Summary: WIT report 2004

IMAGING

Garabito et al. present a short review of the two well stablished 2D-CRS parameters search strategies and present a comparison between the results of the application of both CRS stack implementations to the marmousi data set.

Salvatierra et al. presents a global optimization scheme applied to the CRS problem in the 2-D situation. Numerical experiments illustrate the potential of the method.

Koglin and Ewig briefly present how CRS atributes are used to obtain CRS moveout corrected CRS super gather which are necessary for the subsequent residual static correction. The theoretical background, some recent extensions of the implementation, and a real data example are discussed.

Heilmann and von Steht present a recent extention of the CRS-stack-based imaging workflow able to support arbitrary top-surface topography. The implementation combines two different approaches of topography handling to a cascaded processing strategy demanding very little additional effort. Finally, the CRS stack and also CRS-stack-based residual static corrections can be applied to the original prestack data without the need of any elevation statics. The CRS-stacked ZO section, the kinematic wavefield attribute sections and the quality control sections can be related to a chosen planar measurement level by a redatuming procedure. Due to this redatuming procedure, the influence of the rough measurement surface can be entirely removed from the output sections of the CRS stack. Thus, an ideal input for the subsequent CRS-stack-based processing steps is provided.

Boelsen presents new hyperbolic traveltime formulas for the 2D CO CRS stack that are able to take top-surface topography into account. Two types of topography are considered, namely a rugged topography and a smooth one. Moreover, a stacking operator for a vertical seismic profile (VSP) acquisition geometry is derived. In addition, an approach to redatum the CO CRS stack section is proposed and tested with a synthetic data example.

Boelsen and Mann discuss the application of the 2D CO CRS stack to ocean bottom seismics and show a simple synthetic data example with a comparison of model- and data-derived wavefield attributes. Moreover, a new approach to stack multi-component data in order to obtain PP and PS CO CRS stacked sections is presented.

Kluever reviews the event-consistent smoothing algorithm for the 2D case and introduces its extension to the 3D case. The effect of the smoothing on CRS results is demonstrated using a small 2D real dataset.

Biloti and Schleicher suggest a dip correction for coherence-based migration velocity analysis. They demonstrate how the velocity update can be improved when the reflector dip is taken into account. As an additional search parameter, the reflector dip is also determined. A simple synthetic example demonstrate the feasibility of the method.

Vanelle suggests a simple technique to fill gaps in ray traveltime maps.

Jäger shows how CRS attributes can be used to determine optimum stacking apertures for Kirchhoff (true-amplitude) migration. In this way, the efficiency of the migration algorithm as well as the quality of the resulting images can be improved.

Lüth et al. present a method for imaging sparse three-component seismic reflection data in a heterogeneous 3D velocity model. The location of a reflection point is derived using the polarisation direction of the multicomponent data and the Fresnel volume of the respective wave path is then derived by paraxial ray tracing. The imaging condition is finally restricted to the Fresnel volume of the reflection wave path.

Aleixo and Schleicher derive the image-wave equation, that is a partial differential equation that describes the dislocation of a reflector image as a function of the velocity model, for elliptically isotropic media. The main objective is to remigrate an isotropic into a medium with a certain degree of anisotropy.

Ferreira & Cruz propose a modified true amplitude (diffraction stack) Kirchhoff prestack depth migration using as Green function a superposition of Gaussian beams (GB's). The process takes in consideration the explicit use of the Fresnel volume elements in order to enhance the resolution of the final imaging.

Vanelle et al. describe the traveltime-based implementation of true-amplitude migration. Application to a highly complex synthetic model and a real data set demonstrates the technique. Whereas the results are equivalent to migration with weight functions obtained from dynamic ray tracing, the efficiency of the traveltime-based implementation is considerably higher.

Kaschwich presents a new stratagy for the migration with angular parametrisation in anisotropic media. The method combines the conventional ray shooting with a hyperbolic traveltime interpolation.

Gajewski and Tessmer introduce a seismic event localization method based on reverse numerical modelling, where event picking can be avoided. The quality of the spatial localization and of the estimation of the excitation time is demonstrated using 2- and 3-dimensional synthetic data sets. Cases with noise contaminated seismograms, macro models with incorrect velocities and the effect of sparse receiver arrays are studied for simple and complex subsurface models.

Leite et al. processed seismic land data of the Takutu basin (Amazonas, Brazil) as an example not for comparison with other processing packages but to demonstrate once more the high potential of the data-driven CRS-stack-based imaging methods. The aim of this ongoing project is to establish a workflow for basin reevaluation for oil play. Based on the CRS attributes obtained during the CRS stacking process, the determination of a smooth macrovelocity model via tomographic inversion was conducted followed by pre- and poststack depth migration.

ROCK PHYSICS AND WAVES IN RANDOM MEDIA

Saenger et al. consider effective elastic properties (i.e. velocities) in three different kinds of dry and fluid-saturated porous media. The synthetic results are compared with the predictions of the Gassmann equation and the tortuosity-dependent high-frequency limit of the Biot velocity relations.

Krüger et al. In this work we estimate the effective reflection coefficients of an interface between a cracked and an uncracked material. The study is based on computer simulations using the rotated staggered grid finite difference method

Kaselow et al. test their hypthesis that the general depth trend of P-wave, S-wave, and formation factor at the KTB test site can be explained as a result of progressive crack closure with increasing depth. They also show a comparison between laboratory and logging derived results of the rocks stress-sensitivity.

Yoon et al. consider deep seismic imaging in the presence of heterogeneous overburden.

Grosfeld and Santos review some different approximations for the P-P reflection coefficient and the associated seismic attributes. To illustrate the ability of the attributes to indicate the presence of oil or gas, numerical examples are also presented. Moreover, a new indicator is introduced, based on an impedance-type approximation for the reflection impedance.

MODELING

Tygel and Santos review and discuss the Taylor expressions of traveltime moveouts for reflection rays around a fixed zero-offset ray. These are referred to as normal parabolic and hyperbolic, or simply quadratic normal moveouts. General 2D/3D expressions, with the inclusion of topographic as well as inhomogeneous velocities are reviewed and discussed.

Costa et al. extend the method of 2.5D FD modeling by out-of-plane Fourier transform to acoustic media with variable density. They demonstrate the quality of the method by a comparison to the analytical solution of the wave equation in homogeneous media and by a comparison to the 3D FD results for two inhomogeneous models, including the Marmousi model.

OTHER TOPICS

Shapiro, Rentsch and Rothert demonstrate that the probability of induced earthquakes occurring is very well described by the relaxation law of pressure perturbation in fluids filling the pore space in rocks. Using this observation they show that the spatial distribution of the density of earthquakes provides a possibility to estimate the hydraulic diffusivity on a kilometer scale with a high precision.

Rentsch, Buske, Lüth and Shapiro propose a new approach for location of seismicity based on principles of wave field back propagation. This concept is characterised by a high degree of automation since time consuming manual picking of arrival times is not required.

Sommer, Gajewski and Patzig present a real data case study and demonstrate the influence of anisotropy on the localization of hydraulically induced seismicity at the continental deep drilling site KTB (Germany). An unrecognized anisotropy affects the localization severely. In the KTB case, if anisotropy is not considered and station corrections are not applied, the center of the event cloud is dislocated 500 m to the south which is about 25% of the total lateral extent of the cloud. The anisotropic model perfectly centers the cloud at the injection well.