Bayesian Reservoir Characterization of a Turbiditic Reservoir, Offshore, Brazil

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Abstract
This work presents a reservoir characterization study, focused on porosity, lithology and fluid content inferences from seismic data. The player consists in a deep-water turbidity system, with high porosity sands filled with heavy oil.Throughout the Bayesian methodology and using empirical rock physics models and Gassmann Theory for fluid substitution we infer these reservoir properties, which results in quantitative predictions of porosity and an indicator for lithology and fluid content.

The main source of information is seismic attributes, consisting of VP and VS velocities, which are related to reservoir properties by rock physics relations. However, to quantitatively estimate all parameters of interest from seismic velocities is an ill posed inversion problem. Thus we break the solution in two parts: porosity and lithology inferece, followed by fluid content discrimination.

Initially, following a Bayesian approach, porosity and clay volume are inferred from a set of seismic attributes. Seismic velocities show highly sensitive to porosity, making quantitative predictions relatively well resolved. Lithology shows an instable parameter to infer, considering a sand-shale system. Quantitative clay volume estimation resulted in a high uncertainty model. Despite of a qualitative nature of lithology study, our approach is able to incorporate the information from well data; rock physics and seismic attributes, to produce a probability map for lithologies and lithology a good indicator.

Fluid discrimination from seismic shows more difficult, due to low sensibility of the seismic response to fluid saturation and ambiguity with respect to variations such as pressure, net-to-gross and porosity. A fluid indicator volume is produced, which represent the likely fluid model from the available information.