Geological Insights gained from Nonlinear Multivariate Analysis

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Abstract

The whole goal of petroleum geology is to describe in order to predict. As a science, petroleum geology has enjoyed an explosion in various tools that add to the observations available to us… wellbore tools such as magnetic resonance imaging, chemical stratigraphy, and various 1 to 4 dimensional tools such as surface geochemistry, p wave and multicomponent seismology, microseismology, passive seismology, k-waves, and much more.

How well do any of these methods work? How can we prove it?

Frankly, as an industry, we are excellent at producing new and novel tools, and nearly absent in creating a framework to determine how well they actually predict those things we are trying to predict, such as presence of hydrocarbons, or ultimate producibility of the rock, to name just a couple. This talk introduces a framework whereby various observations can be assessed and compared to one another for both their predictive capabilities (where should I drill and what should I expect) to actually prescriptive capability (how should I best drill/complete/stimulate given the rocks I have) to maximize results. The framework is quantitative, built upon a nonlinear multivariable analysis engine, allowing one to score the merits of any observation in determining its predictive capability.

Examples shown in the presentation include assessing wellbore proximity to faulting in a region as an influencer on production, how subtle geological factors can radically influence ROI when increasing proppant density, to probabilistic identification of unconformity boundaries in seismic volumes, and that use in creating wheeler space (relative geologic time in the y axis) volumes as a precursor for layer stripping in relative structural space, with depositional axes and their migration easily visualized, amongst others.