**Syllabus**

**EAS 305(0): Climate Dynamics**

Examines processes that determine climate and contribute to its change, including atmospheric radiation, ocean circulation and atmospheric dynamics.


- Natalie Mahowald, Snee 2140, 607-255-5166 mahowald@cornell.edu
  http://www.geo.cornell.edu/eas/PeoplePlaces/Faculty/mahowald/
- Gang Chen, Bradfield 1115, 607-255-1503 gchen@cornell.edu
  http://sunspot.eas.cornell.edu/~gc352/


Lecture: MWF 12:20-1:10

Office hours: by appointment (please feel free to come by).

Course web site: we'll use blackboard, so please sign up.

**Course objectives**

- Describe and quantify energy budget of planet and surface
- Describe greenhouse effect quantitatively
- Describe quantitatively impact of water vapor, clouds, aerosols, surface albedo changes on climate
- Describe mean circulation, cause of mean circulation and heat transports of atmosphere and oceans
- Describe natural and anthropogenic climate change forcings and response quantitatively

**Grading:**

25% Homeworks (approximately weekly)
25% Class project and class presentation
20% Mid-term (October 8)
20% Final (at finals time)
10% Class attendance/participation

There will also be a graduate version of this course, requiring additional homework and project.

**Text book: Global Physical Climatology,** by Dennis Hartman . This book is required. It is on reserve at Engineering Library.

**Class project**

Students will form groups of 2-4 students to focus on one particular topic for their class project. The students will give a presentation in class, and submit a 5-10 page double spaced paper on their class project. September 27 the topic of the project, group names, outline and main references will be due, November 19, first draft of presentation is due. November 29, December 1 and 3 will be presentation days.

**Honor Code**

The Cornell Academic Integrity code is expected to be followed in this course. Students should submit their own work for academic credit. For homeworks and the class project, collaboration is allowed in the preparation, but students should be careful that they are contributing an equal share to these collaborations.

The course is co-taught by professors Mahowald and Chen in fall 2010.

**Syllabus**

I. **Introduction to the climate system (Chapter 1 and appendix B).**
August 25: Introduction to course
August 27, August 30: Introduction to the climate system (GPC 1-1.8, Appendix B)

II. **Global energy balance (Chapter 2)**
September 1: Energy flux
September 3: Discussion of IPCC summary for policy makers
September 8: black body radiation and green house effect
September 10: Global radiative budget, global distribution of radiation and heat transports

III. **Atmospheric radiative transfer and climate (Chapter 3.1-3.6,3.8-3.9)**
September 13: Introduction to radiation, gas interactions with radiation
September 15: Gas interactions with radiation and Beer's Law
September 17: Absorption equations/Radiative equilibrium
September 20: Lapse rate /Radiative-convective equilibrium
September 22: Clouds and radiation
September 24: Radiative transfer and climate: problems and solutions.

IV. **Energy balance of the surface (Chapter 4)**
September 27: Energy budget of surface, storage in surface
September 29: Discussion
October 1: Radiative heating of surface
October 4: Atmospheric boundary layer
October 6: Midterm review
October 8: Midterm
(Fall Break)

V. **Atmospheric General Circulation and climate (Chapter 6)**
October 13: Mean circulation
October 15: fluid dynamics
October 18: Rotating table demonstration of atmospheric circulation
October 20: Geostrophy/thermal wind
October 22: Discussion
October 25: Mean circulation/heat transports
October 27: Heat transports/zonal asymmetries

VI. **Ocean circulation and climate (Chapter 7)**
October 29: Mean circulation/temperature salinity diagrams
November 1: Wind driven circulation
November 3: Eddies in the oceans
November 5: Heat transports in the oceans

VII. **Feedbacks (Chapter 9)**
November 8: Radiative forcings and climate response
November 10: Water vapor feedbacks
November 12: snow/ice albedo feedbacks

VIII. **Climate change (Chapter 12/supplemental material)**
November 15: Glacial/interglacial climate change: forcings and response
November 17: Natural climate change: forcings and response
November 19: Anthropogenic climate change: forcings and response
November 22: Discussion
(Thanksgiving)

**Final presentations**
November 29, December 1, 3