Quantifying Uncertainties Around Net Rock Volume: Application of Analogue Informed Facies Models

Alwin ten Hove[1], Sarah Cobain[2], Ben Meyer[2], Luca Colombera[3], Nigel P. Mountney[3]

[1]Petrotechnical Data Systems B.V., Rijswijk, Zuid Holland, Netherlands.
[2]Petrotechnical Data Systems Ltd, London, United Kingdom.
[3]Fluvial & Eolian Research Group, School of Earth & Environment, University of Leeds, Leeds, United Kingdom.

ABSTRACT

A key challenge for geomodellers is the identification and quantification of uncertainties, which become particularly difficult to handle when combining multiple geological concepts, data sources and modelling methods. In reservoirs with limited well control, it is important to incorporate appropriate analogue data to populate the inter-well volume. A novel approach is proposed here that allows for unbiased, analogue-informed modelling to directly control uncertainties in facies-modelling parameters, and to assess their impact on Net Rock Volume (NRV). A case study of a 'braided' fluvial reservoir succession, offshore NW Australia, penetrated by 5 wells, is used to demonstrate this novel approach. Data contained within the Fluvial Architectural Knowledge Transfer System (FAKTS) database, which stores data on fluvial sedimentary units from multiple analogues, is used to generate several scenarios that represent end-member depositional concepts. Raw data were converted from FAKTS into input parameters for direct application in facies modelling algorithms. The uncertainty range of each parameter was captured as part of the conversion, before being applied to uncertainty workflows. The relative impact of all parameters is shown through tornado plots. The impact when utilizing object- vs. pixel-based methods, including their influence on ranges of NRV, was also explored. Traditional random seed modelling on its own predicts little to no difference in NRV since the percentage of sand (Net-to-Gross) was fixed. Changing the size of the geobodies had similar results, as the desired sand percentage could be attained by altering the number of channel bodies. However, object dimensions do affect the reservoir architecture and therefore the potential connected hydrocarbon volume. By comparing the connected sand volume per well, the impact of the dimensional uncertainty on recovery was determined. To assess the impact of different depositional environments, different ranges of sand percentage were considered. To assess the impact of different algorithms, the percentage of sand was altered systematically for each algorithm. This allowed determination of noise level and quantification of the effect of algorithm choice. By combining different concepts and approaches, and linking them to analogue data, the full uncertainty space associated with facies modelling of the chosen field was assessed. The demonstrated methodology is repeatable in application to other reservoirs.