

# GEOL 5730: Seismic Data Processing

Spring 2009, 3 units

Meeting Times: M-W 11-12:15

Instructor:	Dr. W. Steven Holbrook	Office:	ESB 3016
		Office Hours:	M 2-3 pm, W 11-12 am Th 10-11 am
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## Course description:

In this course you will learn to create images of the Earth from seismic reflection data. We will take a hands-on approach, using weekly computer-based labs to introduce the principal steps of seismic data processing. The emphasis will be on gaining practical experience at processing large data sets, rather than on the mathematics of the algorithms, but the labs will be supplemented with lectures and readings on critical material. By the end of the semester, you will be capable of processing a seismic reflection data set from raw gathers to a stacked, migrated section.

The course will consist of 9 weeks of weekly lectures and labs, during which you'll learn the basic steps of data processing, followed by a 3-week period during which you'll work on your final project (supplemented with lectures on special topics).

You will process a marine seismic data set of your choice, selected from one of our own cruises. Options include: a data set across the Storegga Slide off Norway, a crustal-scale data set on a rifted continental margin (the Newfoundland Basin), and a data set on the margins of Costa Rica (both the Caribbean and Pacific).

## Software:

There are many software packages for processing seismic data – from freeware to expensive commercial packages. In this course we will use one of the latter – the Focus package of Paradigm Geophysical. We will also use several other utility programs, mostly for plotting and browsing data files. You must have (or acquire) a basic understanding of Unix.

In addition, we will use one or more of the following visualization programs to interpret seismic data: the Kingdom Suite; GeoFrame.

Time allowing, we will have an introduction to pre-stack depth migration using the Paradigm GeoDepth package.

## Computers:

You will use one of four Unix workstations in the Seismology lab, multi-processor Sun Ultra 80's called adak, tanaga, beothuk, and arenal. You can access these computers from any workstation you wish that has X-window capabilities. Due to limitations in disk space, processor capacity, and software licenses, please refrain from using these computers for anything other than work directly related to this course.

## Reading Materials:

There is no required textbook for this course, but reading materials will be distributed in class. You are responsible for reading all handouts; you will find the material in them indispensable for understanding the processes you will apply to your data sets.

Two textbooks you may find useful are:

1. *Seismic Data Processing*, O. Yilmaz, published by the Society of Exploration Geophysicists.
2. *Exploration Seismology*, R.E. Sheriff and L.P. Geldart, Cambridge University Press.

### Course requirements:

*Attendance.* There is no strict attendance policy; however, it is strongly advised that you attend all classes.

*Grades.* There will be no exams in this class. Your grade will be based solely on your lab reports and final project:

Lab Reports	=	70% of grade
Final Project	=	30 %

Labs turned in late without prior consent of the instructor(s) will be penalized 10% per day.

*Disabilities.* If you have a physical, learning, or psychological disability and require accommodations, please let us know as soon as possible. You will need to register with, and provide documentation of your disability to, University Disability Support Services (UDSS) in SEO, Room 330, Knight Hall, 766-6189, TTY: 766-3073.

*Students and Teachers Working Together.* The College of Arts & Sciences has produced a document called “Students and Teachers Working Together” that describes expectations of both students and faculty regarding such issues as classroom deportment, academic honesty, attendance, office hours, and advising. We encourage you to download this document from the URL listed below and read it carefully.

[http://uwadmnweb.uwyo.edu/a&s/Current/2005Stud&TeachersWorking%20Together\(7-29-05\).doc](http://uwadmnweb.uwyo.edu/a&s/Current/2005Stud&TeachersWorking%20Together(7-29-05).doc)

Here is the first paragraph of that document, which describes the basic philosophy we will adhere to:

*“At a good university, good student/teacher relationships come from mutual respect, trust, and honesty. Learning takes place when teachers and students treat each other with politeness and civility, rather than with anger, ridicule, or confrontation. Indeed, a classroom conducive to teaching and learning is the right of all University of Wyoming students and faculty, and it is the responsibility of both parties to achieve and maintain it even though specifics will vary from course to course. This document, Students and Teachers Working Together, provides some guidelines for carrying out that responsibility.”*

### Labs (preliminary schedule)

- 1: "Trust me, it's SEG Y"  
Seismic data formats
2. *Visualization and gain*  
Introduction to the Focus processing platform  
Data Visualization and gain functions

3. *Geometry*

Offset, CMP, and the Data Cube

4. *Cleaning up noise*

Signal & Noise

Mutes and filtering

5. *Deconvolution*

Compressing the Wavelet: Approaches, costs, and pitfalls

6. *Velocity analysis, NMO, and stacking*

What are all those different velocities anyway? ( $V_{rms}$ ,  $V_{stack}$ ,  $V_{int}$ )

7. *DMO*

How does dip affect stacking velocities?

8, 9. *Migration*

The Zero-Offset Section (exploding reflector)

Time vs. Depth

10. *Multiple suppression*

Special approaches to killing the water column