Prestack migration concepts for AVO measurements on horizontal and dipping layers

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Summary

Amplitude versus offset (AVO) processing is typically based on a model of horizontal reflectors and common midpoint (CMP) gathers. Seismic prestack migration on constant offset sections has also been used to improve the signal to noise ratio (SNR) of the AVO effect on the migrated CMP gathers that are referred to as common reflection point (CRP) gathers.

The use of prestack migration in AVO measurements is aided by the scatterpoint concept that assumes reflectors can be composed of many scatterpoints (or reflecting elements) that are aligned along the reflector. The energy scattered by each point reconstructs to match the specula reflected energy. The energy from each scatterpoint forms a surface in the prestack volume that is often referred to as Cheops pyramid. The location of specula energy from a scatterpoint is identified by the tangential area between the reflected specula energy and the surface of Cheops pyramid. In addition, the incident and reflection angles from a scatterpoint may be superimposed on Cheops pyramid to identify any smearing that may occur. These principles apply to both horizontal and dipping layering.

Conventional constant offset prestack migration can map horizontal and dipping specula energy to corresponding CRP gathers for AVO analysis. This method, however, requires an accurate velocity model before AVO measurements can be obtained.

The equivalent offset method (EOM) of prestack migration forms prestack migration gathers that are referred to as common scatterpoint (CSP) gathers with no time shifting of the input data. This process uses minimal velocity information to rapidly form CSP gathers that that are also well suited for AVO analysis. After the gathers are formed, accurate velocities can be estimated and AVO measurements made.