

Instructor: Dr. B. Geerts, geerts@uwyo.edu, 6062 Eng Bldg, 766-2261.

Class schedule: 30 Jan - 3 Mar and again after spring break (19 March thru 27 April) and also Mon 30 April - we need that first day in finals week for a full 2cr course

location: EN 6060

MWF 2:10 - 3:15 pm

Wed 3:25-5:00 pm: lab, in in EN6060, and a computer lab (EN1034 or EN6028)

Textbook: Lackmann, G. 2011: Midlatitude Synoptic Meteorology (AMS)

Additional books:

Jonathan E. Martin, *Mid-latitude Atmospheric Dynamics*, 1st Edition, Wiley, 2006. This book emphasizes quasi-geostrophic dynamics, but is rather brief in its treatment of isentropic analysis and the IPV framework. It is more theoretical, focused on the dynamics, than Lackmann's book, which contains many color example analyses.

Bluestein, H., 1993: *Synoptic-dynamic meteorology in Midlatitudes*, Vol II. Oxford University Press. This book is more in-depth but rather poorly organized, and sometimes the details overwhelm the main message.

Holton, 2004: *An introduction to dynamic meteorology*, Fourth Edition, Academic Press. This remains the best resource for atmospheric dynamics, and I plan to use some derivations from Holton's book. But Holton does not dwell on weather analysis.

Shapiro, M., and S. Gronas, 1994: *The life cycles of extratropical cyclones*. A 3-volume book based on presentations given at a meeting in Bergen (Norway) in summer 1994, at the occasion of the 75th anniversary of the seminal paper on extratropical cyclones and fronts by Bjerkness and his colleagues at the Bergen School of meteorology.

Newton, C., and E.O. Holopainen, Eds., 1990: *Extratropical Cyclones, The Erik Palmén Memorial Volume*. American Meteorological Society, Boston, 262 pp. A more descriptive survey of extratropical cyclones and their role in the general circulation.

Palmén and Newton, 1969: *Atmospheric circulation systems: their structure and physical interpretation*. This book also views extratropical cyclones in the context of the general circulation. It remains the best source for cyclone lifecycle schematics.

Peixoto and Oort, 1992: *Physics of climate*. This book deals with the general circulation, with an emphasis on energy transports.

Website: <http://www.atmos.uwyo.edu/~geerts/atsc5160/>

Course topics

2. Quasi-geostrophic (QG) theory
3. Isentropic analysis
4. The Potential Vorticity (PV) framework
5. Extratropical cyclones
6. Fronts & frontogenesis
7. Baroclinic instability
8. Cold-air damming

Weather briefings

Each one of us will give three 20 min presentations on some interesting current or recent weather. The objectives are to gain a comprehensive understanding of atmospheric processes at the synoptic space/time scale, and to hone your public presentation skills.

Schedule:

2/1	Bart	3/26	Ghokan	4/6	midterm	4/18	Jacki
2/8	Bart	3/28	Xia	4/9	Dave	4/20	Dave
3/19	Chris	3/30	Chris	4/11	Ghokan	4/23	Ghokan
3/21	Jacki	4/2	no class	4/13	Xia	4/25	no class
3/23	Dave	4/4	Jacki	4/16	Chris	4/27	Xia

Some suggestions about weather briefings

- Read Chapter 11 (Weather Forecasting) in the textbook
- Have your web links prepared, and prepare a list of fields you want to look at. Some products are not on the web. In your second briefing, you are expected to build at least some of your analysis imagery using gempak or IDV.
- Be creative. Explore new regions (like Turkey or China or Australia), new fields, new websites. The focus is on the synoptic scale, but as higher-resolution resources become increasingly available, you may want to delve into the mesoscale.
- When you show unfamiliar maps, pls explain what is shown, and provide the necessary background info if needed.
- Have a thorough insight into the current weather before you start. You can present some of your material using powerpoint, but a canned presentation is unlikely to suffice to address questions.
- Be ready to answer specific, probing questions. I tend to ask questions intended to demonstrate your understanding of basic atmospheric processes or balances, e.g. thermal wind balance. Many aspects, often beyond the scope of our lecture materials, need to be considered, e.g. atmospheric radiation, instability and convection, orographic effects.
- Please remain focused. You don't have to cover the whole forecast period, or the whole country, or all fields. You can choose a specific weather phenomenon (structure & evolution) or address a specific question (QG forcing, Q-vectors, predictability, ...)
- The best briefing demonstrates your ability to do real science and to present this well. Real science means an ability to pick up some interesting weather and the formulation and testing of a hypothesis. The mere mentioning of 'known' concepts is inferior to the questioning of these concepts.
- The audience (other students) should actively participate. The best questions are often those that were never asked.
- Assessments by peers and by me.

NWP Project

Objectives:

- to become acquainted with NWP processes by running your own model and varying physics packages, boundary conditions, resolution, domain, etc
- to better understand synoptic processes, as your model output will serve as basis for the plotting of some new diagnostics in the labs

Method:

- read the relevant chapter in the textbook: Chapter 10 (NWP)
- read the guidelines at <http://www.mmm.ucar.edu/wrf/users/>.
- follow the procedure followed for ATSC 5004 Dynamic Meteorology last semester to edit the namelist files that drive WRF-ARW v3 on bat. Usage details will follow.

Case:

Lee cyclogenesis and cyclone evolution on 1 Feb 2002, following the 28-30 January 2002 Kansas City Ice Storm. Initial time: 00 Z on 31 Jan 2002. Forecast period: 36 hrs. The 32 km North American Regional Reanalysis (NARR) .grb files needed are in /netdata/R1/data/geerts/class/WRF/data/. I suggest you run a single nest at a resolution of 25 km, over a domain from 22;-120 to 55;-62 (SW to NE corners). Other parameters & physics options are yours to choose and justify.

Assessment

ATSC 5160:

Homeworks: 4 homeworks, 7 % each

28%

WRF simulation (in preparation for the labs)	10%
Midterm: Friday 6 April	25%
Final exam: TBD (e.g. Fri 4 May)	30%
Class participation, effort, evidence of progress	7%
Total (ATSC 5160)	100%

ATSC 5007:

Weather Briefings (2 presentations)	40%
Labs (weekly)	60%
Total (ATSC 5007)	100%

A note on Academic Integrity and Plagiarism

Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at the University of Wyoming, and all students are expected to act in accordance with this principle. Consistent with this expectation, all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment *not to engage in or tolerate acts of plagiarism, falsification, misrepresentation, or deception*. Such acts of dishonesty violate the fundamental ethical principles of the academic community and compromise the worth of work completed by others.

Evidence of plagiarism may result in expulsion from the course (with an F grade) as well as dismissal or suspension from the University of Wyoming (Unireg #030-1970).

Students with disabilities

If you have a physical, learning, or psychological disability and require accommodations, please let the instructor know as soon as possible. You must register with, and provide documentation of your disability to University Disability Support Services (UDSS) in SEO, room 330 Knight Hall.