Bay Area Geophysical Society Seminar Series

Tomographic Imaging of the Water and Steam Distribution at The Geysers Geothermal Reservoir using Reservoir-Wide and High-Resolution Seismic Networks

Roland Gritto

Array Information Technology

October 28th 12 noon Zoom talk

Abstract: Seismic tomographic imaging relies on P-wave and S-wave velocities to delineate geological subsurface structures. In contrast, the ratio between seismic P-wave and S-wave velocities (Vp/Vs) is more sensitive to fluid saturation. Vp/Vs-ratio has been utilized in numerous studies to distinguish liquid from gaseous fluids in the Earth's subsurface. Studies include seismic exploration of gas and oil reservoirs, imaging of fluids in fault zones, investigations of volcanic regions to delineate and track movement of liquids (melt) or gases (i.e., CO_2), and investigations of geothermal reservoirs to delineate regions with water and steam concentrations. The Geysers geothermal field in northern California is a steam-dominated reservoir exhibiting high seismicity rates, which offers an excellent opportunity to study the spatio-temporal heterogeneity in water and steam concentrations, as the geothermal resource is replenished by massive injections of treated wastewater from nearby communities. In the first part of this seminar, the three-dimensional Vp/Vs structure is presented for The Geysers geothermal field using seismic travel-time data from more than 32,000 micro-earthquakes recorded by the 34-station permanent seismic network,

which represents the highest resolution seismic imaging campaign at the reservoir-wide scale to date. The results delineate the steam field through low Vp/Vs estimates in the central section of The Geysers within and below the current reservoir. The extent of the anomaly deceases with increasing depth. Spatio-temporal changes in Vp/Vs between the start of the water injection campaign and a later epoch are also investigated. The temporal changes include increases in Vp/Vs that spatially correlate with the locations of the largest injection wells in the central and southeast Geysers, indicating a successful replenishment of the resource, and decreases in Vp/Vs that are confined to the north and northwest Geysers and correlate with the high-temperature reservoir. In the second part of this seminar, the results from a 91-station temporary deployment in the northwest Geysers will be presented, which corroborate the findings of the large-scale study, and illustrate the power of high-resolution seismic imaging.

Bio: Roland Gritto is currently senior geophysicist with Array

Information Technology. He has over 30 years experience in project development, management and scientific research including, seismology, seismic imaging of the shallow and deep Earth's crust, seismic wave propagation through heterogeneous media, active and passive seismic monitoring, nuclear monitoring, and seismic imaging in geotechnical applications. He has led national and international projects, including research in the Middle-and Far East.

Meeting ID:	913 1911 8367
Passcode:	BAGS4ever