Faults Representation Impact on Multiphase Fluid Flow in Production Simulation Models

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With only 10% world-wide drilling success, oil exploration is considered a high-risk game. Faults play a major role in this game. Faults are fundamental to prospect and play assessment as well as to production and field development. They are commonly an overlooked component in the evaluation of hydrocarbon accumulation and migration. The last decade has seen a rapid growth in our understanding of the variables that control fault sealing potential. Despite the current understanding of such variables, practical techniques are few and faults are commonly risked in an intuitive, qualitative manner. Few studies, however, demonstrated that using qualitative fault seal analysis, using those few techniques available, improves successes ratios and reduces costly errors in field development.

In this study, the effects of two different representations of faults on the derived history match are compared for the Pierce Field, North Sea. In the first case, fault transmissibilities were tuned and the faults were extended in order to improve the history match (conventional history matching). In the second case, a step-by-step derivation of the fault transmissibilities in the Pierce Field was adopted based upon the integration of collected and upscaled properties of the host rock along with some empirical relationships. A detailed analysis, supported by microstructural and pertophysical as well as capillary pressure mercury injection fault rock data were used to assign a spectrum of transmissibility multipliers along fault planes to capture the effect of the buoyancy force generated by the hydrocarbon column height on the sealing capacity of the faults. History production data were used to compare the effectiveness of the two methods. The results demonstrate the effectiveness of the derived transmissibilities model in generating a satisfactory history match in a relatively short time period.