P12

Reservoir Integrated Modelling (RIM) Process: A Key to Optimum Field Development

I. Yemez* (Repsol), V. Singh (Repsol) & E. Izaguirre (Repsol)

SUMMARY

To ensure the correct and optimized workflow for the generation of reservoir model, a high-level fit-for-purpose RIM process along with sub-workflows for each discipline have been developed that can be applied at different stages of field development depending upon the business need, resource limitation and input data availability.

Application of these workflows has been demonstrated through an example to assess the project risk by capturing the uncertainties in production and economic forecasts. Finally, this study emphasizes that the integrated reservoir modelling process will continue to evolve as new techniques and technologies are developed and implemented. This in turn, will enhance our ability to capture the physical realities of the real world and reduce the risk associated with the field developments.

Abstract

Finding and developing oil and gas assets has always been a risky business. The industry has witnessed several technological advances that have helped to reduce the risk. However, risk has not been fully reduced due to inherent uncertainties in the workflows used to generate production forecasts of the oil and gas fields using 3D reservoir models. Reservoir Integrated Modelling (RIM) and flow simulation plays a key role in maximizing the benefits at different stages of the field development. The effective 3D interpretation and modelling process requires application and integration of various data, technologies, tools and skills from subsurface to surface engineering, production operations/surveillance and economics disciplines. Cross-discipline collaboration and integration and a better shared use of all available subsurface and analogue data are considered crucial in developing reliable methods and workflows to help the industry make informed business decisions related to development options, ultimate recovery, and enhanced project economics.

To ensure the correct and optimized workflow for the generation of reservoir model, a high-level fit-for-purpose RIM process along with sub-workflows for each discipline have been developed that can be applied at different stages of field development depending upon the business need, resource limitation and input data availability. Each mapped process used in global workflow provide a primary product and these processes are: (1) Geological model from rock analysis; (2) Petrophysical interpretation from log analysis; (3) Stratigraphic framework from stratigraphic analysis; (4) Structural/stratigraphic interpretation from seismic analysis; (5) Reservoir characterization from Geostatistical analysis; (6) Fluid model from fluid data analysis; (7) Production model from production analysis and (8) Flow simulation from flow analysis. Since, the reservoir properties vary spatially due to reservoir heterogeneities (occur at all scales, from pore scale to major reservoir units), to obtain reasonable production forecasts, an adequate understanding of the limitations imposed by the data, associated uncertainty, or the underlying geostatistical algorithms or approaches and their input requirements for the 3D reservoir models are absolutely necessary. Based on the lessons learned from 3D reservoir modelling studies performed in-house in different projects, available public domain literature, authors' and industry experiences, some of the identified key factors affecting production forecasts are: sparse and non-representative data, biased estimates of Original Hydrocarbon In-Place, non-representative inputs distribution in the reservoir models due to lack of conceptual geologic model, inadequate static and dynamic models, poor use of seismic data, use of improper analogs, non-unique history matching calibration processes for brownfields and inappropriate use of uncertainty workflows and tools.

Application of these workflows has been demonstrated through an example to assess the project risk by capturing the uncertainties in production and economic forecasts. Finally, this study emphasizes that the integrated reservoir modelling process will continue to evolve as new techniques and technologies are developed and implemented. This in turn, will enhance our ability to capture the physical realities of the real world and reduce the risk associated with the field developments.