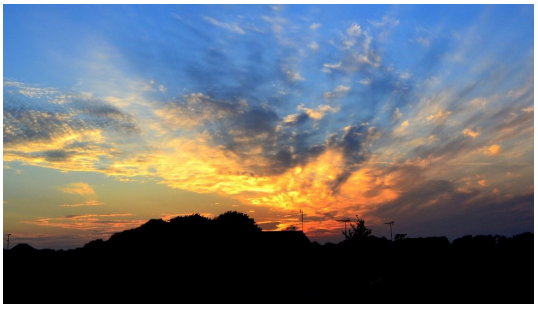
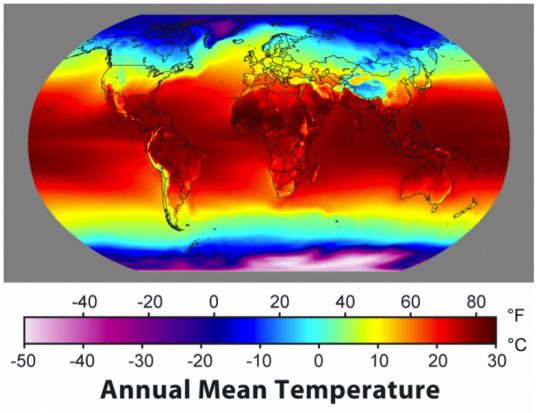
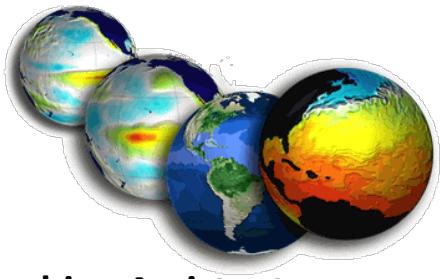
METR 4233

Physical Meteorology III - Radiation and Climate

Fall 2018
MWF 10:00 - 10:50 AM
NWC Rm. 5600







Instructor

Dr. Jason C. Furtado
Office: National Weather Center (NWC) Rm. 5240
Phone: 405.325.1391
Email: jfurtado@ou.edu

Office Hours: By appointment.

Teaching Assistant

Ty Dickinson
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Course Description

***Climate* has a long-lasting impact on our lives, including how we live, the energy we use, what we eat, and our overall cultural values. The Earth climate system is made up of multiple complex interactions across multiple media. Understanding Earth's energy balance and how it is altered is a major tenet of this class.**

METR 4233 is a course for upper-level meteorology and science majors. This course will present a qualitative and quantitative presentation of various radiation and climate processes and their impact on the environment. Topics covered include the global and land-surface energy balance, the hydrologic cycle, ocean dynamics, climate feedbacks, modes of climate variability, and climate change.

Overall, this course will help students gain a scientific understanding of the climate of Earth, its physical aspects, and understand why climate is changing. Thus, the student will be prepared to engage intelligently in discussion of climate and climate change. Applications of this knowledge to other aspects of meteorology (e.g., sub-seasonal forecasting, future climate change projections) will also be discussed.

GOALS

By the end of the course, students will be able to:

1. Explain the basic principles of how the Earth physical climate system functions.
2. Evaluate and understand the Earth global and surface energy balance and how changes in the Earth physical system alter these balances.
3. Examine the role of land-atmosphere-ocean interactions in shaping the Earth climate system.
4. Identify and understand the dominant patterns of climate variability in the Earth climate system.
5. Interpret and explain past and future climate change on Earth based on the synthesis of the above.

Prerequisites

METR 3123 and 3233 [C or better] and MATH 2934 or equivalent [i.e., you have to have a working knowledge of calculus for this course].

Required Text

Global Physical Climatology. 2nd Edition. Dennis L. Hartmann. [Available for purchase at the bookstore, or online. A copy is also available in the NWC library.]

Course Web Page

The web page will be accessible via https://canvas.ou.edu (log on using your OU 4+4). There you will find course materials, assignments, grades, and news and announcements about the course.

Grading

Homework Assignments:	45%
Midterm Exam:	20%
Final Exam:	20%
In-Class Worksheets:	15%

HOMEWORK ASSIGNMENTS. Assignments will be given roughly every 1.5-2 weeks. Homework assignments will be quantitative and qualitative, while a couple of assignments will involve reading and critiquing journal articles. Some problem sets will also include a **programming** component, where students will have to design and/or work with existing code to complete a task. The language of choice for this course will be **Python**. All students should have a working knowledge of Python from earlier METR courses and will have access to Python via SoM Computer Lab computers to complete the assignments. Alternatively, you can install a copy of Python on your own computer (see the SoM IT staff for assistance). You are free to use other programming languages with which you are familiar. **Note:** The professor and the TA are **not** responsible for debugging, especially for other programming languages.

Please show all of your work on your assignments for full credit. Final answers should have the proper units and be boxed (when appropriate). Explanations should be in complete sentences with proper grammar and punctuation. If requested, well-commented and neat code are expected when turning in a programming assignment. While I encourage students to work together on assignments, each student must turn in their own original assignment for a grade. Late homework submissions are not allowed without prior approval and may also be subject to penalty points.

MIDTERM AND FINAL EXAMS. These exams will cover material from roughly each half of the semester. The format will feature multiple choice, quantitative problems, and short answer-style questions. The final exam is not comprehensive per se. However, as with many sciences, concepts "build upon" each other, so you will be required to have some knowledge of earlier concepts. All exams are closed book, and you may only use a calculator as an aid on the exam.

IN-CLASS WORKSHEETS. Collaborative learning is an excellent way to understand scientific concepts. Occasionally, we will work on problems and questions in small groups (~2-3 students) during class and then collectively discuss the answers. These in-class worksheets will be collected and graded, so please come to class and participate actively.

Course Style

The overall structure of the class will consist of traditional lectures covering the major topics. Questions and interactions during class are welcome and **highly encouraged**. Occasionally, we will have group discussion / "think-pair-share" questions during lecture to reinforce concepts and encourage critical thinking. These types of interactions also foster collaborative learning, which is important in the sciences. While certain interactions are graded, others will not necessarily be graded. However, your active participation will contribute positively to your performance in the class.

- Arrive to class on time and prepared to learn.
- Submit assignments timely. Late submissions and makeup exams are **not** allowed without prior approval.
- Be courteous to other students. Place all phones on vibrate/silence, do not text/use social media during class, and keep talking to a minimum.
- Take an **active role** in learning and **ask questions** when needed.
- Seek assistance from the professor and the TA if you do not understand the material or need help with an assignment.

EXPECTATIONS OF THE STUDENT

Reasonable Accommodation Policy

The University of Oklahoma is committed to providing reasonable accommodation for all students with disabilities. Students with disabilities who require accommodation in this course are requested to speak with me as soon as possible. Students with disabilities must be registered with the Disability Resource Center prior to receiving accommodations in this course. The Disability Resource Center is located in University Community Center (730 College Ave). Phone: 405.325.3852. E-mail: drc@ou.edu

Academic Misconduct

Cheating is strictly prohibited at the University of Oklahoma. Simply put, it devalues your degree and ends up marring your character and reputation. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at http://integrity.ou.edu/students.html. If you are caught cheating, I am obligated to report it. Sanctions for academic misconduct can include expulsion from the University and an F in this course. **BOTTOM LINE:** Don't cheat - it's not worth it.

To be successful in this class, all work must be **yours and yours alone**. You may work together on homework assignments and in-class group exercises, but you must submit your own original work for grading.

Religious Holidays

It is the policy of the University is to excuse absences of students that result from religious observances and to provide without penalty for the rescheduling of examinations and additional required classwork that may fall on religious holidays. Any student who has a religious holiday fall on one of the exam days, please see me no later than one week before the exam so as to make other arrangements.

Title IX Resources and Reporting Requirement

For any concerns regarding gender-based discrimination, sexual harassment, sexual assault, dating/ domestic violence, or stalking, the University offers a variety of resources. To learn more or to report an incident, please contact the Sexual Misconduct Office at 405.325.2215 or smo@ou.edu. Incidents can also be reported confidentially to OU Advocates (405.615.0013) 24 hours a day, 7 days a week. Please be advised that a professor/GA/TA is required to report instances of sexual harassment, sexual assault, or discrimination to the Sexual Misconduct Office. Inquiries regarding non-discrimination policies may be directed to: Bobby J. Mason, University Equal Opportunity Officer and Title IX Coordinator at 405.325.3546 or bjm@ou.edu. For more information, please visit http://www.ou.edu/eoo.html.

Adjustments for Pregnancy/Childbirth Related Issues

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact me or the Disability Resource Center at 405.325.3852 as soon as possible. Also, see http://www.ou.edu/eoo/faqs/pregnancy-faqs.html for answers to commonly asked questions.

Class Schedule (Subject to Change)

Week	Dates	Topic	Readings
1	Aug 20, 22, 24	Course Expectations / Introduction and Thermodynamics Review	Chapter 1
2	Aug. 27, 29, 31	Global Energy Balance	Chapters 2 & 3
3	Sept 5, 7	Global Energy Balance / Radiative Transfer **LABOR DAY - SEPT 3 - NO CLASS**	Chapters 2 & 3
4	Sept 10, 12, 14	Radiative Transfer / Radiation Equilibrium Models	Chapter 3
5	Sept ***17, 19, 21***	Surface Energy Balance / Boundary Layer	Chapter 4
6	Sept 24, 26, 28	Geographic Variations in Radiation / Hydrologic Cycle	Chapters 4 & 5
7	Oct 1, 3, (5)	Hydrologic Cycle / Land-Atmosphere Interactions **FALL DAY - OCT 5**	Chapter 5
8	Oct 8, 10, 12	Evaporation / Water Balance	Chapter 5
9	Oct 15, 17, 19	Atmospheric Motions & Fluxes **MIDTERM EXAM**	Chapters 6.1 - 6.4
10	Oct 22, 24, 26	General Circulation of the Ocean	Chapter 7
11	Oct ***29, 31*** Nov 2	Ocean Dynamics / Modes of Climate Variability	Chapters 6.5, 7, & 8
12	Nov 5, 7, 9	Modes of Climate Variability	Chapter 8 / Select Readings
13	Nov 12, 14, 16	Climate Change / Feedbacks	Chapter 10
14	Nov 19	Climate Change / Natural **THANKSGIVING HOLIDAY - NOV 21, 23 - NO CLASS**	Chapter 12
15	Nov 26, 28, 30	Climate Change / Natural + Anthropogenic	Chapters 12 + 13
16	Dec 3, 5, 7	Overview of Climate Models	Select Readings

<u>FINAL EXAM:</u> THURSDAY, DECEMBER 13, 2018 8:00 AM - 10:00 AM NWC Rm. 5600

<u>Note:</u> Dates in **bold** and *italic* are dates that Professor Furtado expects to be out of town. TA Ty Dickinson will be teaching classes those days.