Fluid Imaging of Enhanced Geothermal Systems
Through Joint 3D Geophysical Inverse Modeling

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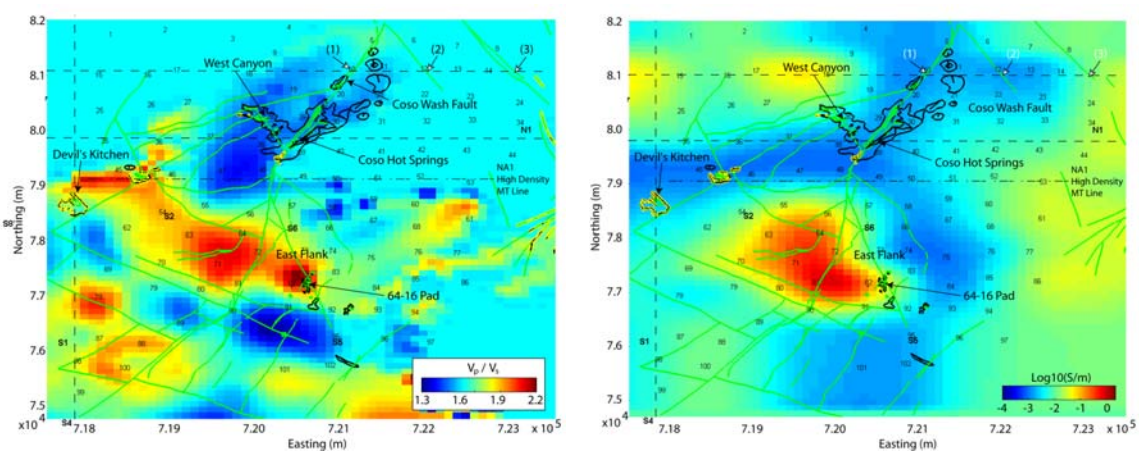
The objective of this work is to determine the feasibility of jointly using data from microseismic and electrical surveys to image the fluid distribution within Enhanced Geothermal Systems (EGS). Critical to the success of EGS is the successful manipulation of fluids in the subsurface. Knowledge in the change in volume and location of fluids in the rocks and fractures (both natural and induced) will be needed to manage injection strategies such as the number and location of step out wells, in-fill wells and the ratio of injection to production wells. Characterizing enhanced geothermal systems (EGS) using joint geophysical imaging holds significant promise, but critical data and capabilities are still lacking. Geophysical properties (seismic velocity/attenuation and electrical conductivity/resistivity) are known to provide useful information on geologic structures related to geothermal fluids. More tantalizing is the correlation between electrical and seismic properties that have been observed at different scales in collocated experiments. Relevant data from multidimensional magnetotelluric (MT) and electromagnetic (EM) and micro earthquake (MEQ) travel time data imaged separately can also produce equivocal models. In these instances, joint imaging of such data is a better approach as it allows for an objective testing of the electrical-mechanical interrelationships of experimental data and the underlying petrophysical properties.



Images of the geophysical attributes seismic velocity and electrical conductivity show spatial correlations indicating a common underlying geological process. The images are 500 m below the surface, and were generated from MEQ and MT data acquired over the Coso Geothermal Field.