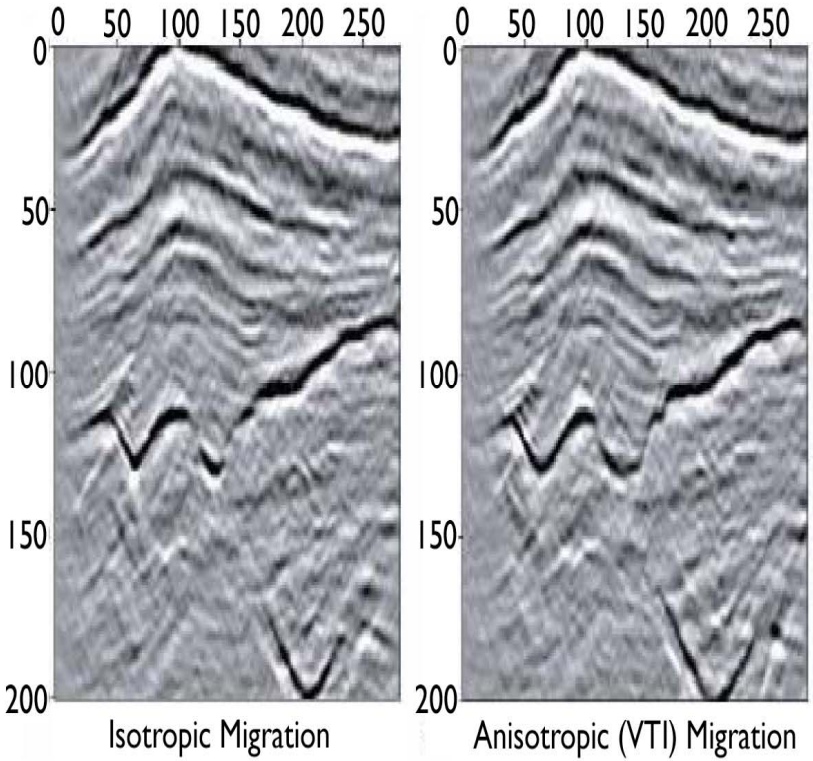
Realistic Velocity Anisotropy Estimation in Complex 3D Environments



Determinations of Vertical Anisotropy are used to Measure Amplitude and Travel Time

Objectives of the Project:

- Develop forward modeling, velocity analysis, and migration methods in anisotropic media
- Methodology and algorithms developed by this project will improve the quality and resolution of seismic images that are critical to the economic exploration for hydrocarbons
- Project to provide critical understanding of the fundamental physics of wave propagation in anisotropic media, which is necessary for the design of optimal seismic surveys used in hydrocarbons exploration

Lawrence Berkeley National Laboratory

Source: LBL

FEW ESD02-005

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Results of the Project:

- Based on the new forward-modeling codes, researchers have developed reverse-time migration codes for both isotropic and anisotropic media. In addition, a two-step velocity analysis procedure has been developed to estimate anistropic parameters using common midpoint gathers.
- **Project has resulted in development of new computer code:**
  - A new Eikonal solver in isotropic and tilted transverse isotropic (TTI) media.
  - New anisotropic finite-difference codes.
  - A new reverse-time migration code.
  - New 3-D Fourier finite-difference depth migration in vertical transverse isotropy (VTI) media.
  - A new 3-D Fourier finite-difference common-azimuth migration code.
  - A new velocity-analysis code using non-hyperbolic moveout.

Source: LBL

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Publication of the Project: (Partial List)

- Zhang, L., B. Hua, H. Calandra, J.W. Rector, and G.M. Hoversten. 2005, “3-D Fourier Finite-Difference Anisotropic Depth Migration”, SEG 2005, accepted.
- Zhang, L., B. Hua, H. Calandra, J.W. Rector, and G.M. Hoversten. “3-D FFD Commom-Azimuth Depth Migration”, submitted to Journal of Seismic Exploration in 2005.
- Zhang, L., J.W. Rector, and G.M. Hoversten. “Eikonal Solver in the Celerity Domain”, Geophysical Journal International, accepted for publication 2004,.
- Zhang, L., J.W. Rector, G.M. Hoversten, and S. Fomel. “Split-Step Complex Pade-Fourier Depth Migration, Geophysics, in revision 2005.
- Zhang, L., J.W. Rector, and G.M. Hoversten. “An Eikonal Solver in Tilted TI Media”, Geophysics, submitted for publication in 2004.
- Zhang, L., J.W. Rector, and G.M. Hoversten. “An Acoustic Wave Equation for Tilted Transversely Isotropic Media”, Geophysical Prospecting, 2004.
- Zhang, L., J.W. Rector, and G.M. Hoversten. “Reverse Time Migration in Tilted Transversely Isotropic Media, J. of Seismic Exploration”, V13, pp.173-187, 2004
- Grechka, V., Zhang, L., and J.W. Rector. ”Shear Waves in Acoustic Anisotropic Media”, Geophysics, V69, pp.576-582, 2004.
- Zhang, L., J.W. Rector, and G.M. Hoversten. “Split-Step Complex Pade migration, J. of Seismic Exploration”, V12, pp. 229-236 2003 .

Source: LBL