A ATM 623: Climate Modeling
Spring Semester 2015 (class number: 10724)

Instructor: Professor Brian Rose
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Meeting time: Tuesday, Thursday 2:45 – 4:05 PM
Meeting place: ES 328

Website: http://www.atmos.albany.edu/facstaff/brose/classes/ATM623_Spring2015/

Grading: A-E, 3 credit
Participation: 15%
Midterm exam: 20%
Assignments: 35%
Final project: 30% (written report = 25%, oral presentation = 5%)

Prerequisites: *permission of instructor*
The course will assume some exposure to geophysical fluid dynamics and climate dynamics at first-year graduate level. Some coding experience in a high-level programming language (Python, Matlab, R, NCL, etc.) is necessary.

Course description and objectives:

The focus of this course will be hands-on investigation of the climate system using numerical and mathematical models. We will collectively get our hands on a range of models, including both comprehensive GCMs and assorted simpler process models. We will use these models to build our understanding of topics such as

- The global energy budget
- The greenhouse effect and radiative-convective equilibrium
- Radiative forcing and climate feedback analysis
- Orbital geometry, insolation, and the ice ages
- Arctic sea ice and its coupling to the global climate system
- Mechanisms of heat transport in the atmosphere and ocean
- Links between tropical precipitation and global energy flows.
- Ocean heat uptake and storage

The specific topics are subject to change and may be adapted to the interests of enrolled students. Students will also conduct independent work for a term paper on a topic of their own choosing.

Course requirements:

- Attendance and participation during in-class exercises
- A computer with internet access and a Python environment
- Recommended: a personal laptop computer with Anaconda or Enthought Canopy
- Occasional short presentations or leading class discussions on selected topics
- Completion of regular assignments and final term project

Textbooks:
There is no required text. I will assign some readings from various sources, including this book:
K. McGuffie and A. Henderson-Sellers (2014), **The Climate Modelling Primer** (4th edition), Wiley Blackwell.
A copy will be on reserve at the Science Library.

Attendance and participation policy:
A significant portion of the course grade is given for class participation. You are expected to attend all lectures and participate fully in class discussions and exercises. Any absence should be discussed with Professor Rose **in advance** whenever possible.

Assignments:
Much of the course will consist of hands-on computing exercises using the Python language. I will provide code to get us started on each problem. You need a Python environment installed on your computer. I strongly recommend either Canopy or Anaconda. Both are comprehensive Python distributions for scientific computing; both will let you install everything you need quickly and easily; Anaconda is completely free and Canopy is free for academic use.

The goal of the exercises is to carry out meaningful calculations. Grading of homework will be based more on scientific understanding than on programming skill.

Mid-term exam:
To be held in class on Thursday March 12. Details will be discussed closer to the exam date.
There is no final exam.

Final project:
Each student will complete an independent research project exploring an issue in climate science and climate modeling. The project must include some original calculations described and carried out by you, as well as references to the peer-reviewed scientific literature. A written report and oral presentation are required. You will submit a project proposal (less than one page) by Friday March 13. You are encouraged to discuss your ideas with the instructor beforehand.

Your written report should be roughly 5 to 10 pages in length, and should follow standard formats for scientific papers (e.g. abstract, introduction, literature review, description of your calculations, results summarized in graphs etc., discussion of results including their shortcomings, conclusions). Grades for the written papers will be determined by both scientific content and clarity of presentation. Reports are due Friday May 8 2015.

Presentations will be scheduled for Thursday April 30 and Tuesday May 5 (the last two class days). Each student will give a 10-minute presentation, followed by a brief class discussion. The purpose of the oral presentations is to share your work with your classmates and practice your presentation skills. Grades for the oral presentation will be based primarily on clarity.

Academic integrity:
In this class we will strive to be interactive, learning by doing and by discussion. Some collaboration on exercises is therefore encouraged. However you are ultimately expected to submit your own work and your own thoughts, and to give proper credit to others for previous work and ideas. Please refer to the UAlbany academic integrity policies here:
http://www.albany.edu/graduatebulletin/requirements_degree.htm#standards_integrity