GEOL484/IB 484: Paleoclimatology **Fall 2018**
Credit Hours: 4
Pre-requisites: None
This course meets requirements for the Geology Major or Minor

Class time:Tue+Thu, 12:00-1:50 PM
Location: Davenport 122
Professor: Jessica Conroy
jconro@illinois.edu
217-244-4855
Office: 3042 NHB
Office hours: Mondays 10AM-11AM. Or by appointment.

Attendance Policy: Attendance is mandatory and is taken in each class. If you miss class, provide Dr. Conroy with a reason for your absence, ideally before class. Part of your grade is based on in-class activities and participation. You will lose points for the day's activity with an unexcused absence. Make up exams will be permitted if an appropriate absence excuse is given.

Course Information

This course surveys the history of climate change on Earth. We will consider both observational and model evidence for past climate change on million-year to interannual timescales, and the natural, external, internal, and anthropogenic mechanisms behind these climate changes. The motivation and lens of this inquiry will be current and future greenhouse-gas driven climate change.

Student Learning Outcomes

By the end of this course, students will:

- Have knowledge of the history of Earth's atmosphere and ocean variability on million-year to interannual timescales, and understand the forcings behind these climate responses
- Have learned about physical, chemical and biological paleoclimate archives, the measurements within each archive type that are used to reconstruct past climate change, and the strengths and weaknesses (uncertainties) of each
- Learn how to apply common statistical treatments, including age models, to paleoclimate data
- Be able to read and evaluate primary scientific literature
- Understand and communicate to both scientists and the general public how paleoclimate information can be used to inform projections of future climate change

Course Materials:

- Textbook: ***Earth's Climate: Past and Future***, W. Ruddiman. 3rd edition. One copy on Reserve at Grainger Library.

- Papers made available on the course webpage (Compass2G)

Date	Topic	Reading
8/23/16	The past as prologue	
8/25/16	The climate system: key circulation patterns and forcing factors	*Ruddiman Ch 1* *Ruddiman Ch 2*
8/30/16	Paleoclimate proxies: an overview	*Ruddiman Ch 3*
9/1/16	CO_2 and climate *Student paper presentation 1: Snowball Earth*	*Ruddiman Ch 4* *Hoffman and Schrag (2002)*
9/6/16	Plate tectonics and climate *Student paper presentation 2: Tibetan Plateau Uplift and Cenozoic Climate*	*Ruddiman Ch 5* *Garzione (2008)*
9/8/16	Greenhouse to Icehouse *Student paper presentation 3: C4 plants*	*Ruddiman Ch 6* *Ruddiman Ch 7* *Cerling et al. (1997)*
9/13/16	Paleocene-Eocene Thermal Maximum *Student paper presentation 4: Ocean acidification at the PETM*	*Penman et al. (2014)*
9/15/16	Orbital forcing of climate *Student paper presentation 5: Glacial cycles and ocean crust production*	*Ruddiman Ch 8* *Crowley et al. (2015)*
9/20/16	The Last Glacial Maximum *Student paper presentation 6: LGM Ice sheet extent and sea level rise*	*Ruddiman Ch 13* *Clark et al. (2009)*
9/27/16	Deglaciation *Student paper presentation 7: CO_2 and Climate- last deglaciation* *Student paper presentation 8: Penultimate deglaciation ITCZ shifts*	*Ruddiman Ch 14* *Shakun et al. (2012)* *Jacobel et al. (2015)*
9/29/16	Interglacials *Student paper presentation 9: Interglacial sea level rise*	*Dutton et al. (2012)*
10/4/16	Millennial variability *Student paper presentation 10: Icelandic loess and millennial climate variability*	*Ruddiman Ch 15* *Jackson et al. (2005)*
10/6/16	The Last 1000 years	*Ruddiman Ch 17*
10/11/16	**MIDTERM**	
10/13/16	Past Monsoon Variability *Student paper presentation 12: East Asian Monsoon-North Atlantic connections*	*Ruddiman Ch 9* *Liu et al. (2013)*
10/18/16	The El Niño-Southern Oscillation *Student paper presentation 13: Holocene ENSO variability*	*Cobb et al. (2013)*
10/20/16	Annular Modes *Student paper presentation 14: Southern*	*Abram et al. (2014)*

	Annular Mode over last millennium	
10/25/16	Alphabet Soup: other climate modes ***Final project ideas due: go over ideas in class***	
10/27/16	Drought *Student paper presentation 15: North American Drought Atlas*	*Cook et al. (2004)*
11/1/16	Climate syntheses and large-scale reconstructions *Student paper presentation 17: Continental-scale temperature over the last 2000 yrs*	*PAGES2K group (2013)*
11/3/16	Climate Models	
11/8/16	Humans and Climate *Student paper presentation 19: Megafauna extinction, climate change, and humans*	*Ruddiman Ch 16* *Sandom et al. (2014)*
11/10/16	A Geological Perspective of the Anthropocene *Student paper presentation 20: Maya Analog to the Anthropocene?*	*Beach et al. (2015)* *Ruddiman Ch 18* *Ruddiman Ch 19* *Ruddiman Ch 20*
11/15/16	Wrap-up *Student Final Presentations [3]*	
11/17/16	*Student Final Presentations [5]*	
11/22/16	THANKSGIVING BREAK	
11/24/16	THANKSGIVING BREAK	
11/29/16	*Student Final Presentations [5]*	
12/1/16	*Student Final Presentations [4]*	
12/6/16	**FINAL EXAM**	

Grading:
20% Midterm
30% Final
20% Final project
20% Paper presentation
10% class participation

Exam Format:

Both exams will be similar in length and format. They will include matching, true/false, short answer, and 1-2 short essays. Final is cumulative.

Final Project:

The final project will be a 20-minute presentation on a topic of your choosing. The presentation itself should be 15 minutes in length, leaving 5 minutes for questions from the class. I expect you to develop a topic and a research question independently (but please talk to me if you feel uncertain about what to investigate). We will present our preliminary research ideas in class on 10/25/16, and provide feedback to one another. Treat this project like you would a term paper, reading the literature carefully and critically, developing a thesis, and conclusions. See rubric for assessment.

Paper Presentation:

Each student is responsible for leading one discussion on an assigned scientific paper during the course of the semester. This is not a trivial task, as scientific papers can be challenging to comprehend even for seasoned scientists. So, start early, and read your paper several times so you deeply understand it, and more importantly, can clearly communicate its importance and main conclusions to the class. After a 10-15 minute overview of the paper content (see grading rubric below), we will have an open discussion for the remaining class time. Your job as presenter will be to help me facilitate the discussion. Come with prepared questions to promote discussion with your fellow classmates.

Class participation:

We will be discussing each paper after the initial overview by the presenter. Your job is to read the paper, and come with your own questions (you should have lots!) and opinions. During lecture, please speak up if you don't understand something or have a question.

Cheating - Cheating of any kind is not tolerated. Examples of cheating include (but are not limited to): using an exam from previous year to study, removing an exam from the examination room, describing exam questions to someone who has not taken it yet, looking at notes during an exam, and giving or receiving aid of any kind during an exam. If you have any questions about what constitutes cheating or if you observe someone cheating, talk to an instructor.

Disability Accommodation - To obtain appropriate accommodation, students with disabilities (physical or learning) must contact Division of Disability Resources and Educational Services (DRES) at Beckwith Hall, 201 E. John St., Champaign (333-4603, disability@illinois.edu, <http://www.disability.illinois.edu/>). Students must complete a form provided by DRES and deliver it to Prof. Conroy explaining what accommodation is needed. No accommodation can be made without this form.

Paper Presentation Rubric

	Score
Content (10 pts): Overview and general significance of paper Methods used (measurements made, and statistics) Key uncertainties Main conclusions Your opinion on paper/topic	
Preparedness (5 pts): Organization of presentation Effective visual aids/handouts For paper: Prepared discussion questions for class (aim for 5)	
Communication (5 pts): Posture, eye contact, enthusiasm Fielding questions from class/interaction with class Promoting discussion Clarity of speech (volume, pronunciation)	
Total **(20 pts possible)**	

<u>Final Presentation Rubric</u>

	Score
Content (10 pts): Overview and general significance of topic Quality of your Research Question Adequate citation of literature (refs slide at end, for figures from papers, provide reference) Main conclusions	
Preparedness (5 pts): Organization of presentation Effective visual aids/handouts	
Communication (5 pts): Posture, eye contact, enthusiasm Fielding questions from class/interaction with class Clarity of speech (volume, pronunciation)	
Total **(20 pts possible)**	

Paper Sign up

	Date	Paper	Student
1	9/1/16	Hoffman and Schrag (2002)	Griffin
2	9/6/16	Garzione (2008)	Lai
3	9/8/16	Cerling et al. (1997)	Martin
4	9/13/16	Penman et al. (2014)	Romero
5	9/15/16	Crowley et al. (2015)	Gabel
6	9/20/16	Clark et al. (2009)	Shaw
7	9/27/16	Shakun et al. (2012)	Wyman
8	9/27/16	Jacobel et al. (2015)	Felch
9	9/29/16	Dutton et al. (2012)	Mannion
10	10/4/16	Jackson et al. (2005)	Wyszkowski
~~11~~	~~10/6/16~~	~~Richey et al. (2016)~~	
12	10/13/16	Liu et al. (2013)	Hatami
13	10/18/16	Cobb et al. (2013)	Mason
14	10/20/16	Abram et al. (2014)	Perciballe
15	10/27/16	Cook et al. (2004)	Sutherland
~~16~~	~~10/27/16~~	~~Dixit et al. (2014)~~	
17	11/1/16	PAGES2K (2013)	Sivapalan
~~18~~	~~11/3/16~~	~~Thompson et al (2011)~~	~~Burton~~
19	11/8/16	Sandom et al. (2014)	Valpey
20	11/10/16	Beach et al. (2015)	Zhang