ATS 640 – Synoptic Meteorology
Fall 2021

Course description:

The primary goals of ATS640 are as follows:

1. To introduce you to the dynamic and thermodynamic characteristics of synoptic-scale systems and the weather they produce
2. To provide practical applications of numerous meteorological principles and concepts
3. To introduce you to map analysis and interpretation

The course consists of two in-person synchronous classes per week on Tuesday and Thursday from 1:00-2:00 pm with a remote option (Zoom). As a result of the global pandemic, I switched this course to a flipped-classroom mode that will continue this semester. I will be recording short modules in the form of video recordings that should be viewed before class (available one week in advance). A schedule for viewing these videos will be provided in the "Modules" section in CANVAS. These modules will replace the traditional "lecture" portion of the course. During each in-person synchronous class, we will begin with a brief review of the important concepts covered in the recorded video modules, discuss real-world examples that demonstrate the concepts in weather systems, and open for questions and discussions with the class. We will also have a Weather Discussion (10-15 minutes) that will be led by students as part of our class forecast competition (more details on this below). Course topics are listed at the end of this document. A course schedule is available on the class CANVAS website.

Instructor:

Professor Kristen Rasmussen
Email: kristenr@rams.colostate.edu
Office hours: Tuesday and Thursday from 2:00 – 3:30 pm; In-person (ATS 312) or remotely via Zoom

Teaching Assistant:

Daniel Veloso
Email: Dan.Veloso_Aguila@colostate.edu
Office hours: Wednesdays from 12-2pm; In-person (ATS 314) or remotely via Zoom

Meeting Times:

COVID-19 Update: All students are required to wear a mask when indoors this semester. Please bring your mask to all classes. Alternatively if you are feeling sick or prefer a remote option, you can join the synchronous classes via Zoom.

Tuesday: 1:00 to 2:00 pm in ATS 101 (remote option available via Zoom)
Thursday: 1:00 to 2:00 pm in ATS 101 (remote option available via Zoom)

Course Evaluation:

25% Mid-term exam
35% Final exam
35% Labs

5% Forecast competition participation

Required Reading:

- Lecture notes: Available on the course CANVAS website.

Other Resources:

- *Atmospheric Science: An Introductory Survey* by John Wallace and Peter Hobbs
- *Mid-Latitude Atmospheric Dynamics: A First Course* by Jonathan E. Martin
- *Mid-Latitude Weather Systems* by Toby Carlson
- *Synoptic-Dynamic Meteorology in Midlatitudes Vol I and II* by Howard Bluestein
- *Midlatitude Synoptic Meteorology: Dynamics, Analysis, and Forecasting* by Gary Lackmann

Hybrid-course interactions:

To support an interactive experience during our course this semester, we will be using three platforms for various purposes described as follows:

- Canvas course website – Canvas will be used to share documents (e.g., lab assignments, course syllabus, calendar, course modules including video recordings, etc.)
- Slack – A dedicated ATS 640 channel in Slack will be used to facilitate rapid discussions between students, the TA, and myself. Note that to preserve work-life balance in the new work-from-home framework, we will respond to any questions posted during working hours (8am-5pm M-F) as soon as we can, but after working hours, the response time will be longer. Slack will also be used for lab questions and we can set up virtual office hour appointments using this tool as well.
- Zoom – Videoconferencing for the synchronous classes will be conducted on Zoom.

Lab Information:

The labs are designed to support the lectures by providing more in-depth analysis and examination of actual synoptic events. A class forecast competition will help students with a practical application of the course material by considering weather around the world.

Meeting Times:

Lectures be divided into shorter modules (several ~20-minute video recordings) that will be available one week before the material will be discussed in class. At the beginning of each synchronous class, a brief (~5 minute) review of the primary concepts will be given, followed by an opportunity for questions from the class. Real-world examples of the concepts will be integrated into the synchronous sessions as well. Lab Introductions will be given on Tuesdays when the labs are handed out. Finally, a Weather Discussion will be given at the end of the synchronous classes by students (assigned a date according to the schedule in Canvas).

Lab Exercises:

- Assigned every Tuesday
- Due on the following Tuesday at the beginning of class

- Carry the same weight (25 points per lab)

Class Forecast Competition:

- Students will forecast the weather conditions at locations around the world on class days throughout the semester (Tuesdays and Thursdays).
- The course TA (Daniel Veloso) will select cites around the world and will be listed in the course schedule available on the CANVAS website.
- Forecasts will be entered into our class forecast competition website (http://rasmussen.atmos.colostate.edu/teaching/ATS640/Fall2021/forecast_contest/login.php)
- Participation in the competition will be ~5% of the course grade. Students will NOT be graded on their performance in the competition.

Weather Discussions:

- Given after the lecture
- Goal: Update on the current weather situation related to Fort Collins and the forecast city of the day.
- Time: 10-15 minutes
- Presented by students starting in the second or third week of the semester. Each student can expect to present approximately twice. The course TA will present the first few weather discussions to provide examples for the students.

Lab Grades

- Made up entirely of your lab exercises.
- For every weekday that an assignment is late, 10% will be taken off.

Academic Integrity:

All students are subject to the policies regarding academic integrity found in the 2018 – 2019 General Catalog, found at http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity, and the student conduct code (https://resolutioncenter.colostate.edu/conduct-code/). Other information on academic integrity can be found on the Learning@CSU website (http://learning.colostate.edu/integrity/index.cfm). Examples of academic dishonesty can be found in these sources. At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.

Special Needs:

Please see the instructor during the first two weeks of the semester, if you have special learning needs that should be accommodated in this class, and refer to http://rds.colostate.edu/accommodation-process/ for more information.

COVID-19 Information (for any in-person classes):

Important information for students: All students are expected and required to report any COVID-19 symptoms to the university immediately, as well as exposures or positive tests from a non-CSU testing location. If you suspect you have symptoms, please fill out

the COVID Reporter (https://covid.colostate.edu/reporter/). If you know or believe you have been exposed, including living with someone known to be COVID positive, or have symptoms of COVID, it is important for the health of yourself and others that you complete the online COVID Reporter. Do not ask your instructor to report for you. If you do not have internet access to fill out the online COVID-19 Reporter, please call (970) 491-4600. You will not be penalized in any way for reporting. If you report symptoms or a positive test, you will receive immediate instructions on what to do, and CSU's Public Health Office will be notified. Once notified, that office will contact you and most likely conduct contact tracing, initiate any necessary public health requirements and/or recommendations and notify you if you need to take any steps. For the latest information about the University's COVID resources and information, please visit the CSU COVID-19 site: https://covid.colostate.edu.

Basic Needs Statement
At CSU, Rams take care of Rams—period. If you are experiencing food, housing, and/or transportation insecurity, please contact lsc_basicneedsinfo@colostate.edu.

Student Disability Center Accommodations
Students who have federally supported disabilities will find information about processes and supports available at this site:
https://disabilitycenter.colostate.edu/accommodations-process/

TOPICS	SUBTOPICS	LABS	CLASSES
Introduction	• Basic variables		1
Instrumentation	• In-situ and remotely-sensed measurements	• Station plots and surface analysis	
Thermodynamics	• Gas laws • Hydrostatic equation • Geopotential height • Thickness • First law of thermodynamics • Specific heats • Potential and equivalent potential temperature • Moisture parameters • Lapse rates • Static stability • Thermodynamic diagrams	• Thickness • Isentropic analysis • Skew-T Ln-P analysis	6
Cloud Types	• Cloud type characteristics		1
Dynamics	• Equations of motion	• Balance winds	7

	• Vertical coordinate systems • Balance winds • Continuity equation • Thermal wind • Vorticity • Omega equation	• Thermal wind • Vorticity and the Omega equation	
Air Masses	• Air mass characteristics		1
Fronts	• Thermal wind implications • Locating fronts • Vertical cross sections • Backdoor cold fronts • Upper-level fronts • Satellite imagery • Other boundaries	• Frontogenesis	2
Jets and Jet Streaks	• Polar and subtropical jets • Role in cyclogenesis • Vertical motion associated with jet streaks	• Jets and jet streaks	1
Troughs and Ridges	• Formation of upper-level systems • Rossby wave dynamics and propagation • Long and short waves • Confluent and diffluent troughs • Tilted troughs • Blocking • Lee troughs	• Troughs and ridge dynamics	2
Extratropical Cyclones	• Cyclogenesis • Conveyor belts and airstreams • Role of jet streaks • Favorable conditions • Precipitation organization • Orographic influences • Explosive cyclogenesis • Case studies	• Extratropical cyclones • Detailed case study analysis	5
Tropical Cyclones	• Characteristics • Formation • Climatology • Records		1

Miscellaneous Flows	• Sea and land breezes • Lake effect snow • Mountain/valley winds • Downslope winds • Topographic blocking • Polar lows • Monsoons		1