

# An Interactive Platform to Evaluate and Execute Groundwater Models for Stakeholder-Driven Decision-Making

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## Theory

Numerical groundwater models can be excellent tools for problems in hydrogeology that require the quantitative representation of complex groundwater systems. Modelling is a common and essential part of many industry projects which rely on predictions of state variables such as groundwater pressure and solute concentrations for decision-making. Thanks to improvements in computing power, scripting/automation, and adoption of non-linear inversion methods, the practice of modeling continues to grow more efficient. Modelers are increasingly able to more thoroughly interrogate hydrogeological data sets and explore methods to assess uncertainty including the development and evaluation of multiple models representing alternative conceptualizations, calibration methodologies and/or prediction priorities; the breadth and complexity of multimodel analysis may, however, surpass intuitive ability to fully consider/interpret their suite of predictions.

Despite advances in modelling tools and methods, there exist barriers that limit the extent to which technical clients (e.g., stakeholders or decision-makers) with little modeling experience can accept and make use of model predictions. The usefulness of modeling products to technical clients is often impaired by factors that are less intuitive to the modelers tasked with making the predictions. These factors include: uncertainty in future stresses (e.g. pumping rates, climate change, future development of the project site); newly acquired empirical data that hasn't been considered in (or conflicts with) the numerical model; and risk of overwhelming decision makers by presenting elaborate multimodel predictions that are difficult to digest.

## Method

We have developed a platform that is designed to overcome the previously mentioned barriers to model usefulness. Work is ongoing but the architecture, philosophy, and some use cases have been developed and will be presented. We will demonstrate a workflow that leverages expert knowledge from the technical client who doesn't need any special modelling software or modelling background. The platform possesses two main functionalities that allow the client to engage with the modeling product:

1. Model evaluation and discrimination, wherein models that are deemed to best represent the predictions of interest are selected through a graphical user interface (GUI). The workflow has been developed to facilitate model discrimination based on, for example, preferred hydraulic parameter values, visual agreement of observed and simulated values, and descriptive statistics which evaluate the fit between observed and simulated values.
2. Execution of selected models to generate model predictions. Pre-computed response matrixes are used to enable clients to generate model predictions in a matter of seconds. Response matrixes are built by taking advantage of the linearity between model predictions and input stresses (e.g. predicted drawdown in a confined aquifer

that results from transient pumping rates). To streamline the management and exploration of multimodel predictions, a GUI is used to trigger model runs and display multimodel output.