

Department of Atmospheric Sciences

COURSE ANNOUNCEMENT – SEMESTER II – 2006–2007

ATMS 530 (Also CSE 568): Global Atmospheric Modeling

Call number: 39360

Instructor: Prof. M. Schlesinger, 208 Atmos. Sci. Bldg., 333-2192

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Room and Time: 109 Atmospheric Science Bldg., 2 p.m. M W F

Credit: 4 hours

Prerequisites: ATMS 401 and 402, or consent of instructor

Atmospheric general circulation models are being used in conjunction with other geophysical models to simulate Earth's past, present and potential future climates. These models are based on the primitive equations, a set of coupled, nonlinear, partial differential equations which is too complex to be solved by means other than numerical methods on the world's fastest supercomputers. In the design and selection of such numerical methods, choices should be made on the basis of reproducing the integral properties of the partial differential equations, including those for the two types of motion governed by the primitive equations – divergent, quasi-irrotational inertia-gravity-wave motion and quasi-nondivergent, rotational large-scale motion. This course will discuss the selection of horizontal and vertical coordinates, the choice of finite-difference horizontal and vertical grids, and the design of finite-difference and spectral algorithms to best simulate these two types of motion. The course will culminate in a comprehensive presentation of the numerical design of the UIUC atmospheric general circulation model.

Course Outline

1. Introduction
2. Introduction to Numerical Methods
3. Ordinary Differential Equations
4. Computational Design of the Adiabatic, Frictionless Processes of the UIUC Atmospheric General Circulation Models: Part I. Vertical Differencing
5. The Choice of Horizontal Grid: Inertia Gravity Waves and Geostrophic Adjustment
6. Nonlinear Advection
7. Computational Design of the Adiabatic, Frictionless Processes of the UIUC Atmospheric General Circulation Models: Part II. Horizontal Differencing
8. Spectral Models

Text: Course notes will be provided by the instructor.