

GEOP 5375: Quantitative techniques in geological sciences

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Textbook: "MATLAB recipes for Earth Sciences" by Trauth, as supplementary reading. An older version is available free online. Multiple other sources.

Overall Goals:

- Introduce geosciences broadly in terms of data types, and not specific fields
- Learn basic coding structures and logic in Matlab
- Instill a research-oriented mentality in applying mathematical models and data statistics to various geoscience problems

Skills:

- Learn various forms of data statistics, time series analysis, spatial data set methods, and apply them to individual student projects.
- Gain an understanding of broad methods applicable to data sets from a range of earth science fields.

Structure:

Lecture material is sourced from several references, and comprises of the mathematical background for lab-based coding assignments. Lectures are held Tuesdays, and accompanying labs are held Thursdays.

Course Outline:

The course is segmented into three broad themes: Scattered data and statistics, Time series data, and spatial data.

Scattered data and statistics:

- Univariate statistics (distributions, statistical tests)
- Bivariate statistics (regression, residuals, linear inversions, simple non-linear inversions)
- Geological, geochemical, and sedimentology data sets

Time Series:

- Fourier theory, filters, wavelet transforms
- Correlation, convolution
- Seismic data, GPS data, gravity, satellite transmissions signatures
- Examples of time series processing techniques (seismic interferometry, receiver functions, GPS satellite tracking)

Spatial data:

- Multivariate statistics, dimensional reduction and basis function modeling
- SVD, PCA, 2D filters, and matrix factorization
- Geospatial mapping of atmospheric, elevation, and weather data sets
- TBD**

Projects:

Class projects will be oriented towards thesis/dissertation topics (for graduate students), and career aspirations (for undergraduate students). Emphasis will be put on producing short trial papers as class projects, and will form the majority of the grade.

Grading:

Lab assignments:	40 percent
Term projects:	60 percent

Students with Disabilities: If you think you may have a disability or if you are experiencing learning difficulties, please contact the Center for Accommodations and Support Services (CASS) at (915) 747-5148 (voice or TTY), in Union East Room 106, or by e-mail at cass@utep.edu. They will provide any necessary accommodations. You should also meet with me in order to facilitate your needs. You are expected to provide documentation of your disability in order to make special arrangements in this class.

Academic Honesty and other issues: The Geological Sciences Department has gone to great lengths in order to make learning the material easier than engaging in scholastic dishonesty, which is defined in the UTEP Student Handbook and also at <http://sa.utep.edu/osccr/academic-integrity/>. Proven violations of these detailed regulations may result in any of the consequences outlined in the Student Handbook. Cellular phones are to be turned off or placed in silent mode during class. Conducting telephone conversations or extensive text messaging during class time may result in disciplinary action.