

# ATOC 1060-01: Our changing environment

## Fall 2009

**Time:** Tuesday and Thursday, 12:30-1:45 pm  
**Location:** Duane (Physics) lecture theatre G1B20  
**Prerequisites:** ATOC 1050  
**Instructor:** Prof. David Noone, Ekeley (CIRES) 234S, 303-735-6073 ([dcn@colorado.edu](mailto:dcn@colorado.edu))  
**Office hours:** Prof. Noone (by appointment.)  
TA Derek Brown (12-2pm Wednesday)

**Textbook:** Kump, L.R., J.F. Kasting and R.G. Crane, *The earth system*, Prentice Hall, 2nd edition, 2004. (New 3d edition is also fine)

**Web Page:** <http://atoc.colorado.edu/~dcn/ATOC1060>  
Lecture notes, homework, projects, reading assignments, data, solutions, due dates and other useful material will be posted on the class web site. This will be the primary location for finding out up to date information about the class. **Check regularly!**

### Summary:

The Earth's climate has been changing since its formation 4.6 billion years ago. Climate varies on all time scales and is known to experience periods of glaciation as well as warmer periods. Since the industrial revolution, humans have burned large amounts of fossil fuels changing the composition of the atmosphere, cleared large forested regions for agriculture and caused climate to change.

This class explores the Earth's climate focusing on the role of physical, chemical and biological aspects the atmosphere, oceans, and land surface. We will examine the water cycle, atmospheric circulations, and ocean currents, and how they influence global climate, El Nino, the ozone hole, human impacts on climate and predicting climate change. This class can be taken by science and non-science majors alike.

**Grading:** homework (40%), in-class problems and clickers (10%), midterm exam (20%), final exam (30%).

**Deadlines:** A deadline for all assignments will be given on the assignment sheet. Late submissions will be accepted by not graded unless special arrangements have been made more that **24 HOURS BEFOREHAND**. All assignments must be handed in as hard copies – no electronic submissions will be accepted.

**In-class exercises and clickers:** We will make use of clickers in class to assist in learning key concepts. Participation is important, so all clicker questions will be scored as 1 point for an answer, and 2 points for the correct answer. The final score will be made up as your best 80% of responses, which allows for you to have missed a small number of classes due to any reason. **Register your clicker!**

**Homework:** There will be 8 homework assignments, handed out approximately *every two weeks*. What you hand in must be your individual work. Most of these assignments will involve simple calculations as well as descriptive answers. **Homework will typically be due at the end of Thursday classes.**

**Reading:** Relevant pages from the textbook and extra reading will be assigned in lectures and via the class web site. Not all of this material can be covered in lecture time, but will be covered in assignments and homework and be on the exam.

**Exams:** All topics covered in lectures, reading, assignments, presentations, and other discussion are candidates for questions on the exams. There will be a midterm and a final. The midterm will focus on topics in the first half of the semester, while the final fill focus on the latter part of the course but will cover the whole semester.

**Final grades:** The final letter grade will be constructed by converting your numerical score using the divisions A-/B+ (80%), B-/C+ (70%), C-/D+ (60%), D-/F (50%).

### ***Absence from class***

It is expected that you attend all classes. All lecture slides, reading assignments, and homework assignments will be placed on the class web site after class. Attendance is not taken, but participation in 80% of clicker questions is expected. This allows you to have missed a number of classes for any reason without penalty on grades.

### ***Religious observance***

Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. See me if special consideration is required. See full details at [http://www.colorado.edu/policies/fac\\_relig.html](http://www.colorado.edu/policies/fac_relig.html). Please make David aware of any expected absence beforehand.

### ***Disability considerations***

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and <http://www.Colorado.EDU/disabilityservices>  
If you have a temporary medical condition or injury, see guidelines at <http://www.colorado.edu/disabilityservices/go.cgi?select=temporary.html>  
Disability Services' letters for students with disabilities indicate legally mandated reasonable accommodations. The syllabus statements and answers to Frequently Asked Questions can be found at <http://www.colorado.edu/disabilityservices>

### ***Classroom behavior***

Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to such behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at <http://www.colorado.edu/policies/classbehavior.html> and at [http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student\\_code](http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code)

### ***Honor code***

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council ([honor@colorado.edu](mailto:honor@colorado.edu); 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at <http://www.colorado.edu/policies/honor.html> and at <http://www.colorado.edu/academics/honorcode/>

### ***Discrimination and Sexual Harassment***

The University of Colorado at Boulder policy on Discrimination and Harassment (<http://www.colorado.edu/policies/discrimination.html>), the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships applies to all students, staff and faculty. Any student, staff or faculty member who believes s/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the ODH and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at <http://www.colorado.edu/odh>

# **ATOC 1060-01: Our changing environment**

**Fall 2009**

## **Course outline**

### **1 Overview of the climate system and global change (1 week, KKC Chapter 1 and first part 2)**

Atmospheric composition, temperature structure of the atmosphere, geographic variations in temperature and variability, overview of general circulation, the cyrosphere, feedbacks, forcing and perturbations.

### **2 Radiation and energy balance (2 weeks, Chap. 3)**

Properties of EM radiation, longwave versus shortwave, Wien's Displacement Law, Plank's Law, Stefan Boltzman Law, albedo. Energy flux at the top of the atmosphere, surface energy balance, atmospheric composition, clouds, and aerosols.

### **3 Atmospheric circulation (2 weeks, Chap 4)**

Forces, effects of rotation, geostrophic and gradient flow, distribution of surface pressure and wind. Temperature and precipitation patterns. Storm tracks, subtropics and tropics. Vorticity, conservation of mass, divergence and vertical motion.

### **4 Oceanic circulation (2 weeks, Chap. 5)**

Wind driven circulation, Ekman layers, pumping an upwelling. Vorticity, Rossby waves and western intensification. Salinity distribution and deep ocean circulation and the role of sea ice.

### **5 Modeling the climate system (1 week, Chap. 6)**

Simple and comprehensive models. Confidence and uncertainty in model simulations, and uses of models in science and policy.

### **6 The carbon cycle (2 weeks, Chap 8, and part of 9.)**

Scrutiny of the Keeling curve. Terrestrial carbon cycle, vegetation cycles and ecosystem links to climate, ocean productivity, chemical considerations, and short, long and very long time scales of carbon reservoirs.

### **7 Climate of the past (2 weeks, Chap 12 and 14)**

Solar and orbital cycles, records of past climate, glacial cycles, ice core records, isotopes, tree rings, corals, variation in atmospheric composition. The Vostok and GRIP climate records. Ancient climate change.

### **8 Observed climate variability (1 week, Chap 15)**

Review of time scale, volcanoes, aerosol forcing, El Nino and the Southern Oscillation

### **9 Contemporary climate change (1 week, Chap 16, some of 18)**

Measuring and monitoring climate change, ice sheets, Arctic change, deforestation, impacts on human activity, global dimming, ecosystem adjustments climate model projections, the IPCC process, policy guidance by science community.

### **10 Ozone depletion and mitigation policy (1 weeks, Chap 17)**

Ozone sources and loss. Radiation effects from ozone in the stratosphere and troposphere. Catalytic cycles, the ozone holes and results of policy implementations.