N385: Workflows for Seismic Reservoir Characterisation

Instructor(s): Pat Connolly

Format and Duration

Classroom - 5 Days
Virtual - 10 Sessions

Summary

Business Impact: Application of the learnings of this course will empower participants to better **delineate reservoir and pay distribution**, which is of particular use during **reservoir appraisal**, **development** and **production**.

This course provides participants with the skills to design and execute workflows to achieve optimal seismic reservoir characterisation results. The course addresses seismic conditioning to enhance the data and seismic inversion to make quantitive estimates of reservoir properties. Coloured inversion and a comprehensive review of AVO methods including extended elastic impedance are also covered. Furthermore, the course provides a review of seismic inversion methods, including both conventional deterministic methods and the latest Bayesian probabilistic approaches.

Learning Outcomes

Participants will learn to:

1. Construct coherent workflows to estimate reservoir properties and associated uncertainties by integrating seismic data with other data types.
2. Apply seismic conditioning methods to maximise bandwidth and optimise correlation with reservoir properties.
3. Analyse relationships between reservoir and elastic properties to determine what may be estimated from seismic data.
4. Select the appropriate inversion algorithm for any given situation.
5. Appreciate the importance of uncertainty quantification in seismic reservoir characterisation.
6. Select appropriate methods to achieve the objectives based on an assessment of data quality and an analysis of rock properties and reservoir geometry.

Training Method

This is a classroom or virtual classroom course comprising a mixture of lectures, discussion, case studies, and practical exercises.

Who Should Attend

This course is designed for geoscientists experienced in working with seismic data and who wish to create coherent workflows to achieve specific quantitative objectives.

Prerequisites and Linking Courses

Participants need a working knowledge of seismic data processing and interpretation, wire-line logging, and reservoir geology. Courses N085 (Introduction to Seismic Interpretation) and N004 (The Essentials of Rock Physics and Seismic Amplitude Interpretation) cover some of the required background.

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Course Content

1. Introduction

- Overview and objectives

2. Coloured Inversion

- Geological studies on bed thickness distributions
- Frequency domain implications
- Coloured inversion and blueing

3. Wavelets

- Optimising wavelets
- Spectral estimation
- Wavelet transforms
- Structurally conformable filtering
- Well ties and wavelet estimation
- Mechanisms of frequency loss

4. AVO Measurements

- Zoeppritz equations and linearisations
- Controls on AVO response
- Measuring AVO
- Data conditioning
- Measurement errors
- Anisotropy

5. AVO Crossplots

- Intercept-gradient crossplots
- Background trends
- AVO classes
- Fluid substitution and AVO
- The structure of intercept-gradient crossplots
- Coordinate rotations
- Elastic property reflectivity vectors

6. AVO Well Analysis

- Elastic & extended elastic impedance (EI & EEI)
- AIGI crossplots
- Well ties with angle stacks
- Choosing chi angles from well-log data

7. AVO Seismic Analysis

- Choosing chi angles from seismic data
- Rock-physics modelling
- DHIs
- Bayes theorem & exploration risking

8. Attribute Maps

- Multi-attribute methods
- Reflectivity and impedance tuning
- Detuning & Seismic net pay
- Uncertainties & limitations
- Map calibration

9. Inversion Principles

- Sources of inversion uncertainty
- Bayesian framework for facies probabilities
- Inversion algorithms

10. Facies Probabilities

- Monte Carlo rejection sampling
- Seismic information content
- Inversion classification
- Principles and application of ODiSI

11. Review