

A Novel Procedure to Correlate Seismic Attributes and Horizontal Well Data in Unconventional Plays

Renjun Wen

Geomodeling Technology Corp, 1100, 665 - 8 Street SW, Calgary, AB T2P 3K7, Canada

renjun@geomodeling.com

Abstract

A key step in applying seismic attributes to reservoir characterization is establishing proper correlations between seismic attributes and well data, which is especially challenging for horizontal wells in unconventional plays, because of two major limitations in traditional methods. First, only vertical or slightly deviated wells have been considered historically, making the methods obsolete for horizontal wells, which are typical in unconventional plays. The second major limitation is that a large difference in the “support” sizes of well data and seismic samples are not explicitly modeled or they are simply ignored, resulting in false correlations or true correlation going undetected between well and seismic data. We have developed a novel procedure that has solved these two limitations, enabling more accurate correlation analysis and improved prediction of reservoir properties from seismic attributes. Our new procedure consists of three steps. First, horizontal well paths are projected to a seismic interpretation object, being a horizon, an interval or a stratigraphic grid. Second, well logs are upscaled to the interpretation object using a window size that corresponds to the “support” size of the seismic attribute samples. A correlation analysis, such as multi-step regression, is then made between the upscaled well data and the seismic attributes. This leads to one or several “best” seismic attributes for the target well properties, such as production rate or fracture density. Since different reservoir facies tend to have different distributions of rock properties, the correlations between seismic and well data must be examined for each facies when data permits. Finally, reservoir properties are predicted from the seismic attributes that have the “best” correlation with the target well properties, by using upscaled well data as the conditioning data if a statistical prediction method is applied or as the training data in a neural network prediction.