Climate Variability and Change
AATM306 (#6943), Fall 2016

Credits: 3 (Grading: A-E)
Professor: Dr. Oliver ELISON TIMM (oelisontimm@albany.edu)
Location: ES 232
Class Schedule: Monday/Wednesday 11:00am-12:20pm
TA(s): NA
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Office hours: Wed 12:30pm-1:30pm, Thu 9:15am-10:15am, or by appointment
Prerequisite(s): AMAT111 or AMAT112 or TMAT118; AATM210. Co-requisite(s): AATM 315 or permission of instructor.

Course overview and structure

This course introduces the climate system, consisting of the atmosphere, land, and ocean. The fundamental physical processes that determine the Earth's climate state and the processes that lead to natural variability will be reviewed. The leading modes of natural climate variability will be described from an empirical observation-based point of view, including impacts on environment and society, and the basic physical concepts will be discussed in connection with the real-world observations. The course introduces the methods applied in climate diagnostics and climate predictions. The final section of this course is an introduction to the anthropogenic climate change problem, with emphasis on the physical processes and implications for climate change predictability. Further, this course discusses the importance of natural climate variability and forced climate change for extreme events and how climate change can provide 'actionable' information for decision/policy making.

The course is taught in a lecture-centered class. In order to reach the learning goals and make a steady progress you should be prepared to participate in class activities (engage or moderate discussions on a specific controversial topic, short presentations, and some hand-on activities). Weekly homework assignments accompany the lectures. The homework exercises are designed to prepare you for the mid-term and final exams.

Aim of the course

To provide students with a deepened understanding of how the climate system works, including the fundamental physics and predictability of the coupled atmosphere-land-ocean system.

To enable students to distinguish between the different types of climate prediction/projection problems, their typical forecasting time scales, and the confidence of such predictions/projections.

To give students the background needed to participate in the climate change debate through a rational and physically-based interpretation of observational data, climate model results, and scientific articles.

Performance evaluation

Homework:

The homework evaluation will be based on the following criteria:

- Ability to identify a critical problem and to find physically and logically justified methods that address or solve the problem.
- Apply learned material, methods and concepts in new situations or similar problems cases.
- Ability to express problems, methods, results, and critical assessments in a concise and precise written text form.

Mid-term exam:

The exam will take place in class around the mid-term point in October. Skills required to succeed in this exam build on the training provided by the homework and class discussions. Students should be prepared to work with mathematical equations, graphs and figures. Ability to express their results in a well-written summary is expected. Details about the format of the exam will be announced in class.

Final Exam:

The format of the exam is the same as in the mid-term exam.
The final exam will be scheduled according to the university calendar during the final exams week: Dec 14th, 3:30pm-5:30pm
(see www.albany.edu/registrar/registrar_assets/Fall_2016_Final_Examination_Schedule.pdf)

The final exam date and time is fixed and cannot be changed. Students are referred to the University's Undergraduate Academic Regulations in the case of potential time conflicts. (*http://www.albany.edu/undergraduate_bulletin/regulations.html*).

Attendance:

Every student is encouraged to attend classes and participate in the class activities. No penalties in relation to the number of missed classes are applied in this course, but it can affect your grading score for class activities if you miss events unexcused (see below). Note that being present in class alone does not automatically yield an A for class activities.

Absence policy:

Please refer to the UAlbany rules posted at *www.albany.edu/health_center/medicalexcuse.shtml*
Further details can be found in the online bulletin (e.g. for emergency cases among others) at *www.albany.edu/undergraduate_bulletin/regulations.html* .

Safety-valve rule:

The lowest grade in the homework is dropped. Note that any unexcused missed homework counts as 0 points. Be advised that we will work out a late-submission policy in the first day of class.

Grading: (A-E scheme)

Class activities: 10%
Homework: 30%
Midterm: 20%
Final: 40%

Academic Integrity:

Please make sure you have read the rules of University at Albany on academic integrity and academic dishonesty. The rules and regulations can be found online at *http://www.albany.edu/undergraduate_bulletin/regulations.html* .

Course overview

(1) Introduction: Weather, climate and climate change

i. Weather, climate, climatology, climate dynamics
ii. Climate variability: all 100% natural?
iii. IPCC reports and the latest "summary for policymakers"
iv. Climate change and the role of social media

(2) Natural modes of climate variability

a. The physical climate system*

i. Atmosphere, ocean, land components
ii. Climate zones
iii. Tropical climate
iv. Extratropical climate

b. Natural climate variability*

i. Causes of climate variability
ii. Tropical climate variability
iii. Extratropical climate variability
iv. Tropical-extratropical interactions

(3) Anthropogenic climate change

a. Physics of climate change

i. Observations
ii. Climate change modeling
iii. Climate change projections
iv. CMIP, IPCC

b. **Climate change and society**

i. Environmental impacts
ii. Decision making and planning
iii. Extreme events and risk assessments
iv. Mitigation and adaptation

* In these sections we will use some standard mathematical formalism to gain more insight into the physical laws that describe qualitatively and quantitatively our climate system.