

EAS 4410 – Climate & Global Change

Time & Place

2:00-2:50 MWF, ES&T L1175

Instructor

Dr. Jie He (E-mail: Jie.He@eas.gatech.edu; Office: ES&T 2232)

Office hours: appointment by e-mail

Grader / Homework help

Ziad Rashed (E-mail: zrashed@gatech.edu)

Course description:

Climate change is among the greatest challenges facing humanity today. The course breaks down the scientific underpinnings of how increasing atmospheric greenhouse gases affect the global climate. By looking at the problem of climate change from multiple angles, students get a decent view of how a modern climate scientist works. The course also addresses the impacts of climate change and discusses the pros and cons of potential solutions. By the end of the course, the student should have a well-rounded understanding of the modern climate change and will be able to make well-informed assessments of new developments as they arise.

Students will be exposed to science from different fields, but no prior knowledge of any of these fields is required. The course consists of 9 Chapters, arranged into four major themes of climate change: science, evidence, impact and solution. On average four lectures are devoted to each chapter, including three regular lectures where the instructor will teach the essential concepts and one discussion lecture where either the instructor will present a special topic or students will discuss previously assigned reading materials.

Textbooks

[Global Warming: Understanding the Forecast, 2nd Edition by D. Archer](#)

[Introduction to Modern Climate Change, 2nd Edition by A. Dessler](#)

Roughly 70% of the course material can be found from these 2 textbooks.

Course Material Overview

Introduction

1. Introduction to Climate Change
 - IPCC. Climate vs. weather.

Archer Chapter 7, Dessler Chapter 1

Science

2. Atmospheric Radiation
 - Energy. Electromagnetic waves. Blackbody radiation. Radiative properties of the atmosphere.

Archer Chapter 2, Dessler Chapter 3

3. Layer Model
 - Solar insolation. Energy balance. Greenhouse effect.

Archer Chapter 3, Dessler Chapter 4

4. Radiative Forcing

- The concept of radiative forcing. Radiative forcing from CO₂, methane, aerosols, etc.
- Archer Chapter 4, Dessler Chapter 6
5. Climate Feedbacks
 - The concept of feedback. Water vapor feedback. Ice albedo feedback. Cloud feedback. Lapse rate feedback.
- Archer Chapter 7, Dessler Chapter 6
6. Carbon Cycle
 - Source and sink. Carbon reservoirs. Atmosphere-ocean-land cycle. Human influence.
- Archer Chapter 8-10, Dessler Chapter 5

Evidence

7. Evidence of Global Warming
 - Temperature measurements. Paleoclimatology. Solar forcing. Internal Variability.
- Archer Chapter 11, Dessler Chapter 2

Impact

8. Impacts of Climate Change
 - Emission scenarios. CMIP projections. Changes in the hydrological cycle, snowpack and extreme weather.
- Archer Chapter 12, Dessler Chapter 8-9

Solution

9. Climate Change Solutions
 - Adaptation. Mitigation. Geoengineering. Progress and outlook.
- Dessler Chapter 11-12, Archer chapter 13

Optional: Negotiating a Climate Change Agreement

Final class if time permits. A simulation of international climate negotiation, where students play the role of delegates from different countries.

Grading:

Homework: 20%

Homework will be given out at the end of every chapter and due one week later. For late submissions, there will be a 10-point deduction per day.

Exam I, II, Final: 50%

All exams will be closed book. Exam I covers the first half of the course and Exam II covers the second half. The final exam includes the whole course. The best 2 scores (out of 3) will be used for calculating the final grade.

Quiz: 30%

Quizzes are given in class, usually at the end of each chapter. Each quiz consists of 5-10 multiple choice questions.

- Grading scale: A(90-100), B(80-89.99), C(70-79.99), D(60-69.99), F(below 60).

Adjustments for 20-21

Classes will be taught in hybrid mode. Monday & Wednesday's classes will be taught in-person and will be made available online as well. Attendance is not required and will not be monitored. Masks are required for attending classes in person. Friday's classes are online and will be used for quizzes, exams, discussions, watching documentaries and extra reading. Each week, the instructor will post about Friday's class on Canvas on Wednesday.

Class material usage

The instructor and students in this class, as members of the Georgia Tech community, are bound by the Georgia Tech Academic Honor Code. The instructor will make available copies of appropriate assignments, samples, and readings. Unauthorized use of any previous semester course materials, such as tests, quizzes, homework, projects, and any other coursework, is prohibited in this course. Using these materials will be considered a direct violation of academic policy and will be dealt with according to [the GT Academic Honor Code](#).