

AOS/Env. Stud. 535: Atmospheric Dispersion and Air Pollution

Syllabus, Spring, 2008

Prof. Tracey Holloway

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Office: Room 201A Enzyme, 1710 University Ave.

Office Hours: After Class, or by appointment

Class information:

Tues. and Thurs., **9:30 am – 10:45 am.**

Room 811 AOS&S Bldg

This course introduces students to the atmospheric chemistry and transport of air pollution, with a focus on how models can be used to understand scientific processes and address policy-relevant questions. Prerequisites: 2 semesters of calculus, at least 1 year of physics or engineering, 1 year of chemistry. Programming experience is also strongly recommended. Please talk to me if you have not had some of this background.

Homework includes:

- HW1 – Developing a one dimensional model of radiative transfer and molecular absorption;
- HW2 – Developing a steady-state Gaussian plume model;
- HW3 – Analyzing measurement data with an atmospheric model of student choice (e.g. the HYSPLIT trajectory model)

HW1 and HW2 are geared toward understanding physical processes of atmospheric chemistry and dispersion. Both are programming assignments, and previous programming experience will be very useful (but it is not required). Students can choose to program in any language, but detailed instructions are provided to introduce novice programmers to Fortran 77. HW3 uses state-of-the-art measurements and models to help develop understanding of atmospheric chemistry and transport.

Classes are structured as lectures with participatory exercises. Each lecture will contain 3 or more example problems associated with lecture material. Mid-term and final exam will draw exclusively from the format of these example problems. Lecture notes will be provided on a course website preceding class, as are supplementary readings.

Grading: 10% Class participation (including attendance); 30% Homework; 20% Mid-term 1; 20% Mid-term 2; 20% Final.

Class Text

Jacob, D. J. *Introduction to Atmospheric Chemistry*. Princeton University Press, Princeton, NJ: 1999.

Readings on the syllabus are listed on the day they are due

Section 1: Overview of atmospheric constituents and their properties

Tuesday 1/22: First Day
Air Pollution Basics

Read: Jacob, Ch. 1

Thursday 1/24:
Atmospheric Composition Units

Read: Jacob, Ch. 7

Tuesday, 1/29:
Basic Models and Application to Radiation

Read: Jacob, Ch 2

Thursday: 2/1
Climate, Chemistry, and Radiation

Tuesday, 2/5:
Fortran Tutorial and start on HW1

Section 2: Tracer Transport in the Boundary Layer and Free Troposphere

Due: , Jacob, Ch. 3

Thursday, 2/7:
Lifetimes & Dispersion

Due: HW #1

Read: Boubel Chapter (on website)

Tuesday, 2/12
Gaussian Plume Models

Due: HW #1, Jacob, Ch. 3

Thursday, 2/14
Review for 1st Mid-Term

Read: TBA

Tuesday, 2/19
Special Topic (Guest Lecture)

Thursday, 2/21
1st Mid-Term Exam

Tuesday, 2/26
Boundary Layer Stability

Due: Jacob, Ch. 4
Thursday 2/28
Turbulence

Jacob, Ch. 5
Tuesday 3/4
Continuity Equations for Air Pollution

Thursday 3/6
Continuity Equation, Part 2

Tuesday 3/11
From the Cont. Eqn. To 3-D models

Due HW#2
Thursday 3/13
Monitoring Air Pollution

Tuesday 3/18 –Spring Break

Thursday 3/20-Spring Break

Tuesday 3/25
Review for Exam

Thursday 3/27
2nd Mid-Term Exam

Section 3: Atmospheric Chemistry

Due: Jacob 9 & 10
Tuesday 4/1
Chapman Chemistry

Due: Jacob, Ch 10
Thursday 4/3
Catalytic Loss Cycles

Thursday 4/8
Solving systems of chemical equations

Due: Jacob, Ch. 11
Thursday 4/10
Global Budgets of CO and NO_x

Due: Jacob Ch. 12

Tuesday 4/15

Global Ozone Budget

Thursday 4/18

Tropospheric Chemistry

Tuesday 4/22

Hands-on PM Measurement

Thursday 4/24

Data Analysis Methods

Tuesday 4/29

Ozone Air Pollution

Read: Jacob Chapter 6

Thursday 5/1

Global Geochemical Cycles

Tuesday 5/6

Quantifying Emissions

Due: HW #3

Thursday 5/8- last day of class

Final Review