Optimizing Seismic Inversion Workflow for Reservoir Characterization: Risks and Rewards

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Developing accurate and high resolution reservoir models implies integration of data from different sources with varying scales, and is therefore one of the major challenges in reservoir characterization. Relatively low resolution of seismic data can only offer a structural model of the reservoir but its availability and areal coverage suggest that it has valuable information to constrain the reservoir model. This information could be extracted by the process of seismic inversion that transforms seismic data into quantitative rock properties, descriptive of the reservoir.

In this study a novel intelligent seismic inversion workflow is presented to achieve a desirable correlation between low-frequency seismic signals, and the much higher frequency well log data. The proposed workflow consists of a systematic progression from well data analysis to rock physics modeling to seismic inversion and finally reservoir property estimation. The results reveals that optimization of seismic inversion workflow must be handled in unique manner. By using a series of simple examples to complicated case histories we demonstrate that significant benefits can be obtained by following an optimized workflow that is tailored to deal with the uncertainties that impact the end product.

We conclude that relative inversion should be performed first so that we may be crystal clear about what information can be extracted only from the seismic without bias from logs. The next step is absolute inversion which implies logs as geologic context and broadens the inversion band to establish the relation between log and seismic. At final stage we should consider more advanced techniques such as model based inversion, elastic inversion, simultaneous and geo-statistical inversion. The role of rock physic will be placed in a stochastic context using the Markov Chain Monte Carlo inversion. This quantifies reservoir fluids and net to grass ratio. The ultimate goal is optimum reservoir characterization and management which leads to success.
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