ATM F401 / 601 - Introduction to Atmospheric Sciences.
CHEM F601 Cross listed with the Department of Chemistry

Instructor: Dr. Javier Fochesatto. Professor of Atmospheric Sciences
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Office: Reichardt Building Room 371 (474-7602)
Office hours:
Friday 9-11 by appointment at Reichardt 371 or by zoom per request.
Class Days:
Course is scheduled for Tuesdays and Thursday 2 to 3:30 in Murie Classroom 107. Login instruction for students by distance will be provided before class starts. Class records will be available when released from zoom.

Course Description:
Introduction to Atmospheric Sciences comprises the study of overall atmospheric thermodynamic including physical, chemical, radiative and dynamical processes in the troposphere. The course develops the governing equation of conservation for trace constituents, dry air, water and total mass as well as the energy (first law of thermodynamics), entropy (second law of thermodynamics), and momentum.

Course objective:
By the end of the course, the student will be able to understand and explore atmospheric processes and put them into equations; solve fundamental problems related to fundamentals of atmospheric sciences and quantitatively describe how they typically occur in applications. The fundamental goals of this course are for the student to develop skills to analyze and interpret atmospheric and meteorological data and to identify processes across time and space scales. This includes application of learned material to different problems or putting learned material together in a new context to solve a problem where atmospheric variables plays a fundamental role. The student will receive training in data processing using advanced atmospheric science research platforms available at the University of Alaska Fairbanks - Atmospheric Facility for Atmospheric Remote Sensing as well as general model datasets and space platform datasets worldwide distributed.

Course Prerequisites:
Undergraduate and Graduate standing in STEM fields (atmospheric sciences, meteorology, geosciences, physics, chemistry, civil and geological engineering, geophysics, hydrology, mathematics) or, for non-degree seeking, permission of instructor is required.

Instructional/Teaching Methods:
This course is offered as face-to-face class with the option to be distance synchronous and asynchronous. Graduate students normally are in field and they require to take the course by distance or by a mixed version of the current available platforms. Please make sure to communicate with the instructor and make the arrangements before class starts.

Required Textbook:
Lectures in Meteorology. 2014.
Mölders, N. and G. Kramm. Springer Atmospheric Sciences Series, Heidelberg.

Additional Material:
Atmospheric Science. An Introductory Survey. 2006.
John Wallace and Peter Hobbs. Academic Press.

Fundamentals of Atmospheric Modeling. 2012
Mark Z. Jacobson. Cambridge University Press.

Lectures and markdown exercises provided by the instructor.

Instructional / Teaching Methods:
This is a lecture course with computing exmaples complemented by datasets analysis including discussions of assigned readings from the current scientific literature. Class numerical examples will be presented in either Jupyter notebook platform using Python or in Matlab using Live Script. Homework would be prepared and submitted in any of these two platforms. The student is responsible to learn about these platforms.

Course Topics:
Frontal systems, hurricanes, clouds
Chemical processes in the troposphere
Kinetic, synoptic and dynamic processes
Thermodynamics of reversible and irreversible processes
Photolysis and gas phase oxidation processes, aqueous chemistry and gas-to-particle conversion
Fundamentals of biogeochemical cycles
Origin of the ozone layer
Solar and terrestrial radiation, major absorbers, radiation balance, radiative equilibrium, radiative convective equilibrium
Basics of molecular, aerosol, and cloud adsorption and scattering
Satellite imaginary
Greenhouse gases
Optical phenomena like rainbows, halos, super-refractivity, etc.
Interactions of the global energy, water, and trace gas cycles and their influence on general circulation and their role in the climate system

Students Learning Outcomes:
By the end of the course, the student will be able to:

- Develop skills to think as an atmospheric scientist and master higher order critical thinking in this field.
- Utilize fundamental equations: governing conservation (balance) equations for aerosol and trace gas constituents, dry air, water substances, total mass (equation of continuity), energy, entropy and momentum and their special approximations, in preparation for

further ATM classes. This includes: a) Describe a process in terms of equations, b) Analyze and interpret weather maps, diagrams, and satellite images, c) Explain the basics of atmospheric thermodynamics, radiation, circulation, cloud and precipitation formation, as well as atmospheric chemistry.

- Interpret chemical or other environmental measurements or model results in the framework of the meteorological situation
- Apply material learned to new problems
- Improve the quality of their presentations
- Put atmospheric sciences concepts together in a new context to solve a problem or very different problems
- Solve fundamental problems related to the basics of atmospheric sciences and discuss the results under different aspects
- Improve skills to discuss science in an effective manner
- Improve the quality of your presentations
- Develop atmospheric sciences based reasonable assumptions about missing terms, data, and information
- Recognize data that are not needed to solve the problem and discard them. Judge in terms as is needed in thesis research
- Analyze the limits of validity of assumption and under which circumstance terms or processes can be neglected

Course Lectures:
The course is composed by ten lectures. The lectures concentrate on specific topics of atmospheric sciences and have variable length. The lectures contain material that describe the atmosphere in general and with special focus on polar systems.

Lecture	Title
0	Syllabus Presentation
1	Introduction to Atmospheric Sciences
2	Introduction to Earth Systems
3	Atmospheric Thermodynamics
4	Clouds and Precipitation
5	Atmospheric Radiation
6	Atmospheric Chemistry
7	Atmospheric Dynamics
8	Atmospheric Boundary Layer
9	Synoptic and Weather systems
10	Climate Dynamics

Detailed Course Calendar L (Lectures), H (Homework), Q (quizzes)

Week	Tuesday	Thursday
08/22 - 08/28	L0, Practicum	L1, Practicum
08/29 - 09/04	L2	L3, H1
09/05 - 09/11	L3	L3,
09/12 - 09/18	L3	L3, **H1**, H2
09/19 - 09/25	L4, Q1	L4,
09/16 - 10/02	L4, Research Paper	L4, **H2,** H3
10/03 - 10/09	L5, Q2	Mid-Term (H1-H3)
10/10 - 10/16	L5,	L6, **H3,** H4
10/17 - 10/23	L6, Q3	L6,
10/24 - 10/30	L6, Research Paper	L7, **H4**, H5
10/31 - 11/06	L7, Q4	L7
11/07 - 11/13	L7,	Mid-Term
11/14 - 11/20	L8, Q5	L8, **H5**, H6
11/21 - 11/27	L9, Q6	Thanksgiving break
11/28 – 12/04	L9-10, Research Papers	L10, **H6**, Presentations
12/05 – 12/11	Finals	

NOTE: In bold is the homework assignment due date.

Grading Scheme:

Exams are comprehensive and integrative where the students will be asked to describe and give scientific support through calculations to a specific problem. **Homework** will be focus on specific calculations and the material should be prepared in Jupyter Notebook or in Matlab using Live Script. **Quizzes** are based on either a problem or a short description of a physical process and are scheduled at the end of a unit. **Practicum** focus on an analysis of datasets acquired from instruments from the Arctic Facility for Atmospheric Remote Sensing AFARS Lab. or from global available reanalysis datasets or provided by the students' own project. Practicum requires to summarize the data analysis on a report following the American Meteorological Society guidance for peer review paper submission either in Word and Latex.
https://www.ametsoc.org/index.cfm/ams/publications/author-information/formatting-and-manuscript-components/. **Research Paper** requires a summary synthesis of a series of peer reviewed journal papers on a specific subject. The topic will be arranged with the instructor so that the papers can be selected with sufficient time. Critical discussions are expected to be summarized in a 3-4 pages following AMS formats.

Grading Policy:
Grades will be assigned in accordance with university policy. Please see "Academics and Regulations" section of UAF 2013-2014 Catalogue. http://catalog.uaf.edu/academics-regulations/grading-system-gpa-computation/
A student who scores greater than 90% on their submitted body of work is guaranteed an A.
A student who scores greater than 75% on their submitted body of work is guaranteed a B.
A student who scores greater than 60% on their submitted body of work is guaranteed a C.
A student who scores greater than 50% on their submitted body of work is guaranteed a D.
The class grade will be based on the following table.

Component	Undergraduate	Graduate
Quizzes/Homework	25% (6%/14%)	25% (6%/14%)
Research Paper	10%	10%
Practicum	15%	15%
Exam 1	25%	25%
Exam 2	25%	25%

Expectations for Graduate and Undergraduate Students:

1) Mid-terms and final-exams are planned to test graduate and undergraduate on the basic lecture material. Graduate exams will contain one additional problem and will be graded with higher expectations but with the same rubric.
2) Research Paper: undergraduates will be required to review one-two journal paper (with instructor guidance) while graduate students will require review of four-five journal articles. Similarly, graduate students will review longer and more sophisticated articles. Graduate students will give an oral presentation on the state-of-our-knowledge on a mutually agreed research paper topic that requires reading journal articles and synthesis.

Blackboard:
It is the student responsibility to download and read the material posted in blackboard. After the course start the students will have immediate access to material posted in the blackboard. Please send the instructor an email if for some reason you cannot access to the blackboard material.

Attendance:
Students must attend class regularly and use the required textbook. Class attendance and participation in-class exercises and discussions are required and will be a part of your grade. Excused absences are approved in advance or absences due to a documented emergency. Such documentation must be made immediately upon the student's return to class. Please understand that this is a college course - you are expected to be on time for class and have all the required material unpacked.

Numerical Exercises:
Computer simulations will be done in Python or in Matlab. Both numeric platfroms are available for UAF students.

Homework:
Includes problem solving with a due date of one-week period. No late homework will be accepted (except in excused absences). Homework should be submitted in any platform using Jupyter Notebook or Live Scripts in Matlab. Late homework will not be accepted unless you make prior arrangements with the instructor. It is your responsibility to prepare homework on time. It is suggested that you plan and schedule your work.

Quizzes:
Scheduled after the due date of the homework and summarizes the homework through one problem or to develop a description/explanation of a given atmospheric process.

Practicum:
The practicum consists on examining a set of data form the AFARS instrumentation or using reanalysis datasets available or data provided by the students research. The student will perform a scientific analysis guided by the development of a research hypothesis that will be discussed with the instructor during the course. The practicum will be summarized in a short research presentation.

Examinations:
Two Mid-Term exams and a Final exam.

Final presentations:
Take place in the final week of classes. You'll have to attend all final presentations given by graduate students enrolled in ATM-601. Only in case of emergency (e.g. field research, conference attendance or sports competitions) you can be excused. Such emergencies have to be brought to the instructor's attention as soon as you find out about them.

Difference between ATM401 and ATM601/CHEM601:
The instructor will try to balance the interests of undergraduate and graduate students. Therefore, the instructor will assign special tasks for graduate students that probe the material assigned at the graduate level. This means there are differences in the degree of difficulty in the assignments as function of the different goals of the learning outcome. Graduate students: 1) will have additional reading and assignments to achieve the learning outcomes, 2) will be required to discuss results under a given aspect (while undergraduate students are not asked to do so), 3) will be required to read a research review paper relevant to the topic of the respective unit, 4) will always be assigned different or additional homework problems at a higher degree of difficulty that will probe applying methods discussed in the additional readings, and/or 5) will have to answer additional or different questions on the questionnaires, 6) will be required to summarize the material in less than 200 words in the questionnaire, 7) will be asked to program simple concepts, and 8) will get quizzes and exams that also probe for the material related to the additional learning outcomes. In other words, tasks designed for graduate students will require skills that undergraduate students usually do not have yet (e.g., programming) and/or that are not an expected learning goal at the undergraduate level (e.g., making reasonable assumptions, justify assumption, testing of the limits of assumptions, identify data not needed to solve the question, etc.). Exams and quizzes will have additional tasks to be solved at the graduate level.

Difference between CHEM601 and ATM601:
There is no difference between the grading scheme for any of the reporting function (e.g., quizzes and exams). The instructor will balance the interests of chemistry and atmospheric sciences students and the importance of the material taught for their discipline by assigning relevant applications to their discipline as much as possible. Thus, the instructor will occasionally assign ATM601 and CHEM601 students different applications, or parts of exams or quizzes. Students can gain extra credit for also doing the tasks not assigned to them. A difference on an application task could be that ATM601 students have to plot the results of a problem for various quantities, while CHEM601 students have to discuss what the results of the problem mean for the chemical distribution in the atmosphere.

Additional policies:
1. No weapons allowed in class.
2. Due dates are firm, with the exceptions mentioned above as well as documented emergencies.
3. The instructor will work with the UAF Center for Health and Counseling's Disability Services Program (http://www.uaf.edu/chc/disability.html) to accommodate students with disabilities.
4. Any student who is an UAF sponsored athletic or who has other personal or situational difficulty that might affect class performance is invited to contact me in the first week of the semester (or as soon as such matters emerge) so that ways of accommodating the difficulty may be anticipated.
5. Please also let me know if you have condition that could require direct medical attention (e.g. pregnancy, allergies, diabetes, other chronic diseases).
6. If you are to attend a conference and/or participate in a field trip, please let me know in the first week of class so that arrangements can be made to make up for the classes missed and how to submit homework assignments.

Academic integrity, honor code and plagiarism:
The instructor expects students to submit own original work and reference all other work and intellectual ideas with appropriate reference and citation. You are subject to the code of conduct http://www.uaf.edu/catalog/catalog_09-10/academics/regs3.html#student_Conduct.

Other important information:
It is essential that you (1) keep up with the assigned readings, (2) budget your time wisely to complete all of your assignments, and (3) seek clarification on any material, which you do not understand, during business or class hours. If the instructor is not covering subjects adequately, or the in-class exercises are confusing or difficult, or if you do not understand the questions/tasks/expectations, please let the instructor know about it. The instructor wants you to understand the material.

Information for Students related to COVID-19:
Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website:
https://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students?authuser=0
Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

Notice of Nondiscrimination (BOR Policy & Regulation 01.02.020)

The University of Alaska is an affirmative action/equal opportunity employer and educational institution. The University of Alaska does not discriminate on the basis of race, religion, color, national origin, citizenship, age, sex, physical or mental disability, status as a protected veteran, marital status, changes in marital status, pregnancy, childbirth or related medical conditions, parenthood, sexual orientation, gender identity, political affiliation or belief, genetic information, or other legally protected status. The University's commitment to nondiscrimination, including against sex discrimination, applies to students, employees, and applicants for admission and employment. Contact information, applicable laws, and complaint procedures are included on UA's statement of nondiscrimination available atwww.alaska.edu/nondiscrimination.