Characterization of Deep Geothermal Systems

Contribution ID: 116

Type: **Poster**

Simulation of temperature logs in high temperature well

Abstract

Difference between resistivity models at two different times can be obtained by inverting the two time-lapse datasets in several different ways: using parallel inversions, sequential inversions, or using differential data with double difference inversion. This paper presents and compares those 3 different processes to invert time-lapse Controlled-Source Electromagnetic data. We demonstrate on synthetic tests that double-difference inversion is the best way to perform time-lapse inversion when the survey parameters can remain fixed between the time-lapsed acquisitions. We show that double-difference inversion allows to remove the footprint of permanent noise distortions, static shift, and most of the nonlinearity

of the inversion process including numerical noise and acquisition footprint. It also appears that the approach is very robust against the baseline resistivity model, and that even a very rough resistivity model built with borehole logs or basic geological knowledges can be sufficient to map the time-lapse changes at their right position. We apply this framework on a time lapse land CSEM dataset acquired over the Reykjanes geothermal field.

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Session Classification: Poster Session