ESTIMATION OF ANISOTROPY IN VTI MEDIA USING MODE CONVERTED WAVE
AVO ANALYSIS

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ABSTRACT
Amplitude variation with offset (AVO) signatures in azimuthally anisotropic (vertically transverse isotropic, VTI) media vary as the character of the anisotropy contrast between layers varies. When the values of two parameters ($\delta$ and $\epsilon$) that quantify the VTI elastic anisotropy are varied, the fraction of energy that reflects from a given layer interface as a mode converted shear wave ($R_{PS}$) also varies for specified angles of incidence. Mode converted AVO cross-plots can potentially be used to identify stratigraphic layers exhibiting intrinsic VTI with the moderate to high degrees of weak elastic anisotropy that are often attributed to shale formations. When the parameter $\delta$ varies from -0.06 to 0.1, a significant degree of spread can be observed on the mode-converted AVO cross-plot. However, when the parameter $\epsilon$ is varied from 0 to 0.09, the degree of spread on the mode-converted AVO cross-plot is much less than for the parameter $\delta$. These results suggest that focus should be placed on inverting for the parameter $\delta$ rather than $\epsilon$ to characterize anisotropy. Additionally, three dimensional plots with a reflectivity coefficient on the vertical axis and both parameters ($\delta$ and $\epsilon$) on the horizontal axes may assist in the inversion for anisotropy. Using this mode-converted AVO information in conjunction with traditional PP AVO cross-plot analysis may increase the confidence in shale formation delineation.
Mode converted AVO cross-plot using 25 geologic layer interface scenarios and varying Thomsen’s $\delta$ parameter from -0.06 to 0.1. Thomsen’s $\varepsilon$ parameter is held constant at zero. The A and B coefficients come from Ramos and Castagna (2001).