

Application of full waveform inversion and pre-stack imaging to 2D land seismic data in a complex terrain

*Takao Nibe¹, Shogo Masaya², Susumu Abe³, Shinji Matsuura², Hiroshi Sato⁴, Tatsuya Ishiyama⁴

1. JGI, Inc., 2. INPEX, 3. JAPEX, 4. ERI

Imaging deep structures using land data acquired in complex terrains of Japan often faces problems such as irregularity of topography and variable shallow structures, variation of reflection points caused by crooked-line geometry, irregular shot interval and low signal to noise ratio. Recently, acquisition of long-offset high density data using combination of cable and cable-free systems in complex terrain is standardized in domestic land acquisition. First Arrival Travel-Time Tomography is applied to such data to estimate subsurface velocity structure where conventional velocity analysis is difficult because of the above mentioned problems.

Although Tomography is able to estimate velocity structure accurately, limited resolution is one of the problems in this method. Full Waveform Inversion (FWI) is a method to estimate high resolution velocity structures compared to tomography since the method uses more information in the inversion process where tomography uses only first arrival time. Recently, a lot of applications are reported widely.

We tried FWI on 2D land data acquired in Japan. First, a synthetic study was done using a similar situation of domestic land data including different source wavelets, irregular sampling, etc. Next, the real data case study is done. We finally applied Pre-stack Depth Migration using FWI result as input and verified their capability of imaging deep structures in the complex terrain.

Keywords: Full Waveform Inversion, Velocity estimation, Reflection seismic exploration