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N656: Acquisition and Processing of Near Surface Seismic Data

Instructor(s): Rob Hardy

Format and Duration
Classroom - 2 Days
Virtual - 4 Sessions

Summary

The quality and accuracy of seismic data is a critical component to characterisation and monitoring of the near surface. The impact of this course is to provide participants with greater awareness of available methodologies and skills to liaise more effectively with specialists to make optimum decisions regarding data quality. This course covers fundamental issues and linkages involved in acquiring and processing seismic data for near surface studies including the re-purposing of existing data. The class uses case histories of near surface imaging and participants will use interactive processing tools to improve their understanding of the latest techniques and how to apply them effectively and efficiently to meet their objectives.

Learning Outcomes

Participants will learn how to:

1. Recognise the most common seismic acquisition and processing techniques used in near surface imaging.
2. Demonstrate the fundamentals of sampling theory, modelling and seismic survey design and consequences for acquisition, processing and near surface objectives
3. Construct a typical seismic processing workflow covering data preparation, parameterisation, noise & multiple suppression, velocity model building, the imaging process & likely issues at each step.
4. Liaise more effectively with specialists to make optimum decisions regarding data quality.

Training Method

This is a 2-day classroom course, comprising lectures, discussion and interactive exercises using case histories to illustrate the basic theory and impact of the techniques discussed. The purpose of this course is to teach fundamentals rather than a particular software suite. To this end, the participants will use a series of web-based software modules to experience the processing options available and learn how to combine the basic tools together to build a flow which meets objectives.

Who Should Attend

This course is aimed at geoscientists seeking an overview of new geophysical techniques and processing methods applied to near surface imaging.

Course Content

Seismic technology is continuously changing towards improved imaging while reducing cost and turnaround. The main aim of the course is to provide a demonstration of current geophysical and processing techniques that can be applied to seismic data for near surface characterisation. From a basic knowledge of seismic processing, the attendees will be given an overview of standard practice, and then for each method we will introduce the basic theory (with few equations), parameterisation, benefits,

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limitations, pitfalls and likely impact. Where possible we will focus on the applications of the techniques using modern real case histories and common terminology. Interactive processing exercises, using land and marine synthetic and real data examples are provided throughout the course to enable the attendees to grasp the importance of key parameters.

Session 1: Basic Theory and Simple Processing Flow

- Geophysics refresher: an acquisition and processing primer including a brief overview of basic wave theory, noise suppression, velocity model building, stacking, imaging and factors affecting resolution of shallow seismic targets.
- Basic building blocks including convolution, sampling, aliasing and interpolation.
- Simple data conditioning techniques including trace scaling, automatic gain control and frequency and dip filtering

Session 2: Survey Design Workflow

- Technical aspects of survey design featuring a basic survey design workflow using rules of thumb and modelling to design surveys for shallow targets

Session 3: Signal Processing, Noise and Multiple Supression Workflow

- Wavelet processing including designature, attenuation compensation and combining acquisition and processing solutions to obtain broadband data and improved resolution of near surface targets.
- Noise: types, suppression and quality control in Marine and Land seismic data
- FK, radon, tau-p analysis denoise examples and quality control.
- Multiple suppression examples and quality control

Session 4: Imaging Workflow

- Basic migration, prestack time migration and gather generation.
- Correcting for velocity variation and complex sub-surface: Prestack depth migration.

Bonus Material

The following sections are available online but not extensively covered during the main sessions.

- Seismic data formats: seismic and navigation formats, pitfalls and quality control.
- Data loading: dynamic range (bit precision), reconciling navigation and seismic data, common pitfalls when loading depth data, land data and gathers with recommended quality controls. Seismic display and colour-bars.
- Processing tenders: a brief overview of tendering seismic processing contracts.