

Syllabus

Course: CLIMATE: Meteorological Analysis Laboratory (Fall 2018)
Web Page: <http://umich.instructure.com/>

Times: Monday, Wednesday and Friday 1:30-3:30 PM (LEC) – Room 2238
Lab portion of the class will be in the GCL Lounge - Room 2134

Course Materials: All necessary materials will be handed out in class.

Honor Code: <http://ossa.engin.umich.edu/honor-council/>

Instructor: Frank J. Marsik, PhD
Office: 2543C Climate and Space Research Building
Office Hours: WED 4:00 to 5:00 pm or by appointment
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E-mail: marsik@umich.edu

Course Summary:

The study of meteorology and climate at the University of Michigan dates back to the 1850's. These early studies in meteorology and climate were focused on the application of this knowledge to the areas of agriculture and maritime shipping, both of which were important economic sectors. Since that time, the development of a fundamental understanding of meteorology/weather prediction and climate has proven to be important in relation to a number of newer disciplines, including:

- Air Pollution
- Architecture and urban planning
- Aviation
- Civil and environmental engineering
- Land-surface processes
- Climate change

The objective of this course will be to develop the skills and understanding necessary to:

1. Objectively analyze and interpret conventional weather observations, using this information to determine the thermodynamic state of the lower atmosphere.
2. Integrate knowledge obtained from prerequisite courses, to objectively analyze current atmospheric conditions and the output from numerical weather models to forecast changes in the thermodynamic state of the lower atmospheric.
3. Apply resulting knowledge to the areas of large-scale general circulation, synoptic-scale weather prediction, as well as air-pollution transport, dispersion and deposition.

Course Pre-Requisites:

It is suggested that students from within the Department of Atmospheric, Oceanic and Space Sciences take Atmospheric Thermodynamics (CLIMATE 350) and Geophysical Fluid Dynamics (CLIMATE 401) courses prior to (or concurrent with) this course. If you are not an CLIMATE major, please see me after class.

Course Materials:

This course does not have a required textbook. In general, the course materials will be drawn from a variety of textbooks, peer-reviewed literature and technical training documents available through the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Air Force. I will hand out pertinent material as needed.

Grading and Exam Details:

The final course grades will be determined using the following guidelines:

Homework	15 %
Forecast Logs	15 %
Forecast Discussion	5 %
Hourly Exam #1	20 %
Hourly Exam #2	20 %
Term Project	25 % [20% for Paper; 5% for Presentation]

The grading for this course will be on a straight scale, percentage-wise: A (94-100), A- (90-93), B+ (87-89), B (84-86), B- (80-83), C+ (77-79), C (74-76), C- (70-73), D+ (67-69), D (64-66), D- (60-63), Fail (<60).

HOMEWORK: There will be a number of homework assignments that help to underscore the material covered in class. These assignments will be due in class on the assigned due date. Assignments may be turned in late with prior permission only. Assignments turned in late without permission will have one point deducted for each day that assignments are late. If assignments are not turned in within one week of the assigned due date, the student will receive no credit for the assignment. You will receive an incomplete for the term until all assignments have been completed.

FORECASTING AND WEATHER DISCUSSION: We will be having a forecasting competition within the class. Our forecasts will be for Detroit, Michigan, with official verification taken from the Detroit Metropolitan Airport. Details of the forecast rules will be passed out within the first two weeks of class. Forecasts will be entered using the following website: <http://weather.engin.umich.edu/forecastgame/>. If you do not have an account on the website, please visit the site and signup!

The grading for the forecasting portion of the class will be as follows:

- Weather Forecasting Logs: For each Friday class session, students will be responsible for writing a Weather Forecasting Log, which includes: observed

conditions, forecast discussion, forecast, verification and verification discussion. Each Weather Forecasting Log will be due at Tuesday, 11:50 pm of the week following the forecast. This will count toward 15% of the total class grade. A template for the Weather Forecasting Log will be located on the Canvas website.

- Weather Discussion: For forecasts made on Monday and Wednesday class sessions, I will be leading the forecast discussion. For Friday class sessions, students will be leading the forecast discussions and will be graded based upon their effort and growth during the course of the term. This will count toward 5% of the total class grade.

- YOU WILL NOT BE GRADED ON FORECAST ACCURACY.

HOURLY EXAMS: There will be two hourly exams during the term. The exams have *tentatively* been scheduled for Friday, October 12th and Friday, November 30th. There will NOT be a final exam.

TERM PROJECT: Everyone in the class likely has a particular type of meteorological phenomenon that peaks their interest the most. This is an opportunity to spend a significant amount of time studying a particular “significant past weather event” of that type. You will be asked to present a detailed, three-day analysis of conditions associated with the event. The following dates will be important:

- Friday, September 28th: You will be required to turn in a one page proposal on which significant weather event you would like to focus on and why. Proposals are due during class. This will provide an ample opportunity to determine if enough data is available for you to perform a sufficiently detailed analysis of your event of interest.

- December 10th: Class Term Project presentations. Reports will be due in my office by 5pm on Friday, December 14th. Of course, you may turn them in earlier if you would like. I would appreciate both a paper and an electronic copy. The electronic copy saves the excessive use of ink and the paper copy makes it easier for me to grade and to provide you with comments.

OTHER IMPORTANT DATES:

- September 14th: No class due to my attendance at NSF Workshop.
- October 15th: No class due to Fall Study Break (October 15th-16th).
- November 19th and 21st: No class during week of Thanksgiving.

NOTE: If any of the above due dates conflicts with a religious holiday, please see me at least one week in advance to make alternate arrangements.

Course Outline⁽¹⁾

- I. Surface Observations
 - a. Observations/Cloud Identification
 - b. ASOS Instrumentation
 - c. Reporting - METAR and SYNOPTIC codes
 - d. Station plotting and isopleths
- II. Upper Air Observations
 - a. Measurement
 - b. Reporting – TTAA, TTBB and PPBB codes
 - c. Interpretation and analysis of constant pressure maps
 - d. Plotting and Analysis of Skew T diagrams
- III. Radar Data Interpretation
 - a. How measurements are made
 - b. Analysis and Feature Identification
- IV. Numerical Weather Prediction Models
 - a. Model assumptions and differences
 - b. Running your own model simulations with WRF
 - c. Model guidance development and interpretation
- V. Satellite Data Interpretation
 - a. How measurements are made
 - b. Enhancement Curves
 - c. Analysis and Feature Identification
- VI. Forecasting Applications
 - a. Standard daily temperatures, winds and precipitation
 - b. Composite chart analysis for severe convective storms
 - c. Lake effect snow

⁽¹⁾ Additional topics will be added as they become relevant. Also, some adjustment of the syllabus may be necessary based upon the backgrounds of enrolled students.

CLIMATE 440: Meteorological Analysis Laboratory

Weather Forecast Log

Forecast Location: Detroit, MI (KDTW)

Forecast Period Beginning 00 Z on _____

Observed Local Conditions at 1800 Z:

Temperature: _____ ° F

Dew Point: _____ ° F

Wind Direction: _____ deg

Wind Speed: _____ knots

Present Weather (Light Rain, Fog, etc.): _____

Current Clouds (Coverage and Height in 1000s of feet):

Past Local Conditions:

Today's 0000Z Temperature at KDTW: _____ ° F

Today's 1200Z Temperature at KDTW: _____ ° F

Please answer the following questions:

What are the dominant weather features that have been impacting the forecast area/location since 0000 UTC (in other words, overnight and thus far today) and how have they influenced our observed conditions? For this section, think in terms trends in our upper level flow, surface pressure patterns and associated fronts, etc.

Based upon the current numerical weather prediction model simulations, how are conditions expected to evolve during our 48-hour forecast period? How will these features impact the cloud cover, temperatures, precipitation and winds across the forecast area/location during this period?

Forecast:

	Day 1 Min	Day 1 Max	Day 1 Precip Category	Day 2 Min	Day 2 Max	Day 2 Precip Category
Your Forecast						
Verification						

Verification Discussion:

Please provide a general description of how well your forecast verified, including some explanation of why you may have erred in your forecast.

Poetry

Pablo Neruda

And it was at that age ... Poetry arrived in search of me.
I don't know, I don't know where
it came from, from winter or a river.
I don't know how or when,
no they were not voices, they were not
words, nor silence,
but from a street I was summoned,
from the branches of night,
abruptly from the others,
among violent fires
or returning alone,
there I was without a face
and it touched me.

I did not know what to say, my mouth
had no way with names,
my eyes were blind,
and something started in my soul,
fever or forgotten wings,
and I made my own way,
deciphering
that fire,
and I wrote the first faint line,
faint, without substance, pure
nonsense,
pure wisdom
of someone who knows nothing,
and suddenly I saw
the heavens
unfastened
and open,
planets,
palpitating plantations,
shadow perforated,
riddled
with arrows, fire and flowers,
the winding night, the universe.

And I, infinitesimal being,
drunk with the great starry
void,
likeness, image of
mystery,
felt myself a pure part
of the abyss,
I wheeled with the stars,
my heart broke loose on the wind.