ATS 606 Introduction to Climate- Spring 2020

Instructor: Professor Eric Maloney
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Web: Class webpage is available on Canvas. Please let me know if you have trouble. Discussion papers will be posted on this site.

Class Schedule: Class meets in 121 ATSW at 10 a.m.-10:50 a.m. TuThu.

Maloney Office Hours: Any time
Michael's Office Hours: TuThu 1 p.m.- 2 p.m.
Luke's Office Hours: Mon,Tue 1:30pm-4pm

Contact hours: 2 (*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.

Text: No textbook will be required, and I will largely use my own notes for the course, which will be posted on Canvas. Two good references are: 1) *Global Physical Climatology*, by D.L. Hartmann, Elsevier, 2016, 485pp (second edition) and 2) *Atmospheric Science: An Introductory Survey,* by J. M. Wallace and P. V. Hobbs, Second Edition, Academic Press, 483pp. 3) *Atmosphere, Ocean, and Climate Dynamics, An Introductory Text*, by John Marshall and Alan Plumb, 319 pp. Homework problems will be assigned from these texts.

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: 40%
First Exam: (Week 8 [tentative]) 25%
Class Project: 25%
Class Participation: 10%
+/- grades will be assigned for a final course grade.

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

Week 2: Global-mean energy budget/balance, latitudinal heating gradients,

Week 3: Radiative transfer, Radiative-convective equilibrium

Week 4: Clouds, cloud-radiative feedbacks

Week 5: Surface heat fluxes

Week 6: Surface energy balance models (e.g. slab ocean model),.

Week 7: The hydrologic cycle

Week 8: The atmospheric general circulation ***Exam 1***

Week 9: Atmospheric general circulation continued: Stationary waves and transient eddies, heat transport, the angular momentum balance.

Week 10: Summertime circulation patterns, monsoons

Week 11: The wind-driven ocean circulation

Week 12: The thermohaline circulation, ocean meridional energy transport, Climate modeling

Week 13: Natural climate forcing and change

Week 14: Climate sensitivity and feedbacks.

Week 15: Anthropogenic climate change

Statement on Academic Integrity

This course will adhere to the CSU Academic Integrity Policy as found in the General Catalog (http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity) and the Student Conduct Code (https://resolutioncenter.colostate.edu/conduct-code/). At a minimum, violations will result in a grading penalty in this course and a report to the Conflict Resolution Services and Student Conduct Services.

CSU Atmospheric Science promotes inclusive community

CSU Atmospheric Science is a leading global institution, and as such, all members of our community regardless of race, ethnicity, culture, religion, sexual orientation, gender identity and expression, physical ability, age, socioeconomic status or nationality are welcome as equal contributors. We value and appreciate diversity, and we believe that diversity on our campus strengthens our entire scientific community.