Atmospheric Dynamics I

METR 3113

Spring 2002 Syllabus

Instructor: Dr. Evgeni Fedorovich
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Time and place: Mon, Wed, Fri 11:30 p.m. - 12:20 a.m., SEC, Room 1410;
Wed 3:30 - 4:20 p.m., SEC, Room N202A.
Office hours: Mon, Fri 4:00 - 6:00 p.m., or by appointment.
Prerequisites: METR 3213 and one of the following: ENGR 2113, ENGR 3223, METR 2103.

Required textbook: Holton, J. R., 1992: *An Introduction to Dynamic Meteorology*, 3rd edition, Academic Press, 511 pp.

Proposed grading: Two written tests (February, April): 20% each. Accumulated points in problem solution and home works: 20%. Final exam (May): 40%.

General information
The course focuses on fundamentals of atmospheric dynamics with emphasis on basic conservation laws for mass, momentum, and heat, and their mathematical formulation and application; notions of circulation and vorticity; and principal features of the atmospheric planetary boundary layer dynamics.

Course outline
I. Introduction. Atmospheric continuum. Meteorological variables. Scales of atmospheric motion. Fundamental forces. Structure of the static atmosphere. Pressure and geopotential. Density/temperature stratification in the atmosphere. Buoyancy.
II. Basic conservation laws. Conservation of momentum. Equations of motion and their approximations. Spherical coordinates. Conservation of mass; the continuity equation. Conservation of energy. First law of thermodynamics. Thermodynamic energy equation.
III. Applications of the basis equations. Basic equations in isobaric coordinates. Horizontal balance of forces. Geostrophic and cyclostrophic flows. Trajectories and streamlines. Thermal wind. Barotropic and baroclinic atmospheres. Horizontal divergence and vertical motion.
IV. Circulation and vorticity. Circulation theorem. Vorticity and potential vorticity. Vorticity equation in different coordinate systems. Barotropic and baroclinic potential vorticity equations.
V. Planetary boundary layer. Boundary layer concept. Atmospheric turbulence. Reynolds averaging. Boussinesq approximation. Turbulence kinetic energy. Planetary boundary layer momentum equations. Flux-gradient theory. Ekman layer. Secondary circulations.

Note: *Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact Dr. E. Fedorovich personally to discuss accommodations necessary to ensure full participation and facilitate educational opportunities.*