AOSC 470/600: Synoptic Meteorology
Fall 2016

Instructor
Daryl T. Kleist
CSS 3421 | dkleist@umd.edu | 301.405.7567

http://www.aosc.umd.edu/~dkleist/aosc600.html

Classes: Tu/Th 12:30-1:45 p.m., CSS 2416, 3 Credits
Office Hours: M/W 1:00-2:00 p.m. or by appointment

Volunteer Teaching Assistant: Mr. Greg Porter (gporter@umd.edu), CSS 4339
Office Hours: Tu 2:00-3:00 p.m. or by appointment

Course Catalog Description:
Atmospheric properties and observations, meteorological analysis and charts, operational numerical forecasts. Application of quasigeostrophic theory, baroclinic instability, midlatitude and mesoscale weather systems. Tropical meteorology. Weather forecasting using numerical and statistical models. Prediction of weather phenomena on the global, synoptic, meso, and local scales. Analysis of surface and upper air data; Norwegian cyclone model; introduction to weather forecasting.

Prerequisites:
AOSC431 and AOSC432 (for AOSC 470)
AOSC 610 (for AOSC600)

Course Objectives:

1. Apply synoptic-dynamic meteorological theory and diagnostic methods to real world situations
2. Read and interpret weather maps
3. Develop necessary skills for interpreting output from numerical weather prediction models with goal of constructing skillful weather forecasts
4. Discuss, communicate, and present weather analyses and forecasts effectively
5. Establish tools to perform own diagnosis and maps

Difference between 470 & 600
The courses are cross-listed and taught concurrently with identical content in a single lecture. *However, the amount of work, exam questions, and evaluation criteria will be different*. Credit will only be granted for 470 or 600. If you are taking credit for 600, you will be treated the same as all other students taking the course for 600 credit, regardless of student status (undergraduate, professional masters, or graduate student).

Required Text
Mid-latitude Atmospheric Dynamics: A First Course, by J. E. Martin, Wiley.

Recommended Texts
Weather Map Handbook, by T. Vasquez, 2nd Edition, Weather Graphics Technologies.

Midlatitude Synoptic Meteorology: Dynamics, Analysis, and Forecasting, by G. Lackmann, AMS Books.

Other Reference Texts
An introduction to Dynamic Meteorology, by J. R. Holton and G. J. Hakim, Elsevier.

Synoptic-Dynamic Meteorology in Midlatitudes Vols. 1 & 2, by H. Bluestein, Oxford University Press.

Selected Journal Articles

Weather Challenge
Participation in the national WxChallenge forecasting competition is ***mandatory*** for this course. While actual forecast performance will not directly impact your grade, lack of participation will. Each missed forecast reduces your participation grade. Bonus points will be available for students that perform better than the instructor in each city. Students will be required to log a minimum set of information for each prepared forecast.

Details regarding sign-up will be distributed early in the semester. Visit the website for more information (http://www.wxchallenge.com). Forecasting for the first city begins on September 26, 2016. I encourage students to participate for the entire year as we will be participating as a group/university. If you anticipate that you will only be participating for the fall semester, please note that upon sign-up. Cost is either $3.00 (fall semester only) or $5.00 (for the entire year).

** Student taking credit for AOSC 600 will be required to provide a short (less than one page) write-up for their *worst* forecast in each of the five cities. The write-up should provide a synopsis of the forecast, what tools were used, and a description of what went wrong and why.

Map Discussions/Weather Briefings
Map discussions will take place at the end of each class. After the first two weeks, students (groups of 2-3) will be assigned to take turns providing a brief review of recent weather, status of current weather, and short-term forecast discussion. A template for how to put together the discussion as well as grading rubric can be found on the course website.

Homework Assignments
Various homework assignments will be handed out throughout the semester. Some of the assignments will be geared toward training on data visualization (with emphasis on Python) to assist in creating specific graphics for map discussions and the research project.

Late Policy
Late assignments (including final case study term paper) will not be accepted without arrangements made prior to due dates. Late assignments will have reduced value (25% same day, 50% one day late).

Exams
There will be three exams: two "mid-terms" and a cumulative final. AOSC600 students will be required to answer all questions. AOSC470 students will be allowed to select a certain subset of questions to answer.

Case Studies/Course Projects
All students (470 and 600) will be required to perform a research project on a historical meteorological event. The project will be performed on a case study of each student's choosing, either from a set of available case data or alternate case with instructor approval.

The cases chosen for the research project should be for a high-impact, synoptic-scale weather event of interest. The research project will require the student to collect the relevant weather maps, meteorological data, and investigate what happened and describe the impact. There will be a few homework assignments throughout the semester to aid in developing the tools necessary to perform such a case study.

Those taking the course for AOSC470 credit will be required to submit a research paper of no more than 2500 words (~8-10 pages, 12 point font, double spaced), with accompanying diagnostics and graphics.

** For those taking the course for AOSC600 credit, a research paper of no more than 2500 words (~8-10 pages, 12 point font, double spaced) and oral presentation will be required.

Details regarding the research project will be distributed early in the semester.

Attendance
This is an upper-level course. There is a lot of material to cover and things move quickly. Attendance and participation is mandatory. Make-up exams and late assignments will not be acceptable without documented, appropriate reasoning and advanced notice.

Honor Code
Academic dishonesty will not be tolerated. Students are responsible for educating themselves and following the university honor code:
http://www.shc.umd.edu/SHC/default.aspx

Student Rights
Please visit the following page regarding University policies and resources:
http://www.ugst.umd.edu/courserelatedpolicies.html

Grading
Mid-Term Exams (25%), Final Exam (20%), Case Study/Research Project (20%), Homework (15%), Weather Briefings (10%), WxChallenge and Class Participation (10%)

Letter grades will be assigned using the following breakdown:
A+ (97-100), A (93-97), A- (90-93)
B+ (87-90), B (83-87), B- (80-83)
C+ (77-80), C (73-77), C- (70-73)
D+ (67-70), D (63-67), D- (60-63)
F (<60)

***Approximate* Lecture Schedule by Week (detailed lectures and material available on course website)**

1 - Introduction, Observations
2 - Numerical Weather Prediction, Forecast Process
3 - Essentials: Governing Equations, Kinematics, Vorticity Equation, Rossby Waves, QG set of equations
4 - Ageostrophic Wind, Sutcliffe Development Theorem
5 - Quasi omega equation, Q-vectors
6 - Height tendency, diabatic processes, QGPV
7 - Energetics, Isentropic Coordinates
8 - Isentropic Potential Vorticity, Cyclogenesis
9 - Diabatic processes, Self-development
10 - Fronts, structure and dynamic characteristics, Frontogenesis
11 - Sawyer-Eliassen, QG frontogenesis, Q-vector
12 - Semi-geostrophy, upper level fronts and cyclogenesis, precipitation processes at fronts
13 - Life cycle of mid-latitude cyclone, Air-flow through mid-latitude weather
14 - Baroclinic Instability, Predictability, Introduction to tropical systems
15 - Presentations