**Atm 611 (Advanced Synoptic Meteorology) Fall 2014**

**Course Outline**

**Instructor: Lance F. Bosart**
**Credits: 3**
**Time: Tu/Th, 2:45-4:05 pm, ES-232**

**Course Requirements:**

a) Exams: Midyear and Final (35%)
b) Problem sets (10%)
c) Class paper presentations (20%)
d) Semester project due Th 4 December 2014 (35%)

**Semester Project:**

The project is on any topic of your choosing (and may be thesis related) in synoptic-dynamic meteorology. The topic may be observational, numerical, or theoretical. The paper should be prepared in standard AMS journal format and should not exceed 2500 words. Project results will be presented orally at the end of the semester.

**Class Paper Presentations:**

Students will be responsible for leading class discussions of current papers in the refereed literature that are relevant to the course topics. Current thinking (subject to change) is that every student will have an opportunity to present twice. Two students would give 30 minute presentations each on a given class day.

**Readings:**

Bluestein, H. B., 1992 and 1993: Synoptic-Dynamic Meteorology in Midlatitudes, Oxford press, Volume I (Ch. 5) and Volume II (Ch. 1).

Holton, J. R. 2004; Holton, J. R. and G. J. Hakim 2013: An Introduction to Dynamic Meteorology ($4^{th}$ and $5^{th}$ Edition), Academic Press ($5^{th}$ edition errata list can be found here: http://holton-hakim.blogspot.com/).

Lackmann, Gary, 2012: Midlatitude Synoptic Meteorology: Dynamics, analysis, and Forecasting, American Meteorological Society.

Markowski, P. and Y. Richardson, 2010: Mesoscale Meteorology in Midlatitudes, Wiley-Blackwell.

Martin, J. E., 2006: Mid-Latitude Atmospheric Dynamics: A First Course. Wiley, Ch. 6-9.

**Syllabus:**

**Kinematics of the Wind Field:**

a) Streamlines versus trajectories
b) Deformation, divergence, and vorticity
c) Lagrangian perspectives on synoptic development

**Quasi-geostrophic (QG) theory:**

a) Review of fundamental concepts and principles
b) Hierarchies of vertical motion methods
c) Q-vector form of the QG omega equation
d) QG potential vorticity and the QG height tendency equation

**The Potential Vorticity (PV) Viewpoint ("PV thinking"):**

a) Dynamical tropopause as a basis for an Eady model perspective on development
b) Reconciliation of "PV thinking" and "QG thinking"
c) Rossby wave trains (RWTs) and Rossby wave breaking
d) Cyclonic wave breaking (CWB) and anticyclonic wave breaking (AWB)
e) PV streamers, anticyclogenesis, cyclogenesis and the subtropical jet stream
f) Atmospheric "seams" and "unseamly" extreme weather events (EWEs)

**Synoptic-Dynamic Meteorology Applications:**

a) Explosive cyclogenesis and anticyclogenesis
b) Jet streaks and cyclogenesis and anticyclogenesis
c) Downstream baroclinic development and RWTs
d) CWB/AWB and tropical-midlatitude and polar-midlatitude interactions
e) Linked extreme weather events associated with CWB and AWB
f) Vertical circulations associated with fronts and jets
g) Midlatitude precipitation systems