

A Review of Techniques for Porosity/Permeability Modeling (Can We Achieve Objectivity in Reservoir Modeling?)

Clayton V. Deutsch*
University of Alberta, Edmonton, AB, Canada
cdeutsch@ualberta.ca

Geostatistical techniques have become accepted and useful for assigning porosity and permeability at a small scale in reservoir models. Facies modeling techniques have also evolved, but the rich variety of facies modeling techniques are not the subject of this presentation. Assigning porosity and permeability will always be required at some scale; within facies or for an entire reservoir zone.

There are many issues related to the assignment of porosity and permeability including data quality, issues of scale, inference of statistical parameters, accounting for geological controls and calibration with geophysical and production data. The intent of this presentation is to focus on some alternate methodologies and to discuss the selection of a technique. Most reservoir properties (facies, porosity, residual saturations,...) are volumetric or mass fractions. Permeability is quite different; it is a rate constant. This leads to different modeling methods.

Minimum, good and best practice of permeability modeling will be reviewed. There are a variety of considerations including the geological setting, the fluids, the amount of historical data and the level of detail being included in the flow simulation. Our primary goal is to create models with a reasonable structure of high and low values. If a high resolution facies model is available with a reasonable number of core data within each facies, then a simple phi-k transform may be appropriate; otherwise, different techniques can be considered.

The last part of this talk will relate to objectivity in numerical modeling. There is no way to attain complete objectivity, but there are some related considerations that are important: (1) reproduction of features known to be important for the process and reservoir type, (1) transparency – few hidden assumptions, (2) accessibility of required input parameters, (3) robustness of the results with respect to input parameters, (4) little room for mistakes/blunders, (4) internal consistency of the available data and the model, (5) fidelity of the model with data not used in modeling, (5) checkability of the results, (6) fairness of the predicted uncertainty when compared to new data.