2023 ARMA Future Leader Webinar Series

Every Two Weeks on Fridays 9-10 AM MT

15th lecture: October 6, 2023

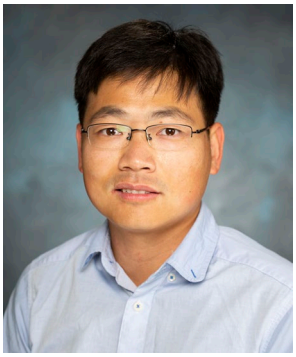
Please reach out to shahrzad.roshankhah@utah.edu to get the Zoom meeting information.

Speaker: Hui Wu

Fracture flow evolution during heat recovery from enhanced geothermal systems and its impact on long-term thermal performance

Flow channeling has been characterized as a detrimental mechanism that may lead to premature thermal breakthrough in an Enhanced Geothermal System (EGS). The positive feedback between fluid concentration in preference flow channels and thermal drawdown-induced thermal stress is one of the main causes of severe flow channeling. A mechanism that may alleviate flow channeling is the increase of water viscosity with the decrease in temperature, resulting in larger flow impedance in colder channels and therefore promoting diverse flow patterns. In this study, we quantitatively investigate flow channeling behavior under the combined effects of thermal stress and temperature-dependent viscosity in a single-fracture EGS. We developed a field-scale EGS model with a horizontal fracture to simulate the coupled thermo-hydro-mechanical (THM) processes and considered both homogeneous and heterogeneous fracture aperture distributions. Results indicate that the temperature-dependent viscosity has a positive effect that can partially mitigate the negative impact of thermal stress on flow channeling. Nevertheless, this mitigating effect is limited to the early stages of the thermal extraction process. Furthermore, flow channeling is exacerbated with decreasing injection temperature under the combined effects of thermal stress and temperature-dependent viscosity. The results provide important insights into the dynamical evolution of fracture characteristics and the underlying flow behavior in an EGS.

Biography:



Dr. Hui Wu is currently an assistant professor in the School of Earth and Space Sciences at Peking University. Before he joined Peking University in March 2022, he was a staff scientist in the Computational Geosciences Group at Lawrence Livermore National Laboratory (LLNL). He obtained his B.S. in Hydraulic Engineering and Ph.D. in Civil Engineering from Tsinghua University, China, in 2010 and 2015 respectively. His research mainly focuses on the characterization, stimulation, and modeling of subsurface fractured reservoirs, with applications in geothermal energy and CO_2 sequestration.