

Geophysics for Geothermal Energy

Introduction

Geophysics provides technology with which we can "look" into the subsurface. It is a key enabler for many activities in the search for hydrocarbons, minerals, fresh water, and geothermal energy. Of the many existing geophysical methods, two are important for exploring and producing geothermal energy. These are Seismic and Electromagnetic methods.

In the first method, high resolution seismic up to 250 Hz can be acquired with short offsets. For deeper geothermal sources, long offset seismic is collected. Long offsets are needed for Refraction Static corrections and in case Full Waveform Inversion is applied using refracted and diving waves. For geothermal application, the presence of fractures and their orientation, being natural or induced is an important property that can be derived from seismic (anisotropy).

The second important geophysical method for geothermal energy is electrical and electro-magnetic methods. Electrical or Direct Current surveys use grounded electrodes for source and receivers. They measure the potential difference using increasing receiver electrode spacing. Changes in measured potentials contain information on the resistivities of the subsurface. Electro-Magnetic can use either grounded or inductive sources (aerial surveys), but also natural sources as used in Magneto-Telluric surveys. An important application uses Ground-Penetrating Radar. These Electro-Magnetic sources can be a harmonic source (using a single frequency) and the measurement of the magnitude and phase delay, or real and imaginary responses are used. The other Electro-Magnetic source option is a step-off function. The subsurface information is then contained in the amplitude decay after shut-off.

Who should attend?

Those involved in projects related to extracting energy from the subsurface, shallow as well as deep.

Learning methods and tools

The course uses a user-friendly Learning Management System, called Moodle. In Moodle different modules provide study material, videos, and presentations. The course consists of two parts. Each part contains a quiz which is meant to reinforce the learning. The quiz, based on "Mentimeter" software, consists of multiple-choice questions.

Requirements

A reasonable understanding of geology and geophysics.