

11:670:211 Meteorological Analysis

Course Syllabus

Fall 2023

Instructor Information

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Office Hours: M 4–5 and F 11–12

Textbook

Required: *Synoptic Analysis and Forecasting: An Introductory Toolkit*, by Shawn Milrad
(ISBN 978-0-12-809247-7)

Learning Objectives

Upon completion of this course, students will be able to:

1. Describe the key parts of weather systems and their locations (both horizontally and vertically) in the context of a weather discussion.
2. Translate weather observations to and from METAR code, symbols, and plain language.
3. Identify areas on weather maps where kinematic quantities commonly encountered in meteorology (e.g., divergence, vorticity, advection) are positive, negative, or weak.
4. Describe what an isopleth is and identify isopleths that can't possibly be correct even if the underlying data is not shown.
5. Produce analyses of weather maps that incorporate fronts, isopleths, and other meteorological features given a set of observations plotted on that map.
6. Use foundational elements of the Linux command-line interface.
7. Describe how meteorological measurements are made and interpret them.
8. Use observations and computer tools as part of their weather forecasting process.

These objectives support Meteorology Program Learning Goals 1, 3, 4, and 5.

Course Summary

Whether you are a Meteorology major or not, you have undoubtedly encountered weather information in your daily life, either through apps on your phone, your favorite weather websites, or even watching a TV weathercast. But where does all this information come from, what does it mean, and how can we use it to make our own forecasts? Broadly speaking, the purpose of this course is to get you down and dirty with real meteorological data to answer these questions. In class, we will examine and interpret in-situ observational data, human-generated data, computer-generated data, and remotely sensed data in two ways. First, we will start each class with a weather discussion, which will give us a chance to look holistically at weather systems currently affecting us. Then, we will explore a new concept in detail during the remaining part of each class. You will be given frequent opportunities to practice what you've learned in assignments distributed at the end of some classes. Finally, we will also participate in the WxChallenge throughout the semester so that you can try out your new knowledge in a weather forecasting context.

Course Activities and Assessments

Weather discussions are held at the beginning of most classes. They last 10–15 minutes and give us all the opportunity to answer the question "What has happened, is happening, and will happen?" using *primary* sources, as a meteorologist on the job would. For any given discussion, you will take on one of three roles: discussion leader, inquirer, or evaluator. Rubrics and other details regarding how points are earned during this activity will be distributed separately. If you find our class's discussions do not fully satisfy your weather fix, you are welcome (but not required) to attend the weather discussions that are led by the seniors on Fridays at 12:25 PM in Room 223.

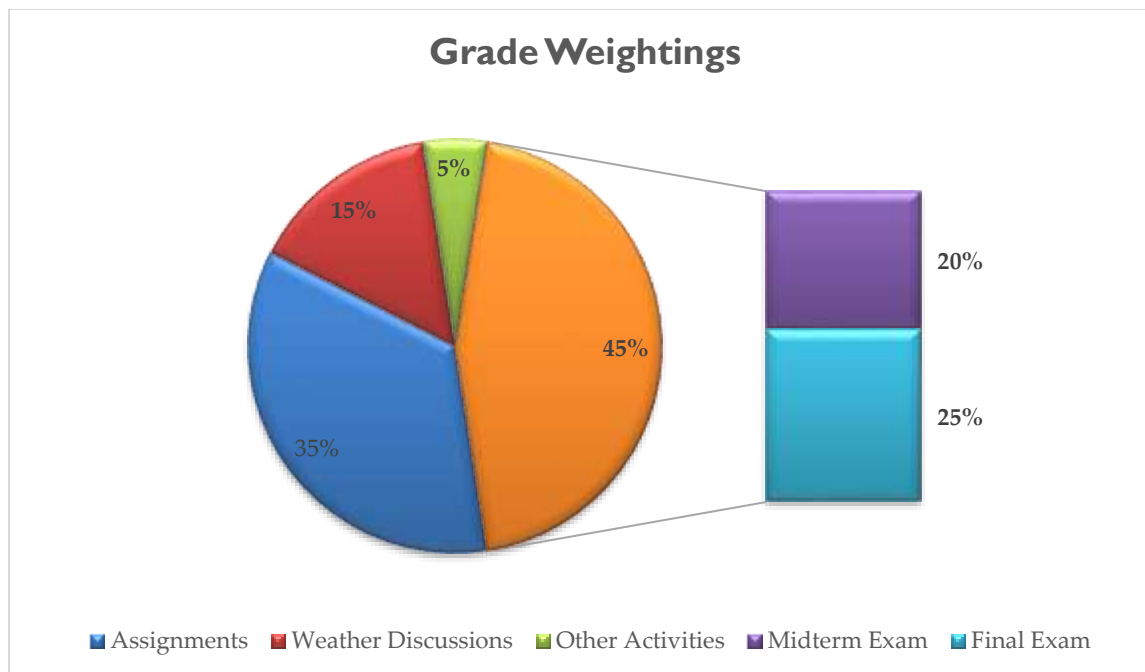
Assignments will be given approximately weekly (see the ✓s on the schedule for the precise dates) and provide additional practice working through problems and concepts recently covered during class periods. Unless otherwise stated, I will collect them at the beginning of class one week after they are assigned. Often, you will have some time to work on the current assignment in class. Some assignments will require the computer resources in Room 323 to complete. You can check the room schedule here (on the Rutgers network only): <https://www.des.rutgers.edu/envsci/>, but if getting to Room 323 isn't convenient, you will also have the option of setting up the necessary resources on your own computer. For some of the other assignments, we will be drawing weather analyses on paper. For these assignments, **you will need colored pencils!** (I'll have my own set of colored pencils available as a backup.)

Exams will be given on October 26 and December 19. The exams give you the opportunity to confirm that you have met the learning objectives I have set out for this course. I recognize that life happens, and you may have an important event on one of these dates. If that's the case, **please let me know as soon as possible**. If a last-minute issue arises (e.g., a verifiable illness), I will make every effort to arrange for a make-up. Note that the final exam is comprehensive, but I will weight it more toward the topics we cover after the midterm.

Other Activities will take place throughout the semester. The general rule for these is, if you make a good-faith effort and complete the activity, you will receive a point; if not, you won't. The primary activity in this category is the WxChallenge, which is an intercollegiate forecasting contest administered by the University of Oklahoma. In this contest, we will issue forecasts four times a week (Mondays through Thursdays), with the forecast city fixed for two weeks at a time. This contest runs throughout the school year; this semester the contest begins September 25 and ends December 11. Each time you successfully make a forecast, you will receive a point (no matter how good or bad the forecast ends up being), up to a maximum of 38 points. (Since there are 40 forecasts to make over the course of the semester, this is equivalent to having two free missed forecasts.) Although performance does not contribute toward your overall course grade in general, I will award you one bonus percentage point on your final grade if you beat me in the cumulative standings at the end of the semester. In addition, if you win your division of the contest (for most of you, this is Division 4) for a particular forecast city, you will receive one bonus percentage point on your final grade.

Grading Procedures

Course activities will contribute to your final grade in the following proportions:



Your final percentage grade in the course will be a number between 0 and 106 (theoretically). These percentages will be rounded to the nearest integer and converted to grades using the following scale:

A	91+	C	70–75
B+	86–90	D	60–69
B	81–85	F	<60
C+	76–80		

I reserve the right to lower the grade cutoffs, but I will never raise them. In other words, if your final percentage grade is 91, you are guaranteed an A. If it is 90, you are guaranteed a B+, but you might receive an A instead. In no circumstance will I treat students inequitably. For instance, if two students each had a final percentage grade of 80, I would not give one a C+ and the other a B.

Late Assignment Policy

I expect assignments to be submitted on the given due date. However, I understand that unforeseen circumstances (e.g., illness, family emergency, computer crash, etc.) may hinder your ability to meet the due date. Thus, **you have three "late days" that you may use over the course of the semester.** You may turn in one assignment three days late, or three assignments one day late each, or some other combination, without being penalized. I only count "business days", so going from Friday to Monday counts as one day instead of three.

Even if you have used your late days, it is to your benefit to submit assignments late because you can earn up to 90% of the points if it is one day late, 80% of the points if it is two days late, etc. Please reach out to me with any concerns about missing or late assignments or issues you are facing that are interfering with classwork.

Absence Policy

Please use the Rutgers absence-reporting website at <https://sims.rutgers.edu/ssra/> to report any absences from this class. Then follow-up with an email directly to me. If you complete these steps, I will award you any in-class participation points you might have missed that day.

Your Feedback

Although I have taught this course many times, that doesn't mean I can't improve! I welcome any feedback (positive or negative) you have about this course. You can provide this feedback in two ways:

- E-mail me, or talk to me directly.
- Slip an anonymous note in my mailbox (by the copy machine on the second floor).

Schedule

NOTE: The ✓'s below indicate when new assignments will be distributed.

<i>Date</i>	<i>Topic</i>	<i>Reading</i>	
September	5	Introduction, computer setup, time zones, and geography	1.1 ✓
	7	Weather discussions; units for temperature and pressure	1.2
	12	METARs and the station model	2
	14	Decoding METARs	3 ✓
	19	NWS text data	
	21	Interpreting upper-air maps	4
	26	Analysis of upper-air observations	5 ✓
	28	Analysis of upper-air observations II	6
October	3	Kinematics	7.1–7.3
	5	Plotting vorticity and divergence	✓
	10	Weather station field trip	
	12	Advection; Larry from CES	7.4, 8.2
	17	Plotting advection	9 ✓
	19	Geostrophic wind	
	24	Thickness and the hypsometric equation	8.1 ✓
	26	Midterm Exam	
	31	Numerical weather prediction	
November	2	Model output statistics & BUFKIT	
	7	Ensemble forecasting	
	9	Analysis of surface observations	10 ✓
	14	Analysis of surface observations II	
	16	Synoptic climatology and forecasting tips	15 ✓
	21	Vertical structure of the atmosphere	
	28	The skew-T diagram	13.1, 14 ✓
	30	Severe weather parameters	13.2
December	5	Plotting severe weather parameters	✓
	7	Satellite imagery	11
	12	Radar imagery	12
	19	Final Exam (12–3 PM)	

Academic Integrity

See <http://nbacademicintegrity.rutgers.edu/> for information on the university's policy on Academic Integrity. The principles of academic integrity require that a student:

- Properly acknowledge and cite all use of the ideas, results, or words of others.
- Properly acknowledge all contributors to a given piece of work.
- Make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- Obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.
- Treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- Uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that

- Everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
- All student work is fairly evaluated and no student has an inappropriate advantage over others.
- The academic and ethical development of all students is fostered.
- The reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

Diversity and Inclusion Statement

It is my intent that students from all diverse backgrounds and perspectives will be well served by this course, that students' learning needs will be addressed both in and out of class, and that the diversity that students bring to this class will be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. However, I may trip up from time to time, such as by saying "you guys" when I mean to refer to everyone regardless of gender. Your suggestions on how I can improve are encouraged and appreciated. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Student Wellness Services

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901

<http://health.rutgers.edu/medical-counseling-services/counseling/>

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professionals within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)
(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901
<http://vpva.rutgers.edu/>

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty.

Disability Services
(848) 445-6800 / Lucy Stone Hall (54 Joyce Kilmer Ave), Suite A145, Piscataway, NJ 08854
<https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

DoSomething button through Rutgers Dean of Students office:
<http://health.rutgers.edu/do-something-to-help/>

Wellness Coaching through Rutgers HOPE:
<http://health.rutgers.edu/education/hope/wellness-coaching/>

Self-Help Apps found on the Rutgers Student Health website:
<http://health.rutgers.edu/education/self-help/self-help-apps/>

NJ Hopeline: (855) 654-6735

National Suicide Hotline: (800) 273-8255