

ATS640 Synoptic Meteorology

Course Description:

The primary goals of ATS640 are:

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; and
3. to introduce you to various forecasting techniques and map interpretation.

The course consists of approximately four hours of class per week, with about one hour of lecture and one hour of lab on each day. Course topics are listed at the end of this document. A scored but non-graded forecasting contest will also be held. In-class weather briefings will be given by all students as part of the forecasting contest. Each student can expect to lead 2 discussions over the course of the semester. While the forecasting contest will not affect your grade, participation is expected.

Instructor:

Prof. Susan C. van den Heever

Room 425

Email: sue@atmos.colostate.edu

Teaching Assistant:

Peter Marinescu

Room 415

Email: pmarin@atmos.colostate.edu

Office Hours: Wednesday: 1-2 pm

Meeting Times:

Tuesday and Thursday: 1:00 – 3:00 pm

Evaluation:

25% Mid-term exam

35% Final exam

40% Labs

Required Reading:

Lecture notes from the web:

<http://reef.atmos.colostate.edu/~sue/vdhp/ats640/ats640.php>.

Other Resources:

Atmospheric Science: An Introductory Survey by John Wallace and Peter Hobbs

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

Lab Information:

The labs are designed to support the lectures by providing more in-depth analysis and examination of actual case studies.

Meeting Times

Labs will begin a few minutes after the lecture section and weather discussion.

Tuesdays: Assign and discuss the lab exercise.

Thursdays: Review concepts and answer questions on the lab assignment.

Lab Exercises:

- Assigned every Tuesday.
- Due on Friday at 12:00 pm (to be handed in to Peter).
- Carry approximately the same weight (~25 points).

Weather Discussions:

- Given after the lecture.
- Presented by students starting a couple weeks into the semester.

Forecasting Competition:

- Forecasting competition for Fort Collins and an out of state city
- Scored but non-graded

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 Section 1.6 of the 2010 – 2011 General Catalog, found at

<http://www.catalog.colostate.edu/Content/files/2012/FrontPDF/1.6POLICIES.pdf>, and the student conduct code (<http://www.conflictresolution.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/csuinto/accommodations.asp> for more information.

Topics	Subtopics	Labs	Classes
Introduction	<ul style="list-style-type: none"> • Basic variables 		1
Instrumentation	<ul style="list-style-type: none"> • In-situ and remotely-sensed measurements 	<ul style="list-style-type: none"> • Station plots and surface analysis 	1
Thermodynamics	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Thickness • Isentropic analysis • Skew-T Ln-P analysis 	6
Cloud Types	<ul style="list-style-type: none"> • Cloud type characteristics 		1
Dynamics	<ul style="list-style-type: none"> • Equations of motion • Vertical coordinate systems • Balance winds • Continuity equation • Thermal wind • Vorticity • Omega equation 	<ul style="list-style-type: none"> • Balance winds • Thermal wind • Vorticity and the Omega equation 	7
Air Masses	<ul style="list-style-type: none"> • Air mass characteristics 		1
Fronts	<ul style="list-style-type: none"> • Thermal wind implications • Locating fronts • Vertical cross sections • Backdoor cold fronts • Upper-level fronts • Satellite imagery • Other boundaries 	<ul style="list-style-type: none"> • Frontogenesis 	2
Jets and Jet Streaks	<ul style="list-style-type: none"> • Polar and subtropical jets • Role in cyclogenesis • Vertical motion associated with jet streaks 	<ul style="list-style-type: none"> • Jets and jet streaks 	1
Troughs and Ridges	<ul style="list-style-type: none"> • Formation of upper-level systems • Rossby wave dynamics and propagation 	<ul style="list-style-type: none"> • Troughs and ridge dynamics 	2

	<ul style="list-style-type: none"> • Long and short waves • Confluent and diffluent troughs • Tilted troughs • Blocking • Lee troughs 		
Extratropical Cyclones	<ul style="list-style-type: none"> • Cyclogenesis • Conveyor belts and airstreams • Role of jet streaks • Favorable conditions • Precipitation organization • Orographic influences • Explosive cyclogenesis • Case studies 	<ul style="list-style-type: none"> • Extratropical cyclones • Detailed case study analysis 	5
Tropical Cyclones	<ul style="list-style-type: none"> • Characteristics • Formation • Climatology • Records 	<ul style="list-style-type: none"> • 	1
Miscellaneous flows	<ul style="list-style-type: none"> • Sea and land breezes • Lake effect snow • Mountain / valley winds • Downslope winds • Topographic blocking • Polar lows • Monsoons 	<ul style="list-style-type: none"> • 	1