

Syllabus: Climate and Global Change Fall 2012

EAS 8803 / 4410

Lecturers:

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Primary References:

Earth's Climate: Past and Future. Ruddiman

IPCC Fourth Assessment, sundry references and handouts

Secondary: Web sites, handouts.

Course philosophy:

My opinion on the causes of global warming is irrelevant. Nor is your opinion. I am concerned with your ability, and the ability of others, in defending their point of view from a solid physical basis. That is the aim of the course.

Course outline:

(A) A perspective on climate and climate change:

- Has climate changed over the most recent decades?
- Is this the result of anthropogenic influences, natural variability of climate or part of the long-term variability of climate forced, for example, by orbital changes in solar radiation?
- What do you think about global warming? An informal and anomalous poll.
- A discussion of mitigation, adaptation or ignoring?
- Policy choices: national energy independence vs reductions in fossil fuel.
- Developed nations versus less-developed nations.
- Population growth versus environmental change

(B) Basic elements of climate:

- Energy balance and heat transfer
- Radiation balance
- Radiative temperature and actual surface temperature,
- Climate feedbacks, tipping points and buffering.
- How do planets work? Our place in the universe.
- The nonlinearity of climate

(C) The spheres:

Current structure of the hydrosphere, atmosphere, ocean and cryosphere. What is the basic structure of each of the spheres in the present climate? How do they work and interact?

(D) Geochemical cycles

The climate of the planet is governed by a series of geochemical cycles that often interact. Of particular importance are the oxygen, water and nitrogen cycles. How these determine the present climate state and the climate of the past (and future?) will be studied extensively.

(E) Climates of the past (last several billion years to present)

- Paleoclimate tools and models
- A description of the evolving climate of the planet from formation to the present.
- The climate epochs
- What has caused long-term changes in climate? Solar variability (the Milankovich cycles) and the carbon cycle

(F) Recent climate change over the last 1000 years:

- Tools: models and data
- The “Medieval Warm Period” and the “Little Ice Age”
- The early 20th century warming
- The mid-20th century cooling
- The recent warming
- Differentiation between natural oscillations and forced changes

(G) Opinions

- The four International Panel on Climate Change (IPCC) assessments
- The view of the IPCC: the “consensus” perspective.
- Alternative views

(H) Dealing with Climate Change and Hazards

- Adaptation
- Mitigation
- Alternative energy sources
- Geoengineering: science fiction or a possibility

Course Evaluation:

Mid-terms (3 @ 20%), problems sets (20%) and term paper or group project.

Plagiarism is not an option

Class Format

It is important that each of you access the prescribed reading prior to the class. There will be some formal lecturing but a large part of the course will be thorough discussion and problem solving in which all of you will be participants. There will be formatted around work sheets.

Contacts All of us will be available for discussions at any time but we would prefer it if you could make an appointment: see above for contact information. The same rule applied for TA office hours.