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Simple geomodels to improve individual horizontal well results in the Deep Basin: a guide for non-experts

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Summary

An overview is given of the basic set of geomodelling tools employed by a team of Deep Basin asset geoscientists, all without in-depth geomodelling experience, to prognose and steer horizontal wells. The team's transition to the use of simple geomodels for operations is summarized, including the major advantages and key learnings. Tools developed within the asset team that allow realtime Petrel images to be viewed on mobile devices are also discussed.

Introduction

Accurate geosteering is necessary to make horizontal wells economically successful. In many developments in the Deep Basin, the suite of tools and realtime logs available to the geoscientist is often limited by budget, placing more reliance on a geoscience team's expertise to plan and deliver horizontal wells. Maximizing the amount of time spent in-zone with the minimum amount of steering in delivering that objective is imperative to a well's deliverability and cost, respectively.

Fortunately many sophisticated tools exist to allow construction of geomodels that precisely reflect our understanding of the subsurface, both pre-drill and during drilling operations. Unfortunately many of these packages have a reputation for being complicated. Furthermore, the perceived steep learning curve is perhaps not best experienced while attempting to keep the bit turning on a 2500+m lateral in a +/-1m target window, at 3000+mTVD.

The majority of drills in much of the operating area in question do not require fully-developed geomodels to allow wells to be drilled with a high rate of success: vertical well control is sufficiently dense that only simple structural and property models are needed to assist in geosteering, which in this area often targets fluvial features delineated by 3D seismic. While structural complexity is generally minimal, a key benefit to familiarizing an entire asset team with building and populating simple geomodels is the number of model versions that can be generated rapidly. With some basic geomodelling tools, the asset geoscientist can drill a well with several pre-drill scenarios fully modelled and updatable in concert with realtime data feeds: often a significant improvement on a single, static model that is tracked by loading LAS and survey files to spreadsheets or similar. Furthermore, the tools available in most geomodelling software allow much clearer visualization of operations across a variety of platforms.

Theory and/or Method

The adoption of a readily accessible, shared database storing industry data and user interpretations (Petrel Studio) has allowed us to generate simple, accurate models to utilize for prognosis and operations on a per-well basis. Generation of these models is fast: a user can build a fit-for-purpose, drill-ready 3D model from scratch in a few hours. Scenarios addressing modest structural uncertainty,

differential compaction, and depositional scenarios are readily generated and visualized in 3D. The basic workflow employed by an asset geoscientist will summarized.

Over the course of a ~12 month period, all of the asset team's operations were transitioned to Petrel. None of the asset geoscientists were expert geomodellers; indeed, many had not previously used such software. The simple geomodel approach has completely replaced the previous method, which involved prognosing and drilling wells using customized spreadsheets. This transition was not without its hiccups – some common pitfalls will be reviewed.

Using a set of Petrel workflows and simple scripts we have also developed tools that provide customized workstation model images in realtime to any internet-connected device. A user can now check on the status of their well and view its realtime data in their Petrel geomodel, using their cellphone. While this is not a direct replacement for vendor-provided MWD data, it is an addition that provides a quick health-check on the status of a well, and enhances understanding without the need to log in to a workstation.

Examples

Examples will be drawn mainly from the Spirit River in target sands ~6-30m thick. Problems with differential compaction, MWD vs wireline data, integration of seismic data, and integration of regular and more sophisticated realtime data streams will be reviewed. An overview of realtime image streaming to mobile devices will be given. All examples use the Petrel platform.

Conclusions

The use of simple geomodels has significantly enhanced our ability to drill more complicated targets with greater reliability. No asset-team user employing such models was an expert geomodeller, but with a set of basic geomodelling tools, they are now better-able to visualize, prognose, and safely deliver horizontal wells.

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