near-real-time in conjunction with the field experiments, with more detailed simulations performed on a longer timeframe.

Experiment 2 is designed to examine hydraulic shearing in a new test bed at SURF at a depth of about 1.25 km (4100 level) in amphibolite under a different set of stress and fracture conditions than Experiment 1. This testbed consists of 9 boreholes, in addition to two earlier-drilled characterization boreholes. Of the 9 boreholes, one is used for injection, four contain grouted instrumentation, and the remaining four are adaptively used for production and monitoring. The testbed construction optimized encounters with approximately five fracture set orientations. Experiment 3 will investigate unconventional stimulation methods and will follow Experiment 2 at 1.25 km depth.

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