11:670:453 *AIR QUALITY MODELING*

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Objectives:
- To provide students with a command of the concepts essential to understanding the principals and governing equations regarding chemical transformation and transport of atmospheric trace gases and particles.
- To provide an examination of contemporary numerical/computational techniques for atmospheric modeling

Office Hours: Wednesday before class 8:15-9:15.

Required Electronic Text Books:

A Primer on Scientific Programming with Python, Third Edition, by H. P. Langtangen

A Hands-On Introduction to Using Python in the Atmospheric and Oceanic Sciences, by J. W.-B. Lin

Complementary Texts:
Fundamentals of Atmospheric Modeling, M.Z. Jacobson, Cambridge University Press, New York, 1999, 656pp, reprinted 2000 edition

Atmospheric Chemistry and Physics: From Air Pollution to Climate Change, J.H. Seinfeld and S.N. Pandis, John Wiley & Sons, Inc., Hoboken, NJ, 2006 edition.

Getting Started:
LINUX commands: http://www.pixelbeat.org/cmdline.html
C shell scripts: http://bima.astro.umd.edu/checker/node22.html

Course Structure and Grading:
Programming practice will be a regular part of the class. Periodic homework is assigned and due at the start of class indicated. Late homework will not be accepted without prior approval of the instructor. Homework will be graded and returned. Exam questions will be similar in design to homework problems.

Each student will participate in a group modeling project, described below. Students will also prepare and deliver a report, as if to a client and participate in a presentation on a topic of their choice, related to material discussed in this course. The project will require development of modeling code.

Grades are weighted as follows:
Watching short lectures BEFORE class on You Tube 5%
Homework: 25%   Exam: 25%   Project: 45%

Group Project:
Each student will participate in a team project and is expected to contribute. Students can pick a suggested topic (to be provided in class) or come up with their own, upon instructor approval. Project proposals will be due in October.   Students will prepare a final report, as if for a client. The report shall be 8-10 pages including figures and tables. Computer codes will be attached as an Appendix.   In addition, each group will prepare a 15 minute oral presentation and poster describing their project.

Project Grading:
Written report of work
       Organization and clarity   (15%)
       Comprehensiveness and completeness   (10%)
       Technical quality   (20%)
       Coding style*   (10%)
Oral/Poster presentation of the work   (15%)
Individual student participation in project**   (15%)

Extra Credit: successful demonstration of code application in a CMAQ simulation (max = +20 pts.)

*grade for coding style will depend largely on the adequacy of comments (e.g., abundance, clarity, applicable references, units for variable definitions)

**evaluated, in part, by student collaborators

Semester Schedule

Date			TOPIC	HW and Project Due Dates
Sep	3	We	Intro and overview: weather, climate and air pollution; atmos. Structure & composition	
			LINUX & You tube channel introduction	
	10	We	Continuity Equation	
			Python Basics; programming practice	
	17	We	gas-phase species, chemical reactions and rates	**HW1**
			Python ; programming practice	
	24	We	sources of emissions and ambient pollution	
			vizualization of gridded data	
Oct	1	We	methods to solve chemical ODEs and PDEs	**project groups and topic**
			Python; programming practice	
	8	We	modeling gas phase chemistry - I	
			Python; programming practice	**HW2**
	15	We	urban, free tropospheric and stratospheric chemistry	
			Python; programming practice	
	22	We	EXAM	
			EXAM	
	29	We	chemical equilibrium and dissolution	
			Python; programming practice	
Nov	5	We	aqueous chemistry and partitioning	
			Python; programming practice	**HW3**
	12	We	bi-directional flux	
			Python; resistor modeling	
	19	We	overview, structure and science processes of CMAQ and GEOS-Chem models	**HW4**
			Python; programming practice	
	26		no class - Friday classes this day	
Dec.	3	We	class time alotted for final project preparation	
	10		**Presentations**	**NO FINAL**