# Applied Hydrogeophysics for Improved Aquifer Characterization

Julianne Robinson, Jiawei Li, Ryan Smith
Civil and Environmental Engineering, Colorado State University

**Abstract.**
There is a growing need to characterize and monitor groundwater resources as the climate changes and water use increases, particularly in regions of the world that depend on groundwater for irrigated agriculture and domestic water supply. Geophysical measurement methods like time-domain electromagnetic surveys can address the need for cost-effective, high-resolution hydrostratigraphic data collection with greater spatial and temporal coverage than direct-sampling methods. Applying geophysical data to improve conceptual groundwater models requires integration with other forms of data like lithology from well drillers' logs. This project analyzed hydrogeological characteristics in the Parowan Valley in Utah by interpolating geophysical datasets collected using towed time-domain electromagnetic (tTEM) surveys with lithology data from well logs. Co-kriging, a form of spatial interpolation, was used to conduct the analysis. Geophysical data were converted from resistivity to lithology through a rock-physics transform process prior to interpolation. Higher variance was observed in kriging results relying on geophysical data alone, compared to the combined datasets. Reliability of resistivity data as an indicator for lithological properties relies on the accuracy of the rock-physics transform, which was affected by varying levels of saturation in the Parowan Valley. Results of this analysis show that geophysical data can inform conceptual models through greater spatial and temporal coverage compared to direct-sampling measurements but must be used in conjunction with other types of data and rely on an understanding and consideration of site-specific characteristics for accurate interpretation. Geophysical datasets collected through time-domain electromagnetics can serve as an important addition to other forms of data to inform water management in the Parowan Valley and other arid and semi-arid regions dependent on groundwater.