A Bayesian Model for Sequence Stratigraphic Bounding Surfaces

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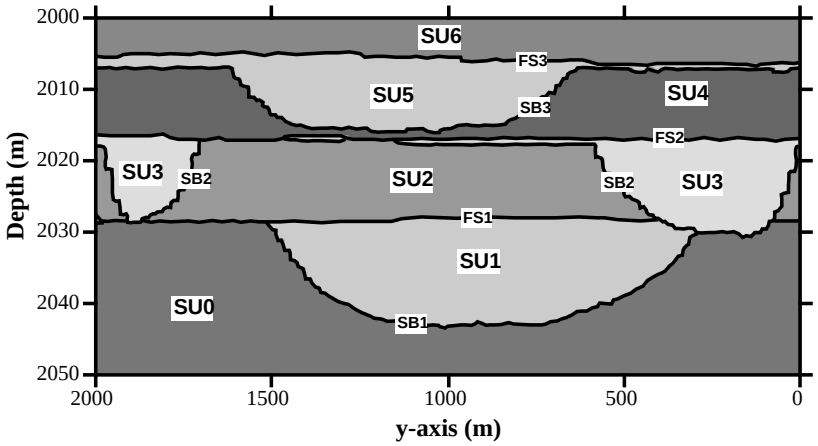
Abstract The adoption of sequence stratigraphy concepts to reservoir description involves the correlation of different types of bounding surfaces from well-to-well to produce a high resolution reservoir zonation. Where the geometry of these surfaces is associated with significant uncertainty a stochastic modelling approach is required to provide a correct basis for field development decisions. This article presents a stochastic model, based on transformed Gaussian fields for describing different types of sequence stratigraphic bounding surfaces.

The focus of this paper is on the stochastic model for a particular type of erosional surface termed sequence boundaries. The expectation of a sequence boundary is modelled by one or several incised valleys. Each valley is modelled by a fibre specifying the expected direction, and correlated 1D Gaussian fields defining deviation from the expected direction, width, depth and asymmetry. The cross-sectional form is described by two polynomials.

A Bayesian approach is adopted for parameter estimation. Prior distributions describing the general geologic knowledge and uncertainty associated with this knowledge are combined with reservoir specific observations into posterior distributions. As the model is too complex to allow an analytical estimation of the posterior distributions, an experimental approach has been developed where, for each valley, N fibres with corresponding model parameters and conditioning points are drawn from the prior distributions and the 'probability' for each fibre is calculated from the multinormal probability density function.



Vertical cross-section through a reservoir zonation defined by 3 flooding surfaces and 3 sequence boundaries which define 7 sequence stratigraphical units. SU1, SU3 and SU5 are incised valleys.