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Quantifying AVO Attributes and their Effectiveness

Amplitude variation with offset techniques are used by exploration and production groups to assist in hydrocarbon location in clastic depositional settings. While exploration groups tend to use AVO attributes for detection and risk quantification, exploitation and production groups use AVO attributes for detection and reservoir characterization. Accurate geoscience and engineering characterization (parameterization) of the reservoir can result in accurate prediction of hydrocarbon reserves and effective production of the reservoir. It is therefore essential to understand what seismic attributes will best contribute to the characterization of the subsurface reservoir. This paper focuses on the accuracy of AVO attributes commonly used in reservoir characterization. In particular, the effectiveness of lambda-mu-rho, elastic impedance, intercept-gradient and neural network attributes, and their ability to accurately predict reservoir extent are presented.

One might argue (as does this author) that all of these techniques are essentially the same, owing to the fact that each attribute set comes from the measurement of amplitude variation with offset across a velocity-corrected CMP gather. But some geoscientists prefer one attribute type over another, or logistically only have access to a certain attribute. This paper examines the differences between the methodologies of extracting the various attributes and more importantly, compares the final computed attribute answers. Please note that looking for the best AVO attribute for reservoir characterization does not mean that this attribute will be the sole seismological contribution to the reservoir parameterization for reservoir simulations, but rather a qualifier as to the best AVO input (if any) to accompany other geophysical and geological inputs to the modeling.