

Seismic data processing involves a chain of computational steps performed between acquisition and interpretation of seismic data. This is a hands-on course, where we will process several datasets in order to develop an understanding of the basic principles of seismic reflection data analysis and to gain computational skills in analyzing field data.

As a course project assignment, your team will process a field dataset of your choice and will present the processing results to the class.

This course carries the *Quantitative Reasoning* flag. Quantitative Reasoning courses at UT Austin are designed to equip you with skills that are necessary for understanding the types of quantitative arguments that you will regularly encounter in your professional life.

Class objectives:

1. To familiarize students with key concepts in seismic data analysis.
2. To develop data analysis skills through hands-on experience.
3. To uncover research areas that are open for further investigation.

Key Topics: In his book *Seismic Data Analysis*, Oz Yilmaz identifies three basic transformations involved in seismic data processing: deconvolution, stacking, and migration.

Deconvolution attempts to improve temporal resolution by collapsing seismic wavelets and suppressing reverberations. Historically, it was the first successful application of computers and digital signal processing in geophysics.

Stacking takes advantage of redundancy (multiple coverage) in seismic observations and serves the dual purpose of noise suppression and velocity estimation. It is typically combined with additional steps for near-surface corrections and coherent-noise attenuation.

Migration moves seismic events recorded at the surface to their subsurface locations. It is an imaging process, which improves seismic resolution by focusing diffraction events. The quality of migration output strongly depends on the accuracy of velocity estimation.

Processing of data acquired on land differs from processing of marine data. Land-data processing involves elevation corrections, corrections for near-surface velocity variations, and suppression of surface waves. The key problem in marine-data processing is suppression of surface-related multiple reflections.

There are also important differences in processing data from classic 2D seismic profiles and modern 3D acquisition schemes. 3D data are typically acquired at irregularly sampled surface locations and involve a data regularization step in processing.

In this course, we will gain experience in processing both land and marine datasets and both 2D and 3D acquisitions.

Meetings:

Tuesdays and Thursdays, 2:00–3:30, by Zoom and in JGB 3.204.

Instructor:

Sergey Fomel

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Phone: (512) 913-6826

Office hours: by appointment.

Prerequisites:

Basic mathematics (calculus, linear algebra, probability theory), time series analysis (GEO 325K or equivalent), seismic exploration (GEO 465K or equivalent). Computer programming experience is helpful.

Textbook:

Seismic Data Analysis by Oz Yilmaz: Society Of Exploration Geophysicists, 2nd Edition, 2001, ISBN 1560800941.

Available in a wiki form at http://wiki.seg.org/wiki/Seismic_Data_Analysis.

Software:

Madagascar open-source software package

Course Web Page:

Use **Canvas** and **GitHub**

Homework: Bi-weekly assignments with computer exercises.

Grading:

50% homework assignments

50% data processing project

100%

Spring break:

March 14-19.

Data processing project presentation:

To be announced.

Students with disabilities:

The university is committed to creating an accessible and inclusive learning environment consistent with university policy and federal and state law. Please let me know if you experience any barriers to learning so I can work with you to ensure you have equal opportunity to participate fully in this course. If you are a student with a disability, or think you may have a disability, and need accommodations please contact Services for Students with Disabilities (SSD). Please refer to SSD's website for contact and more information: <http://diversity.utexas.edu/disability/>. If you are already registered with SSD, please deliver your Accommodation Letter to me as early as possible in the semester so we can discuss your approved accommodations and needs in this course.