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Integrating Disciplines in a Shared Earth Model Environment - Reservoir Characterization of a Nisku Pool in S.Alberta

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ABSTRACT

This presentation describes a new way of working in an integrated, multidisciplinary technical environment.

Traditionally, the reservoir characterization workflow follows a sequential or linear pattern. The seismic interpreter picks tops and faults to generate a structural framework, which is passed on to the reservoir geologist who produces geologically correct reservoir layering. The petrophysicist then populates these layers with petrophysical properties for the geologist to produce a hydrocarbon pore volume map. The hydrocarbon pore volume is then passed on to the reservoir engineer who then scales-up the geological layers to produce a reservoir simulation. Aside from the inherent inefficiency of communication in the team using this approach, all these steps were performed on stand-alone platforms or software applications.

With the advent of increased computing power and powerful new software, companies are applying a completely different workflow to the process of reservoir characterization. The ‘new’ approach follows a more circular or iterative process, which by its nature, is far more integrated. The geophysicists - who need more accurate time-depth conversions and algorithms to predict petrophysical properties directly from seismic volumes - to the geologists - who need accurate prediction of ‘petrofacies’ from logs and core to populate uncored wells in a field and facilitate better correlation of the interwell space in the earth model. The petrophysicist, together with the geologist and geophysicist are directly involved in both these steps, using the frequently large wireline dataset to calibrate seismic and predict rock types. Then, the integration of all data – not just logs, with the goal of reducing risk or uncertainty in the in-place hydrocarbon calculation is still a fundamental requirement in shared earth modeling. The next link in the circle requires the characterization team to iterate the geoscience model with the reservoir engineers for simulation of the reservoir. This is a crucial step which allows actual production history matching to validate several aspects of the shared earth model.

The Nisku example presented here shows how the shared earth modeling concept has been used to better understand the reservoir and optimize hydrocarbon-in-place volumes. All disciplines have been integrated into a single 3D volume of data that allows constant interaction when parameter changes or new data are introduced.

For each input parameter of the hydrocarbon-in-place equation, sensitivities have been performed, tied back to production history matching. This has allowed the correct level of heterogeneity to be applied to the geological model, together with the optimal approach to water saturation calculation within the model. This approach to validation has lead to better, more accurate quantification of hydrocarbon reserves, especially when compared to the ‘traditional’ approach of reservoir characterization.

Finally, once a history match is achieved, a series of recommendations are made to management, which include optimal well placement for both field injection and production.