GEOGRAPHY 5941
SYNOPTIC ANALYSIS AND WEATHER FORECASTING
AUTUMN SEMESTER 2017

Instructor: Dr Jeff Rogers — Office: Derby Hall 1055
Office Hours: before or after class or by appointment — e-mail: rogers.21@osu.edu
Class times: T, Th 12:45 – 2:05 p.m. Db0135
Prerequisites: Geography 5900, Geography 5940, Math 1152, Physics 1251.
Course Website: http://carmen.osu.edu — Class computer login: G5941 pass: Geog-5941AU17
Logout of your machine at the end of each class.

Course Objectives: The primary objective of this course is to serve as an introduction to the fundamentals of, and techniques involved in, synoptic-scale analysis of winter storms and the forecasting of their weather. Discussion of the fundamentals of weather forecasting includes understanding the physical models available to analyze synoptic-scale weather patterns, evaluation of the physical processes that create temperature change, vertical motions, precipitation, and those processes that lead to cyclones and fronts, causing them to evolve and produce weather. Techniques of synoptic weather analysis revolve around weather maps and methods used to analyze them in order to predict horizontal and vertical motions and make weather forecasts. Analysis of forecast output will be evaluated in order to compare precipitation and vertical motion forecasts among different models. Students will acquire the skills needed to make competitive weather forecasts and will learn to develop and present weather synopsis discussions.

Upon successful completion of the course, students will be able to use synoptic weather charts and numerical forecasting products, along with knowledge gained in the course, in order to make forecasts of temperature, precipitation and other meteorological conditions for 1-2 days in advance. You will have a good understanding of the conceptual models of wave cyclones, including those of their structure and evolution, and you will be able to explain the role of various physical processes, such as PVA, thermal advection, atmospheric stability, and diabatic heating, in the development and evolution of mid-latitude wave cyclones.

Your total grade (100%) will be determined as follows:
Mid-term exams: 40%
Final Exam: 25%
Assignments: 35%
The assignment grade will include:
1. Take-home assignments.
2. Small point value in-class analyses, assigned and due at the end of each class (no make-ups)
3. Assignments involving weather forecasts submitted by 7:00 p.m. Monday through Thursday of Autumn Semester (only) to the University of Oklahoma National Weather Forecast Contest. Participation is mandatory and will cost $5; details will follow of grading of this assignment.

Assignments must be done individually unless it is announced that the assignment is a group effort. Proof of a medical problem is necessary to excuse an absence on an exam day. There is no class on Thursday October 12 or November 23.

Autumn 2017 Synoptic Meteorology Lecture Topics

Introduction and Review

(i) History of weather forecasting and Geographic factors affecting North American Weather;
(ii) Basics: Coordinate systems; Equations of motion; gradient wind, hydrostatic equilibrium, ideal gas law, hypsometric equation
(iii) Rossby waves, upper air weather features, and weather spells;
(iv) Air masses and fronts; air mass modification; Characteristics of fronts
(v) Bergen school cyclone model; occlusion processes, theory weaknesses.

Horizontal and Vertical tropospheric motions and their cause

(i) Thickness and thermal wind, tropospheric wind climatology
(ii) Streamlines and Trajectories, Potential temperature and isentropic analysis;
(iii) Thermodynamics and principles of Air Temperature Forecasting
(iv) Geostrophic Thermal Advection (solenoids on synoptic charts);
(v) Equation of continuity, ageostrophic motions and tropospheric divergence; pressure tendency
(vi) Atmospheric relative and absolute Vorticity, CAV trajectories, vorticity advection on synoptic charts; Association between divergence and vorticity advection;
(vii) Potential vorticity
(viii) Linking lower & upper troposphere thru div, vort & thermal advection

Mid-term Examination 1: ~ Week 6 & Mid-term Examination 2: ~Week 10

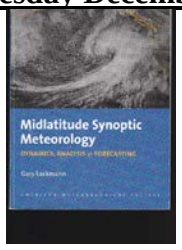
Weather Features & Processes producing atmospheric vertical motions

(i) Barotropic, Equivalent Barotropic, and Baroclinic Surface Weather map Features;
(ii) Frontogenesis processes & the different types of mid-latitude fronts
(iii) Jet Streaks
(iv) Forecasting topics: precipitation type and heavy snow forecasting; fog & wind

Cyclogenesis and characteristics of mid-latitude cyclonic storms

(i) Cyclogenesis - The Petterssen Development Equation; The self-development process;
(ii) The Baroclinic (Rossby) Wave Instability Theory;
(iii) Storms as Conveyor belts; split fronts and the satellite view of surface weather
(iv) The Shapiro-Keyser cyclone model
(v) The Great Plains cyclone model and its main component: the cold front aloft;
(vi) Regional storms: Alberta clippers; Panhandle Hooks; East Coast Cyclones and "Bombs"

Final Examination: Tuesday December 12, 2017; 2:00 - 3:45 p.m. in Derby 135



by Gary Lackmann
not required, but the best synoptic book in decades