ÍSOR
Iceland GeoSurvey

Geothermal

Geophysical Exploration

Geophysical exploration plays a central role in geothermal investigations.

A range of physical parameters is measured, including resistivity, density, sound velocity, magnetism, and dielectric properties of the subsurface rocks, all of which helps in characterization of the subsurface.

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Our Geophysical Capabilities

ÍSOR offers the following geophysical services for geothermal exploration and other applications:

Resistivity surveying

Transient Electromagnetic (TEM) and Magnetotelluric (MT) soundings. State-of-the-art processing and interpretation of data, including joint 1D inversion of TEM and MT for static shift correction of MT, as well as 2D and 3D inversion.

Micro seismicity

Setting up and operating local seismic networks, both permanent and temporary. Analysis of passive seismic data for the determination of hypocenters, magnitudes, focal mechanisms, and tomographic inversion.

Gravity and geodetic surveying

Gravity surveys for rock density studies (Bouguer) and high-precision micro-gravity surveys for reservoir monitoring. High-precision differential GPS and GNSS surveying alongside gravity measurements for monitoring crustal movements. State-of-the-art data processing and interpretation.

Magnetic surveying

Total magnetic field surveys on the ground, complemented by drone-borne (UAV) magnetic surveys for rapid, high-resolution mapping of dikes, faults, and alteration zones across rugged or inaccessible terrain. Integrated processing and interpretation of ground and airborne data.

Ground Penetrating Radar (GPR)

High-resolution imaging of the shallow subsurface using multi-frequency and low-frequency GPR. The method reveals geothermal fractures, stratigraphy, and groundwater horizons at a level of detail that deeper geophysical methods cannot resolve alone. Surveys are designed to match antenna frequency to target depth, from near-surface detail work to penetration through thick lava sequences.

Active seismic methods in engineering geology

Both seismic refraction and seismic reflection surveys for structural and engineering purposes, using explosive or airgun energy sources. State-of-the-art 2D data processing and interpretation.

Resistivity surveys carried out by ÍSOR (Iceland GeoSurvey) provide essential information on the physical properties of geothermal systems. Temperature dependent assemblies of secondary minerals form by water-rock interaction (alteration) within geothermal systems, producing a distinctive resistivity structure that can be used to map the size and shape of the reservoirs.

Monitoring and locating micro earthquakes yield information on fault movements, permeability, and heat mining from heat sources, while tomographic inversion reveals sound velocity anomalies. Gravity surveys constrain density variations such as dense intrusions. Magnetic measurements, acquired both on the ground and from unmanned aerial platforms, locate dikes and detect demagnetization associated with hydrothermal alteration. Ground penetrating radar (GPR) complements deeper methods by imaging the shallow subsurface at high resolution, including fractures, stratigraphy, and groundwater horizons.

A joint interpretation of complementary data (geophysical, geological, and geochemical) is the crucial final stage in geothermal exploration.