Session title

Groundwater model optimsation and uncertainty

Description

"Groundwater models are powerful tools for understanding subsurface systems, yet they inevitably operate under uncertainty due to limited data, structural simplifications, and imperfect knowledge of aquifer properties. Modern uncertainty analysis focuses not on producing a single “best” model, but on quantifying how unknowns influence the predictions that matter for management. Techniques such as ensemble simulation, parameter-space exploration, and sensitivity-based workflows help identify which aspects of the system are well constrained and which remain uncertain. A key insight is that good calibration does not guarantee reliable forecasts. Predictions may depend on parameters that historical data cannot adequately inform. Uncertainty analysis therefore evaluates how prediction-relevant parameters vary within plausible ranges and how this variability affects outcomes. This approach supports transparent, risk-aware decision making by showing not only what the model predicts, but how confident one can be in those predictions. In a decision-support context, groundwater modelling becomes an iterative, collaborative process. Instead of presenting a single deterministic result, modellers communicate ranges, likelihoods, and assumptions, enabling stakeholders to weigh risks, evaluate trade-offs, and design management strategies that remain robust even when the subsurface is imperfectly known."

Keywords

Groundwater modelling, calibration, uncertainty analysis, decision support

Session Chair

Jeremy White

Conveners

Katie Markovich
Joe Hughes