EC008: Seismic Methods

Format and Duration
Self-Paced - 5 Hours

Summary

The fundamentals of the seismic method are an essential background, whether you are trying to characterise the shallow sub-surface to site a windfarm, understand a reservoir to extract hydrocarbons, or to use a reservoir to store CO_2. This course provides an appreciation of the strengths and weaknesses of key seismic methods and will cover what questions to ask about seismic resolution, structural imaging, and depth maps. The first module will describe the relevant parts of the seismic process including basic theory and introduction to seismic data acquisition and processing. Later modules expand on seismic acquisition and processing and structural imaging. In more specialised modules we investigate wavelets and seismic resolution before coving simple issues on depth conversion and mapping the subsurface.

Learning Outcomes

Participants will learn to:

1. Explain the strengths and limitations of seismic technologies and interpretations.
2. Recall the types of tools and analyses available to seismically image the subsurface and assess geological risks.
3. Participate in technical conversations with geophysicists and contractors and distinguish whether their recommendations are likely to improve the way you approach subsurface imaging.
4. Evaluate requests for capital to fund additional geophysical studies or seismic data, as appropriate.

Training Method

This is a self-paced e-learning course. Learning materials are structured into short sections, each including interactive text and image content, animations, video, and audio. An end of course quiz is scored to provide the learner with their learning progress. Approximately 5 hours learning time.

Who Should Attend

This course is designed for geoscientists, petrophysicists, and engineers involved in multidiscipline teams using geophysical techniques as well as individuals responsible for managing or supervising exploration or asset teams. This material is targeted towards early career subsurface professionals, non-geophysicists, or those seeking a quick refresher.

Course Content

Introduction to Seismic Methods
This module will describe the relevant parts of the seismic process from data acquisition, processing through to structural imaging.

- Basic concepts – types of sources, types of waves – surface, body, P, S

- Wavefronts vs. raypaths
- Velocity and density, acoustic impedance
- Reflections, reflection coefficient, depth to time conversion
- Shot gathers, single fold, multiple fold
- Stacking and zero-offset concept
- 2D geometry and coverage

Seismic Acquisition

In this module, we will cover in more detail 2D and 3D land and marine seismic acquisition concepts and how different choices in survey design can affect the quality of the final image.

Seismic Processing

This module will discuss key data processing stages required to manipulate recorded shot records into images of the subsurface. 2D and 3D processing – binning, statics, velocity analysis, NMO, stack, Time migration, migration velocity determination, Depth migration, Image ray tracing, Complex depth conversion and map migration

Simple Depth Conversion

This module will explain the process of converting seismic data from a time scale to a depth scale. By the end of this module, you will be familiar with different types of velocities and the depth conversion methods used for each.

Structural Modelling

This module will demonstrate the principles of normal incidence and vertical incidence modelling and their use in verifying seismic interpretations.

Wavelets

This module will describe the types of wavelets, the frequency domain and phase definition.

Resolution

This module will explain the importance of resolution to the accuracy of seismic interpretation. We will cover both vertical and horizontal resolution and discuss how to maximise resolution for a given target.