Well Log Uncertainty Analysis and Pre-Drill Information Studies with Geostatistics and Data Analytics for Unconventional Resources

Wendi Liu[1], Jose Salazar[1], Didi Ooi[2], Drew Derenthal[2], Michael Pyrcz[1]
[1]University of Texas at Austin; [2]Anadarko

9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

The imprecise measurements, heterogeneity and sparse sampling relative to the scales and coverage required for reservoir production forecasting lead to uncertainty in unconventional resources. An accurate model of the local reservoir property uncertainty is essential to support decision making and pre-drill prediction. Due to the dense well coverage, unconventional plays have a strong reliance on data-driven statistical characterization of well data to evaluate uncertainty. This study proposes a geostatistical workflow with 2D well log averages from Delaware Basin to quantify the local pre-drill uncertainty given local well data, spatial trends and spatial continuity. Initial univariate analysis which includes dispersion variance and outlier detection accounts for information loss from full 3D well log to 2D average and detects transitional and discrete boundaries. The uncertainty model is calculated based on kriging estimation and kriging variance assuming stationarity. The stationarity can be achieved by integrating data-driven trend modeling and geological segmentation to remove the trends from data. The workflow can be applied to assess the uncertainty reduction for pre-drill value of information studies, where impact of proposed additional wells on the uncertainty model can be demonstrated. The workflow is able to integrate geological expertise judgement with spatial data analytics into the uncertainty analysis and add data-driven value for unconventional reservoir pre-drill information studies.