Reliance Industries Uses New Integrated Geocellular Modeling Approach to Forecast KG Basin Reserves

Case study: Petrel geobody interpretation workflow improves accuracy of reservoir delineation in a deepwater channel-levee complex

Challenge
Improve forecasting accuracy of petroleum reserves estimates in the Krishna-Godavari basin (KG basin) and find an alternative, more reliable method to delineate complicated reservoir geobodies.

Solution
Use the following technology tools and services to resolve geobody modeling and extraction issues:
- Petrel® 2008 software with Seismic Volume Rendering & Geobody Extraction module—to create a new geobody interpretation workflow
- SIS onsite consulting—to provide Petrel software expertise.

Results
Improved efficiency and accuracy of the geobody extraction process; gained confidence in results from integrated reservoir analysis and interpretation; increased accuracy and reliability of reserves estimates; and created a workflow that can be used on other challenging reservoir delineation and development projects.

Improve reservoir delineation accuracy
Reliance Industries Limited was grappling with the tedious, time-consuming task of identifying boundaries of a complicated channel-levee system located in the KG basin, which covers the deltaic and interdeltaic areas of the Krishna and Godavari rivers and extends offshore along India’s east coast. The company wanted to not only extract the over-bank reservoir boundaries, but also establish a lateral and vertical connection of geobodies within the entire system. This would require a thorough demarcation of areas where continuous stratigraphic objects exist, including the channel-levee complex, delta areas, and channel bars.

Previously, Reliance had exclusively used aerial demarcation techniques that resulted in variations and did not provide accurate maps of the channel’s depth. Although legacy software was used to pick geobodies, they could not be converted onto true 3D grids, and were therefore not incorporated in the reservoir model. Actual reserves were difficult to estimate based on the existing workflow. A new approach was needed to capture the exact vertical extension of the channel-levee complex to delineate the reservoir and estimate reserves more accurately.

The channel-levee complex after converting the picked geobodies from seismic directly onto a 3D grid in the geocellular model. (Red represents the channel, yellow represents the levee, and blue represents the interchannel.)
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Use geobody interpretation workflow to model reservoir
SIS workflow demo and project plan
Schlumberger Information Solutions (SIS) experts designed a geobody interpretation workflow demo that both showcased the new geobody extraction feature of Petrel software and addressed the problems Reliance was facing with its current modeling methods. This led to a joint team effort between the SIS-India Petrel team and a Reliance project team, who together refined the workflow to obtain a more reliable representation of the reservoir features. The project plan was carried out by a multidisciplinary team consisting of a geologist, a geophysicist, and reservoir engineers with the objective of producing accurate forecasts for the KG basin channel-levee system.

Single integrated platform
The advanced technology of Petrel software provided the team with a single integrated platform, enabling them to execute the complete workflow using one application. Previously, the same type of work was done piecemeal (identifying the connected bodies, mapping them in polygon, exporting from interpretation software, importing into modeling software, and then modeling). The new integrated technology significantly reduced the cycle time to perform interpretation and modeling tasks, while also reducing the uncertainty involved in estimating reserves.
Improvements over past constraints
Another benefit of the Petrel software was its ability to incorporate data from various independent analyses. Specifically, the team was able to include a detailed thin bed characterization and petrophysical analysis results from core data in their reservoir model. Furthermore, probe alignment along the channel dip made it possible for the team to identify and demarcate the channel more accurately. Finally, the integrated approach of geobody picking and modeling enabled both facies and reservoir property modeling in the picked geobodies. These were all major improvements over previous modeling and geobody processing constraints.

Increased confidence in reserve estimates
The Petrel geobody extraction tool worked as planned and in a more efficient manner—taking only about one-fifth of the time typically required for such a complex job. Reliance was able to obtain good-quality seismic data, model the reservoir, and compute reserve estimates with much greater confidence than before. With the combined help of SIS experts and software technology, the KG basin reservoir was fully identified and demarcated, allowing accurate population of reservoir properties within the geological model. Future Reliance projects will also be able to use the newly developed geocellular modeling technique to efficiently build accurate models through integration of all geological, geophysical, and well data.

“...This project has helped to open up a new integrated approach to geocellular modeling, with greater emphasis on accurate representation of our reservoir characterized by a channel-levee complex.”

Dr. Vidyadhar A. Kamath
VP Petroleum Engineering
Reliance Industries Limited

Box probe model with root-mean-square amplitude (RMS amplitude) of seismic volume to identify the channel. The colors indicate a variation in RMS amplitude values. In this figure, the seismic volume represents approximately 250 km².

Grouping of the entire channel’s geobodies when converted into a single facies, or object, in the geocellular model.
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