Integrated analysis of seismic data, well log, drill stem test and outcrop description to build a calibrate earth-model for a channelized turbidite reservoir in the Calumbi Formation, Sergipe Sub-basin, Brazilian offshore.

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Abstract

Sandy channelized reservoirs in deep water environments are significant for oil exploration, appraisal, and production. However, there are several limiting factors for the reliable subsurface characterization of this type of sedimentary environment, especially the ones related to heterogeneities. Despite the fact of being the conventional approach adopted in dealing with this kind of reservoirs, the low seismic resolution aspect is a challenge to properly address the main heterogeneities issues. Inverted seismic volumes enhances the confidence of rock properties spatial distribution into the geological models, even without eliminating the uncertainties. Methodologies of using synthetic elastic properties modeling, such as velocity, density and thickness is a known way to assess and optimize geostatistical models, associating the intrinsically data responses reducing uncertainties in the spatial distribution of them, due to the presence of high vertical-resolution well data. The study discusses the limitations of using average information from seismic data to extrapolate well data to adjacencies due to ambiguities arising from differences in lithologies, fluid content, and layer thickness that can provide the same seismic signature. The following work is centered on exploring a new approach to the creation of parameterized earth models, which involves utilizing both 1D and 3D elastic properties modeling. This study aims to advance our understanding of the potential benefits of such an approach. It was discussed the use of well information, specifically drill stem test data, in conjunction with seismic interpretation to better understand the hydraulic features of a reservoir. The seismic volume interpretation provided an idea of the external geometry of geological bodies, but the limited vertical resolution made it difficult in providing more detailed internal geometries. The seismic data was calibrated using information obtained directly from the rocks through well-logs interpretation, enabling the identification of the seismic signature desired order interval. The focus of the study is on the Maastrichtian turbidite reservoirs of the Calumbi Formation in the Sergipe Sub-basin, and we describe the methodology used in creating feasible and representative geological models of these reservoirs. We combine various data sources, including logs, drill stem test, seismic data, and outcrop descriptions, building a detailed model of the subsurface geology. This multidisciplinary approach allows us to create a calibrated property model that was compared to an existing dynamic data, confirming the approach´s success. The findings arise have implications for all the E&P border, as the creation of reliable geological models is crucial for successful hydrocarbon activities.