

Introduction to Industry Seismic Reflection Methods and Applications

Times and locations

Lectures Tues. and Thurs. 11:00AM - 12:20PM IGPP Revelle 4301

Instructor

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Text

Background reference texts will be available electronically through the UCSD Library.

Class Website

Lectures, quizzes, assignments, exercises and background materials will be posted on the class website <http://igpphome.ucsd.edu/~lsrnka/ISRMA/>.

Summary

This course is an overview of reflection seismic methods and their applications as practiced by the resource, environmental and other industries and by agencies such as the USGS. The course covers the history of active-source seismic methods; land and marine seismic acquisition; seismic wave types and their simulation; the basics of reflection data processing and imaging including velocity analysis; vertical seismic profiling; basic well logs and their interpretation; 1D synthetics and seismic-well ties; basic reflection data interpretation of rock types and fluids in geological settings, including direct hydrocarbon indicators (DHIs); emerging reflection seismic methods such as full waveform inversion (FWI); and mineral, geotechnical, environmental, and oil and gas applications. Detailed building of skills in specific seismic acquisition, processing, or interpretation software is not done in this course, since the variety of software packages is too broad and constantly changing to allow choosing the best examples.

The goal of this course is for students to gain familiarity and knowledge of the basic concepts, theory, and principal ways in which active-source (vs. natural-source such as earthquake) reflection seismology is used today in practical applications, in particular in the environmental and resource industries. The course emphasizes technical breadth over depth. The course meets twice per week in 80-minute sessions. There are no formal prerequisites for this class, but basic knowledge of geology and geophysics is assumed (SIO103 or equivalent). This course complements SIOG 227A. Some familiarity with advanced algebra, vector calculus, and basic scientific computer programming such as in Matlab is assumed. Grades are based on quizzes, homework, and a few exercises. Active participation in class is expected. There is no final exam.

Outline

1. Introduction and overview
2. History of active source seismology
3. Land and marine acquisition and signal characteristics
4. Seismic wave types and propagation
5. Mathematics refresher for processing and modeling
6. Seismic velocities
7. Basic seismic data processing
8. Basic seismic modeling and imaging
9. Traveltime-to-depth conversion
10. Basic well logging and log interpretation
11. Vertical seismic profiling (VSP)

12. One-dimensional seismic synthetics and well-seismic ties
13. Seismic stratigraphy
14. Basic 2D and 3D interpretation, in various structural settings
15. Reflection seismic attributes
16. Fluid and lithology prediction, including direct hydrocarbon indicators (DHIs)
17. Emerging seismic methods including Full Waveform Inversion (FWI)
18. Geotechnical, environmental, mineral, and archeological applications
19. Oil and gas applications: exploration, development, and production
20. History and state of the energy industry, emphasizing the hydrocarbon sector