SAVE NOW, PAY LATER? MULTI-PERIOD MANY OBJECTIVE GROUNDWATER MONITORING DESIGN GIVEN SYSTEMATIC MODEL ERRORS AND UNCERTAINTY

Patrick Reed, The Pennsylvania State University, 814-863-2940, preed@engr.psu.edu

1. Patrick M. Reed, The Pennsylvania State University
2. Joshua B. Kollat, The Pennsylvania State University

This study demonstrates how many-objective long-term groundwater monitoring (LTGM) network design tradeoffs evolve across multiple management periods given systematic models errors (i.e., predictive bias), groundwater flow-and-transport forecasting uncertainties, and contaminant observation uncertainties. Our analysis utilizes the Adaptive Strategies for Sampling in Space and Time (ASSIST) framework, which is composed of three primary components: (1) bias-aware Ensemble Kalman Filtering, (2) many-objective hierarchical Bayesian optimization, and (3) interactive visual analytics for understanding spatiotemporal network design tradeoffs. A physical aquifer experiment is utilized to develop a severely challenging multi-period observation system simulation experiment (OSSE) that reflects the challenges and decisions faced in monitoring contaminated groundwater systems. The experimental aquifer OSSE shows both the influence and consequences of plume dynamics as well as alternative cost-savings strategies in shaping how LTGM many-objective tradeoffs evolve. Our findings highlight the need to move beyond least cost purely statistical monitoring frameworks to consider many-objective evaluations of LTGM tradeoffs. The ASSIST framework provides a highly flexible approach for measuring the value of observables that simultaneously improves how the data are used to inform decisions.