Multi-Cross-hole 3-D reverse time migration imaging

Fei Cheng¹,² and Jiangping Liu²
¹China University of Geosciences, College of Marine Science and Technology, WuHan, China (feicheng@cug.edu.cn)
²China University of Geosciences, Institute of Geophysics and Geomatics, WuHan, China

Cross-well 2-D seismic CT imaging method has been widely used in many fields such as oil-gas exploration and engineering geological exploration, but for the real three-dimensional space, this traditional method can only obtain the two-dimensional velocity profile between the two wells, cannot obtain the lateral geological structure outside the profile; Besides, the seismic signal received from cross-well exploration is the response of geologic body in three-dimensional space, which may be influenced by the geologic body outside the two-well profile, and that will give a result of image distortion and having an effect on geological interpretation. Based on the theory of three-dimensional acoustic wave equation, this paper implements a three-dimensional cross-well reverse-time migration imaging method to obtain the cross-well 3-D geological structure with the observed value from multiple wells by using the first-order velocity-stress acoustic wave equation and firing time imaging conditions. Calculation results of the typical theoretical models show that: The multi-well three-dimensional imaging method adopted in this paper can accurately and effectively realize the cross-well 3-D geological imaging with high resolution and reliable results. Multi-well three-dimensional imaging method can effectively obtain the cross-well three-dimensional structure distribution, which can solve the issue of hard to obtain the transverse structure change by 2-D imaging. It also can solve the imaging problems of big dip angle interface in CT imaging and obtains the true cross-well 3-D geological structure with the multiple well data, which can provide the basis for cross-well 3-D seismic exploration.