

GROUND WATER--Paper entitled, "Ground-water models cannot be validated," by Leonard F. Konikow and John D. Bredehoeft.

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OFFICE OF GROUND WATER TECHNICAL MEMORANDUM NO. 93.04

Subject: GROUND WATER--Paper entitled, "Ground-water models cannot be validated," by Leonard F. Konikow and John D. Bredehoeft.

Ground-water models of various types and complexities have become accepted and widely used in the Water Resources Division over the past several decades. As we use these important tools and report on their results, it is essential that a proper perspective on their validity and uncertainty is maintained.

The subject paper, published in *Advances in Water Resources*, volume 15, no. 1, 1992, p. 75-83, addresses a number of concerns with respect to model errors, model uncertainty, and model testing. The paper also takes issue with use of the terms validation and verification. The last paragraph of the paper summarizes well their argument:

What is usually done in testing the predictive capability of a model is best characterized as calibration or history matching; it is only a limited demonstration of the reliability of the model. We believe the terms validation and verification have little or no place in ground-water science; these terms lead to a false impression of model capability. More meaningful descriptors of the process include model testing, model evaluation, model calibration, sensitivity testing, benchmarking, history matching, and parameter estimation. Use of these terms will help to shift emphasis towards understanding complex hydrogeological systems and away from building false confidence into model predictions.

We encourage all users of ground-water models to read the paper by Konikow and Bredehoeft carefully. Furthermore, the terminology they suggest should be adopted in reporting on ground-water model results. The use of one term instead of another will not affect the level of confidence that is justified for a particular application of a model of a physical system, but the terminology used might be important in adequately conveying to the reader and reminding ourselves of the level of confidence in the model that is appropriate.

Acting Chief, Office of Ground Water

Attachments

Distribution: A and B
S (NR (20), CR (35), WR (5)), FO and PO
(memo and report)