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Abstract

The primary controls on subsurface reservoir heterogeneities and fluid flow characteristics are sedimentary facies architecture and associated petrophysical rock fabric distribution. A specific sedimentary environment can be conceptually represented by facies modelling. The availability of different facies prediction algorithms enables the possibility for spatial description and distribution of facies. The geo-modeler can utilize those algorithms carefully, in conjunction with the conceptual facies model, to create consistent models using limited local data. In effect, a limited amount of local data with the guidance of a well-understood conceptual facies model potentially results in improved local facies predictions.

Facies probabilities used for guiding numerical facies predictions could be generated using facies proportions from well data with one of the kriging algorithms to get a 3D probability cube for each facies. However, the main limitation for this approach is the low confidence away from well control. Calibrated seismic data to generate the 3D probabilities is therefore an important supplementary data source.

The main challenge for geocellular facies modeling is to distribute the facies stochastically while maintaining a geologically-meaningful spatial distribution. The absence of a conceptual depositional model for a reservoir could lead to a randomly scattered facies model, which will be guided only by the variogram model. This workflow applies post-stack seismic acoustic impedance results for inferring facies probabilities in a carbonate field in Saudi Arabia. By applying such a guided workflow, facies modeling using seismic information alone acts as a substitute when a conceptual depositional model is absent. In this case, a reasonable spatial distribution of facies is obtained, and a random scattered non-geologic result is avoided.