GEOV113

Reading list and syllabus

GEOV113 – Reading list

Part 1

- E-Modules – http://buster.geo.uib.no/emodules

Part 2

- ***Tutorial – Processing of multichannel seismic data: An introduction, including exercises and Matlab programs***, by Atle Austegard, lecture notes available on class website, UiB, 2014 (all sections)

- ***An Introduction to Geophysical Exploration, 3rd edition***, by P. Kearey, M. Brooks, and I. Hill, Blackwell Publishing, 2002 (Chapters 1-4)

- ***Slides of presentations given in class,*** will be posted on class website

GEOV113 – Part 1 (weeks 35-41)

EXERCISES, E-MODULES, GEOV113, AUTUMN 2014

http://buster.geo.uib.no/emodules

Exercise 1-7: in pairs, oral presentations. Exercise 8: in groups, 3 students pr. group, written, 3-6 pages.

Exercise 1 (E-module: Geophysical Principles).

a) Describe the three elements in the 'background' chapter of the e-module you consider as most important concerning acquisition of seismic data.

b) Suggest a seismic source that reduces the bubble-pulse and optimizes the effect of the ghost and directivity.

Exercise 2 (E-module: Seismic Equipment).

Two seismic surveys (2D) are to be performed in a fjord. The aim in Acquisition I is structures at ca. 10 km depth, whereas mapping of the uppermost ca. 100 m below the seafloor is the main target in Acquisition II. Discuss possible choices of source and receiver in both cases (consider geophysical aspects only).

Exercise 3 (E-module: Seismic Processing).

Describe the different general steps that should be included in the processing of the data from Acquisition I, exercise 2. How can we, in addition, attenuate water multiples caused by hard seafloor, as well as side-swipes from the sides of the fjord? Could these two effects have been attenuated during the acquisition?

Exercise 4 (E-module: Land seismic).

Discuss different sources, receivers and geometries that could be used in acquiring reflection seismic data on land, in an area with strongly varying weathering layer.

Exercise 5 (E-modules: OBS Acquisition, OBS Processing, OBS modeling P-waves).

In which cases would you consider to acquire 2D OBS-data instead of 2D multi-channel reflection data? Describe the different procedures related to scale. Finally, describe the different steps in processing of regional OBS-data.

Exercise 6 (E-module: 4C Seismic).

Discuss the main benefits and drawbacks of reservoir-scale, 4C seismic, relative to surface seismic.

Exercise 7 (E-module: 3D Seismic).

Discuss the main differences between 2D and 3D Seismic data.

Exercise 8 (All modules, written, 3 students pr. group, 3-6 pages).

You are to acquire seismic data over an anticline located at about 5 km depth partly on land, in the transition zone (20 m water depth) and in deeper water (100 m water depth). Discuss various options you have in order to optimize this task. Explain your choice of type and geometry of sources and receivers.

All e-modules listed above are part of the syllabus (pensum) in GEOV113. The syllabus also includes: **E-modules: Logistics, Seismic Recording.**

GEOV113 – Part 2 (Weeks 42-46)

The second part of GEOV113 comprises the 10 lectures listed below. The sections of the tutorial covering the topics discussed in each lecture are given in parentheses following the heading "Theory". Most of the theory may also be found in Chapters 1-4 of Keary et al. (2002). The theory is accompanied by 10 computer-based exercises, which students will be able to work on during weekly practical sessions. Students should be ready to discuss and explain their results in class.

Lecture 1:
Theory (1.1, 1.2, 1.3; Kearey 2.1-2.3): cosine signal, amplitude, frequency, phase, Fourier theorem
Exercises 1 & 2

Lecture 2:
Theory (1.4, 1.5; Kearey 2.1-2.3): linear and constant phase, random noise, SNR, digitization, sampling, aliasing
Exercises 3 & 5

Lecture 3:
Theory (1.6, 1.7; Kearey 2.4): digital filtering, convolution, Gibbs phenomenon
Exercise 6

Lecture 4:
Theory (Tutorial 2.1; Kearey 3.1-3.4, 11.8): Wave propagation, elastic constants, P- and S-velocities
Exercise 7

Lecture 5:
Theory (Tutorial 2.2; Kearey 3.6.2, 3.6.3, 3.7): Wave fronts, rays, and travel times
Exercise 8

Lecture 6:
Theory (Tutorial 2.3-2.5; Kearey 3.5, 3.6.1): Attenuation, pulse shape and synthetic seismograms
Exercise 9

Lecture 7:
Theory (2.6, 3.1, 3.2; Kearey 4.2, 4.3): resolution, trace gathers, NMO

Lecture 8:
Theory (3.2-3.4; Kearey 4.7): Velocity analysis, Dix formula, and a first image
Exercises 10

Lecture 9:
Theory (3.5; Kearey 4.9): diffraction and migration of reflection data

~~Lecture 10:~~
~~Theory (chapter 4): a brief review of noise~~

Over the course of Part II, students will be working on a “synthesis homework” consisting of questions covering all the theory learned in Lectures 1-10. Completion of this synthesis homework is mandatory to be allowed to take the exam. Thus, it must be completed and approved by the instructor prior to the exam. This homework can be executed either individually or in teams of two students.