(The) Impact of Improved Hydrogeological Representation Through the Use of Airborne Electromagnetic Data on Reducing Model Forecast Uncertainty

John Richins and Kevin Befus, University of Arkansas

Airborne Electromagnetic (AEM) geophysical data have been widely utilized to define geological structures and aquifer characteristics for numerous large-scale groundwater models. While AEM data significantly enhances our comprehension of aquifer geology, there remains a notable scarcity of studies that evaluate how integrating AEM data into groundwater flow models reduces model forecast uncertainty. To fill this gap, we utilized tools within PEST++ and the Pyemu Python Library to analyze and quantify the reduction in uncertainty of model predictions. The analysis was run on two MODFLOW 6 models developed for the Shellmound Groundwater Transfer and Injection Pilot Project in Shellmound, Mississippi, which incorporated varying degrees of geological detail derived from AEM data. In one model, AEM was used to split the alluvial aquifer portion of the model into layers, whereas in the other, AEM data was only used to determine the base of the alluvial aquifer. We found that in the model that used more AEM data, parameters that incorporated AEM data were the most important for reducing forecast uncertainty for head levels at monitoring wells surrounding the injection site. Whereas, in the model that used less AEM data, model parameters that did not incorporate AEM data were the most important for reducing forecast uncertainty. This showed that AEM data was important to reducing forecast uncertainty in groundwater flow models. The reduced uncertainty of the model forecasts allows for more accurate model predictions to better forecast groundwater management and remediation outcomes.

John Richins

John Richins is currently a Ph.D. student at the University of Arkansas, where his research focuses on groundwater modeling. John also holds a Master’s and a Bachelor’s degree in Science from Oklahoma State University. Before returning to school full-time to pursue his Ph.D., John worked as an environmental geologist for private consulting firms on groundwater remediation projects.