

ATM401, ATM601, CHEM601
Introduction to Atmospheric Sciences
Fall 2009

Class time: TR 11:30am to 1pm

Classroom: IARC 407

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Hours: Tuesday 1-2 pm, Thursday 1-2 pm

Course Description: Introduction to Atmospheric Science comprises the physical, chemical and dynamical processes of the troposphere. The governing conservation (balance) equations for trace constituents, dry air, water substances, total mass (equation of continuity), energy (1st law of thermodynamics), entropy (2nd law of thermodynamics), and momentum (Newton's 2nd axiom) are presented and explained. This presentation includes basics of cloud physics, and simplifications like the hydrostatic and geostrophic approximations and their application in models. Static and conditional stability criteria are explained too. Phenomena discussed include, for instance, frontal systems, hurricanes, foehn wind systems (Chinook), monsoon, El Nino Southern Oscillation (ENSO), ice fog. Chemical processes taking place in the atmosphere are analyzed based on kinetic processes, but thermodynamic equilibrium is also discussed. The discussion comprises, among other things, photolytical and gas phase oxidation processes, aqueous chemistry, as well as gas-to-particle conversion. Fundamentals of biogeochemical cycles (e.g., CO₂, H₂O, nitrogen, etc.) and the origin of the ozone layer are covered as well. The chapter on radiation includes solar and terrestrial radiation, major absorbers, radiation balance, radiative equilibrium, radiative-convective equilibrium, basics of molecular, aerosol, and cloud adsorption and scattering. Satellite imagery, greenhouse gases (e.g., CO₂, H₂O, CH₄, etc.), and optical phenomena like rainbows, halos etc. are included. Interactions of the global energy, water, and trace gas cycles and their influence on general circulation and their role in Global Change are presented. Moreover, fundamentals in numerical modeling of atmospheric and hydro-meteorological processes are provided.

Course goal: By the end of the semester, all students will have the basic knowledge required to take other ATM classes.

Course objective: By the end of the semester, you should be able to understand and explore the physical, chemical and dynamical processes of the atmosphere, and put them into equations. You should be able to solve fundamental problems related to the basics of atmospheric thermodynamics, the earth's radiation budget, atmospheric dynamics, cloud- and precipitation formation as well as atmospheric chemistry. You should be able to read and analyze a weather map or climate diagram, interpret diagrams and satellite images, know the basics of general atmospheric circulation and climatology as well as atmospheric chemistry. Fundamental goals are that you develop skills to think as an atmospheric scientist and that you learn higher order thinking. This includes application of learned material to very different problems or putting learned material together in a new context to solve a problem.

Suggested readings/textbooks: There is no textbook available that covers the entire course material. I recommend making use of the excellent libraries on campus and work with several books as you need them. Textbooks that provide good material are:

Andrews, D.G., 2000. Introduction to Atmospheric Physics. Cambridge University Press.

Wallace, J.M. and P.V. Hobbs, 1977, Atmospheric Science an Introductory Survey. NY: Academic Press.

Wallace, J.M. and P.V. Hobbs, 2006, Atmospheric Science an Introductory Survey. NY: Academic Press.

I will give a short evaluation of these books in the first class. It is not required that you buy them all. As these books are available at the bookstore and in the library you can have a look at them and decide whether your individual style of preparing, repeating and learning goes better with the one or the other book. It is recommended to have a look at other books frequently. You should also read other printed material, even if not assigned.

Other course resources: I will put class material on **Blackboard** after a topic is finished. I expect you to download them from the web and to read them. I also provide other material in class. This material is not intended to substitute for readings. It is only to give you an idea, as to what I think is the important issues of a topic. The material will only be available after a chapter is finished because scanning through the material in class could distract you in class; I want you to look at textbooks; and posting material after finishing a chapter allows me to add special information on questions that may occur in class.

It is your responsibility to apply for an UAF email account because Blackboard access is only available with a UAF account. You will be hooked up automatically for access to Blackboard when you registered for CHEM601, ATM401 or ATM601. However, if problems occur with this automatic procedure and you cannot log in, send me an email so that I can verify the email address, enroll you into Blackboard, and set up your Blackboard account.

Attendance: You should attend class regularly and use a book of your choice related to Introduction to Atmospheric Sciences. Class attendance and participation in the in-class exercises are required and will be a part of your grade. Unexcused absences lead to deduction of the attendance points and lessen your chances to accumulate points from quick-tests, presentation of your homework, etc. that would have been discussed the day of your absence. 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.

Homework: due at the start of class on Tuesdays. Each student is expected to be able to present the tasks in front of the class. The contributions should be thorough and complete, reflecting the thought that you have put into your tasks. You are expected to present your homework at the board when you are called to do so. You will be picked randomly several times per semester for presenting the homework. If you cannot present or do not have the homework, when you are chosen to be the presenter, you will get an F on your class participation. You may excuse yourself once in a semester for not having your homework.

No late homework will be accepted (except in excused absences). Late homework should be submitted in readable style. "Readable style" means typed, double-spaced, using at least a 12-point font, one-inch margins, and in hard copy format. It is simply too tricky to edit and make comments in single-spaced type.

If you have not met these stipulations, I will return it to you ungraded. Late homework will not be accepted via e-mail or fax unless you make prior arrangements with me.

It is the student's responsibility to prepare homework in time. I strongly suggest that you plan and schedule your work and start working on your homework before it is due. I recommend having backup systems in place so you can have all work completed on schedule. Getting work done on time is a key to early success in your business or scientific career. A major complaint of employers is that faculty do not instill a sense of responsibility in students.

It is part of your homework - even when not said explicitly - to read parts of books on the subject of the class, the readings and the notes provided. This means that at the beginning of the class I will ask questions and you can offer to answer them, but I also reserve the right to randomly ask students who do not volunteer. The answers are also part of your class participation grade.

Class participation: encompasses to actively contributing to solving in-class exercises, presenting homework, participation in discussions and group-work, and answering questions. Hint: It is better you ask the class or me a question than I ask you a question that you cannot answer.

In-class exercises: These will often involve group work and are an important learning element to develop your ability to solve scientific questions, and to improve your understanding by applying the material you learned in class. They are also preparation for the exams and your future education at UAF and professional life. If group work is assigned as homework, grading will be 50% on how you perform as a team and 50% on the results the group presents. Every group member must be equally able to answer questions.

In-class presentations: You must always be able to present the tasks that you provided as homework in front of the class. This means that you will not be told in advance when you will be the person who presents the homework in class. Should you not be able to explain and reproduce the homework you provided or the homework is incomplete or incorrect points will be deducted. If you co-work in groups, everybody of the group must be able to calculate the homework at the board in class. It is the student's responsibility to be aware of and to be prepared for each assigned task when it is due. Give the person who is speaking your undivided attention. It is not only common courtesy, but scanning through pages of notes, whispering or talking can distract, annoy, and even intimidate students around you as well as myself. Essentially, you should treat classmates as you would like, and expect, to be treated yourself.

Pop-up quizzes: There will be unannounced 10 minutes quizzes. These quizzes cover material of all previous classes, results from homework assignments that were due that week, reading material related to the class and sometimes discussion or solving of a problem. Only in case of emergency, I will allow you to start later on a quiz.

Examinations: It is the student's responsibility to find out when and where the examinations will take place and to be there in time. Only in case of emergency, I will allow you to start later on the exam. There is usually another exam scheduled in this classroom right after your own exam so the room has to be free in time. This means that I cannot give you extra time if you arrive late. **Currently the exam is scheduled for finals week. However, if students bring a scheduling conflict to my attention by the end of the first week of classes I will teach during finals week and have an exam at a different time.**

Difference between CHEM601 and ATM601: There is no difference between the grading of the completeness, correctness, and understanding of the homework, quizzes and examinations. I try to balance the interests of chemistry and atmospheric science students and the importance of the material taught for their discipline. Thus, I will occasionally assign ATM601 and CHEM601 students different kind homework or parts of exams or quizzes. Students can gain extra credit for also doing the tasks not assigned to them. A difference on a homework assignment 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.

Difference between ATM401 and ATM601: There is no difference between the grading of the completeness, correctness, and understanding of the homework, quizzes and examinations. I try to balance the interests of undergraduate and graduate students. Therefore, I will often assign special tasks for undergraduates that probe the presented material at the undergraduate level. In the case of tasks that are assigned to all students or the atmospheric sciences students, undergraduate students will get the full points possible on a task if they reach 90% of the points possible for a graduate student, i.e. the grading is shifted towards lower expectations. Moreover, there will be tasks that are ONLY designed for graduate students and these tasks are indicated as such. These tasks require skills that undergraduate students usually do not have yet (e.g., programming). Since undergraduate students have less experience in making presentations, a "clumsy" presentation of homework to the class will not automatically lead to a lower grade on class participation. You will only get an F on class participation if it is obvious that this is not your own work. This means for undergraduate students I will not grade the way of presenting the homework.

Additional policies:

1. No weapons allowed in class.
2. Due dates are firm, with the exceptions mentioned above as well as documented emergencies.
3. If you have a disability and require any auxiliary aids, services or accommodations under the Americans with Disabilities Act, please contact me after class, see me in the my office, or call me during the first week of the semester to be able to define specific accommodation needs and have enough time for any necessary preparation. If you have any kind of a physical or learning disability you must tell me about it. All disabilities are documented by UAF's Center for Health & Counseling and instructors receive a formal letter requesting that accommodation are made for any student 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. allergies, diabetes, pregnancy).
6. If you intend to go to **AGU or another conference or on a field trip** , you **must** tell me this in the first week of class. Only then I will work with you and your advisor for arrangements regarding this class. It is your responsibility to make up for the classes missed.

Other important information: I will have to miss a class in October because I have to attend a UCAR meeting as UAF's UCAR representative. Dr. Kramm will teach the class on my behalf. There is a possibility that I will have to miss two classes in December because I may be required to attend an air pollution conference. I will provide that information as soon as I have it so that we can make arrangements. You will be given assignments unless I find another faculty member to teach the class. 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 office or class hours. If I am not covering subjects adequately, or the in-class exercises are confusing or difficult, or if you do not understand the questions in your homework, quiz or examination, please let me know. I want you to understand the material and that you can solve the assigned problems.

Academic integrity, honor code and plagiarism: I expect 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.

Grading Policy: This is a success-oriented course. My aim is for all students to meet their individual learning and grade goals. Of course, this does not mean that you can avoid working hard. Instead it means that (1) all students who do well in the class participation, quizzes and examinations will be rewarded accordingly and (2) the grade distribution will not be adjusted to make sure it fits a bell-shaped curve. I expect that (1) you aim to give your personal best in the course, and (2) use in-class exercises and questions, homework, quizzes and examinations as an opportunity to demonstrate your understanding of the material. Each of you enters the course as an average student, i.e. with a "C" grade and proceeds to work from there. To obtain an "A" grade you will need to produce work that far exceeds my normal expectations. My normal expectations are regularly attending the classes, hard work evidence of time spent with the material and an ability to demonstrate understanding of all concepts.

Grading for this class will follow the UAF guidelines included in the following table:

| GRADE | UAF GUIDELINES |
|-------|--|
| A | An honor grade indicates originality and independent work, a thorough mastery of the subject, and the satisfactory completion of more work than is regularly required. |
| B | Indicates outstanding ability above the average level of performance. |
| C | Indicates a satisfactory or average level of performance. |
| D | The lowest passing grade indicates work of below average quality and performance. |
| F | Indicates failure to meet lowest standards. |

The grade will be 10% attendance, 25% quizzes, 15% in-class participation, and 50% exam. To get a "C" grade, 50% of the points in each category have to be earned. I will give +/- grades with the following UAF rules A 4.0, A- 3.7, B+ 3.3, B 3.0, B- 2.7, C+ 2.3, C 2.0, C- 1.7, D+ 1.3, D 1.0, D- 0.7, and F 0.0, respectively. Thus, 90% and better is an A, 85-89% is A-, 77-84% is B+, 70-76% is B, 64-69% is B-, 57-63% is C+, 50-56% is C, 44-49% is C-, 40-43% is D+, 39-42% is D, 30-38% is D-, less than 30% is F. Grades of "incomplete" will be given only in cases where an extraordinary, exceptional reason, submitted in writing by the student and judged valid by me. See UAF policies for details.

Tentative Fall 2009 Schedule:

Learning is an interactive process and each class is individual. Although I have put a lot of thought into the sequence of topics, this schedule is tentative by purpose and subject to change as necessary due to availability of support materials, adaptation to specific needs of the class, etc. The schedule for this class will remain an on-going construction in light of what is accomplished in each class meeting. Since this course will be attended by undergraduate and graduate students both it will be unavoidable to insert additional subjects or to explain subjects in more detail because of the different levels of the students. Moreover, to get a better understanding for atmospheric sciences it will be required to pick up subjects that are caused by actual weather events. Departures from the schedule, such as additional readings, assignments, deadline changes, and activities, may be announced in class. These changes will take priority over the printed schedule. It is your responsibility to be in class and to keep up-to-date on whatever changes I make, or the class negotiates.

Thursday 9/3: Discussion of class syllabus if required; Introduction to Blackboard if required; Discussion of Plagiarism; Introduction: "What is Atmospheric Science?"

Tuesday 9/8 – Thursday 9/10: Brief review; Basics of atmospheric science (continued); Meteorological elements

Tuesday 9/15 – Thursday 9/17: Brief review; In-class exercises; Gas laws & Hydrostatics

Tuesday 9/22 – Thursday 9/24: Brief review; In-class exercises; Thermodynamics

Tuesday 9/29 - Thursday 10/1: Brief review; In-class exercises; Thermodynamics (continued); Clouds

Tuesday 10/6 - Thursday 10/8: Brief review; In-class exercises; Clouds (continued)

Tuesday 10/13- Thursday 10/15: Brief review; In-class exercises; Atmospheric radiation

Tuesday 10/20 - Thursday 10/22: Brief review; In-class exercises; Atmospheric radiation (continued)

Tuesday 10/27 - Thursday 10/29: Brief review; In-class exercises; Dynamics

Tuesday 11/3 - Thursday 11/5: Brief review; In-class exercises; Dynamics (continued)

Tuesday 11/10 - Thursday 11/12: Brief review; In-class exercises; Dynamics (continued); Air chemistry

Tuesday 11/17 - Thursday 11/19: Brief review; In-class exercises; Air chemistry (continued)

Tuesday 11/24: Brief review; In-class exercises; Air chemistry (continued)

Tuesday 12/1 - Thursday 12/3: In-class exercises; Review

Tuesday 12/8 - Thursday 12/10: Synoptic

Wednesday 12/16 - Saturday 12/19 (Finals week): Examination (make yourself familiar with the classroom and time scheduled for the examination)