Geomodeling

A Geomodel is, in its simplest terms, a spatial representation of the porosity, permeability and hydrocarbon saturation in a reservoir. Ultimately, geomodels are consistent 3D representations of a wide range of data and knowledge relevant for the understanding of hydrocarbon systems.

Depending upon the reservoir and the time in its lifecycle, the complexity of the model will vary significantly. The careful design of a conceptual model - a highly integrated process which requires detailed knowledge from various disciplines - customizes the modeling workflow to the project`s requirements and provides best possible solution for improved reservoir management decision making.

Some of the uses of a geomodel are:

Initial Field Development

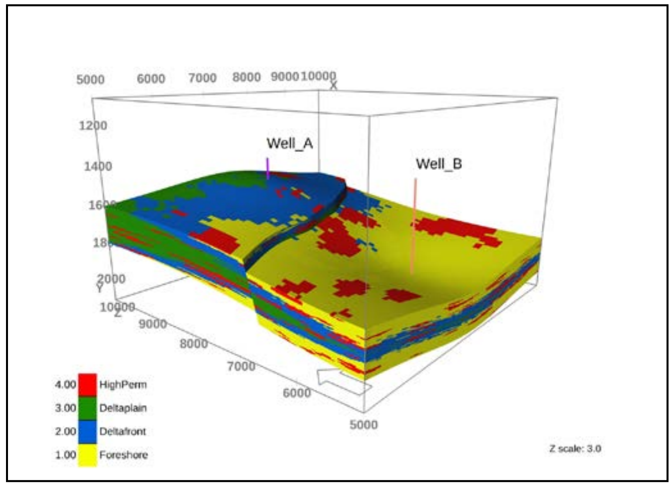
- OOIP and GOIP estimates
- Rock property ranges and spatial distribution
- Recovery factor and reservoir connectivity analysis
- Identification & quantification of key uncertainties
- Well planning
- Initial field development strategy

Mature Field Production

- Identification of bypassed zones and attic hydrocarbons
- Reservoir management (production and field development scenarios)
- EOR/IOR

Inputs for a geomodel can come from all areas and scales of the exploration and production process, from seismic and well log data to outcrop analogue studies and core analysis. The complex techniques for utilizing and integrating different datasets into the final model continue to be refined.

Among the benefits of a geomodel are being able to generate multiple realizations/scenarios for a reservoir in order to quantify the effect of different parameters for both static and dynamic values; and further data from the reservoir can be integrated into an updated model.



Workflow

Structural Modeling

Surfaces and interpreted faults taken from seismic data are tied to well stratigraphy to create a cellular framework, representative of the reservoir’s relevant physical dimensions. The grid's horizontal and vertical resolution is optimized based upon the well distribution, complexity of the reservoir geology and the size of relevant geological structures and features. The model can be made in fine detail and then upscaled to a coarser level for dynamic simulation later, if needed.

Property Modeling

Well data that has been processed by a petrophysicist, such as porosity and saturation, gives a great deal of information about the reservoir that needs to be extrapolated to the rest of the reservoir. Using geostatistical tools (e.g. SGS) combined with outcrop analogue studies, the best methods for distributing the rock properties throughout the geocellular model can be defined.

Data from the well is averaged to give a single value for each cell in that space in a process called ‘upscaling’. It is at this stage, where fine details such as thin impermeable shale layers, or streaks of high permeability layers among other heterogeneities, must be accounted for and preserved in the final data. Data ranges are checked pre and post upscaling to ensure that these values are not lost in the averaging process.

Depending upon the complexity of the geological framework, the depositional environment, and the available input data, different geostatistical tools (e.g. SIS, TGS, OBM or MPS) are available to extrapolate geological facies away from the well data. The resulting facies model facilitates to condition the rock property distributions to the reservoir geology. Facies proportions, geobody sizes and orientation, geological patterns and spatial trends can therewith be captured and cross validated against outcrop analogue studies of similar environments to ensure the geological details are correct.

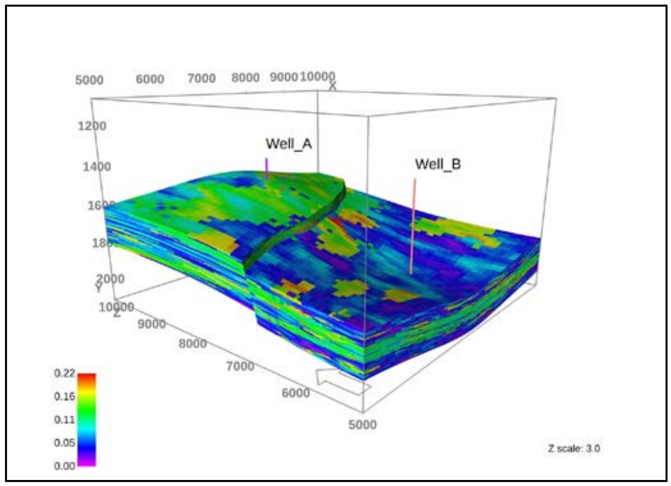
Uncertainty Analysis

Observed data is not always reliable, and hence the level of uncertainty must be quantified for an accurate economic analysis of the reservoir. Each input, such as the interpreted surfaces, facies proportions and property ranges, are analysed to determine their variation and how much effect each has upon the OOIP and GOIP values, and how the spatial uncertainty may affect the ultimate recovery.

For instance, in a low relief field, a slight variation in the top structure surface can yield a large difference in the OOIP and GOIP values. Creating different models of both the optimistic and pessimistic cases can help determine this uncertainty and place a more accurate value for the range of hydrocarbons present in the reservoir.

<u>The Task Fronterra Difference</u>

- The unique integrated approach combines all available and relevant data into a consistent reservoir model, to ensure key dynamic drivers are considered before the static model's construction.
- Task Fronterra draws on a wealth of global experience and knowledge in a variety of basins and reservoir types. Our geomodelers are supported by our multi-disciplinary team of geologists, petrophysicists, geophysicists and engineers throughout the company, in our offices around the world.
- Our flexibility ensures rapid delivery of results and quick deployment of experts wherever they are needed.



Task Fronterra Geoscience is a global independent provider of industry leading, integrated geoscience solutions, from single well analysis to complete reservoir studies.
Some tasks described herein may be performed by one or more associates.