

Topics

2-7.1 Static Geomodels

Title

Modeling complex tectonic structures in any kind of grid without space deformation

Authors and affiliations

Jean-Marc CHAUTRU^{1*}, H el ene BINET¹, Pedram MASOUDI¹, Fran ois GEFROY¹ and Didier Renard²

¹ Geovariances, 49 Bis avenue de Franklin Roosevelt, 77210 Avon, France

² MINES ParisTech – PSL University, Centre de G eosciences, 35 rue Saint Honor  77305 Fontainebleau, France

*Corresponding: chautru@geovariances.com

Abstract

In order to achieve an accurate reservoir characterization, geometrical complexities of reservoir geobodies must be taken into account. Hence, restoration of the complex geobodies, impacted by tectonic activities, folding and faulting, is a primary issue in geological modelling of petroleum reservoirs. Accounting for the shape of geobodies is critical to ensure proper stratigraphic correlations between wells and realistic spatial distribution of petrophysical properties.

Facing the geometrical complexities, a common solution is producing curved grids, fitted to folding pattern as it is done in most of the main geological modelling software. This approach leads to very satisfactory geological models, but such models are not always easy to transfer to the Reservoir Engineer which is often requiring quite regular grids for flow simulations dedicated to History Match and Production Forecasts. This upscaling results in losing the initial geological resolution, hence incorporating uncertainty in the static model, which will be projected to the dynamic model. Such loss is generally difficult to control.

This paper describes an alternative method for generating distorted geobodies following folds and faults inside any kind of grid, irregular or regular, structured or unstructured. It is based on the combination of local geostatistics and a mathematical framework using properties of Stochastic Partial Differential Equations (SPDE). It allows generating geological models with facies or petrophysical properties spatial distributions following structural shapes, whatever the output grid could be, with a good level of performance.

The SPDE technique is efficient enough to manage large grids and large datasets. It means that is possible to generate, with a reasonable computation time, very high resolution geological models with structurally driven properties distribution, which can be upscaled by preserving the geological consistency in reservoir grids of any shape, regular, irregular, Voronoi, or any unstructured grids.