



Standard Guide for Comparing Ground-Water Flow Model Simulations to Site-Specific Information¹

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1. Scope

1.1 This guide covers techniques that should be used to compare the results of ground-water flow model simulations to measured field data as a part of the process of calibrating a ground-water model. This comparison produces quantitative and qualitative measures of the degree of correspondence between the simulation and site-specific information related to the physical hydrogeologic system.

1.2 During the process of calibration of a ground-water flow model, each simulation is compared to site-specific information such as measured water levels or flow rates. The degree of correspondence between the simulation and the physical hydrogeologic system can then be compared to that for previous simulations to ascertain the success of previous calibration efforts and to identify potentially beneficial directions for further calibration efforts.

1.3 By necessity, all knowledge of a site is derived from observations. This guide does not address the adequacy of any set of observations for characterizing a site.

1.4 This guide does not establish criteria for successful calibration, nor does it describe techniques for establishing such criteria, nor does it describe techniques for achieving successful calibration.

1.5 This guide is written for comparing the results of numerical ground-water flow models with observed site-specific information. However, these techniques could be applied to other types of ground-water related models, such as analytical models, multiphase flow models, noncontinuum (karst or fracture flow) models, or mass transport models.

1.6 This guide is one of a series of guides on ground-water modeling codes (software) and their applications. Other standards have been prepared on environmental modeling, such as Practice E 978.

1.7 The values stated in SI units are to be regarded as the standard.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appro-*

priate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.9 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 ASTM Standards:

D 653 Terminology Relating to Soil, Rock, and Contained Fluids²

E 978 Practice for Evaluating Mathematical Models for the Environmental Fate of Chemicals³

3. Terminology

3.1 Definitions:

3.1.1 *application verification*—using the set of parameter values and boundary conditions from a calibrated model to approximate acceptably a second set of field data measured under similar hydrologic conditions.

3.1.1.1 *Discussion*—Application verification is to be distinguished from code verification which refers to software testing, comparison with analytical solutions, and comparison with other similar codes to demonstrate that the code represents its mathematical foundation.

3.1.2 *calibration*—the process of refining the model representation of the hydrogeologic framework, hydraulic properties, and boundary conditions to achieve a desired degree of correspondence between the model simulations and observations of the ground-water flow system.

3.1.3 *censored data*—knowledge that the value of a variable in the physical hydrogeologic system is less than or greater

¹ This guide is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Zone Investigations.

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² *Annual Book of ASTM Standards*, Vol 04.08.

³ *Annual Book of ASTM Standards*, Vol 11.04.