METR 5413
ADVANCED SYNOPTIC METEOROLOGY
Spring 2022

Instructor: Prof. Howie "Cb" Bluestein

Instructor contact information: Office: NWC 5351 (far northwest corner on 5th floor) Owing to the COVID-19 pandemic, I anticipate being in residence at the NWC only during my class time and do not anticipate being in residence at other times until the pandemic is over or has receded considerably. I hope, however, that I can be in my office from time to time towards the end of the semester, especially during my spring field program.

Office phone: 405-325-3006; I do not check voice mail on my office phone when I am not in residence, so please contact me by e-mail.

E-mail address: hblue@ou.edu

Cell phone: 405-919-9535 Please do not call, but do text for emergencies *only*; please use e-mail for all other correspondence; I will try to respond within 24 hours.

Classroom: NWC 5720 (If any of us feels uncomfortable about the classroom size and layout, we will go to Zoom until the pandemic wave recedes. The original classroom assigned is much too small for comfort.)

Class day and time: Tues. and Thurs., 10 – 11:15 AM CST/CDT

***I will be participating in a NASA snowstorm field program in parts of New England from late January through the end of February and will be shuttling back and forth to Oklahoma by airplane. I will also be participating in an NSF educational project in New York during the same time period. Both will involve my being with the RaXPol radar. There will likely be a guest lecturer in my absence; if not, the class will be given at irregular times and days in person if I am in Oklahoma or by Zoom and recorded if I am away, and made available in case you cannot attend class owing to a scheduling conflict. PLEASE be patient as I try to navigate both the pandemic and a field program at the same time. This will not be easy.*

Office hours (virtual): Since I am not in residence, there will be no formal in-house office hours for your safety and for mine. If you would like to consult with me, please e-mail me and I will set up a Zoom meeting at a mutually agreeable time. Tuesday and Thursday afternoons will probably work the best for me, at times when I have no other conflicting meetings. "Floating virtual office hours" may be cancelled if there is a severe-thunderstorm outbreak (or a threat of the aforementioned).

Texts: *Synoptic-Dynamic Meteorology in Midlatitudes (Vol. I): Principles of Kinematics*

and Dynamics and (Vol. II): Observations and Theory of Weather Systems. H. Bluestein, Oxford Univ. Press, 1992 and 1993, respectively. Corrections to the first two printings may be found on my website at http://weather.ou.edu/~hblue/corrections. Some notes based on recent journal articles will be distributed electronically. These notes may eventually be included in later editions of the text.

Prerequisites: An undergraduate lecture course and lab in synoptic meteorology. It is highly recommended that you have already taken METR 5113 (Advanced Atmospheric Dynamics I) and received a grade of B or above. **Please do not enroll in this course if you received a C in METR 5113 or have taken its equivalent and also not earned a B or better or if you have not taken its equivalent at all, unless you have consulted with me first.** It is recommended that you know how to access, display, and manipulate synoptic-scale rawinsonde and surface data. I realize that more and more of you in past years may not have the prerequisite background. For those of you who do not, it might be helpful to sit in on the undergraduate synoptic course first or simultaneously. If you are unfamiliar with how to access weather data or how to interpret weather maps, I can try to find someone to help you, but owing to the pandemic it may have to be done virtually.

The main objective of the course is to learn how synoptic-scale features such as extratropical cyclones and anticyclones, upper-level troughs and ridges, and surface and mid-tropospheric fronts behave and why they behave the way they do. When possible, I will try to relate the theory to practical weather forecasting and to climate change.

Course outline:

I. Geostrophic phenomena Quasigeostrophic theory revisited: Role of diabatic heating; effective static stability; effects of variations in static stability. Alternative formulations of omega equation and height-tendency equation: Sutcliffe/Trenberth formulation; Q vectors; quasigeostrophic potential vorticity. Quasi-geostrophic diagnosis: Application to understanding how and why surface and upper-level weather systems form and propagate. A quasigeostrophic analytic model: Application to baroclinic-instability theory; "bombs" and polar lows. Group velocity and Hovmöller diagrams; blocking. Atmospheric rivers.

II. Non-quasigeostrophic phenomena Observations of surface and middle-upper tropospheric fronts and upper-level jets. Kinematics of frontogenesis. Dynamics of frontogenesis: quasigeostrophic frontogenesis; vector form of the frontogenesis function; geostrophic- momentum approximation; Sawyer-Eliassen equation; semigeostrophic equations; semigeostrophic frontogenesis; symmetric instability

III. IPV thinking Isentropic potential vorticity and the invertibility principle; structure and behavior of synoptic-sale systems in terms of IPV; Rossby-wave propagation; barotropic and baroclinic instability; generation of IPV; tropopause polar vortices (TPV).

I will take part of the class time on some days to give a short weather briefing, with

the objective of illustrating some of the material covered in lectures and to whet your weather appetite.

Grades: There will be two, non-comprehensive, in-class exams during the regular class period and no final exam. Your grades will based only on these two exams.

Because I do not have TA support and the enrollment is large, problem sets are optional; if you choose to work on them, problem sets and solutions will be made available online. I highly recommend that you work on them to help you learn the material and some of the problems are from previous exams. Course-related information (e.g., problem sets, solutions, supplementary material) to be disseminated at the class site http://weather.ou.edu/~hblue/metr5413.

The University of Oklahoma is committed to providing reasonable accommodation for all students with disabilities. Students with disabilities who require accommodations in this course are requested to speak with the professor as early in the semester as possible. Students with disabilities must be registered with the Office of Disability Services prior to receiving accommodations in this course. The Office of Disability Services is located in Goddard Health Center, Suite 166, phone 405/325-3852 or fax only 405/325-4173.
All students are expected to be familiar with and abide by the OU Academic Misconduct Code. Information on this code and other student policies is located at http://studentconduct.ou.edu.