

# ADVANCED SYNOPTIC METEOROLOGY

METR 5413

Spring 2009

Classroom: NWC 5600                      Class day and time: Tues., Thurs. 10 – 11:15 AM

Instructor: Adjunct Prof. Charles A. Doswell III

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Office hours: Mon., Wed., 1:30 - 2:30 PM (tentative)

Other times by appointment please!

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 the Web at <http://rossby.metr.ou.edu/~hblue/corrections>. Some recent journal articles will be distributed.

Prerequisites: METR 4123 (Dynamic Meteorology II: Synoptic-Scale Systems) and METR 4423 (Synoptic Meteorology Lab), or the equivalent. It's highly recommended that you have already taken METR 5113 (Advanced Atmospheric Dynamics I).

Course outline:

I. Geostrophic phenomena

Quasigeostrophic theory revisited: Role of diabatic heating; effective static stability; effects of variations in static stability. O'Brien's adjustment schemes, geostrophic adjustment. Alternative formulations of omega equation and height-tendency equation: Trenberth formulation; Q

vectors; P vectors; C vectors; quasigeostrophic potential vorticity. A quasigeostrophic analytic model: Application to baroclinic-instability theory; "bombs" and polar lows. Group velocity and Hovmoller diagrams; blocking.

## II. Non-quasigeostrophic phenomena

Observations of surface and middle-upper tropospheric fronts. 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 of synoptic-scale systems in terms of IPV; Rossby-wave propagation; barotropic and baroclinic instability.

Grading: in-class exams 40%, problem sets 20%, class participation 10%, comprehensive final exam 30%

Course-related information (e.g., problem sets, solutions, supplementary material) to be disseminated via the internet at the class site <http://weather.ou.edu/~hblue/metr5413>

(Website may change)