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Fault Transmissibility Estimation and Its Impact on Reservoir Simulation

In reservoir simulation, the cross-flow behavior of faults has traditionally been treated simply as a calibration parameter for history matching or by applying a transmissibility multiplier uniformly to all faults. In this study, we present ongoing efforts to integrate 3D geologically-realistic estimates of fault zone transmissibility into reservoir simulation. For many years, accurate geologic estimates of fault transmissibility were not warranted because faulted geometries could not be accurately represented in simulation models. This limitation has been greatly reduced through the development of an integrated Gocad-based workflow that produces faulted simulation models to accurately represent the connectivity of faulted flow units (Chambers et al, 1999, SPE 51889). As a further enhancement, we present an efficient Gocad-based method that modifies non-neighbor grid cell connections to include a transmissibility term for the fault zone itself, assuming a shale gouge model. A series of heuristic reservoir simulation models, containing an injector-producer pair across a single fault in a heterogeneous reservoir, illustrate the sensitivity of well performance to different fault zone models, including differences in fault zone thickness. A case study containing two intra-reservoir faults illustrates the application of this 3D fault transmissibility approach in a field with complex production history and compares the results to more traditional simulation approaches. Although this 3D fault transmissibility approach represents an improvement over traditional methods, accurate prediction of fault zone permeability and thickness from geologic first principles remains difficult and limits the accuracy of simulation predictions.