Geography 421/621 -- Climatology
Fall Semester 2009

Time: Monday, Wednesday 2:30pm—3:45pm
Room: MS-321
Professor: Dr. Jeffrey Underwood
Office: MS-226
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Course Description
This course will provide conceptual analysis of processes operating in the troposphere at different temporal and spatial scales. Emphasis will be given to understanding synoptic scale weather systems and the relationship between upper-atmospheric circulation and surface weather phenomena. Analysis of surface, upper-air, and remotely sensed data will be undertaken to gain understanding of teleconnections such as ENSO.

Course Goals
After completing this course students should be able to discuss, in some detail, the following:
1) The physical characteristics of the troposphere
2) Processes that generate and modify waves in the upper-troposphere
3) Synoptic scale weather systems including mid-latitude cyclones
4) The influence of the Pacific Ocean on climate in North America
5) Data resources and analysis techniques for synoptic scale investigations

Course Requirements (421)
1. Examinations (**3**) (60%)
2. Research Paper (**1**) (20%)
3. Class Participation (discussion of assigned readings) (20%)

Course Requirements (621)
1. Examinations (**3**) (40%)
2. Research Paper (**1**) (40%)
3. In-class Presentations (20%)

Each student's grade will be based on their performance in the activities listed above. GOEG 621 students will be required to make numerous in-class presentations, and GOEG 421 students will be expected to participate in discussion lead by the instructor and the graduate students in the class.

Grading
A-F (+/-)

Class Policies
Policies concerning behavior in class and issues of academic dishonesty can be reviewed in the 2009-2010 Graduate Catalog and 2009-20010 Undergraduate Catalog. All academic dishonesty issues will be handled according the University policy. Students with disabilities will be given full access to this course as discussed in the Undergraduate and Graduate Catalogs.

Course Schedule

NOTE: The lecture and reading schedule below may be changed by the professor. Any changes will be announced in class.

NOTE: Most journal articles can be found by using the UNR library at:
http://www.knowledgecenter.unr.edu/ejournals/Default.aspx

August 24: **Introduction to Course**

August 26: Introduction to Climatology
Reading→ Barry and Chorley Chapter 1
Reading → Carleton, A.M. 1999. Methodology in Climatology, *Annals of the Association of American Geographers*, V. 89, No. 4, pp. 713-735.
Research → Wx Forecast MODELS http://www.rap.ucar.edu/weather/
Research → Soundings http://raob.fsl.noaa.gov/
Research → Surface Climate Data http://lwf.ncdc.noaa.gov/oa/climate/datasel.html

August 31: Composition of Atmosphere
Reading → Barry and Chorley - Chapter 2
Investigate→ (AMS publications) http://www.ametsoc.org/pubs/journals/index.html
Investigate → AMS Glossary http://amsglossary.allenpress.com/glossary

September 2-9: Solar Radiation, Heat, and Temperature
Reading → Barry and Chorley – Chapter 3
Topics:
- Laws of thermodynamics
- Thermodynamic diagrams
- Inversions
- Controls of temperature

September 14-16: Moisture in the Atmosphere
Reading → Barry and Chorley – Chapter 4
Topics:
- Phase changes of water
- Water vapor
- Clouds
- Precipitation processes

September 21: **Pressure and Motion in the Atmosphere**
Reading → Barry and Chorley – Chapter 6
Topics:
- Pressure levels and geo-potential height
- Surface wind
- Geostrophic wind
- Vorticity
- Vertical motion

September 23: EXAM ONE

September 28-30: Atmospheric Stability/ Skew-T
Reading → Barry and Chorley – Chapter 5
Topics:
- Stability indices
- Skew-t analysis

October 5-7: Planetary-scale Circulation

Reading → Barry and Chorley – Chapter 7

Topics:

- Global energy balance
- Global energy transport
- Mid-latitude circulation
- Inter-tropical circulation
- Polar circulation

October 12-14: Mid-latitude Weather Systems

Reading →Barry and Chorley Chapter 9

Topics:

- Rossby Theory
- Cyclones
- Wave length, amplitude, speed, translation
- Jet Streams

October 19-21: Blocking Climatology

Reading→ To be assigned

Topics:

- Types of Blocks
- Weather and Blocking
- Climatology of Blocking
- Blocking and Teleconnections

October 26: Teleconnections

Reading→ To be assigned

Topics:

- Definition
- Weather outcomes
- Examples
- Climate outcomes

October 28: EXAM TWO

November 2: ENSO (GRADUATE STUDENT LECTURE)

Reading→ Leetmaa, A. 1999: The first El Niño observed and forecasted from start to finish. *Bull. Am. Met. Soc*., 80, 111-112.

Reading→ Ropelewski, C. F., and M. S. Halpert, 1986: North American precipitation and temperature patterns associated with the El Nino/ Southern Oscillation (ENSO). *Mon. Wea. Rev*., 114, 2352-2362.

Topics:

- Definition
- Pacific Ocean Temperature
- ENSO influence on wx and climate
- ENSO Transition
- SOI

November 4-9: MJO (GRADUATE STUDENT LECTURE)

Reading→ Zhang, C. and J. Gottschalck, 2002: SST Anomalies of ENSO and the Madden-Julian Oscillation in the Equatorial Pacific. Journal of Climate, 15, 2429-2445.

Reading→ Mo, K. C. and R. W. Higgins, 1998: Tropical influences on California precipitation. J. Climate, 11, 412-430.

Topics:

- Definition
- MJO Indices
- Phase Identification
- MJO influence on wx and climate

November 16-18: PDO (GRADUATE STUDENT LECTURE)

Reading→ PDO-http://jisao.washington.edu/pdo/

Topics:

- Definition
- Phase Identification
- PDO Indices
- PDO influence on wx and climate

November 23-25: North American Monsoon Climatology

Reading→ Adams and Comrie, 1997: The North American Monsoon, *Bull. Amer. Met. Soc*.,Vol. 78, No. 10, pp. 2197-2213

Reading → Higgins and Gochis, 2007: Synthesis of Results from the North American Monsoon Experiment (NAME) Process Study. *Journal of Climate*, Vol. 20, Iss. 9, pp. 1601–1607.

Topics:

- Monsoon circulation
- Geography of the NAM
- NAM bursts and breaks

November 25-30: Drought Climatology

Reading→ http://drought.unl.edu/DM/MONITOR.html

Topics:

- Surface Data
- Drought Indices
- Hemispheric Circulation

December 2-7: Regional Climatology

Reading→ Barry Chapter 10

Topics:

- North America
- Europe
- The Mediterranean

December 9: Exam Prep Day (no class)

FINAL EXAM: Monday December, 14 Time→2:15-4:15