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Real Time 3D Modeling to Optimize Geosteering in Clastic Reservoir –Case Study

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ABSTRACT

This paper presents the impact of dynamically updating 3D structural- and petrophysical- geological models to optimize real time geosteering through stringer sands with effective porosities in clastic reservoirs. The depositional environment of siliciclastic reservoirs imposes reservoir development challenges as the heterogeneity within the play system and within each sediment may vary considerably. Historically, stochastic modeling techniques have been used to predict the extent of lithofacies between wells where no hard data exists. Combined with a proper understanding of the depositional environment, stochastic and deterministic modeling techniques can closely simulate the actual distribution of petrophysical properties and their variance within reservoirs.

Reservoir modeling has been used for reservoir studies and production simulation, historically with cell resolutions as coarse as 100's of meters/feet. Such models used to require hours to update. These advancements have triggered new opportunities and more applications of modeling, allowing model-centric approaches to be effectively integrated into time-sensitive workflows. Geosteering is one of the evolving reservoir development and drilling frontiers where accurate real time decision cycles are mandated to achieve drilling objectives with minimum loss.
This paper demonstrates a new approach to updating an integrated reservoir model in near-real time, both structurally and petrophysically, to optimally geosteer wells through the most productive zones of the reservoir. The proposed workflow assumes the availability of pre-built geological models populated with at least a porosity attribute. Instead of relying on quick look effective porosity logs, which are subject to many unknown parameters, we present a new methodology to convert porosity models to gamma ray models which can be more easily correlated with the LWD gamma ray log, resulting in faster model updates.

To accelerate update, model updates were sectored around the active well. Sector boundaries need to be carefully selected to honor the influence of adjacent wells during Krigging. The horizontal and vertical resolution of the cropped model can also be increased to approximate the well log resolution. High resolution model is then populated with the full field petrophysical properties and used for Geosteering.The paper concludes by summarizing lessons learned using this approach, the pros and cons, and possible areas for future enhancement.