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Quantifying Fluid Contacts Range and the Likelihood of Lateral Connectivity through Pressure Trend Uncertainty Analysis

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The depth of a fluid contact can be determined with a high degree of certainty if it is penetrated by a well. More commonly, the contact must be inferred by intersecting the pressure trend of a water leg with that of a hydrocarbon-bearing interval from different well. Combining regressed pressure trends from wells frequently ignores gauge, gradient and depth uncertainties. Quantification of these uncertainties, within the context of pressure trend analysis to determine lateral connectivity and fluid contacts, can have a significant impact on reserve estimations. A methodology has been developed that can account for the uncertainties and serves to delineate the range of contacts and the likelihood of connectivity in a statistically meaningful way.

The techniques described in this paper have been successfully applied in the Deepwater Gulf of Mexico. Two case studies are presented. The first case study addresses the uncertainty of the free water level (FWL) of a major reservoir in the Mars-Ursa Basin. In this, the FWL was estimated by a conventional intersection of an oil gradient obtained from a well and water gradient from another. Subsequent re-analysis indicated that the well penetrating the water leg had a large depth uncertainty associated with it and the FWL could fall within a range expanding around 400 feet. The second case study highlights the potential pitfalls in making simple assumptions about connectivity.

These examples illustrate how applying the proposed methodology can lead to a better description of the range of outcomes that should be incorporated in reservoir models.