Physical Meteorology III. Radiation and Climate

(METR 4233)

Fall 2002 Syllabus

Instructor: Dr. Evgeni Fedorovich
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Time and place: Mon, Wed, Fri 09:30-10:20 a.m.; Room SEC 1410.
Office hours: Mon, Wed 04:00 to 06:00 p.m., or by appointment.
Prerequisites: METR 3113 and 3212, or permission of instructor.

Textbook: Wallace, J. M., and P. V. Hobbs, 1977: *Atmospheric Science: An Introductory Survey*. Academic Press, 467 pp.

Recommended additional texts
Holton, J. R., 1992: *An Introduction to Dynamic Meteorology*, 3rd edition, Academic Press, 511 pp.
Guyot, G., 1998: *Physics of the Environment and Climate*. John Wiley & Sons, 632 pp.

Proposed grading: Two written tests (October, November): 20% each. Accumulated points in class quizzes and home works: 20%. Final exam (December): 40%. Bonus points for active work in class.

General information
The course focuses on basic physical processes in the lower atmosphere associated with solar and terrestrial radiation transformation in the earth-atmosphere system, dynamic and thermal interaction between the atmosphere and the earth surface, and atmospheric energy balances.

Course outline
I. Composition and structure of the lower atmosphere.
Composition of the atmosphere. Meteorological variables. Atmospheric scales. Atmospheric planetary boundary layer. Atmospheric surface layer. Density/temperature stratification in the atmosphere. Atmospheric humidity. Hydrostatic stability in the lower atmosphere. Buoyancy.
II. Radiation and radiative transfer in the earth-atmosphere system.
Radiation characteristics. Quantities and units. Radiation spectra. Reflection and refraction, absorption and scattering. Solar (short-wave) radiation and its transformations in the atmosphere. Surface albedo. Emission of radiation. Long-wave radiation in the atmosphere. Radiation balance at the surface.
III. Physical processes in the atmospheric boundary layer.
Conductivity and diffusivity. Convection and turbulence. Turbulent flow in the atmospheric planetary boundary layer. Turbulent transport of momentum, heat, and mass. Boundary layer profiles of wind, temperature, and humidity. Diurnal cycle of the atmospheric boundary layer. Properties of the atmospheric surface layer. Surface fluxes and their evaluation from meteorological measurements. Air pollution in the atmospheric boundary layer.
IV. Atmospheric energy balances and their role in climate formation.
Surface energy balance. Meteorological regimes of simple underlying surfaces. Climate characteristics on global, regional, meso-, and microscales. Greenhouse effect.

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 your educational opportunities.*