



Stratigraphic Reservoir Characterization for Petroleum Geologists, Geophysicists, and Engineers: Chapter 13. Geologic and Engineering Modeling (Developments in Petroleum Science)

Fuge Zou

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In this chapter, the principles of reservoir modeling, workflows and their applications have been summarized. Reservoir modeling is a multi-disciplinary process that requires cooperation from geologists, geophysicists, reservoir engineers, petrophysics and financial individuals, working in a team setting. The best model is one that provides quantitative properties of the reservoir, though this is often difficult to achieve. There are three broad steps in the modeling process. The team needs to first evaluate the data quality, plan the proper modeling workflow, and understand the range of uncertainties of the reservoir. The second step is data preparation and interpretation, which can be a long, tedious, but essential process, which may include multiple iterations of quality control, interpretation, calibration and tests. The third step is determining whether to build a deterministic (single, data-based model) or stochastic (multiple geostatistical iterations) model. The modeling approach may be decided by the quality and quantity of the data. There is no single rule of thumb because no two reservoirs are identical. Object-based stochastic modeling is the most widely used modeling method today. The modeling results need to be constrained and refined by both geologic and mathematical validation. Variogram analysis is very important in quality control of object-based stochastic modeling. Outcrops are excellent sources of continuous data which can be incorporated into subsurface reservoir modeling either by 1) building an outcrop “reservoir” model, or 2) identifying and developing outcrop analogs of subsurface reservoirs. Significant upscaling of a reservoir model for flow simulation may well result in an erroneous history match because the upscaling process often deletes lateral and vertical heterogeneities which may control or affect reservoir performance, particularly in a deterministic model. Reservoir uncertainties are easier to manipulate by object-based stochastic models. Choosing the best realization approach for the reservoir model is the key to predicting reservoir performance in the management of reservoirs.

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