

GLOBAL CLIMATE CHANGE (ENVS 204-001)

Instructor: Professors Irina Marinov and Ben Horton.
Teaching Assistant: Marcie Occhi, PhD student

Contact: Irina Marinov: 254B Hayden Hall or imarinov@sas.upenn.edu
Ben Horton: 158 Hayden Hall or bphorton@sas.upenn.edu

Office Hours: by appointment

Global Climate Change fulfills the following requirements:

Quantitative Data Analysis (All Classes)

Sector VI-Physical World (Class of 2009 and earlier)

Sector VII-Natural Science and Mathematics (Class of 2010 and later)

Class meeting days/time and classroom assignment

Mondays, 2-5pm, lecture room CHEM B13.

Lab meeting days/time and classroom assignment

Wednesdays, 3-5pm, CHEM 514 and Meyerson B4.

Recommended Reading

1. The Earth System (3rd Edition), by Kump, Kasting and Crane. 2010, Prentice-Hall. This book you can buy at the bookstore (Penn Book Center at 34th and Walnut)
2. Encyclopedia of Quaternary Science
<http://www.sciencedirect.com/science/referenceworks/9780444527479>
3. IPCC Fourth Assessment Report (AR4) <http://www.ipcc.ch/>

Books on reserve at Van Pelt Library:

1. The Earth System (3rd Edition), by Kump, Kasting and Crane. 2010, Prentice-Hall. **(2 copies)**
2. The Climate Crisis: An Introductory Guide to Climate Change, by D. Archer and S. Rahmstorf. 2010, Cambridge U. Press.
3. Global Warming: Understanding the Forecast, by D. Archer. 2006, Wiley-Blackwell.
4. Climate Change 2007: The physical science basis
5. Climate Change 2007: Synthesis Report.

These last two are part of the IPCC Fourth Assessment Report, or AR4, and are also online at <http://www.ipcc.ch/>

6. "Atmosphere, Ocean and Climate Dynamics: An Introductory Text" by John Marshall and Alan Plumb, Academic Press 2008.

Overall Course Goal

To provide an understanding of the Earth's climate system and how and why this has changed through time. The emphasis will be placed on spatial and temporal scales in the modern system before exploring the evidence for past change, possible mechanisms to explain these changes, and the implications of these changes to past, present, and future global climates. The course aims to provide you with a sound understanding of the role of the various components of the climate system,

as well as providing a hands-on opportunity to undertake practical sampling work (land and marine based) and applied laboratory research methodology.

On successful completion of the module students are expected to be able to:

1. Reconstruct the history and scales of climate changes;
2. Appreciate the mechanisms that act to drive climate change;
3. Show an understanding of the long-term natural climate variability on a global and regional scale;
4. Understand the importance of natural environmental change, against which to assess human impacts, recent climate change and issues of future environmental change.
5. Assess future climate change's potential impacts and options for adaptation and mitigation

The core of the material is presented during one three-hour lectures during the semester followed by laboratory practicals.

Exam questions will only be drawn from materials and discussions presented in lecture and recitation.

We will post the major graphs and figures (as power point files or pdf files) for each lecture on blackboard (<https://courseweb.library.upenn.edu/>) under course documents the night before I present it. These files are lecture aids and not complete notes for the lecture. **You should print out the handouts before class and take notes directly on the printouts.** This is the most effective way to prepare for this class. With the printed figures and graphs in hand, you can concentrate on understanding the concepts and taking good notes without being distracted with having to redraw the figures or tables at the same time.

Grading

- Labs (including Lab participation) 30%
- Mid term exam #1 20%
- Mid term exam #2 20%
- Final Exam 30%

Labs

Labs will be Wednesdays (3-5pm). Please bring your laptops for all labs. Note that class and lab participation are mandatory. We will be recording your presence during labs and will be taking points off your Lab grade for missed labs.

Lab 1: Observational temperatures.

Lab 2: Paleoclimate.

Lab 3: Sea levels.

Lab 4: Energy balance

Lab 5: Oceanography

Lab 6: Hurricanes

You can turn in electronic versions of the labs (which include graphs, etc.), or you can print out your graphs and write your responses by hand.

On Wednesday 9/12, we will have an Excel tutorial taught by Anu Vedantham (Weigle Information Commons Director, Van Pelt Library). Please bring your laptop to this.

Mid Term #1: Monday 8th October;

Mid Term #2: Wednesday 14th November;

Final: Week of 12th December

Academic dishonesty and plagiarism

See the student handbook or go to <http://www.vpul.upenn.edu/osl/acadint.html>. In addition, you will be required to sign your exams and your signature will be verified for authenticity.

Policy on Religious Holidays

The University recognizes/observes holidays as listed on <http://www.vpul.upenn.edu/osl/holidays.html>.

If you observe any other holidays, please make special arrangements in person with your instructors within the first two weeks of class.

Class Schedule (subject to change), Monday 2-5pm & Wednesday 3-5pm

| Dates | Lecture | Dates | Lab |
|-------|---|---------------------|---|
| 09/10 | Climate change: physical science basis (BPH) | 09/12 | Excel Tutorial |
| 09/17 | Climate change: the mechanisms (BPH) | 09/19 | Observational temperatures (BPH) |
| 09/24 | Past climates: Ice cores (BPH) | 09/26 | Paleoclimate lab (IM) |
| 10/01 | Past climates: oceans (BPH) | 10/03 | Paleoclimate lab (IM) (and prep for mid term#1) |
| 10/08 | Mid term #1 | 10/10 | Paleoclimate lab (IM) |
| 10/15 | Past climates: sea level (BPH) | 10/17 | Sea levels (BPH) |
| 10/22 | <i>Fall Break</i> | 10/24 | Energy Balance of the planet (IM) |
| 10/29 | The global energy budget (IM), Svetlana talk on Satellite Stuff | 10/31 | Energy balance of the planet (IM) |
| 11/05 | The atmosphere and oceans in a changing climate Part 1 (IM) | 11/07 | Oceanography lab (IM) |
| 11/12 | The atmosphere and oceans in a changing climate Part 2 (IM) Adam Garber visit, PennEnvironment, 3:50pm. | 11/14 | Mid term #2 |
| 11/19 | A changing carbon cycle. Climate modeling. (IM) Daniele Bianchi, McGill (talk on ocean anoxia). | <i>Thanksgiving</i> | |
| 11/26 | Future climates. Climate modes of variability (IM) | 11/28 | Oceanography lab (IM) |
| 12/03 | Extreme events (BPH) | 12/05 | Hurricanes (BPH) (and prep for final) |

