



Standard Guide for Calibrating a Ground-Water Flow Model Application¹

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1. Scope

1.1 This guide covers techniques that can be used to calibrate a ground-water flow model. The calibration of a model is the process of matching historical data, and is usually a prerequisite for making predictions with the model.

1.2 Calibration is one of the stages of applying a ground-water modeling code to a site-specific problem (see Guide D 5447). Calibration is 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.

1.3 Flow models are usually calibrated using either the manual (trial-and-error) method or an automated (inverse) method. This guide presents some techniques for calibrating a flow model using either method.

1.4 This guide is written for calibrating saturated porous medium (continuum) ground-water flow models. However, these techniques, suitably modified, could be applied to other types of related ground-water models, such as multi-phase models, non-continuum (karst or fracture flow) models, or mass transport models.

1.5 Guide D 5447 presents the steps to be taken in applying a ground-water modeling code to a site-specific problem. Calibration is one of those steps. Other standards have been prepared on environmental modeling, such as Guides D 5490, D 5609, D 5610, D 5611, D 5718, and Practice E 978.

1.6 *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 appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.7 *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
- D 5447 Guide for Application of a Ground-Water Flow Model to a Site-Specific Problem²
- D 5490 Guide for Comparing Ground-Water Flow Model Simulations to Site-Specific Information²
- D 5609 Guide for Defining Boundary Conditions in Ground-Water Flow Modeling²
- D 5610 Guide for Defining Initial Conditions in Ground-Water Flow Modeling²
- D 5611 Guide for Conducting a Sensitivity Analysis for a Ground-Water Flow Model Application²
- D 5718 Guide for Documenting a Ground-Water Flow Model Application²
- 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 foundations.

3.1.2 *calibrated model*—a model that has achieved a desired degree of correspondence between the model simulations and observations of the physical hydrogeologic system.

3.1.3 *calibration (model application)*—the process of refining the model representation of the hydrogeologic framework, hydraulic properties, and boundary conditions to achieve a

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

³ *Annual Book of ASTM Standards*, Vol 11.05.