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Issues and status of 3D seismic reservoir property estimation

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Abstract: This document seeks to review and summarize issues about 3D seismic reservoir characterization and current technology trends for overcoming such issues. We list major difficulties in quantitative reservoir property estimation from 3D seismic data as i) poor understanding about the relationship between seismic attributes and reservoir properties, ii) the scale difference between seismic data and target geological model, and iii) integration of qualitative geological understanding into quantitative modeling framework. We then introduce several key efforts in two field examples for resolving them through integrated modeling. In the first example in a carbonate reservoir, rock physics study led to physical understanding of the identified correlation between Vp/Vs ratio and the absolute permeability, as well as AI(Acoustic Impedance) and porosity. We subsequently conducted porosity and permeability modeling using these relations, including a vertical downscaling step by the Gaussian Simulation with Locally Varying Mean method, which accomplished the final model consistent with well and seismic data. In the second example in a deep sea sandstone reservoir, non-unique relationship between seismic attributes, AI and EI(Elastic Impedance), and reservoir properties(lithology and pore fluid type) was quantified through statistical expression using PDFs(probability density functions) derived from well log data. The PDFs were used for interpreting seismically derived AI and EI to provide most-likely facies/fluid distribution. Finally, we present an example of applying multiple-point geostatistics for integrating seismically derived facies probability and prior geological information about the facies distribution. These field examples lead us to a conclusion that seismic reservoir property estimation methodology should be defined after careful consideration of the geological and geophysical background of the target fields, as well as the quality, quantity, and density of available data.

Key words: [3D seismic survey](#), [reservoir characterization](#), [seismic attribute](#), [AVO inversion](#), [geostatistics](#), [Vp/Vs ratio](#), [rock physics](#)

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