

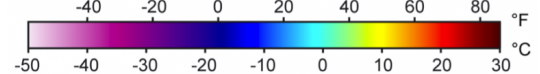
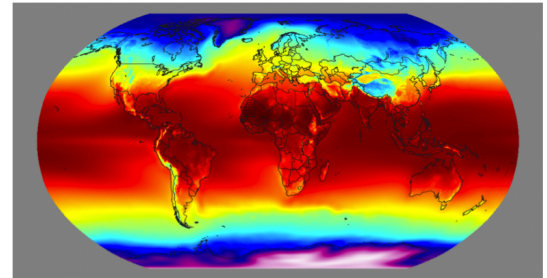
# METR 4233

## Physical Meteorology III - Radiation and Climate

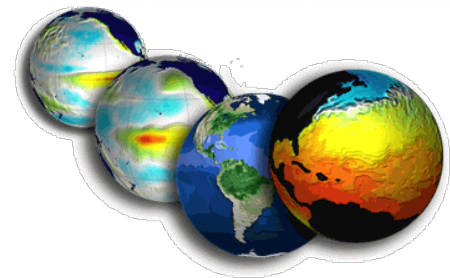
Fall 2016

MWF 10:00 - 10:50 AM

NWC Rm. 5600



Annual Mean Temperature



### Instructor

Dr. Jason C. Furtado

Office: National Weather Center (NWC) Rm. 5240

Phone: 405.325.1391

Email: [jfurtado@ou.edu](mailto:jfurtado@ou.edu)

Office Hours: By appointment.

### Teaching Assistant

Jonathan Edwards-Opperman

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### Course Description

***Climate has a long-lasting impact on our lives. It affects how we live, energy production, food availability, and our overall cultural values. The Earth climate system is made up of multiple complex interactions, with the main driver being input of solar radiation. Understanding how the total energy budget of Earth changes is a major component 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 to be covered will 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 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 at the bookstore or online.]

## Course Web Page

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

## Grading

<b>Homework Assignments:</b>	45%
<b>Midterm Exam:</b>	20%
<b>Final Exam:</b>	25%
<b>In-Class Worksheets:</b>	10%

**Homework Assignments.** Assignments will be given out roughly every 1.5-2 weeks. The majority of the homework assignments will be quantitative problem sets, including problems from the textbook and others which I design. Later in the course, homework assignments will include reading and summarizing /critiquing journal articles on modes of climate variability or other more qualitative assignments. Please show all of your work on your assignments for proper credit. Answers should have the proper units and your final answers should be boxed. Also, I encourage students to work together on assignments. **However**, each student must turn in their own assignment and their own work for a grade.

**Midterm & 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 will only on material from the second half of the course. However, as with many sciences, concepts “build upon” each other, so you will be required to have some knowledge of earlier concepts.

**In-Class Worksheets.** Collaborative learning is an excellent way to learn and understand concepts in addition to traditional lectures. Occasionally, we will also work on problems and questions in small groups (2-3 students) during class and then collaboratively discuss the answers. These in-class assignments 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**. If you don't ask questions when things are unclear, then neither of us benefit from classroom lecture. We will These types of interactions also foster collaborative learning, which is important in the sciences. While certain interactions are graded (i.e., in-class worksheets), 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 and take exams on the assigned date. **No late submissions or makeup exams are 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 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 Office of Disability Services ( prior to receiving accommodations in this course. The Office of Disability Services is located in Goddard Health Center, Suite 166 (Phone: 405.325.3852 or TDD only 405.325.4173).

## **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, but you must submit your own original work for grading. All exams are **closed book**, and you may only use a calculator as an aid on the exam.

## **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 (8 AM to 5 PM, Monday-Friday) or [smo@ou.edu](mailto: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](mailto: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 22, 24, 26	Introduction & Course Expectations / Math + Thermodynamics Review	Chapter 1
2	Aug. 29, 31, Sept 1	Global Energy Balance	Chapters 2 & 3
3	Sept 7, 9	Global Energy Balance / Radiative Transfer <b>LABOR DAY - SEPT 5 - NO CLASS</b>	Chapters 2 & 3
4	Sept 12, 14, 16	Radiative Transfer / Radiation Equilibrium Models	Chapter 3
5	Sept 19, 21, 23	Surface Energy Balance / Boundary Layer	Chapter 4
6	Sept 26, 28, 30	Geographic Variations in Radiation / Hydrologic Cycle	Chapters 4 & 5
7	Oct 3, 5, 7	Hydrologic Cycle / Land-Atmosphere Interactions	Chapter 5
8	Oct <b>10</b> , 12, 14	Evaporation / Water Balance	Chapter 5
9	Oct 17, 19, 21	Atmospheric Motions & Fluxes <b>MIDTERM EXAM</b>	Chapters 6.1 - 6.4
10	Oct 24, 26, 28	General Circulation of the Ocean	Chapter 7
11	Oct 31 Nov 2, 4	Ocean Dynamics / Modes of Climate Variability	Chapters 6.5, 7, & 8
12	Nov 7, 9, <b>11</b>	Modes of Climate Variability	Chapter 8 / Select Readings
13	Nov 14, 16, 18	Climate Change / Feedbacks	Chapter 10
14	Nov 21	Climate Change / Natural <b>THANKSGIVING - NOV 23, 25 - NO CLASS</b>	Chapter 12
15	Nov 28, 30 Dec 2	Climate Change / Natural + Anthropogenic	Chapters 12 + 13
16	Dec 5, 7, 9	Overview of Climate Models Final Exam Review	Select Readings

**FINAL EXAM: FRIDAY DECEMBER 16, 2016 8:00 AM - 10:00 AM NWC Rm. 5600**