



# USC University of Southern California

## GEOL 440: Geophysics and Geoengineering

### Description

**Units:** 4

**Term:** Spring 2022

**Lectures:** Tu/Th 2:00-3:20 pm

**Location:** ZHS 118 (Zumberge Hall, first floor)

**Labs:** Fri 9:00-10:50 am

**Location:** ZHS B65 (Zumberge Hall, downstairs)

**Field trip:** February 11-13, 2022.

**Location:** Mojave National Preserve.

**Instructor:** Sylvain Barbot ([sbarbot@usc.edu](mailto:sbarbot@usc.edu))

**Office Hours:** (upon appointment).

### Course Description

The course provides a quantitative introduction to important concepts of geophysics. We will define plate tectonics and the lithological, mechanical, and thermal properties of the oceanic and continental lithospheres. We will describe the deformation that occurs at active plate boundary through faulting, folding, and volcanic unrest. Elements of data analysis will be covered in the labs, including building maps, time-series analysis, Fourier methods, solving partial differential equations, and least-squares fitting. The course includes a field trip at the Mojave National Preserve, illustrating volcanism and surface processes.

### Field Trip

The course includes a 3-day field trip involving two nights of camping at the Mojave National Preserve. Transportation with the Earth Department suburban vehicles. Basic camping equipment provided. Must bring your own tent and personal gear. The following schedule is tentative.

Day 1: Transportation to the Mojave Desert and 3-hour hike in and around Amboy Crater, a 10,000 year-old cinder cone surrounded by lava field (-115.790698, 34.544631). Set camp at Hole-in-the-Wall campground.

Day 2: Visit cinder cone lava beds and lava tubes (-115.751563, 35.216300). 3-hour hike at Kelso Dunes (-115.699180, 34.892123).

Day 3: Guided tour of Mitchell caverns at Providence Mountains State Recreation Area (-115.513242, 34.943765) and back to USC.

## Learning Objectives

By the end of this course, the students will be introduced to a quantitative description of Earth's dynamic processes, including deformation, heat transport, and wave propagation. The students will be familiarized with data processing techniques, including time series analysis, data fitting, and map design.

## Prerequisites:

MATH 126 and 1 from PHYS 135B or PHYS 152.

## Communication

Regular communication will be conducted through Blackboard (<https://blackboard.usc.edu>).

## Lectures

From Tuesday, January 11<sup>th</sup> to Thursday, April 14<sup>th</sup> 2022 there will be **24 lectures**. Spring recess is March 13-20. The lectures of February 8 and February 10, 2022 are cancelled in preparation for the field trip.

## Examinations

The grades will be based on attendance (50%) and lab work (50%).

## Required Materials

Access to a Posix computer with scientific computing tools (Matlab, Python) is required.

## Assignments

There will be no assignments outside those provided in the labs.

## Academic integrity

University policies on academic dishonesty are printed in SCAMPUS. Because cheating negatively affects everyone in the class, we will follow USC guidelines and report all academic misconduct. USC policies on cheating are strict and the minimum punishment is failure in the class and possible expulsion. Please don't make us have to turn you in! And remember that even the appearance of impropriety can be a concern.

More information at <https://policy.usc.edu/scampus/>.

## Classroom norms

Student participation during lecture and laboratories and encouraged. Always feel free to ask questions and clarifications. Active participation in the laboratories is absolutely necessary.

## Lecture outline

- 01-06 Plate tectonics, structure of the lithosphere, oceanic and continental crusts.
- 07-14 Tectonic deformation, types of faults, faulting and folding, volcanisms, earthquakes.
- 15-20 Wave propagation, seismic sources.
- 21-24 Heat transport, heat flow, mantle convection.

Lecture content is subject to change without warning.

## Textbook

Turcotte, D.L. and Schubert, G., 2002. Geodynamics. Cambridge university press.