Course Syllabus
ATMO336: Weather, Climate, and Society
Spring 2016 Semester

Web Page:

All required course material is available from the class web pages and links therein.

http://www.atmo.arizona.edu/courses/spring16/atmo336/home.html

There will also be a few activities done on the course D2L pages. All students registered for the class should have access to the D2L page for ATMO336, Section 001.

Course Hours / Location

Monday, Wednesday, and Friday, 10:00 – 10:50, Integrated Learning Center (ILC), Room 125.

Instructor:

Dr. Dale Ward, Dept. of Atmospheric Sciences, PAS Building, Room 566D

Email: dward@email.arizona.edu

Office Hours: Tuesday 1 – 2 PM or by appointment

I prefer that you make an appointment if you would like to meet with me outside of the posted office hours. If you come to my office without an appointment, I may or may not have time to meet with you.

Teaching Assistants:

Thomas Whipple, Dept. of Hydrology, Harshbarger, Room 228B

Email: twhipple@email.arizona.edu

Office hours: Monday and Wednesday 1 -2 PM

Raj Mukherjee, Dept. of Atmospheric Sciences, PAS Building, Room 476

Email: rajarshi316@email.arizona.edu

Office hours: Friday 2 – 3 PM

About your Instructor:

I received a PhD in atmospheric sciences from the University of Arizona in 1998. My research interests are in the area of satellite remote sensing. Currently I am working with a team

to develop and implement a new active microwave system to determine the concentrations of water vapor and other trace gases in the atmosphere.

I have been the instructor for Atmospheric Sciences 336 for 15 years. I have also taught a Atmospheric Sciences 170, which is a TIER I natural sciences elective.

I live on the east side of Tucson with my family. In my spare time I enjoy hiking and biking the many trails around Tucson.

Course Objectives and Expected Learning Outcomes:

This course examines basic weather phenomena, climate variability and climate change, and their associated effects on people. The first part of the course is mostly weather topics, while the second part is mostly climate and climate change. Students are challenged to apply the basic physical concepts that are taught in the reading to understand and explain some of the common phenomena in our atmosphere, such as the formation of clouds and thunderstorms. On the issue of human-caused climate change, students will closely examine some of the evidence and arguments both for and against a strong anthropogenic component to recently observed climate changes. Students are then asked to draw their own informed conclusions about the possible influence of human activity on climate change, the type of governmental policies they would support, and personal actions that they may take to reduce their influence on climate change.

After taking this course you will be able to:

- Read and interpret common weather charts, including 500 mb height maps and skew-t diagrams
- Construct basic, cool season weather forecasts using 500 mb maps
- Explain the limitation of numerical weather forecasting
- Describe the seasonal shift in wind direction that takes place during the North American Monsoon over Tucson and the associated changes in weather
- Discuss the vertical structure of temperature, density, and pressure in the atmosphere, as well as effects of altitude changes on the human body
- Summarize the water cycle on Earth and its important role in Earth’s climate
- Explain what clouds are and how and why they form
- Describe the conditions that lead to the formation of thunderstorms, tornadoes, and hurricanes
- Summarize how weather conditions influence human comfort
- Identify the human influence on stratospheric ozone, factors that influence exposure to ultraviolet radiation, and effects of ultraviolet exposure on the human body
- Explain how radiation controls the average surface temperature of the Earth, including the atmospheric greenhouse effect

- Review how human emissions of greenhouse gases have perturbed the system
- Summarize the historical increase in anthropogenic greenhouse gases, which includes the issue of the missing carbon sink
- Discuss the current evidence and arguments both for and against a strong human component to recent climate changes, which includes climate model simulations, uncertainty in simulations, indirect proxy estimates of past climate changes, and recent observations of climate changes
- Make an informed decision about the potential influence of human activity on climate change
- Determine what actions should be taken to reduce the influence of human activity on climate change
- Describe the reason for seasonal changes on Earth as well as the changes that happen at different latitudes
- Explain some of the other factors, beside latitude, that determine regional climate
- Describe some of the optical phenomena that takes place in the atmosphere, such as blue skies, white clouds, and haze.

Grading:

Your class grade is based on your weighted class average. The weighting is given below:

Grade Item	Weight in class average
HW#1. 500 mb forecasting homework	5%
HW#2. Problem set on atmospheric vertical structure and winds	4%
HW#3. Problem set on humidity, human comfort, and stability	4%
HW#4. Global Warming Essay	7%
Research Paper (Extra credit for available for submitting topic)	20%
*Exam 1	15%
*Exam 2	15%
*Exam 3	15%
*Exam 4	15%
*Optional Final Exam	(Up to 30%)
Total	100%

The final grading scale may be curved depending on overall class performance. However, the grading scale will not be more difficult than A(90%), B(80%), C(70%), D(60%), E(<60%).

The final exam is optional. If you do not take it, then your grade is fully determined by the other grade items in the list. If you decide to take the final exam, at a minimum it will replace the lowest of your three in class exams, even if it is lower. If it is to your benefit, then the final exam score will also be used to replace your second lowest in class exam score, but only if this

improves your class average. Thus, if you take the final exam, it will count for at least 15% of your final grade and 30% if it helps you.

Late written work, which includes homework assignments and the research paper, will be subject to a penalty of 10% per day late.

Missed exams can only be made up after presenting documentation for University-approved absences. This includes all holidays or special events observed by organized religions for students who show affiliation with that particular religion and absences pre-approved by the UA Dean or Students. In most cases, you are expected to notify the instructor before missing the exam in class at which time a make-up date will be arranged. In general I prefer make-up exams to be taken before the exam is given in class.

No extra credit opportunities, except for the research paper topic, are planned.

Description of Grade Items:

Homeworks: There will be four homework assignments given during the semester. A brief description and approximate due dates are provided below. Homework assignments will be posted under the homework link on the class web pages. You will be given sufficient time to complete each assignment. Homework assignments will be graded based on the quality and clarity of your English as well as the content.

Homework #1 is a 500 mb forecasting project that will be due around February 3.

Homework #2 is a brief problem set that may require simple calculations. It will cover atmospheric vertical structure and winds and will be due around February 10.

Homework #3 is a brief problem set that may require simple calculations. It will cover humidity, human comfort, and stability, and will be due around March 2.

Homework #4 is a short opinion essay on global warming. It will be due around April 25.

Important note – you are expected to write answers to the homework questions and discussions in your own words. This means no direct copy and paste from anywhere is allowed. This includes the class reading pages, any other internet or printed material, and fellow students. While you are encouraged to work together on homework questions if you wish, your submitted answers need to be written in your own words. No credit will be awarded for answers "pasted" or "copied" from another source. Please refer to the section "Student Code of Academic Integrity" below.

Exams: Exams count for 60% of your final class grade. Four in-class exams are scheduled. These exams consist of a mixture of multiple choice and short answer questions. The in-class exams are not comprehensive in that the questions concentrate on material presented since the previous

exam. However, it is expected that you are familiar with some of the basic concepts covered early in the semester.

The in-class exams given during the spring 2015 semester will be available from the class web pages to show you the type of questions asked.

The final exam is optional. If you decide to take it, the final exam grade replaces the lowest of the grades of your previous exams (even if it is lower). Thus, if you do poorly on one exam or miss one exam, you can make for it up by taking the final. Your final exam score will also replace your second lowest exam score (only if higher than your second lowest exam score). Therefore, if you take the final exam it will count for at least 15% of your final grade (by replacing your lowest exam score) and 30% of your final grade (if you score higher than your second lowest exam score). The final exam is comprehensive in that it covers all of the material presented during the semester.

Final exam is Friday, May 6 from 10:30 – 12:30 in the regular classroom, ILC 125.

Research Paper: The details of the research paper are described in a link under the homework section of the course web pages. A printed copy of the paper is due in class on the due date. In addition, you are required to upload a copy of the paper to a "Dropbox" on the course D2L pages. An extra credit research paper topic, which is basically a statement of your proposed paper topic and a few arguments or points on both sides of your issue or topic question, is due by February 3. If you chose to submit a topic proposal, you will be given feedback on your proposed topic. The research paper is due by March 10, which is just before spring break, though it can be turned in early.

Topics and Tentative Course Schedule

The course material is broken into topics (in bold). The titles of the associated course reading pages are given below each topic. Reading pages are available from the course web pages.

Week / Dates	**Topics /** Readings	**Assignments**
1. 1/13 - 1/24	**Introduction to 500 mb maps; Interpreting 500 mb maps; Weather forecasting with 500 mb maps** Introduction to 500 mb height maps Winds and Precipitation f rom 500 mb maps Weather Forecasting Using 500 mb maps The 500 mb Weather Pattern and Common Weather Terminology	*Read through course information* *Read Instructions for Research Paper;* *Begin Considering Topics for Research Paper* **Week 1 Discussion Posts** **Week 1 Homework Quiz**

2. 1/25 – 1/31	Numerical Weather Forecasting **Overview of Atmosphere** The Atmosphere Some Properties of Gases; Kinetic Model Composition of the Atmosphere **Vertical Structure of the Atmosphere** Vertical Structure of Temperature, Pressure, Density	*Continue to Work on Selecting Paper Topic; Begin work on 500 mb Forecasting Assignment*
3. 2/1 - 2/7	Human Response to Air Pressure and Density Changes The Skew-T diagram **1.4) Wind and Pressure on Weather Maps;** Winds; Pressure and Winds on Weather Maps A Crash Course in Cyclogenesis **1.5) Water in the Atmosphere** Water in the Atmosphere A Closer Look at Evaporation and Condensation	**Optional Topic Statement for Research Paper Due; 500 mb Forecasting Assignment Due;** *Work on Homework #2 Problem set*
4. 2/8 – 2/14	*Review for exam #1 (2/8)* *Exam #1 (2/10)* **Measures of Water in the Atmosphere** Tracking Water: Relative Humidity and Dew Point	**HW #2 due** **Exam #1**
5. 2/15 – 2/21	**Weather Effects on the Human Body** Energy Transfer Temperature, Humidity, Wind and Human Comfort **Clouds (What They Are and Why They Form)** Clouds Why Does Rising Air Cool? Conditions that Force Air to Rise Precipitation **Stability / Thunderstorms** Moving Parcels Up and Down	*Work on Research Paper*
6. 2/22 – 2/28	Stability of the Atmosphere Introduction to Thunderstorms Thunderstorm Lifecycle and Severe Thunderstorms **Severe Weather** Tornadoes	*Work on Research Paper* *Work on Homework #3 Problem Set*
7. 2/29 – 3/6	Lightning *Review for exam #2 (3/2)* *Exam #2 (3/4)*	**HW #3 Due** **Exam #2** *Work on Research Paper*
8. 3/7 – 3/13	**Hurricanes** Hurricane Introduction and Characteristics Hurricane Energetics and Strengthening Hurricane Movement and Damages	**Research Paper Due (3/9)**

9. 3/21 – 3/27	Atlantic Hurricane Cycles; Links to Climate Change? **Monsoon Season in the Southwest** The North American Monsoon **3.2) Impacts / Possible Trends in Severe Weather** Impacts of Extreme Weather; Possible Trends **3.3) Ozone and uv Radiation** Ozone and the Ozone Hole Ultraviolet Radiation and its Effects	
10. 3/28 – 4/3	**3.5) Introduction to Climate Change** Weather vs Climate Introduction to Climate Change **3.6) How Radiation Controls Earth's Temperature** Solar Radiation and the Earth's Energy Budget I Infrared Radiation, Greenhouse Effect, Energy Budget 2	
11. 4/4 – 4/10	*Review for exam #3 (4/4)* *Exam #3 (4/6)* **Increasing Greenhouse Gases, Carbon Dioxide** Increasing Greenhouse Gases Atmospheric Carbon Dioxide and the Carbon Cycle	**Exam #3**
12. 4/11 – 4/17	**Predictions of Change, Models and Uncertainty** Uncertainty in Climate Prediction and Climate Models Climate Models and Their Predictions of Change Potential Impacts of Global Warming **4.4) Historical Temperature Changes** Reconstructing Past Climates The Climate of the Pleistocene Is the Earth Fragile or Rubust? The Climate of the Holocene Controversy: Global Average Temperature Reconstruction over the last 2000 Years	*Homework #4: Global Warming Essay assigned*
13. 4/18 – 4/24	**4.5) Recent Temperature Changes and Implications** The Present Warming: 20th Century through Today Global Warming: Summary and Discussion **4.6) Factors that Determine a Region's Climate** Seasonal Changes on Earth	*Work on Global Warming Essay (HW #4)*
14. 4/25 – 5/1	Other Factors that Control Climate **4.7) Common Optical Phenomena** Blue Skies, Red Sunsets, White Clouds, Haze *Review for exam #4 (4/27)* *Exam #4 (4/29)*	**Global Warming Essay Due** **Exam #4**
15. 5/2 – 5/7	No New Reading. *Release pre-final class grades;* *Discuss how to prepare for final exam;*	**Optional Final Exam** **May 6, 10:30 – 12:30** **C.E. Chavez, Room 111**

	Optional Final Exam (5/6)	

Reading Material / Texts

All of the course reading material is available from the course web page under the lectures link. There are no required outside textbooks for this class.

Honors Credit

Honors students are welcome to take this course for honors credit. Please contact Dr. Ward early in the semester to draw up an honors contract.

Student Code of Academic Integrity

Students are expected to adhere to the University of Arizona's Code of Academic Integrity as described in http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity. If you commit plagiarism, you could either receive a zero for that assignment, an F grade for the entire course, or even expulsion from the University depending on the severity of the case. If you are unsure what constitutes plagiarism, please see the article on avoiding plagiarism from the University libraries at http://library.arizona.edu/help/tutorials/plagiarism/index.html. Thus, when you use source material in writing your research paper, whether primary or secondary sources, you must make sure that you clearly indicate where you took it from. The Web can be a great search tool, but never copy from the Web without clearly identifying the source.

In addition, do not copy from work completed by your classmates or by students who have taken this course in previous semesters. You can discuss papers and other assignments with fellow students, but your final work needs to consist of your own ideas and words. If you receive help in writing your research paper from the writing center or a tutor, make sure the paper you submit still represents your own work.

Help with Writing

The University has a free writing center where trained consultants are available to work individually with you on your writing at any point in the process, from brainstorming to editing. You can drop in for short sessions, make appointments for longer sessions, or even work with a tutor online. For more information, please see http://thinktank.arizona.edu/tutoring/writing.

Policies Against Threatening Behavior by Students

The Arizona Board of Regents (ABOR) Student Code of Conduct, ABOR Policy 5-308, prohibits threats of physical harm to any member of the University community, including to one's self. Threatening behavior can harm and disrupt the University, its community, and its families. "Threatening behavior" means any statement, communication, conduct, or gesture,

including those in written form, directed toward any member of the University community that causes a reasonable apprehension of physical harm to a person or property. A student can be guilty of threatening behavior even if the person who is the object of the threat does not observe or receive it, so long as a reasonable person would interpret the maker's statement, communication, conduct, or gesture as a serious expression of intent to physically harm. Information on prohibited behavior, procedures for reporting threatening behavior, and disciplinary processes can be found at http://policy.web.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Nondiscrimination and Anti-Harassment Policy

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. The University encourages anyone who believes he or she has been the subject of discrimination to report the matter immediately. All members of the University community are responsible for participating in creating a campus environment free from all forms of prohibited discrimination and for cooperating with University officials who investigate allegations of policy violations. Information about the University of Arizona's nondiscrimination and anti-harassment policies can be found at http://policy.web.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy.

Special Needs and Accommodations

It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268 or http://drc.arizona.edu/students/connect) to establish reasonable accommodations.

Please be aware that the accessible tables and chairs in the classroom should remain available for student who find that standard classroom seating is not usable.

Subject to Change Statement

Information contained in this course syllabus, other than the grade policy, may be subject to change with advance notice as deemed appropriate by the instructor.