Syllabus

Course Name: Climate Modeling

Course Number: ATS 421/521 **CRN** 56581&3/2&4 **Term:** Spring 2015

Course Credits: 4 including 1 h of lab, lectures MWF 9-9:50 Kidd 028, lab F 11-11:50 Kidd 028

Instructor: Andreas Schmittner, Burt 256, aschmitt@coas.oregonstate.edu, 541 737 9952

Prerequisites: ATS 420/520 (recommended, talk to instructor if not taken); no prior programming knowledge required. Note that ATS 420/520 has math and physics prereqs.

Course Content
Numerical models of the physics, chemistry, biology, and geology of Earth's climate system. Range of climate models from a simple, single equation to complex, state-of-the-science systems used for future projections. Theoretical concepts linked to practical applications through hands-on programming exercises and data analysis.

Schedule:
Week 1: Zero-Dimensional Energy Balance Model, Ice-Albedo Feedback
Week 2: Climate Sensitivity, One-Dimensional Energy Balance Model
Week 3: Numerics, Two-Dimensional Energy Balance Model
Week 4: Radiative Convective Models
Week 5: General Circulation Models, Mid Term Examination
Week 6: Models of Ocean Circulation
Week 7: Models of the Cryosphere
Week 8: Models of Land Vegetation and Ocean Biogeochemical Cycles
Week 9: Regional Climate Models, Reanalyses
Week 10: Evaluation of Climate Models, Future Projections

Measureable Student Learning Outcome
Students will be able to

- Explain fundamental principles and theoretical concepts of simulating Earth's climate system, its components, and energy and material fluxes among them
- Simulate climate using a range of computer programs
- Modify FORTRAN source code, compile and run climate models on UNIX operating systems
- Analyze large datasets of complex climate model simulations
- Compare climate model output to observations
- Understand problems, challenges and uncertainties in climate modeling

Additionally ATS521 students will be able to

- Evaluate the ability of climate models to reproduce observed variables
- Create simple numerical models

Evaluation of Student Performance

50% homeworks
30% exams (10% mid-term, 20% final)
10% presentations
10% participation in discussions

Homework assignments and exam questions will be different for graduate and undergraduate students, reflecting the different learning outcomes. Homework assignments for undergraduate students will focus on analyzing output from climate models such as calculating streamfunctions or meridional heat fluxes. Graduate students will write more computer code creating their own simple climate models.

Learning Resources

Textbook: Goosse H., P.Y. Barriat, W. Lefebvre, M.F. Loutre and V. Zunz. Introduction to climate dynamics and climate modeling. Free online textbook available at http://www.climate.be/textbook.

Class notes and detailed instructions for programming and running models will be made available at the class web-site.

Statement Regarding Students with Disabilities

Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098.

Statement of Expectations for Student Conduct:

http://oregonstate.edu/studentconduct/regulations/index.php