Uncertainty Assessment in Reservoir Static Model: Parameterization of Reservoir Attributes in Jurassic Carbonate Fields with Limited Data Set

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ABSTRACT

Reservoirs are characterized by various attributes viz structure or entrapment, facies, porosity, saturation that are results of unique sequence of geological processes. Uncertainty is associated while estimating reservoir attributes in process based numerical reservoir static model. There are two major sources of uncertainty in simulated reservoir models. Firstly, it is a consequence of our inadequate knowledge about reservoir due to the limited dataset. Secondly, it results from the measurement, interpretation and simulation of different-scale G&G data. Various methodologies have been adopted to quantify and minimize uncertainty in reservoir models. The proposed approach uses regional geological understanding of the field; statistical analysis of G&G data and their applicability as input for the uncertainty assessment; while predicted versus actual drilling results and core-to-log integration define the uncertainty range. The velocity model uncertainty is addressed for estimating uncertainty with reservoir trap. It is quantified by generating an envelope above and below the seismic interpreted horizon. Facies interpretation and interpolation uncertainty are addressed separately. The facies proportions have a direct impact on the in-place volume of the field. A rational statistical and analytical approach is applied to compute the ranges of uncertainty in facies fractions. Regional geological data are employed to guide the range of uncertainty associated with the depositional strike direction and facies distribution away from the wells. A twofold approach is used to achieve the petrophysical properties uncertainty. Conventional core interpretation is integrated to quantify the interpretation uncertainty, and subsequently interpolation uncertainty of properties is also incorporated. Extensive workflow-based uncertainty analysis was carried out on base case models involving all parameters defined by the proposed methodology to determine the likely uncertainty in this in-place hydrocarbon volume estimation. Based on several hundred uncertainty realizations of the model, the probabilistic distribution, P10, P50 and P90 is estimated. The proposed methodology is successfully applied to several Jurassic carbonate reservoirs in Kuwait on land fields with the objective of supporting decision making in early development.