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Distributed Acoustic Sensing Technology in a Magmatic Geothermal Field – First Results From a Survey in Iceland

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Seismic methods are particularly suited for investigating the Earth's subsurface. Compared to surface-measurements , wellbore measurements can be used to acquire more detailed information about rock properties and possible fluid pathways within a geothermal reservoir. For high temperature geothermal wells, however, ambient temperatures are often far above the operating temperature range of conventional geophones.

One way to overcome this limitation is the application of fiber optic sensor systems, where only the passive optical fiber is subjected to downhole conditions. Their applicability is thus determined by the operating temperature range of the optical fiber. Choosing appropriate fibers, such sensor systems can be operated at temperatures far above 200°C. Along an optical fiber, the distributed acoustic sensing technology (DAS) can be used to acquire acoustic signals with a high spatial and temporal resolution. Previous experiments have shown that the DAS technology is well suited for active seismic measurements.

Within the framework of the EC funded project IMAGE, a fiber optic cable was deployed in a newly drilled geothermal well (RN-34) within the Reykjanes geothermal field, Iceland. Additionally, a >15 km fiber optic cable, already available at the surface, was connected to a DAS read-out unit. Acoustic data was acquired continuously for 9 days. Hammer shots were performed at the wellhead as well as along the surface cable in order to locate individual acoustic traces and calibrate the spatial distribution of the acoustic information. During the monitoring period both signals from on- and offshore explosive sources and natural seismic events could be recorded. We compare the fiber optic data to conventional seismic records from a dense seismic network deployed on the Reykjanes in the course of the IMAGE project. Here, first results from the seismic survey will be presented.