Static Reservoir Modeling in an Incised Valley Fill: A Case Study in Optimization from Postle Field, Texas County, Oklahoma

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Reservoir characterization, modeling and simulation are a necessary part of any enhanced oil recovery program. Today there have been many advances in static reservoir modeling but as new levels of complexity are introduced, we also introduce the demand for more computing power and computation time. Optimizing the modeling process without sacrificing model integrity has the potential to save valuable resources and aid in overall efficiency.

Postle Field is a mature oil and gas field in Texas County, Oklahoma which produces from Pennsylvanian valley fill sandstones. EOR practices in the form of water flood and CO2 miscible flooding in the field have led to the need for reservoir modeling and simulation in order to increase recovery.

Incised valley fills are inherently complex and it is often difficult to achieve realistic static models because of severe heterogeneity, issues with data resolution, upscaling and lack of computation time and power. This study focuses on optimizing the modeling process by exploring how models change as a function of input parameters, such as cell dimensions, inclusion of stratigraphically significant surfaces, facies modeling and geo-body types, as well as incorporation of additional seismic and geo-statistical data.

A total of sixteen models each varying systematically in complexity were created. Thirty realizations of each model were run and pore-volumes were calculated and averaged for comparison. Selected models were then history matched and compared using both the full field and individual well performance history matches.

Preliminary results show similar trends in the full field history match, indicating that in complex heterogeneous systems, simpler models with coarser grids and lack of geostatistical and seismic data may be as robust as the more complex ones. A full field history match, however, is not sufficient to evaluate model quality; individual well performance matches must be considered. Results show that well performance matches are significantly improved with the addition of data, demonstrating the need for integration of multiple data sets at many scales to accurately represent geologically complex reservoirs. The results of this study help to define best practices for static modeling in valley fill systems; optimizing time and resources and increasing overall efficiency.