

SIO108 Introduction to Paleoclimatology
Fall Quarter, 2016
Vaughan Hall 100, Scripps Institution of Oceanography

Course Instructor: Dr. Jane L. Teranes, LSOE, Scripps Institution of Oceanography

Contact Information: Office: Old Scripps Building, second floor; Office hours: Tuesday/Thursdays after or by appointment.

email: jteranes@ucsd.edu, phone: (858) 822-2099.

Course Description: An introduction to basic principles and applications of paleoclimatology, the study of climate and climate changes that occurred prior to the period of instrumental records. A review of processes and archives of climate data will be investigated using examples from Earth history.

Rationale and goals: Paleoclimate records provide the necessary context for understanding long-term climate variability and for assessing extreme climate conditions. Such longer perspectives on climatic variability can be obtained by studying natural phenomena that are modulated by climate and that leave a lasting mark in the geologic record. This survey course covers an introduction to the methods of paleoclimate reconstruction and the current state of knowledge about the paleoclimate history of the Earth- from the early Earth to the recent climate change. Topics include an evaluation of climate forcings and response as well as a comprehensive examination of the theory and assumptions inherent in the most commonly used methods for reconstructing paleoclimate data. The goal of this course is to provide a foundation in the study of and current research in paleoclimatology, and provide the background to understand how paleoclimatology can inform policy-making related to current and future climate change.

Objectives: Upon successful completion of this course, students will be able to:

- Be able to identify climate forcings and responses.
- Discuss the various components of Earth's climate system, such as the cryosphere, atmosphere, biosphere, and hydrosphere. Develop a mechanistic understanding of complex component interactions and have the ability to map out both negative and positive feedback loops.
- Investigate the variable time scales upon which different climate processes occur and understands as residence time, and periodicity.
- Discuss tools and techniques used to interpret changes in Earth's climate through geologic time.
- Recognize and critique modern paleoclimate studies through the use of primary literature in climate science.

Course Grade and Description:

Assignments (20%); Midterm (20%); Research Paper and Presentation (20%); Participation (10%)
Final (30%)

Textbook: *Earth's Climate: Past and Future* 3rd edition, William Ruddiman.

Overview of topics:

Week 1. Fundamentals of Paleoclimate

Topics: Geologic time, climate system, feedbacks

Reading: Chapters 1-2

Week 2: Climate archives

Topics: Ice cores, sediment archives, speleothems, geochemistry, biota, data modeling.

Reading: Chapters 2-3

Week 3. Climate Change on tectonic scales: Processes and Examples

Topics: Plate tectonics, weathering, CO₂ and other greenhouse gases

Examples: Snowball Earth, Supercontinents, Himalayas/Tibetan Plateau

Reading: Chapters 4-5

Week 4: Greenhouse World and Icehouse World

Topics: Cretaceous, Paleocene-Eocene Thermal Maximum, Middle Miocene Climate Transition

Reading: Chapter 6-7

Week 5: Orbital Scale Climate Change

Topics: Milankovitch cycles, high resolution climate records

Reading: Chapter 8-10

Week 6: Orbital Scale Climate Change

Topics: Orbital-interactions, feedbacks

Reading: Chapters 11-12

Mid-Term Exam: Tuesday Nov. 8 (covering lecture material and Part I – III in the textbook)

Week 7: Climate During and Since the Last Glacial Maximum and Deglaciation

Topics: Glacial geomorphological records, deep-sea records, ice cores

Examples: Heinrich events, Dansgaard-Oeschger Cycles, Younger Dryas Event

Reading: Chapter 13-14

Week 8: Millennial Oscillations in Climate and Climate Change over the last 1,000 years

Topics: Millennial Oscillations, the Medieval Optimum, the Little Ice Age

Reading: Chapter 15, 17

Week 9: Humans and Climate

Topics: Human civilizations and climate, recent climate change

Reading: Chapter 16, 18

Week 10: Student presentations and topics, Final Review

Schedule and important dates:

Lectures: TTH 12:30-1:50pm, Vaughan Hall 100, Scripps Institution of Oceanography

Mid-Term Exam: Tuesday Nov. 8 (covering lecture material and Part I – III in the textbook)

Student presentations: November 29, Dec 1 (more information to follow)

Final Exam: Friday Dec 9th, 11:30-3pm