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INVERSE SENSITVITY ANALYSES FOR DECISION ANALYSES RELATED TO CONTAMINANT REMEDIATION

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There is a pressing need for better decision analysis methodologies and techniques for environmental problems. The US NRC recently estimated that the cost to perform federally mandated remediations at groundwater sites is over $100 billion. Furthermore, according to US NRC, 90% of court-mandated groundwater remediations fail. Subsurface contaminant-flow processes and their parameters are notoriously difficult to observe, measure, and characterize. Furthermore, these processes build upon a combination of multi-scale (from pore to field scales) irregularities and heterogeneites that are difficult to simulate and characterize as well. All of these factors cause poorly constrained long-term predictions of contaminant behavior. Post-factum analyses of model predictions and decision analyses for contaminant sites frequently demonstrate failures. Here we demonstrate an inverse methodology based on robust and computationally efficient stochastic methods. Based on observed data, we identify acceptable stochastic models, estimate their parameters, and rank their performance. After that we apply the stochastic models (a single model or an ensemble of weighted models based on their ranking) to simulate the field-scale contaminant behavior. We utilize the proposed framework to perform robust uncertainty quantifications and decision-support analyses related to contaminant remediation.