ATS 606 Introduction to Climate - Spring 2014

**Instructor:** Professor Eric Maloney  
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Maloney’s Office Hours: Any time

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**Programming TA:** Robert Nelson  
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**Web:** Class webpage is available on RamCT (Blackboard). Please let me know if you have trouble. Discussion papers will be posted on this site.

**Class Schedule:** Class meets in ATS 101 at 10 am-10:50 am MWF.

**Maloney Office Hours:** Any time  
**Brandon’s Office Hours:** Mon, Wed, Noon – 2 p.m., or any time door is open.

**Contact hours:** 3 (At least 2 hours of effort are expected to complete and homework and computing assignments outside of class for each hour of class time.)

**Student Learning Goals and Objectives:** The successful student will gain a broad graduate level process-oriented understanding of the Earth’s climate system. The material will provide a strong foundation for further specialized study on the climate system that provides contributions to the peer-reviewed scientific literature.


The format of the class will be lecture/discussion. I intend to follow the outline included here, which is inspired by the outline in Hartmann. We will also address current themes or problems in climate research and spend time reading papers from the recent scientific literature and discussing them in class, especially near the end of the course.
**Grading:** The course requirements and grading will be approximately as follows:

*Homework:* 20%

*First Exam:* (Week 7 [tentative]) 25%

*Second Exam:* (Week 12 [tentative]) 25%

*Modeling Project:* 25%

*Class Participation:* 5%

**Modeling Project:**
The modeling project will entail developing a simple heuristic climate model in one dimension. The model uses the concept of radiative-convective equilibrium in a single column with different imposed profiles of radiative constituents (e.g., greenhouse gases, clouds). The project will involve a multistep programming project that first models a multi-layer atmosphere in radiative equilibrium, then a many layer atmosphere in radiative equilibrium with a stratosphere, followed by a column in radiative-convective equilibrium. The project will explore the timescale of the climate system by using simple slab oceans of different depths as well as imposition of greenhouse gas and cloud perturbations to explore the concept of climate sensitivity. This project is a nice introduction to scientific computing for those with limited experience.

The project will be assigned in steps, with individual modeling assignments expected to be turned in on an assigned schedule. We will start the project relatively early in the course, and build on it as the course progresses.

**Course Outline:**

*Week 1:* The Sun, global-mean energy budget/balance

*Week 2:* Latitudinal heating gradients, radiative transfer, radiative-convective equilibrium

*Week 3:* Clouds, cloud-radiative feedbacks, surface heat fluxes

*Week 4:* Surface energy balance models (e.g., slab ocean model), the hydrologic cycle.

*Week 5:* Climate modeling, the atmospheric general circulation

*Week 6:* Atmospheric general circulation continued: Stationary waves and transient eddies, heat transport, the angular momentum balance.

*Week 7:* **Exam 1,** Summertime circulation patterns, monsoons, the wind-driven ocean circulation,

*Week 8:* The thermohaline circulation, ocean meridional energy transport.

*Week 9:* Ocean-atmosphere coupled climate variability

*Week 10:* Paleoclimate
Week 11: Natural climate forcing and change

Week 12: **Exam 2**, Climate sensitivity and feedbacks.

Week 13: Anthropogenic climate change

Week 14: The hydrologic cycle and climate change, changes in tropical transients including hurricanes

Week 15: Regional climate change, the changing nature of ENSO

**Statement on Academic Integrity**
This course will adhere to the CSU Academic Integrity Policy as found in the General Catalog (http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf) and the Student Conduct Code (http://www.conflictresolution.colostate.edu/conduct-code). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.