Geophysical Research Abstracts
Vol. 21, EGU2019-11545, 2019
EGU General Assembly 2019
© Author(s) 2019. CC Attribution 4.0 license.

Pre-Stack Depth Migration with Reflection Tomography: A Multi-Channel Seismic Line Offshore Java

Yueyang Xia (1), Dirk Klaeschen (1), Heidrun Kopp (1,2), and Michael Schnabel (3)

(1) GEOMAR - Helmholtz-Zentrum für Ozeanforschung Kiel, Dynamik des Ozeanbodens, Kiel, Germany (yxia@geomar.de), (2) Christian-Albrechts-Universität zu Kiel, Kiel, Germany, (3) BGR Federal Institute for Geosciences and Resources, Hannover, Germany

Seismic reflection tomography is one method to update a preliminary velocity model for depth imaging. By residual move-out analysis of reflectors in depth migrated image gathers and the local reflector dip, an update of the velocity is estimated by a ray-based tomography. This is an iterative process spanning depth migration with updated velocity model, common image point (CIP) gather analysis, reflector dip estimation, tomography and velocity update.

To stabilize the tomography, several preconditioning strategies exist (e.g. top-to-bottom, short offset to long offset, predefined depth weights). All these parameters are part of the tomography algorithm and reproducible. Most critical is the estimation of the residual move out, to account for the depth of the reflector in the CIP offset-gathers. Because many closely spaced image gathers must be picked, manual picking is extremely time consuming and not reproducible. Automatic picking algorithms exist also for non hyperbolic events but the filtering and smoothing of discrete picks is difficult. To overcome these shortcomings, the Non-Ridged Matching (NRM) method was used to estimate a move-out displacement vector. NRM is used e.g. to merge photographic images, or to match two seismic images from time-lapse data. By applying the vector estimation only between neighboring traces from near to far offsets for each CIP-gather, a non-hyperbolic displacement gather is estimated for each data sample. This move-out field gather can be filtered and smoothed with standard seismic processing methods. To discretize the full move out field to individual picks needed for the tomography, predefined horizons or a simple regular grid can be used depending on the complexity of the subsurface structure.

The application to a multichannel seismic line offshore Java across a subduction zone will illustrate the method and the advantages of the NRM method to estimate a detailed velocity structure in a complex tectonic regime.