Velocity Model Building Techniques for Prestack Depth Migration in Thrust Terrains

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Abstract

Traditionally, velocity model building techniques for prestack depth migration are based on flattening of gathers in the prestack domain. However, in areas of low signal-to-noise, this approach may become difficult due to poor data quality. In these situations, velocity model building using stack data is desirable. One such approach is the velocity scan.

We present results using a form of velocity scan from a thrust terrain where shallow diatomites have absorbed much of the seismic signal and produced low quality gathers. We compare and contrast several techniques applied to the data, including layered and non-layered 1-D vertical updating, target-line based depth-domain tomographic inversion, and velocity scans, whereby the latter approach, combined with partial gridding, provided the best image in terms of stack response but also improved structural integrity.

As the velocity scan allows the interpreter to pick events on scanned stack panels where they are the strongest, together with the ability to isolate events in depth through partial gridding, the interpreter can form the image that best represents the informed opinion of 'true' structure, particularly in well controlled production settings. In this way, the velocity model is data-driven but influenced by the interpreter. This 'structure-driven' approach to model building is discussed in detail using the thrust terrain data set as an example.