

GEOL 484 / IB 484: Paleoclimatology

Credit: 4 hours

Fall 2015, T Th

1:00-2:50 PM

Classroom:

Instructor: Jessica Conroy

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Office hours: Tue 4-5 or by appointment

Course Description:

Survey of Earth’s past climate variability, ranging from million-year to interannual time scales. Introduction to paleoclimate proxies from tree rings, marine and lake sediment cores, ice cores, corals, and speleothems. Focus on the drivers of climate change, major modes of climate variability, and how paleoclimate data can inform projections of future climate change.

Course Goals:

By the end of this course, students will have learned:

- the history of Earth’s atmosphere and ocean variability on million-year to interannual timescales
- the nature of physical, geochemical, and biological proxies used to reconstruct past climate change
- statistical treatments, including age models and uncertainties, for paleoclimate data
- 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.

And papers (see list below) made available on the course webpage (Compass2G)

Grading:

Paper Presentations: 20% (2 presentations)

Final Paper: 30%

Final Project Presentation: 10%

Class Participation: 10%

Midterm: 15%

Final: 15%

Grade	Percent
A	94–100
A-	91–93
B+	87–90
B	84–86
B-	81–83
C+	77–80
C	74–76
C-	71–73
D+	67–70
D	64–66
D-	61–63
F	0–60

Schedule:

Date	Topic	Readings	Lead
8/26/14	The past as prologue	Masson-Delmotte 2013 (IPCC AR5 Ch 5)	Conroy (lecture)
8/28/14	The climate system: key circulation patterns and forcing factors	<i>Ruddiman Ch 1</i> <i>Ruddiman Ch 2</i> <i>Ruddiman Ch 3</i>	Conroy (lecture)
9/2/14	Pre-Quaternary: Snowball Earth	Hoffman et al (1998) <i>Ruddiman Ch 4</i>	Conroy (lecture)
9/4/14	Pre-Quaternary: Climate and tectonics	Raymo and Ruddiman (1992) Berner et al (1983) <i>Ruddiman Ch 5</i>	
9/9/14	Pre-Quaternary: PETM	Zachos et al (2003) <i>Ruddiman Ch 6</i>	Conroy (lecture)
9/11/14	Pre-Quaternary: PETM cont.; greenhouse to icehouse	Higgins and Schrag (2006) Zachos et al. (2001) <i>Ruddiman Ch 7</i>	
9/16/14	Orbital scale: astronomical forcing	Hays et al (1976) <i>Ruddiman Ch 8</i>	Conroy (lecture)
9/18/14	Orbital scale: Glacial-interglacial cycles	Huybers and Wunsch (2006) EPICA (2004) <i>Ruddiman Ch 10</i>	
9/23/14	LGM and deglaciation	Shakun et al., 2012 <i>Ruddiman Ch 13-15</i>	Conroy (lecture)
9/25/14	LGM and deglaciation	Bond et al (1995) Clark et al (2009)	
9/30/14	The Holocene-millennial trends	Haug et al (2001) Mayewski et al (2004)	Conroy (lecture)
10/2/14	The Holocene-abrupt climate change	Alley et al (1997) Dixit et al (2014)	
10/7/14	Monsoons	Wang et al (2008) Carolin et al (2013) <i>Ruddiman Ch 9</i>	Conroy (lecture)
10/9/14	Monsoons	Wang et al (2005) Sinha et al (2011)	
10/14/14	ENSO-Holocene	Carre et al (2014) <i>Ruddiman Ch 17</i>	Conroy (lecture)

10/16/14	ENSO-last millennium	Cobb et al (2003) Yan et al (2011)	
10/21/14	ENSO teleconnections; Decadal to centennial Pacific variability, PDO	Graham et al (2011) Ault et al. (2013) <i>Ruddiman Ch 18</i>	
10/23/14	MIDTERM		
10/28/14	Extratropical Modes: AMO	Gray et al (2004) <i>Ruddiman Ch 17</i>	Conroy (lecture)
10/30/14	Extratropical Modes: NAO	Shindell et al (2001) Trouet et al (2009)	
11/4/14	Extratropical Modes: SAM and NAM	D'Arrigo et al (2003) Abram et al (2014)	Conroy (lecture)
11/6/14	Westerly winds/Southern Ocean/carbon	Sigman and Boyle (2000) Anderson et al (2009)	
11/11/14	Drought reconstruction: North America	Cook et al (2007)	Conroy (lecture)
11/13/14	Drought reconstruction: Asia	Cook et al (2010) Pederson et al (2014)	
11/18/14	Temperature reconstruction	Mann et al (1998)	Conroy (lecture)
11/20/14	Climate syntheses	Mann et al (2009) Ahmed et al (2013)	
11/25/14	THANKSGIVING BREAK		
11/27/14	THANKSGIVING BREAK		
12/2/14	presentations		
12/4/14	presentations		
12/9/14	presentations		

Paper Presentations

Each student is responsible for presenting **2 papers** throughout the semester. The goal of this exercise is to teach you how to *critically* read the primary literature, and sharpen your scientific communication skills.

Evaluation Metric:

Did your presentation accurately convey the content of paper? (Main point, figures, methodology, results)

Presentation style: were you articulate? Did you know what you were talking about? Could I see the figures you put up?

Opinions and context: I want to see here that you thought deeply about the paper—do you have opinions? Can you place this paper in a larger scientific context?

Back up (part of participation grade):

For each paper, I will also have one student as ‘back up,’ in case the lead presenter cannot make it. I will evaluate you on how well you participate in questions/discussion, and how well you answer my questions.

Schedule:

	Date	Paper	Student
1	9/2/14	Hoffman et al 1998	
2	9/4/14	Raymo and Ruddiman 1992	
3	9/4/14	Berner et al 1983	
4	9/9/14	Zachos et al 2003	
5	9/11/14	Higgins and Schrag 2006	
6	9/11/14	Zachos et al 2001	
7	9/16/14	Hays 1976	
8	9/18/14	EPICA 2004	
9	9/18/14	Huybers and Wunsch 2006	
10	12/4/14	Shakun et al 2012	
11	9/25/14	Bond et al 1995	
12	9/25/14	Clark et al 2009	
13	9/30/14	Haug et al 2001	
14	9/30/14	Mayewski et al 2004	
15	10/2/14	Alley et al 1997	
16	10/2/14	Dixit et al 2014	
17	10/7/14	Wang et al 2008	
18	10/7/14	Carolin et al 2013	
19	10/9/14	Wang et al 2005	
20	10/9/14	Sinha et al 2011	
21	10/14/14	Carre et al 2013	
22	10/16/14	Cobb et al 2003	
23	10/16/14	Yan et al 2011	
24	10/21/14	Graham et al 2011	
25	10/21/14	Ault et al. 2013	
26	10/28/14	Gray et al 2004	
27	10/30/14	Shindell et al 2001	
28	10/30/14	Trouet et al 2009	
29	11/4/14	D’Arrigo et al 2003	
30	11/4/14	Abram et al 2014	

31	11/6/14	Sigman and Boyle 2000	
32	11/6/14	Anderson et al 2009	
33	11/11/14	Cook et al 2007	
34	11/13/14	Cook et al 2010	
35	11/13/14	Pederson et al 2014	
36	11/18/14	Mann et al 1998	
37	11/20/14	Mann et al 2009	
38	11/20/14	Ahmed et al 2013	

Final Paper and Presentations

Students will be responsible for a final paper and class presentation on a topic of their choosing. Students are expected to discuss their potential topic ideas at my office hours early in the semester.

Paper: 10-15 pages (excluding references), double-spaced, Times New Roman font, 1” margins.

Paper will be evaluated on:

- Formatting
 - o Introduction, body, conclusion, references
- Developed thesis statement/hypothesis testing
- Organizational structure (coherent paragraphs, sentences, and transitions)
- Grammar
- Adequate and proper citation of the literature

Presentation: 15 minutes in length, professional conference-style talk. High quality presentation slides expected (details and examples will be presented in class)

Online Paleoclimate Data Resources

<http://www.ncdc.noaa.gov/data-access/paleoclimatology-data/datasets>

<http://www.pangaea.de/>

<http://www.neotomadb.org/>

- **Attendance Policy** - Regular class attendance is expected of all students. Please contact the advisor in advance if you must miss class to late work and make-up assignments
- **Cheating** - Cheating of any kind is not tolerated. **See 1-402: Academic Integrity Infractions** for more details (http://studentcode.illinois.edu/article1_part4_1-402.html)

- **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.