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Reservoir Characterization Guided by Seismic Attributes; Successes, Pitfalls and Best Practices from the Niger Delta

Abstract

We establish a series of "Best-Practices" and "Pitfalls" to guide integration of 3D and 4D seismic data into reservoir simulation models for the Niger Delta. These practices improve predictions of porosity, saturation and reservoir performance used to make critical business decisions. These practices result from 50+ reservoir simulation studies conducted by Chevron Nigeria Ltd (CNL) for critical business decisions such as determining the location of wells in new fields, optimizing water-floods, etc

CNL reservoirs generally have good quality seismic data, and these reservoirs provide an excellent laboratory to compare seismic integration techniques. On many occasions, reservoir porosity and fluid saturation can be confidently estimated from seismic data. However, predictions of reservoir performance can vary dramatically (e.g. oil recovery can vary over an order of magnitude) depending on how seismic data is integrated into the model.

Some seismic integration "Pitfalls" are difficult to avoid when modeling reservoirs. One example is the overestimation of vertical sweep efficiency due to limited seismic bandwidth. Several classes of spatial seismic "noise" can likewise lead to underestimation of lateral sweep efficiency and distortions of hydrocarbon pore-volume in the reservoir. Often there are too few wells for a valid correlation between logs and seismic attributes. These "Pitfalls" can significantly impact predicted oil recovery, and expected economic performance.

An example "Best Practice" includes recognizing and isolating seismic noise from signal before estimating reservoir properties. Partitioning wells into stationary regions (hydrocarbon bearing vs. wet) and proper quality-control of the output model are other examples.