Summary: WIT report 2012

IMAGING

Bauer et al. extend the i-CRS multi-parameter stacking operator to converted waves and investigate it with two different parametrizations. The resulting three and five parameter operators are subject to several numerical studies in simple generic models in order to examine their traveltime accuracy and their ability to estimate the optimization parameters. A comparison that also considers a hyperbolic operator reveals the superiority of the new non-hyperbolic five parameter operator.

Bobsin et al. investigate a four parameter extension of the i-CRS formulae. The fourth parameter is the overburden velocity. Accuracy and sensitivity studies show an improved behavior in terms of traveltime accuracy and sensitivity towards the kinematic wave field attributes in comparison with CRS, MF abd i-CRS (three parameter). The application as a stacking operator leads to comparable results with the three parameter i-CRS.

Coimbra et al. discuss the use of the focusing of remigration trajectories starting at incompletely migrated diffraction events for seismic diffraction imaging and velocity model improvement. The method uses an approximate velocity model as input. It provides diffraction locations in the depth domain and information about the average velocity model which can be converted to interval velocities. They demonstrate the feasibility of the method using synthetic data examples from three simple constant-gradient models and the Sigsbee2B data.

Coimbra et al. introduce a data-driven stacking technique that transforms 2D/2.5D prestack multi-coverage data into a stacked common-offset (CO) section, referred to as OCO stack. The method combines offset continuation with stacking techniques to allow for the a horizon-based velocity analysis method, where root mean square (RMS) velocities and local event slopes are determined by stacking along event horizons.

Faccipieri et al. propose a combined approach in which the conventional CRS stack is superimposed by a CRS diffraction-enhanced stack in such way that we can recover the diffractions attenuated in CRS stacked sections. Such a combination will ensure, not only a signal-to-noise enhanced stack, but also preservation of finer diffraction details. The proposed approach has been tested with good results employing marine seismic data acquired offshore Brazil.

Gelius et al. address the question of how to form a high-resolution image of diffracted wave contributions in seismic reflection data. Straightforward use of migration type of reconstruction methods will not be able to preserve the fully resolving power of diffractions, due to the diffraction-limit conditions inherently attached to those approaches. We propose a new high-resolution imaging technique based on a windowed or steered MUSIC implementation. Application of the method on both synthetic and field data demonstrated a resolving power beyond that of standard migration.

Pronevich et al. suggested a new traveltime approximation of diffracted waves for general anisotropic media. The traveltime expression formulated as a double-square-root equation that allows to accurately and reliably describe diffraction traveltimes. Numerical examples and application of the method to a synthetic data set demonstrate how the new approximation work.

Takahata et al. review key topics associated with deblurring of prestack depth migrated seismic images based on the use of resolution functions and propose an approach based on regularized 2D spiking deconvolution. The potential of this technique is illustrated by the use of synthetic data.

Vanelle and Gajewski extend their traveltime-based strategy for amplitude-preserving migration to anisotropic media. The required Greens functions are generated using only traveltimes. This has the advantage that dynamic ray tracing methods with their high demand on model smoothness need not be applied. Examples demonstrate the quality of the high image quality as well as the accuracy of the reconstructed reflection amplitudes.

Vanelle et al. extend the i-CRS operator to account for the presence of seismic anisotropy. They demonstrate that the new operator leads to a highly accurate traveltime description. Furthermore, they conclude that the estimation of anisotropy parameters with the i-CRS operator has high potential.

MODELING

Bloot et al. use the theory of vector-field decomposition with the purpose of solving the VTI elastic wave equation in a homogeneous medium. The result is an elegant generalization of known facts of the classic isotropic case, particularly Helmholtz decomposition into decoupled wave equations for P and S waves.

FULL WAVEFORM INVERSION

Dunkl explains the implementation of a 3D elastic full waveform inversion. Random medium model data is inverted with different acquisition geometries, and a comparison to 2D full waveform inversion is shown.

Groos et al. investigate the influence of the initial P-wave velocity model on the reconstruction of the S-wave velocity model in a full waveform inversion (FWI) of shallow seismic Rayleigh waves.

Heider et al. show some necessary steps to invert for the fiel data. These steps are tested with a synthetic random distributed velocity model.

Macedo et al. study a decomposition based on scattering theory that allows to break the acoustic-wavefield sensitivity kernels with respect to model parameters into background and singular parts. Their numerical results show that those subkernels can be used to backproject the scattered residual only into model space and obtain background-model perturbation estimates. In an experiment with restricted acquisition geometry (reflection data, narrow offset), the multiple-scattering subkernels take advantage of medium self-illumination provided by the scattered wavefields.

Przebindowska et al. investigate the influence of the parameter choice describing the medium on the multi-parameter acoustic inversion of marine reflection seismics.

Schäfer et al. discuss effects of geometrical spreading corrections towards 2D full waveform inversion of shallow seismic surface waves.

OTHER TOPICS

Marcondes et al. built two physical anisotropic model, acquired ultrasonic measurements under varying stress level, and analysed the results. They show the relationships between seismically derived elastic parameters and fracture parameters. On the basis of this information from rock samples or analogous models, or even cross-well data, it might be possible to characterize the properties of a fractured reservoir or even figure out which regions of a reservoir are more extensively fractured.

Morelatto and Biloti make an analysis of the structure tensor ability to estimate local slopes on

2D seismic data, in order to perform structure enhancing filtering. They compare this method to two different methods of slope estimation using plane-wave destruction.

Raub et al. discuss the influence of the dynamic ocean on the imaging of the water column. The investigation is quantified by a synthetic modeling study considering an ocean model close to the Strait of Cardiz. The images of the water column may show only very little similarities depending on acquisition time. Particularly the lateral extent of imaged structures highly depends on the acquisition direction with respect to the flow of water masses.

Werning and Gajewski show the effects of a dynamic ocean on time-lapse seismic data of the subsurface. Synthetic data are used for this study. The influence on the repeatability of the data is discussed.