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Uncertainty Assessment in Static Reservoir Simulation by Using Stochastic and Stratigraphic Forward Modeling

Rock properties prediction in static reservoir simulation can be obtained by various methodologies, including deterministic, stochastic, inversion and stratigraphic forward modeling. The latter technique is now commonly used in industry as a basis for reservoir prediction and development. However, a good assessment of its predictive power, with respect to sensitivity of parameters and uncertainty of realizations is lacking. We are testing a methodology to assess these sensitivities and uncertainties on the basis of outcrop-calibrated simulation. The calibration data set is based on high-resolution stratigraphic analysis of Cretaceous carbonate outcrops in Southern France. Various scenarios were obtained from forward, deterministic and stochastic simulation techniques. A Similarity Vector has been defined to allow qualitative and semi-quantitative comparison of the models with the outcrop reality. The Similarity Vector combines multiple similarity factors, which measure or estimate model deviations. The similarity factors are dependent of the model resolution and include geometrical parameters (shape, volume, dimensions, patterns) and geological characteristics (facies, facies stacks, stratigraphic surfaces, net-to-gross). The uncertainty of each of the realizations can be estimated by the weighed average of the deviations. The cause of the model deviations and consequent uncertainties are assessed by sensitivity analysis of the controlling parameters and input data. In this way, it is possible to link the ''modelling uncertainty'' to the critical parameters for the various simulation methods. This link allows the assessment of subsurface model uncertainty for similar simulation methods applied to analogue geological settings. The developed methodology has been applied to a producing field.