

**School of Meteorology
University of Oklahoma**

**METR 4403/5403: Application of Meteorological Theory to Severe
Thunderstorm Forecasting**

**Spring 2025
Class Hours: 9:30 – 10:20 am, MWF
Class Location: NWC 1350**

Instructor: Dr. Ming Xue

Email: mxue@ou.edu

Office Hours: 10:30am–12:00 pm Monday, Wednesday or by appointment.

Logistics for office hours: Office hours will generally be in person in Ming Xue's office NWC 2502, but if needed Zoom session can be arranged using the following link:

<https://oklahoma.zoom.us/j/95198963526?pwd=MTVFc1AxR3pKVkFwdm5TTjdGSTlYZz09>

Send me an email beforehand in that case.

Learning Management System: canvas.ou.edu and class website at <http://twister.ou.edu/METR4403>.

SPC/NSSL Instructors: Andrew Moore, Andrew Lyons, Harry Weinman, Matthew Flournoy and others.

Emails: andrew.moore@noaa.gov, andrew.lyons@noaa.gov, and harry.weinman@noaa.gov

Office hours: by appointment

Course Meeting Time, Location, and Mechanics:

Lecture: MWF 9:30–10:20 am in NWC 1350.

Final exam time: Monday 5 May 2025, 08:00–10:00 am. NWC 1350.

Course mechanics: Classes will be held in-person in NWC 1350. Course materials, including additional readings and videos, will be posted at the class website or on canvas. Prerecorded lecture videos will be used in lieu of holding make-up classes, as needed.

If you are not able to attend a regular in-person class period because you are sick or because of other legitimate reasons, we will try to arrange virtual attendance via Zoom. **If you cannot attend a regular in-person class period, please contact me ahead of time to let me know, and obtain the Zoom link.** The two midterm exams and final exam will be held in-person in NWC 1350, so everyone should plan to attend in person on these days.

Course Prerequisite:

Majors only; METR 4424 (Synoptic Meteorology Laboratory) with a grade of B or better or permission of instructor.

Course Description from Catalog:

This course provides an opportunity to bridge the academia and operational forecasting realms and provide an opportunity for students to learn from experienced meteorologist-forecasters who have performed research on a variety of topics. No student may earn credit for both 4403 and 5403.

Course Goals:

This is a 3-semester-hour course that instructs students on applications of meteorological theory to forecasting severe thunderstorms. This course bridges the academia and operational forecasting realms by including lectures from multiple SPC forecasters and researchers, providing an opportunity for students to learn from experienced professionals who have performed research on a variety of topics and hands-on experience producing practical severe weather forecasting.

In turn, students will gain appreciation for challenges in operational meteorology and learn about forecasting methods and gaps in our understanding of meteorological applications of theory with regard to severe thunderstorms. This experience will also foster stronger relationships between the School of Meteorology and the Storm Prediction Center.

This course also includes a critical hands-on approach to practicing severe-thunderstorm forecasting. In-class forecasting exercises will be an integral part of the course, requiring students to actively participate in small and large groups and present to the class.

Students will gain additional appreciation for communication of scientific information and discussion/interpretation of weather data in simulated, quasi-real-time scenarios.

Texts and Materials:

No textbook is required. Relevant course materials will be provided on canvas. **Colored pencils are required for some sessions.** A video lecture series created for this class is available online at the following website: <http://www.spc.noaa.gov/exper/spcousom/>. These videos contain nearly all of the material covered in this course and will serve as a valuable student resource.

In-Class Teaching Methods:

Lectures will consist of a mixture of styles, including presentation of material using a combination of hand-written notes on the whiteboard, visualizations in Powerpoint, and web-based materials. We will also work on in-class activities that will reinforce concepts from lecture and will help prepare you for the exams.

Student Responsibilities:

1. You are expected to attend class and be an active participant in the class by:
 - a. being mentally engaged during class
 - b. asking questions about course material
 - c. actively participating in weather discussion and other in-class activities
 - d. turning in assignments on time

2. If you are struggling with the course material or just have questions, attend office hours for help. Do not wait until the end of the semester to ask questions.
3. Arrive on time (**before** 9:30 AM) and depart on time (**not before** 10:20 AM). I understand that circumstances arise on occasion that may lead to you being late to class. However, I want to make it clear that if you are habitually late, it will bother me and it will impact your grade.
4. Refrain from disruptive conversations with people sitting around you and disruptive use of electronic devices, and remain in your seat during lecture. Those with repeated disruptions will be dismissed from lecture.
5. Cheating is not acceptable. Anyone caught cheating will be granted an automatic "F" in this course. See the "Academic Integrity" section below.

Course Activities:

Participation: Participation scores will be assigned based on the quality of contributions to class discussions (asking and answering questions), general courtesy towards instructors and speakers, involvement in class activities including occasional, irregularly scheduled weather briefings. There will also be occasional in-class activities that will be turned in at the end of class and will count toward participation. Participation in forecast exercises will be a crucial part of the participation grade. Tardiness and unexcused absences will result in participation-grade deductions. For examples of top-quality participation contributions / weather briefings, reference descriptions of “distinguished” work provided in the following document:

http://weather.ou.edu/~scavallo/classes/metr_4491_5491/WX_BriefingRubric.pdf.

A higher level of participation is expected from graduate students. Graduate students may participate by facilitating small-group environments conducive to learning, communicating more challenging aspects of the course to less-experienced students, and fostering strong teamwork and leadership skills. These skills reflect those required by forecasters to be successful in a real-time, operational setting.

Journal entries: There will be 2-3 journal entries assigned during the semester. Journal entries must be completed individually. In general, the goal of the journal entries is to forecast a chosen severe event from three days out to the day of the event. Think of yourself as an SPC forecaster who needs to update a forecast once per day. Use what you have learned in class to forecast coverage, severity, hazard type (convective mode) and timing as you can.

Homework: Three to four take-home assignments will be administered throughout the semester on an irregular basis. Graduate students will be given one additional slightly more involved take-home assignment.

Midterm exams: Midterm Exam 1 consists of problem solving that applies theoretical principles discussed during the course to operational forecast scenarios. A combination of equation derivations, applications of these equations, and chart analysis / forecasting may be covered in the first midterm. Midterm Exam 2 will be a similar format, with emphasis on material covered since the first midterm exam.

Final exam: The final exam will largely consist of a forecasting challenge. Students will inherit a 06Z SPC convective outlook and will be provided selected observational and model information used as the basis for a 13Z forecast update. They will be expected to create the 13Z forecast graphically and write a discussion that substantiates the new forecast, applying any relevant principles discussed through the class in a concise manner. A small portion of the final exam will consist of other course material and/or derivations.

Grading:

The percent contribution from each component to your final grade is as follows:

Participation: 5%
Journal entries: 15%
Homework/Quizzes: 20%
Midterm exam #1: 20%
Midterm exam #2: 20%
Final exam: 20%

Final letter grades will be assigned as follows:

A: $\geq 90.0\%$
B: 80.0% to 89.99999...%
C: 70.0% to 79.99999...%
D: 60.0% to 69.99999...%
F: less than 60.0%

There is **no extra credit** in this course. There will be **no arbitrary final grade raises**, so please do not ask.

Additional Support for Learning:

If you are struggling to understand something, ask the Instructors questions.

Course Policies:

Absences & Make-up Policy

You are expected to attend class and actively participate in the exercises and discussions. Students with excused impediments to involvement in course activities (University/academic commitment, health/family issue, jury duty, etc.), traditionally absences, should contact me in advance of the absence. If an excused absence falls on an exam day, contact me as soon as possible to arrange acceptable accommodations for making up missed work.

Late Assignments

You are expected to submit assignments on time. Late submission of assignments will result in the loss of 10% on the first day and 5% on each of the subsequent days unless related to an excused absence. Unless otherwise noted, all assignments are due by the start of class on the provided date. Note that assignments will be considered one day late if turned in following the start of class (i.e., after 10 AM) on the designated date or before 10 AM on the following date, two days late if turned in after 10 AM on the following day or before 10 AM two days after class, etc.

Tentative Course Schedule (subject to change):

Instructor	Date	Week Day	Topic
Weinman	1/13/2025	Mon	Basic ingredients for svr storms
Moore	1/15/2025	Wed	Surface and Upper Air Analysis
Weinman	1/17/2025	Fri	Skew-T & Parcel Theory
	1/20/2025	Mon	No Class (MLK day)
Weinman/Lyons	1/22/2025	Wed	Skew-T/Lapse Rate Tendency
Lyons	1/24/2025	Fri	Lapse Rate Tendency
Flourney	1/27/2025	Mon	QG Height Tendency
Flourney	1/29/2025	Wed	QG Height Tendency
Flourney	1/31/2025	Fri	QG Omega
Flourney	2/3/2025	Mon	QG Omega
Flourney	2/5/2025	Wed	QG + Skew-T Application
Moore	2/7/2025	Fri	Vertical Wind Shear
Nixon	2/10/2025	Mon	Hodographs Pt. 1 - Basics/intro
Nixon	2/12/2025	Wed	Hodographs Pt. 1 - Basics/intro
Nixon	2/14/2025	Fri	Hodographs Pt. 2 - Vorticity and SRH
Nixon	2/17/2025	Mon	Hodographs Pt. 2 - Vorticity and SRH
Lyons	2/19/2025	Wed	Convective Mode
Lyons/Moore	2/21/2025	Fri	Convective Mode Pt. 2
Moore	2/24/2025	Mon	Forecast Discussion Lecture
Moore	2/26/2025	Wed	Forecasting Exercise
Lyons	2/28/2025	Fri	Hail Forecasting
Weinman	3/3/2025	Mon	Supercell Pressure Perturbations Pt. 1
Weinman	3/5/2025	Wed	Supercell Pressure Perturbations Pt. 1
Weinman	3/7/2025	Fri	Supercell Pressure Perturbations Pt. 2
Weinman	3/10/2025	Mon	Supercell Pressure Perturbations Pt. 2
Xue	3/12/2025	Wed	Midterm Review/Questions
Xue	3/14/2025	Fri	Midterm 1
	3/17/2025	Mon	No Class (Spring Break)
	3/19/2025	Wed	No Class (Spring Break)
	3/21/2025	Fri	No Class (Spring Break)
Moore	3/24/2025	Mon	Fire Weather Forecasting
Halbert	3/26/2025	Wed	Tornadogenesis
Moore	3/28/2025	Fri	Supercell and Tornado parameters
Lyza	3/31/2025	Mon	Tornado Climatology
Lyza	4/2/2025	Wed	Tornado Climatology
Edwards	4/4/2025	Fri	Tropical Cyclone Tornadoes
Edwards	4/7/2025	Mon	Tropical Cyclone Tornadoes
Squiteiri	4/9/2025	Wed	MCS Motion
Squiteiri	4/11/2025	Fri	MCS Motion
LaDue/Wood	4/14/2025	Mon	Supercell Radar Applications
LaDue/Wood	4/16/2025	Wed	Supercell Radar Applications
Xue	4/18/2025	Fri	Midterm 2
Weinman	4/21/2025	Mon	Satellite
Lyons/Xue	4/23/2025	Wed	CAM lecture/models and use in operations

Rich/Moore	4/25/2025	Fri	Forecasting Philosophy
Weinman	4/28/2025	Mon	MCD exercise
Lyons	4/30/2025	Wed	Outlook Exercise/Real Time
Lyons	5/2/2025	Fri	Outlook Exercise/Real Time
	5/5/2025	Mon	No Class (Finals week)
	5/7/2025	Wed	No Class (Finals week)
	5/9/2025	Fri	No Class (Finals week)
	5/13/2025	Tue	Final Grades Due

University Policies:

Copyright Syllabus Statement

Sessions of this course may be recorded by the instructor. These recordings are the intellectual property of the individual faculty member and may not be shared or reproduced without the explicit, written consent of the faculty member. In addition, privacy rights of others such as students, guest lecturers, and providers of copyrighted material displayed in the recording may be of concern.

Students may not share any course recordings with individuals not enrolled in the class or upload them to any other online environment.

Academic Integrity

Cheating is strictly prohibited at the University of Oklahoma, because it devalues the degree you are working hard to get. As a member of the OU community it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at <https://www.ou.edu/integrity/students>.

To be successful in this class, all work on exams must be yours and yours alone. You may not receive outside help. On examinations you will never be permitted to use your notes, textbooks, calculators, or any other study aids or electronic devices such as cell phones, laptops, watches. Should you see someone else engaging in this behavior, I encourage you to report it to myself or directly to the Office of Academic Integrity Programs. That student is devaluing not only their degree, but yours, too. Be aware that it is my professional obligation to report academic misconduct, which I will not hesitate to do. Sanctions for academic misconduct can include expulsion from the University and an F in this course, so don't cheat. It's simply not worth it.

Religious Observance

It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty.

Reasonable Accommodation Policy

The University of Oklahoma will reasonably accommodate otherwise qualified individuals with a disability unless such accommodation would pose an undue hardship or would result in a fundamental alteration in the nature of the service, program, or activity or in undue financial or administrative burdens. The term reasonable accommodation is used in its general sense in this policy to apply to employees, students, and visitors.

Reasonable accommodation may include, but is not limited to:

- (1) Making existing facilities readily accessible and usable by individuals with disabilities;
- (2) Job restructuring;
- (3) Part-time or modified work schedules;
- (4) Reassignment to a vacant position if qualified;
- (5) Acquisition or modification of equipment or devices;
- (6) Adjustment or modification of examinations, training materials, or policies;
- (7) Providing qualified readers or interpreters; or

(8) Modifying policies, practices, and procedures.

Students who require accommodations in this course are requested to speak with the professor as early in the semester as possible. Students with disabilities must be registered with the **Disability Resource Center** (www.ou.edu/drc) prior to receiving accommodations in this course. The DRC is located in University Community Center, 730 College Ave, phone 405/325-3852.

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 to 5, M-F) or smo@ou.edu. Incidents can also be reported confidentially to OU Advocates at 405/615-0013 (phones are answered 24 hours a day, 7 days a week). Also, 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: Marci Gracey, Institutional Equity Officer and Title IX Coordinator at 405/325-3546 or mgracey@ou.edu. For more information, 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 your professor or the Disability Resource Center at 405/325-3852 as soon as possible. Also, see https://ou.edu/eoo/faqs/pregnancy-faqs/jcr_content/contentpar/download/file.res/FAQ's_Pregnant%20and%20Parenting%20Students.pdf for answers to commonly asked questions.

Final Exam Preparation Period

Pre-finals week will be defined as the seven calendar days before the first day of finals. Faculty may cover new course material throughout this week. For specific provisions of the policy please refer to OU's Final Exam Preparation Period policy (<https://apps.hr.ou.edu/FacultyHandbook#4.10>).

Emergency Protocol

During an emergency, there are official university [procedures](#) that will maximize your safety.

Severe Weather: If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather *1. LOOK* for severe weather refuge location maps located inside most OU buildings near the entrances *2. SEEK* refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building. *3. GO* to the building's severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows. *4. GET IN, GET DOWN, COVER UP.* *5. WAIT* for official notice to resume normal activities.

[Link to Severe Weather Refuge Areas](#), [Severe Weather Preparedness - Video](#)

Armed Subject/Campus Intruder: If you receive an OU Alert to shelter-in-place due to an active shooter or armed intruder situation or you hear what you perceive to be gunshots:

1. GET OUT: If you believe you can get out of the area WITHOUT encountering the armed individual, move quickly towards the nearest building exit, move away from the building, and

call 911. 2. *HIDE OUT*: If you cannot flee, move to an area that can be locked or barricaded, turn off lights, silence devices, spread out, and formulate a plan of attack if the shooter enters the room. 3. *TAKE OUT*: As a last resort fight to defend yourself.

For more information, visit

<http://www.ou.edu/emergencypreparedness.html> [*Shots Fired on Campus*](#)

[*Procedure - Video*](#)

Fire Alarm/General Emergency: If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates: 1. *LEAVE* the building. Do not use the elevators. 2. *KNOW* at least two building exits 3. *ASSIST* those that may need help 4. *PROCEED* to the emergency assembly area 5 *ONCE safely outside, NOTIFY first responders of anyone that may still be inside building due to mobility issues.* 6. *.WAIT* for official notice before attempting to re-enter the building. [*OU Fire Safety on Campus*](#)

Mental Health Support Services

If you are experiencing any mental health issues that are impacting your academic performance, counseling is available at the University Counseling Center (UCC). The Center is located on the second floor of the Goddard Health Center, at 620 Elm Rm. 201, Norman, OK 73019.

To schedule an appointment call (405) 325-2911.

For more information please visit <http://www.ou.edu/ucc>.