ATMO 1300-002: Introduction to Atmospheric Science
Spring Semester 2020

Instructor:

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MCOM 1215 (12th floor)
Office hours: Tuesday 3:30-4:30 PM, or by appointment.

Class meetings: Tuesday and Thursday 2:00-3:20 PM, MCOM 353

Class Website: http://www.blackboard.ttu.edu, then login to Blackboard

Prerequisite: None

Recommended Text: There are several introductory textbooks that cover the same material in essentially same way. It is recommended to have one of the following texts (it doesn't need to be the latest edition):

- *Essentials of Meteorology – An invitation to the atmosphere*, by C. D. Ahrens, Cengage Learning (7th Ed.)
- *Meteorology – Understanding the atmosphere*, by S. Ackerman and J. Knox, Jones and Bartlett Learning (4th Ed.)

Core Curriculum:

ATMO 1300 is a Core Curriculum course in the Natural Sciences. The objective of the study of the natural sciences component of a core curriculum is to enable the student to understand, construct, and evaluate relationships in the natural sciences, and to enable the student to understand the bases for building and testing theories. The natural sciences investigate the phenomena of the physical world.

Course Purpose:

This course presents a survey of atmospheric properties and physical processes that determine current weather and long-term climate trends. The purpose of ATMO 1300 is to enhance the student's general knowledge in the realm of natural science. Students graduating from Texas Tech University should be able to explain some of the major concepts in the natural sciences and demonstrate an understanding of scientific approaches to problem solving, including ethics. This course satisfies the Core Curriculum (graduation requirement) in Natural Sciences.

Coordinating Board / Student Learning / College Level Objectives

I. Coordinating Board Objectives:

Learning Objective 1: Critical Thinking – analyzing, evaluating and synthesizing information

Expected learning outcomes & methods of assessment:

Upon completion of this course, students should be able to:

1. Apply their understanding of solar and terrestrial radiation to identify and evaluate factors influencing the energy balance of the earth/atmosphere system, including the atmospheric greenhouse effect. Questions related to varying solar angles and the role of greenhouse gases and clouds in controlling temperature will be included on a pre- and post-course knowledge survey and/or in-class exams. The number of students correctly answering the questions will allow a quantitative measure of the percent improvement from the initial pre-course survey.

2. Apply their understanding of the forces of motion to explain the flow of air in the atmosphere on various space and time scales. Questions related to individual forces that operate in the atmosphere and the balance of those forces at both the surface and upper atmosphere will be included on a pre- and post-course knowledge survey and/or in-class exams. The number of students correctly answering the questions will allow a quantitative measure of the percent improvement from the initial pre-course survey.

3. Apply their understanding of adiabatic processes and atmospheric stability to explain processes related to cloud formation. Questions related to how adiabatic processes lead to saturation and how determining the stability of the atmosphere relates to the type of cloud that forms will be included on a pre- and post-course knowledge survey and/or in-class exams. The number of students correctly answering the questions will allow a quantitative measure of the percent improvement from the initial pre-course survey.

Learning Objective 2: Empirical and Quantitative skills – manipulation and analysis of numerical or observable data resulting in informed conclusions.

Expected learning outcomes & methods of assessment:

Upon completion of this course, students should be able to:

1. Use surface observations to evaluate numerical parameters related to atmospheric moisture. Questions related to specific quantitative measures of humidity in the atmosphere will be included on a pre- and post-course knowledge survey and/or in-class exams. The number of students correctly answering the questions will allow a quantitative measure of the percent improvement from the initial pre-course survey.

2. Use analyzed surface and upper air observations to identify horizontal pressure gradients and various pressure features such as cyclones and anticyclones. Questions regarding the interpretation of either surface or constant pressure maps will be included on a pre- and post-course knowledge survey and/or in-class exams. The number of students correctly answering the questions will allow a quantitative measure of the percent improvement from the initial pre-course survey.

II. TTU Student Learning Objectives:

Learning Objective 1: Demonstrate knowledge of the scientific method and contrast it with other ways of understanding the world.

Expected learning outcomes & methods of assessment:

Upon completion of this course, students should be able to:
Identify the fundamental elements of the scientific method. The scientific method will be contrasted with other methods of understanding the atmosphere such as weather folklore or anecdotal observations. Questions regarding the scientific method will be included on a pre- and post-course knowledge survey and/or in-class exams. The number of students correctly answering the questions will allow a quantitative measure of the percent improvement from the initial pre-course survey.

Learning Objective 2: Demonstrate knowledge of the tools and methods used by scientists to study the natural world.

Expected learning outcomes & methods of assessment:

Upon completion of this course, students should be able to:
Identify and explain how Doppler radar and weather satellites are used by atmospheric scientists to observe and study the atmosphere. The use of numerical models in forecasting and research will also be presented. Questions designed to assess knowledge of how radar and satellites are used will be included on a pre- and post-course knowledge survey and/or in-class exams. The number of students correctly answering the questions will allow a quantitative measure of the percent improvement from the initial pre-course survey.

Learning Objective 3: Explain some of the major theories in the Natural Sciences.

Expected learning outcomes & methods of assessment:

Upon completion of this course, students should be able to:
Identify and explain various aspects of theories related to such topics as tornado-genesis and natural/anthropogenic climate change. Specific questions related to topics such as these will be included on a pre- and post-course knowledge survey and/or in-class exams. The number of students correctly answering the questions will

allow a quantitative measure of the percent improvement from the initial pre-course survey.

Learning Objective 4: Describe how Natural Sciences research informs societal issues, including ethics.

Expected learning outcomes & methods of assessment:

Upon completion of this course, students should be able to:
Identify certain topics in atmospheric science such as climate change and severe/ hazardous weather phenomena that can impact society and discuss how they may impact decision-making and policy development. The importance of ethics in atmospheric research will also be discussed. Specific questions will be included on a pre- and post-course knowledge survey and/or in-class exams. The number of students correctly answering the questions will allow a quantitative measure of the percent improvement from the initial pre-course survey.

III. College Level Competency Objective:

Learning Objective 1: Students graduating from Texas Tech University should be able to explain some of the major concepts in the Natural Sciences and to demonstrate an understanding of scientific approaches to problem solving, including ethics.

Expected learning outcomes & methods of assessment:

Upon completion of this course, students should be able to:
Discuss and critically evaluate viewpoints on atmospheric science topics. Students will also understand the proper role of hypothesis testing and experimental design in conducting research on atmospheric phenomena, and the value of scientific integrity. Specific questions will be included on a pre- and post-course knowledge survey and/or in-class exams. The number of students correctly answering the questions will allow a quantitative measure of the percent improvement from the initial pre-course survey.

Exams: There will be four (4) regular exams. Each exam will be closed-book, closed-notes. The exams will not be cumulative. That is, there will be no specific questions from previous exam material. However, you may need to apply previously learned material since many of the concepts in atmospheric science build on more basic concepts.

- The first three exams will be held in the same classroom and time as the lectures.
- The fourth exam will be given in the regular classroom (MCOM 353) but during the scheduled final exam time, Friday May 8th, 4:30 PM – 7:00 PM.
- You should leave the classroom immediately after turning in the exam.

- If you show up late for the exam, you must still complete the exam by the end of the class time.
- Your cell phones must remain stored in your bag or pocket and cannot be used as pocket calculator. If you need to use the restroom, you must leave your phone with the instructor. Your phone will be returned after the test.

Attendance and Quizzes:

I will take several unannounced attendance quizzes during the semester. Attendance/quizzes will be taken sometime during the class. These will make up 10 % of the final grade, so regular attendance is strongly encouraged.

Determination of the Final Course Grade:

Each exam counts by 25 %. With regular attendance you can boost your score by 10 %.

Letter-Grade scale:

85.0 % or above: A
75.0 % - 84.9 %: B
65.0 % - 74.9 %: C
55.0 % - 64.9 %: D
Below 55.0 %: F
The grade scale may be curved to the benefit of the students.

Attendance is taken randomly in the form of quizzes.

Make-up exams:

If you must be absent on the day of the exam for a legitimate reason, **you** must schedule a time to take a make-up exam. Unless other arrangements are made, make-up exams must be taken within five (5) days, not counting weekends, of the regularly scheduled exam date. It is the student's responsibility to schedule a make-up exam. Legitimate reasons for absences on exam dates include:

1) Illness with documentation from a physician.
2) Participation in an official college sponsored activity, with proper documentation.
3) Death in the immediate family with a note from the Deans' office.
4) Jury duty with the appropriate legal documentation.
5) Religious holiday observance.[1]

Grade Postings:

You can view your current score on Blackboard: www.blackboard.ttu.edu

[1] Note: A student is excused from classes or other required activities, including examinations, to observe a religious holiday and for time needed for travel for the purpose of observance of a religious holiday and is not required to give advance notice of such absence. If you miss an exam due to an unplanned emergency and are unable to notify the instructor before the scheduled exam date, you must still provide written justification for your absence.

Academic Integrity: Cheating in any form will not be tolerated. Refer to the Code of Student Conduct in the Student Handbook: http://www.depts.ttu.edu/dos/docs/Student%20Handbook%202011-2012.pdf

Students with Disabilities:

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office in 335 West Hall or 806-742-2405.

Civility in the Classroom:

Students are expected to conduct themselves in a courteous and respectful manner during class. The classroom is a learning environment so talking to others or reading newspapers, etc. is a distraction to you and to those around you. Laptops are permitted as long as they do not cause any distractions. Please turn off or silence your cell phone. If you must receive an emergency call, please excuse yourself from the classroom.

Detailed Syllabus ATMO 1300-004
(topics subject to minor changes)

Part 1: Basics

Week	Date	Ahrens (AN) Ackerman/Knox (AK)	Topic
1	Thu 1/16	-	General overview of atmospheric sciences; Pre-class survey
2	Tue 1/21	AN: Ch. 1, 2 AK: Ch. 1, 2	Earth as part of the solar system; seasons; composition of the atmosphere; vertical structure of the atmosphere
	Thu 1/23	AN: Ch. 2, 3 AK: Ch. 1, 2	Pressure, density, and temperature; Introduction to radiation
3	Tue 1/28	AN: Ch. 2 AK: Ch: 2	Radiation: scattering, reflection, refraction, and absorption
	Thu 1/30	AN: Ch. 4, 15 AK: Ch. 2, 5	Radiation cont'd; atmospheric optics (halos, rainbows); heat conduction; convection
4	Tue 2/4	AN: Ch. 4, 5 AK: Ch. 4	Water in the atmosphere; phase changes; heat index
	Thu 2/6	AN: Ch. 4, 5 AK: Ch. 4	Cloud formation, precipitation processes
5	Tue 2/11		Exam 1

Part 2: Synoptic Meteorology

Week	Date	Ahrens (AN) Ackerman/Knox (AK)	Topic
5	Thu 2/13	AN: Ch. 1, 4 AK: Ch. 5	Meteorological observations: in-situ and remote-sensing measurements
6	Tue 2/18	AN: Ch. 1, 4 AK: Ch. 5	Meteorological observations
	Thu 2/20	AN: Ch. 4 AK: Ch. 4	Cloud classification
7	Tue 2/25	AN: Ch. 4 AK: Ch. 5	Satellites, appearance of clouds and cyclones
	Thu 2/27	AN: Ch. 6, 10 AK: Ch. 9, 6	Fronts and air masses; Atmospheric dynamics: forces
8	Tue 3/3	AN: Ch. 8 AK: Ch. 10	Geostrophic balance; jet streams; cyclogenesis
	Thu 3/5		Exam 2

Part 3: Convective Storms and Severe Weather

Week	Date	Ahrens	Topic
10	Tue 3/10	AN/AK: -	Instability and convection
	Thu 3/12	AN: Ch. 10 AK: Ch. 11	CAPE, ingredients for deep convection; single-cell thunderstorms
10	Tue 3/24	AN: Ch. 10 AK: Ch. 11	Storm organization and vertical wind shear: Supercells, multicells, MCSs
	Thu 3/26	AN: Ch. 10 AK: Ch. 11	Severe convective weather: tornadoes, hail
11	Tue 3/31	AN: Ch. 10, 11 AK: Ch. 8, 11	Tornado and tornado safety; downbursts
	Thu 4/2	AN: Ch. 10 AK: Ch. 11	Cloud electrification and lightning
12	Tue 4/7	AN: Ch. 10, 11 AK: Ch. 8, 11	Tropical storms and hurricanes
	Thu 4/9		Exam 3

Part 4: General Circulation and Climatology; Weather Forecasting

Week	Date	Ahrens	Topic
13	Tue 4/14	AN: Ch. 7 AK: Ch. 7, 8	General circulation; El Nino and La Nina (ENSO); Monsoons
	Thu 4/16	AN: Ch. 7, 12 AK: Ch. 7, 14, 15	Climate, climate classification, climate variability
14	Tue 4/21	AN: Ch. 13 AK: Ch. 15,16	Past climates, anthropogenic climate change, climate skepticism, IPCC
	Thu 4/23	AN: Ch. 9 AK: Ch. 13	Chaos theory
14	Tue 4/28	AN: Ch. 14 AK: Ch. 13	Scientific forecasting
	Thu 4/30	AN: Ch. 14 AK: Ch. 13	Numerical weather models; online weather resources
15	Tue 5/5	AH: Ch. 14 AK: Ch. 15	Air pollution; Ozone hole; post-class survey; class evaluation
	Fri 5/8		**Final exam** MCOM 353 **4:30 - 7:00 PM**