

Syllabus: Synoptic Analysis and Forecasting

Course ID# 21415 (undergrad) 21414 (grad)

3 Credit Hours

Course Overview: *Synoptic meteorology is the study of continental-scale (i.e. synoptic) atmospheric conditions and the processes that drive changes to these conditions. Topics examined include atmospheric forces and flow balances; development and evolution of low and high pressure systems, frontal systems, jet stream and upper-air features; quasi-geostrophic theory; observational tools; operational numerical weather models; and weather forecasting techniques.*

<u>Instructor:</u>	Dr. Jana Houser Email: houser.262@osu.edu	Office: 1124 Derby Office hours: Mon 10:30-12:00, Open door
<u>TA:</u>	Cole Good Email: good.361@buckeyemail.osu.edu	Office: 1155 Derby Office hours: Wed 10-11:30

***PLEASE NOTE: If you email me a question that you can find the answer to on the syllabus, or online somewhere, I will refer you back to the syllabus without answering your question!**

Class Information: **Course Format:** Lecture
Meeting Times: Monday/Wednesday 12:45 - 2:05, DERBY 070
Prerequisites: Geog 5940, Math 1152, Phys 1251
Textbook: *Midlatitude Synoptic Meteorology* by Gary Lackmann
 ISBN: 978-1-878220-10-3 (NOTE: This is not required, but it is STRONGLY encouraged that you purchase the text book as it will aid in the delivery of course material.)

*IMPORTANT ILLNESS AND TRAVEL RELATED INFORMATION: This class will be offered in person. If you find yourself ill and/or needing to quarantine (or cannot attend class in person for some university sanctioned reason), I will live-stream our class via Zoom. HOWEVER: this is not a default option. YOU MUST CONTACT ME PRIOR TO THE START OF CLASS to make arrangements for me to start the Zoom. Additionally, there are a few times where I will be traveling over the semester (see the calendar on the last page). On these dates, I will deliver class via a remote lecture on Zoom.

ZOOM INFO: <https://osu.zoom.us/j/97756178909?pwd=KgFnebOf4sUrcpThFd0eD4beXumEbY.1>

Recommended course equipment: In order to complete activities, it is strongly recommended that you purchase a digital pen that will allow you to write directly on the digital word document assignments. If you don't know where to start, I recommend the XP Pen (I personally have the Deco 01), which can be used very easily with Macs or Microsoft systems by simply plugging in the tablet to a USB port.

Big Picture Course Goal: **Identify, explain, and forecast the behavior, evolution, and weather patterns associated with synoptic-scale weather systems using quasi-geostrophic theory to scientifically back arguments and observations.**

Expected learning outcomes to assist in accomplishing the big-picture goal:

- 1) *Interpret* weather conditions from surface, upper air, radar and satellite data.
- 2) *Identify* synoptic-scale features such as surface lows, Rossby waves, jetstreaks, etc.
- 3) Use governing and supporting physical equations to *explain* atmospheric behavior.
- 4) *Diagnose* regions of synoptic-scale upward and downward vertical motions, height rises and height falls expected from quasi-geostrophic theory.
- 5) *Predict* where midlatitude cyclones will develop.
- 6) *Forecast* the evolution of Rossby waves

- 7) *Predict* surface weather associated with various configurations, stages of evolution, and storm-relative locations of synoptic-scale systems and their associated fronts.

Grading: Final grades will be assigned according to the OSU standard system and will not be curved (In other words, if you have an 89.49% you earn a B+):

Grade Scale

A	A-	B+	B	B-	C+	C	C-	D+	D	E
>92.5%	89.5 – 92.5%	86.5 – 89.5%	82.5 – 86.5%	79.5 – 82.5%	76.5 – 79.5%	72.5 – 76.5%	69.5 – 72.5%	66.5 – 69.5%	59.5 – 66.5%	<59.5%

Assessment:

Exams (2): (2 midterms – 15% each, total 30%)

Weekly quizzes: 20%

Weekly Homework: 20%

WxChallenge: 10%

Class participation: 10%

FINAL PROJECT: 10%

Exams (30%): There will be two midterm exams worth equal weights for this course scheduled during class time. Exam dates are tentatively scheduled as shown on the last page.

Weekly quizzes (20%): At the beginning of **MONDAY'S** class, there will be a quiz that will evaluate students' preparation for that week's material. The quiz will be taken twice, back to back, once independently and once in your group. Both grades will count for credit according to the percentages determined at the beginning of the semester. *If you are absent, you can make arrangements to take the quiz individually if you contact me **within 24 hours** of the absence.* If you are absent, your individual grade will also count as your group grade. You can have **2 make ups** during the semester unless there are extenuating circumstances *that we have been in communication about.* If you are late to class, you will NOT be granted extra time to complete your quiz. The lowest quiz grade (individual AND group) will be dropped.

Homework (20%): Each Thursday, a portion of class time will be spent on homework problems. The goal of the homework is to get you to immediately apply what you have learned in class. Homeworks will be made available following MONDAY's class and will be due SUNDAY NIGHT at 9:00 PM.

WxChallenge (10%): Since this is a forecasting based class, you will be expected to exercise your skills by participating in the National Weather Challenge! Each city will contribute 10 points towards the final grade in this category. Part of your grade (7/10 points) is based purely on participation. So, if you manually enter 100% of the forecasts, you will automatically receive partial credit (7/10 points). The remaining 3 points will be based upon forecast accuracy. If you place in the national consensus at the end of the forecasting timeframe for a city, you automatically earn full credit. If you place in the local consensus, but not in the national consensus, you will earn 9 points. If you are not in the local consensus but are in the top 50% of the nation, you will earn 8 points. Anyone placing below the 50% mark will earn 7 points. You are allowed ONE missed forecast per city. Any additional missed forecasts will result in a 0.5 point deduction per missed forecast. (So, out of 8 forecasts, if you miss 3, you will lose 1 point. This point will be deducted from your final rank-based point assignment for the city at the end of the forecast period.) If you, for example, placed in the top 50% but not local consensus, AND you missed 3 forecasts, you will be assigned a 7/10 for that city. There are FIVE cities throughout the semester.

Class participation (10%): *This grade is earned based upon your attendance and your group peer-evaluation.* Each group member will anonymously evaluate the others' preparation and participation in group quizzes and activities twice during the semester. The average of an individual's responses will be used as this grade unless there is an obvious outlier in the evaluations. See Group Evaluation Rubric handout on Canvas document.

Final Project (10%): In lieu of a final exam, there will be a final project due during finals week at the end of the semester. This project requires you to follow the evolution and associated conditions of a mid-latitude

cyclone and explain how and why it evolved the way it did. For more information including rubric, see the Final Project handout on Carmen.

Attendance Policy: While attendance is not formally part of your grade, I expect students to be at class EVERY LECTURE. Failure to do so will result in decreased peer evaluation grade and missed content delivery. IF YOU MISS CLASS FOR ANY REASON, Please communicate with me ASAP.

***NOTE: This course is executed following the “Team-based Learning” pedagogical method. As such, there will be distinct differences between this course and the traditional lecture-style class.**

Class Time: You are expected to come prepared to class on MONDAY having already read through the week’s course materials (book, Powerpoints and/or videos). Class material will be posted on Canvas and students may access this information at any time. In order to aid you in your preparation, I have provided you with book references matching the Powerpoint slide content. Book readings are not required, but are added to be an additional source of information. Content for assignments/exams will be based off powerpoints.

Monday’s Class: We will start class time immediately with the quiz. Following the quiz, we will identify topics/questions that students want to focus on for that week, and this material will be what we talk about in class time through a series of “mini lectures”. *NOTE: There will be some powerpoint content that we do not explicitly talk about in class. But you will STILL be responsible for knowing this content. This is why it is SO IMPORTANT for you to come to class prepared. That way you know what to ask and what topics you need clarification on.

Wednesday’s Class: We will finish up with any remaining mini-lecture topics that were not covered on Tuesday. Otherwise, Thursday will consist entirely of active learning activities including group discussion-based multiple choice questions, and application-based homework questions for the remainder of the class time. The homework questions are similar to exam questions and are therefore good study tools.

*I will be working on campus on Mondays and Wednesdays. Other days of the week, I will be working remotely.

Class Specific Details, Policies and Procedures: Synoptic Forecasting

1. Classes will begin AT 12:45 whether you are here or not. Please try not to be late as this disrupts the class environment.
2. **Make-up exams will only be allowed if arrangements have been made PRIOR TO the exam date** or for unusual extenuating circumstances.
3. Assignments, course materials and grades will be updated and posted on Carmen.
4. If you have special needs for any reason, please see <http://www.ohio.edu/disabilities/> for information. I will only be able to grant you special permissions if you have the appropriate documentation of your disability and your needs.
5. **Cell phones and other electronic devices ARE ONLY PERMITTED** for use in the classroom or the lab for polling purposes, for completing assignments or if you have a specific need that requires their use. In such situations please notify me of your need and provide any university documentation that supports it.
6. **For remote lectures, students are expected to have their cameras ON during the entire duration of Zoom meetings.** I do not care if you just rolled out of bed, or if you are in last night’s clothes, but I want to see your face, as do your classmates.
7. **Computers** in the lab are ONLY to be used when working on assignments. Use of the computers during lectures is not permitted.

Course Outline: (Updated 9/15/25)***This course outline is subject to change based upon lecture/classroom pace and unforeseen circumstances**

<i>Class Date</i>	<i>Topics</i>	<i>Book Material</i>	<i>Homework</i>
8/25-8/31 Week 1	Introduction, Scales of motion, Units, Variables, Surface Analysis Review, Isoplething, Analyzing Fronts	Ch 1.1, 1.2, table 1.3, Ch 12, Slides	HW1 Due 8/31
9/1-9/7 Week 2	NO CLASS 9/1 – Labor Day Intro to numeric weather prediction, weather models, Forecasting Techniques	Ch 10.1, 10.2, 10.3, 10.4 intro, 10.4.3, 10.4.4, 10.5 intro, 10.6 intro, 10.6.1, 10.6.3 intro, 10.7, Ch 11.2, 11.3, Slides	HW2 Due 9/7 Quiz 1
9/8-9/14 Week 3	Basic Governing Equations, Kinematics of the wind field	Ch 1.3 Ch 1.5 intro, 1.5.1, 1.5.2, Slides	HW3 Due 9/14 Quiz 2
9/15-9/21 Week 4	Advection, vorticity equation, synoptic-scale forces and force balances	Slides	HW4 Due 9/21 Quiz 3
9/22-9/28 Week 5	Jet streams, geostrophic wind, thermal wind, ageostrophic wind, Convergence, divergence and relation to surface patterns, and secondary circulations	Ch 1.4, Slides	HW5 (practice only) Quiz 4
9/29-10/5 Week 6	Exam 1: 9/29 - All material through 9/29 Intro to QG Dynamics, QG Omega	Ch. 2.1 – 2.3, Slides	NO Homework NO QUIZ
10/6-10/12 Week 7	QG Omega, Trenberth	2.3, Slides	HW6 Due 10/12 Quiz 5 with Week 6
10/13-10/19 Week 8	Q-G Height tendency equation and adiabatic influences	Ch. 2.4, Slides	HW7 Due 10/19 Quiz 6
10/20-10/26 Week 9	Rossby Waves	Ch 5 intro	HW8 Due 10/26 Quiz 7
10/27-11/2 Week 10	Intro to midlatitude cyclones, conveyor belt theory, Midlatitude Cyclone Weather Dr. H Traveling! Zoom or Asynch Lectures	Ch 5 intro, 5.3. (stop before 5.3.5), Slides	HW9 Due 11/2 NO QUIZ
11/3-11/9 Week 11	Behavior and evolution of midlatitude synoptic systems – QG perspective	Ch 5.3.5, Slides	HW10 (practice only) Quiz 8 (Weeks 10 & 11)
11/10-11/16 Week 12	Types of midlatitude cyclones Exam 2: 11/12 - All material from 9/25-11/4		NO HW Quiz 9
11/17-11/23 Week 13	Fronts, Frontogenesis, Kinematic Frontal Circulations	Slides	Start HW11 Quiz 10
11/24-11/30 Week 14	Dynamic frontogenesis 11/26: NO CLASS, Thanksgiving		HW 11 Due 11/24 Quiz 11
12/1-12/7 Week 15	Winter Storms	Ch 6.1 - 6.4, Slides	HW12 Due 12/3 Quiz 12
12/8-12/14 Week of 12/15	Thermal Hs and Ls, Cold Waves Final Exams (12/12 5 PM Final Project Due)	Slides	Quiz 13, No HW NO HW

COLLEGE OF ARTS AND SCIENCES STATEMENTS:

Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>. Don’t cheat. Don’t copy. Don’t plagiarize.

If academic misconduct is suspected, the professor reserves the right to impose one or both of the following consequences:

1. A grade penalty, such as an F, may be imposed on the project or in the course.
2. A formal student conduct referral may be filed with the Office of Community Standards and Student Responsibility.

***PLEASE NOTE: HAVING ANOTHER PERSON COMPLETE OR PROVIDE YOU WITH ANSWERED ASSIGNMENT OR EXAM QUESTIONS, INCLUDING MATERIALS FROM PAST YEARS IS CONSIDERED CHEATING BY BOTH PARTIES AND IS GROUNDS FOR ACADEMIC DISCIPLINE RANGING FROM RECEIVING A 0 ON THE ASSIGNMENT TO FAILURE OF THE COURSE**

If a student is caught cheating *in any capacity* on any material, disciplinary action will be taken.

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Student Accessibility:

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Religious Accommodations:

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by

allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Office of Institutional Equity. (Policy: Religious Holidays, Holy Days and Observances)

Statement on Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614--292--5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614--292--5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

Statements on harassment and Diversity:

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at <http://titleix.osu.edu> or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu.

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.