

Stochastic 3-D Modeling for Supporting the Santa Barbara – Pirital Full Field Compositional Simulation, Eastern Venezuelan Basin

Marquez, Hector Jose¹, Luis Guaiquirian², Jeff Bayless³ (1) SPE, EAGE, Puerto La Cruz, Venezuela (2) Petroleos de Venezuela, Puerto la Cruz, Venezuela (3) ROXAR INC, Puerto La Cruz, Venezuela

The Santa Barbara - Pirital field is located in the Monagas state, next to Carito and Furrial fields. The field is defined as an asymmetrical anticlinal, presenting a considerable level of heterogeneity as result of a combination of geological events, including complex compressional faulting and a diversity of sedimentary environments.

Available data for this study include lithology and petrophysical well logs, 3-D seismic, core analysis and production history (started in 1989 by well SBC-1E) for both Oligocene and Cretaceous reservoirs.

A high resolution modeling grid of 62 millions cells was built using corner-point geometry and incorporating 188 faults. Finally, reservoir properties were distributed using stochastic 3-D non-stationary modeling for both facies and petrophysics.

Facies modeling was performed for each one of the twelve genetic units, combining Truncated gaussian simulation and Sequential Indicator Simulation tools to describe sub-environments (large-scale heterogeneity), and sand/shale distributions inside sub-environments (finer scale). The resulting realizations reproduced the conceptual sedimentologic model.

For petrophysical modeling, a Sequential Gaussian Simulation algorithm with trends was used. Blocked well log data was inspected to check the distribution and spatial variation of effective porosity and permeability within each facies. Three realizations were produced and re-scaled in order to measure uncertainty. After flow simulation, the one with the best match to historical data was selected as the most representative.

This is the first full-field geostatistical model to honor reservoir heterogeneity. It will be used to simulate the further development of the field and to maximize oil recovery through water and gas injection processes.