

Geography 321: Climatology

Spring 2015, 2:00-3:20p, Tuesdays and Thursdays, 207 Chapman (CRN xxxxx)

Instructor: Patrick J. Bartlein, 154 Condon Hall, x6-4967, bartlein@uoregon.edu, Office hours: TBA.

GTF: TBA

Overview: The *climate system* is a set of environmental systems including the atmosphere, ocean, and biosphere, that are coupled to one another and vary over time and space, and *climatology* is the study of that system. This course covers the basics of energy and moisture in the climate system, atmospheric circulation processes and patterns, and the spatial and temporal variations of climate, including those produced by human action. The course will also trace the development of our understanding of the physical basis of climatology, the development of conceptual and numerical models of climate, and how complex systems like the Earth's climate system are studied.

Text: No textbook; .pdfs will be posted on Blackboard, including links to current assessments of climate variations.

Reserve texts: The following textbooks present more technical discussions of climatology and atmospheric physics. *Global Physical Climatology*, D.L. Hartmann, (1994) Academic Press, 411 p. [SCIENCE QC981 .H32 1994], *Fundamentals of Atmospheric Physics*, Salby, M.L. (1996), Academic Press, 627 p. [SCIENCE QC861.2 .S25 1996], *Physics of Atmospheres*, J.T. Houghton, (2002) Cambridge Univ. Press, 320 p.[SCIENCE QC880 .H68 2002]

Prerequisites: Geog 141 (or similar preparation, with consent of instructor)

Web Pages:

- Course web page: <http://blackboard.uoregon.edu/>
- Weather and climate page: <http://geog.uoregon.edu/weather/>
- Supplemental materials page, syllabus, etc.: <http://geog.uoregon.edu/bartlein/courses/geog321/>

Grading: 100 pts. total. Two examinations (26 pts each), one in week 6, the other during the scheduled final exam period (12:30pm, Thurs., June 11th), four quizzes (4 pts each), plus completion of eight exercises that involve the analysis of information from the Internet that illustrates the day-to-day and seasonal variations of weather and climate (4 pts each, 32 pts total for the exercises).

No make-up exams or quizzes. Do not miss class on the days that exams or quizzes are given. Quizzes may be given at any time during the lecture period they are scheduled in. With *adequate documentation* of the medical or other issue that created an unavoidable absence, scores from another exam or quiz may be substituted for a single missed exam or quiz. The exam and quiz questions will consist of a mix of multiple-choice and short-answer questions, and will emphasize concepts (as opposed to factoids), and will also include questions aimed at your ability to synthesize material presented in the lectures, readings, and related web pages, as well as to interpret images showing current weather conditions.

Exercises must be handed in by 5pm on their due date. Exercises that are 24 hrs late will have 1 point deducted, and after 48 hrs, 2 points. All exercises must still be completed to pass the course, even if they are too late to receive full points. There will be several questions on each exam based on this material.

Based on student performance in previous offerings of this course, 88 pts or above will be required for an A, 77-87 pts. for a B, and at least 60 pts. for a C.

Expected effort: Lectures will meet for 1.5 hours each, twice a week. Exercises will require on average an additional 2 hours per week, sometimes more. In addition to the usual reading and study, it will be beneficial to spend a little time each day to follow the day-to-day variation of the weather and progression of the season in a regular fashion.

Other topics: The visual inspection and interpretation of the maps and images will be important, but accommodation for alternative methods of course-material access may be possible--please see me as soon as possible. Collaboration on the exercises may be useful, and is not a bad idea, but answers should be written individually. Other academic dishonesty policies will be enforced (see: <http://uodos.uoregon.edu/StudentConductandCommunityStandards/tabid/68/Default.aspx>)

Also, the support provided by the following may be useful: UO Division of student affairs: <http://studentaffairs.uoregon.edu/> University Counseling and Testing Center: <http://counseling.uoregon.edu/dnn/>

Classroom etiquette: It would be fine (and might be a good idea) to bring notebook computers, tablets and smartphones to class, but using them for purposes other than note taking or browsing climate-related web pages during class would be unprofessional.

Expanded course description: The climate system is a set of environmental systems including the atmosphere, ocean, biosphere, cryosphere, hydrosphere, and lithosphere. These systems are coupled to one another and vary over time and space, and climatology is the study of that coupled system. The temporal and spatial variations of the climate system are generated by variations in the input of solar radiation, by the geological controls of atmospheric composition and the arrangement of continents and oceans, and by human impacts on atmospheric composition and the nature of the land surface. Understanding how the climate system works therefore requires input from all of the environmental sciences, and because human activities clearly influence climate, is also connected to the social sciences.

The first part of the course examines the basic controls of and variations in energy and moisture in the climate system, and describes their temporal and spatial variations. The middle part of the course examines atmospheric circulation, its maintenance, and role in redistributing energy and moisture around the globe, as well as the connection between larger-scale atmospheric circulation features and the seasonal and day-to-day variations of weather at a place. The third part of the course examines the spatial and temporal variations of climate, including the global and regional variations of weather and climate, climate history on multiple time scales, and future climates.

We will also trace the development of our understanding of how the climate system works as illustrated by the progressive elaboration of simple models of atmospheric circulation into the conceptual model that underlies both the explanation of the connection between large-scale circulation features and surface conditions, and the numerical models that are used for day-to-day weather forecasting and for projecting future climate changes.

Learning objectives: In addition to providing some intermediate-level material on weather and climate, the material in the lectures, reading and exercises addresses some cross-cutting concepts in geography and Earth Science, as well as some practical skills that are useful in both academic and casual contexts. The general concepts include

- understanding both top-down and bottom-up hierarchies of controls and responses
- the application of both conceptual and mechanistic models in explaining how environmental systems work
- understanding how remote/ultimate causes can govern local/proximate responses

Practical skills include:

- the use of Internet information sources to “diagnose” the controls of current environmental conditions
- how to develop a “personal” forecast of ongoing weather conditions and climate anomalies
- how to characterize the climates of different regions around the globe, including both the regional controls of climate and their expression in the long-term average conditions in those regions

Lecture topics, quiz, exam, and exercise schedule: (Readings will appear on the Blackboard web pages.)

Week	Date	Day	Topic	Quizzes, Exams	Exercises (due 5pm)
1	3-31 4-1	Tu Th	Introduction, atmospheric composition and structure		
2	4-7 4-9	Tu Th	Energy in the Earth-atmospheric system	1st quiz	1 Basic observations
3	4-14 4-16	Tu Th	Moisture in the atmosphere		2 Satellite images
4	4-21 4-23	Tu Th	Circulation of the atmosphere and ocean	2nd quiz	3 Conditions at Eugene
5	4-28 4-30	Tu Th	Vorticity and secondary circulation features		
6	5-5 5-7	Tu Th	Upper-level flow and surface weather	1st exam	4 Precip. and radar
7	5-12 5-14	Tu Th	Extratropical climates	3rd quiz	5 Forecasts
8	5-19 5-21	Tu Th	Tropical climates		6 Atm. circulation
9	5-26 5-28	Tu Th	Climatic variations	4th quiz	7 Climate anomalies
10	6-2 6-4	Tu Th	Anthropogenic climate change		8 Climate trends
	6-11	W	8:00a	2nd exam	