Quality Control of Land Seismic Processing (G079)

Tutor(s)

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Overview

This course will provide participants with fundamentals needed to liaise with specialists and discuss workflows and quality control for land seismic data processing. Using modern case histories and basic theory, the course covers fundamentals, established workflows and advanced technology. Demonstrations will use interactive processing tools to improve the students' understanding of the latest techniques and how to quality control effectively and efficiently to meet their objectives.

Objectives

You will learn to:

1. Discuss the most common land seismic acquisition and processing techniques used in seismic exploration and production and become more proficient in the terminology used to describe them.
2. Recognise seismic processing parameter selection for specific objectives such as amplitude interpretation for exploration and reservoir characterisation.
3. Discuss quality control of land seismic processing workflows covering data preparation, parameterisation, noise & multiple suppression, velocity model building, imaging and post-migration processing.
4. Become aware of newer acquisition and processing techniques alongside their potential benefits & pitfalls.

Level and Audience

Fundamental. This course is aimed towards geoscientists seeking fundamentals of land seismic processing methods and those who wish to more effectively liaise with specialists and apply quality control. We start from first principals, but it is helpful if participants have a basic knowledge of land seismic acquisition and processing terminology and are actively working with seismic data.

Duration and Logistics

Classroom: A 2-day course comprising a mix of lectures and case studies. The manual will be provided in digital format and participants will be required to bring a laptop or tablet computer to follow the lectures and exercises.

Virtual version: Four 3-hour interactive online sessions presented over 4 days comprising lectures, discussion and demonstrations using case histories to illustrate the basic theory and impact of the techniques discussed. A digital manual and exercise materials will be distributed to participants before the course. Some reading and several exercises can be completed by participants off-line.

Course Content

Session 1: Land Seismic Processing Workflow

- Seismic refresher including a brief overview of basic wave theory, noise suppression, velocity analysis and QC, stacking, imaging and resolution.
- Basic techniques such as frequency analysis, convolution, sampling, aliasing, interpolation and regularization.
- Quality control of data conditioning techniques including surface consistent deconvolution, trace scaling, automatic gain control, frequency filtering.

Session 2: Survey Design basics to optimize resolution, denoise and imaging

- Current seismic acquisition trends.
- Quality control of formats, geometry and amplitude corrections.
- Noise: types, suppression and quality control for land seismic data.
- FK, FX, radon, tau-p analysis: examples, pitfalls and quality control.

Session 3: Imaging and Earth Model Workflow

- Basic migration, prestack time migration and gather generation.
- Correcting for velocity variation and complex sub-surface: Prestack depth Migration and full waveform inversion (FWI).
  Statics: elevation, refraction, tomographic and reflection based residual statics are compared using a series of synthetic and recent real case histories to emphasis quality control rules of thumb.
- Tomography techniques and role of interpreter in anisotropic velocity model building and quality control featuring recent land case histories.

Session 4: Post-Migration Data Enhancement and Introduction to Specialised Processing

- Case histories featuring post-migration data enhancement, 3D survey merging and gather conditioning for future AVO analysis and inversion.
- Specialised processing: Multicomponent, Elastic and 4D concepts
- Summary of quality control stages, tools leading to better and more reliable data quality.

Additional Topics and Material:

The following additional sections are included online but not discussed in detail during the class:

- Seismic data formats: seismic and navigation formats and quality control.
- Workstation Data loading: including common pitfalls.
- Processing tenders overview.