Effective Groundwater Model Calibration: With Analysis of Data, Sensitivities, Predictions, and Uncertainty
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DESCRIPTION

Methods and guidelines for developing and using mathematical models

Turn to *Effective Groundwater Model Calibration* for a set of methods and guidelines that can help produce more accurate and transparent mathematical models. The models can represent groundwater flow and transport and other natural and engineered systems. Use this book and its extensive exercises to learn methods to fully exploit the data on hand, maximize the model's potential, and troubleshoot any problems that arise. Use the methods to perform:

- Sensitivity analysis to evaluate the information content of data
- Data assessment to identify (a) existing measurements that dominate model development and predictions and (b) potential measurements likely to improve the reliability of predictions
- Calibration to develop models that are consistent with the data in an optimal manner
- Uncertainty evaluation to quantify and communicate errors in simulated results that are often used to make important societal decisions

Most of the methods are based on linear and nonlinear regression theory.

Fourteen guidelines show the reader how to use the methods advantageously in practical situations.
Exercises focus on a groundwater flow system and management problem, enabling readers to apply all the methods presented in the text. The exercises can be completed using the material provided in the book, or as hands-on computer exercises using instructions and files available on the text's accompanying Web site.

Throughout the book, the authors stress the need for valid statistical concepts and easily understood presentation methods required to achieve well-tested, transparent models. Most of the examples and all of the exercises focus on simulating groundwater systems; other examples come from surface-water hydrology and geophysics.

The methods and guidelines in the text are broadly applicable and can be used by students, researchers, and engineers to simulate many kinds systems.

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**ABOUT THE AUTHOR**

MARY C. HILL, PhD, is Project Chief for the U.S. Geological Survey (USGS) and a recipient of the USGS Meritorious Service Award, the ASCE Walter Huber Research Prize, and the NGWA M. King Hubbert Award. Dr. Hill is President of the International Commission for Ground Water. She is Adjunct Professor at the University of Colorado at Boulder and the Colorado School of Mines.

CLAIRE R. TIEDEMAN, MS, is a Research Hydrologist at the U.S. Geological Survey, where her work involves calibrating and evaluating models of complex groundwater flow systems, developing methods to evaluate prediction uncertainty, and characterizing flow and transport in fractured-rock aquifers. She is a recipient of the USGS Superior Service Award and an Associate Editor of the journal Ground Water.

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**FEATURES**

- Presents a set of methods and guidelines for calibrating and analyzing mathematical groundwater models

- Focuses on practical application of the methods, organized into four categories: (1) model development guidelines, (2) model testing guidelines, (3) potential new data guidelines, and (4) prediction uncertainty guidelines

- Helps readers address societal issues related to natural and engineered systems that are conducive to quantitative modeling, and to use the models and available data more effectively
- Describes methods and guidelines that are generally applicable to models of any environmental system
- Covers topics that “are of critical importance to application of numerical models to solving scientific and engineering problems” according to one review
- Contains practical exercises on illustrative groundwater flow system and management problems that professionals and students can apply all the methods in the book
- Ties the exercises into two of the widely-used software applications of MODFLOW and UCODE

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