

AVO analysis using horizontal component of seismic data in equivalent offset migration method

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On exploring subsurface resources such as oil or natural gas reservoirs, seismic reflection survey has been widely implemented in order to image subsurface structures. In recent years, utilization of S-wave or converted wave is required for estimating lithology or petrophysical properties of reservoir rock. However, such an analysis of S-wave seismograms had been relatively difficult. On the other hand, equivalent offset migration (EOM) proposed by Bancroft et al. (1998) is one of the prestack time migrations and has been found to be effective method for imaging S-wave information on the common scatter point (CSP) gather with recorded horizontal component in our previous study. Furthermore, S-wave AVO effect has also been confirmed by the amplitude reversal of S-wave event on the CSP gathers.

Therefore, we propose the procedure of accurate estimation of densities and shear modulus with S-wave source. First, we conduct numerical experiment with a 2D layer model using horizontal point force to obtain horizontal component seismic data, in which we can get higher S/N data about S-wave. Second, we implement EOM with those data to get CSP gather, and calculate each cross-correlated value versus incident angle as observed waveform information. Third, in contrast, we generate calculated waveform information as a function of incident angle and physical properties with geometrical spreading, radiation pattern and S-wave reflection coefficient. Finally, we can estimate the optimal solutions by minimizing the misfit from the both information.

Keywords: AVO analysis, Equivalent offset migration, Common scatter point gather