Physics 240
Atmospheric and Environmental Physics
Spring 2006 Syllabus

Instructor: R. David Baker
Moody Science 109
x2244
dbaker@austincollege.edu

Class and Laboratory Meeting Time: MWF 1:30-3:00 PM
Office Hours: MWF 3:00-4:00 PM, or by appointment

Course Description

Energy balance at the Earth's surface and local climate are intricately linked. The Earth system receives most of its energy directly from the Sun. This energy, in the form of electromagnetic radiation, is converted to other forms of energy on Earth: infrared radiation, thermal energy, kinetic energy, and potential energy. Local surface climate conditions influence (and are influenced by) the partitioning of energy into these various forms. For example, deserts may convert most incoming solar radiation into thermal and kinetic energy while oceans may convert most of it into potential energy. Furthermore, energy imbalances help generate storm systems and move mass (such as air or water) from one region to another.

In this project-based course, students will measure the local energy balance at the Austin College Weather Station. Students will be introduced to basic theory of weather, climate, and energy balance. A systems approach will be used in which energy and mass are exchanged between two reservoirs (atmosphere and geosphere). Students will become experts on at least one instrument of the Austin College Weather Station, replace that instrument, calibrate it, and validate its measurements. Toward the end of the semester, students will participate in a field campaign in which research-quality measurements of the surface energy balance are recorded.

Student Learning Objectives

After completing this course, students should be able

- To understand Earth as a complex system of interacting "spheres"
- To observe and analyze current weather observations via the Web
- To investigate land-atmosphere interaction through surface energy measurements
- To integrate various traditional scientific disciplines (including biology, mechanics, thermal physics, and electronics) in the study of the environment
- To be an expert on a scientific instrument, including understanding the basic physics of the sensor, analyzing measurements, and evaluating data quality
- To solve complex problems through improved critical thinking skills
- To collaborate with peers on Earth system science research
- To communicate their research results to a wider audience

Required Text

Oke, T. R., *Boundary Layer Climates*, 2nd Edition, Routledge (1987).

Additional readings will be made available throughout the semester.

Roles and Responsibilities

You are expected to take an active role in your learning. Perhaps in some of your previous courses, the instructor's role was to provide information and your role was to take notes and memorize the material. Things are different in this course. The instructor will provide a stimulating intellectual environment for you to ask questions, to explore new ideas, to communicate these ideas in oral and written form, and to expand your scientific knowledge and perspective. How much you learn and how much you grow depends on you. Your responsibilities include:

- *Attendance at all class meetings*. This course requires student participation and group interaction. To get the full benefit from this class (and other college courses as well), you should attend all class sessions.
- *Active engagement in learning activities*. This course will utilize a variety of learning approaches. Although there will be some traditional lectures from the professor, there will also be group discussions, hands-on activities, and student presentations during regular lecture time. You should be prepared to participate fully during all meeting times.
- *Careful reading of the textbook*. Our classroom discussions and lectures will assume a certain familiarity with climate and weather concepts. You are expected to read the appropriate sections in your textbook before class.
- *Initiative, perseverance, expertise, and teamwork*. We will be upgrading the Austin College Weather Station during this course for accurate, state-of-the-art measurements. Quality of the measurements depends on the quality of your individual instruments. The group will depend on you to make sure your instrument is working, calibrated, and validated. Late or incomplete work not only affects you, it affects the rest of the group and our scientific results.
- *Academic integrity*. In this course, you will be working often in small groups in the laboratory to complete assignments. We encourage collaborative learning with your peers. However, all written assignments, quizzes, and exams must be your own work. Plagiarism and cheating will not be tolerated and will result in failure of this course. Please refer to the Academic Integrity section below for more details.

Course Activities and Assignments

- ***Participation***. Active participation in this course is expected, and attendance at all sessions is required. You will be responsible for leading a weather briefing at least once during the semester.
- ***Homework***. Homework on course material will be offered each week. It may include problem sets, summaries of scientific articles, and laboratory assignments.

- ***Exam***. This course will have one exam during the semester. The main purpose of this exam is for you to synthesize concepts of surface energy balance and land-atmosphere interaction and apply them to a new situation.
- ***Research Project***. You will become an expert on at least one instrument on the Austin College Weather Station. You will understand the basic physics of the instrument, the basic physics of the phenomenon measured by the sensor, and its implementation on the weather station. In addition, you will know how the sensor fits into the "bigger" picture of energy balance measurements. You will install a new sensor, calibrate it, and validate its measurements. The new calibrated sensors will be used for a two-week field campaign in which the surface energy balance will be measured. You will report your findings in poster format.

Grading

Class Participation	10%
Homework	25%
Exam	25%
Research Project	40%
Total	**100%**

Grading Scale	
A	90-100
B	80-90
C	70-80
D	60-70
F	below 60

The numerical values for specific letter grades may be changed at the discretion of the professor, but the minimum value will not be raised. For example, the minimum value for a B may be below 80 but it will not be changed to a value above 80.

Academic Integrity

A recent national survey suggests that college students and faculty have different perspectives on academic integrity and cheating. The following list provides a *partial* list of actions that Austin College faculty consider violations of academic integrity:

1. Turning in work done by someone else.
2. Working on an assignment with others when the instructor asked for individual work.
3. Receiving unpermitted help on an assignment.
4. Writing or providing a paper for another student.
5. Getting Q/A from someone who has taken test.
6. In a course requiring computer work, copying a friend's program rather than doing your own.
7. Helping someone else cheat on a test.
8. Falsifying lab or research data.
9. Fabricating or falsifying a bibliography.
10. Copying from another student during a test or examination without his or her knowing it.
11. Copying from another student during a test with his or her knowledge.
12. Copying a few sentences of material from a written source without footnoting them in a paper.

13. Turning in a paper either purchased or plagiarized, in large part, from a term paper "mill" or website.
14. Copying a few sentences of material from an Internet source without footnoting them in a paper.
15. Using unpermitted crib notes (cheat sheets) during a test.
16. Copying material almost word for word from any written source and turning it in as your own work.
17. Altering graded test and submitting it for additional credit.
18. Turned in a paper copied from another student.
19. Using a false excuse to obtain extension on due date.
20. Hiding or damaging library/course material.
21. Cheating on a test in any other way.
22. Cheating on a written assignment in any other way.

If you have questions about academic integrity issues, please do not hesitate to discuss these issues with the instructor.

Physics 240 Schedule

Week	Topic	Chapter Sections	Weather Station
Week 1 1/30 – 2/3	Energy Exchanges	1.1-1.3	Group Meeting
Week 2 2/6 – 2/10	Mass Exchanges	1.4	
Week 3 2/13 – 2/17	Subsurface Energy	2.1-2.2	Group Meeting
Week 4 2/20 – 2/24	Surface and Atmospheric Climates	2.3-2.4	Sensor Presentations
Week 5 2/27 – 3/3	Non-vegetated surfaces: Desert	3.1	Sensor Presentations
Week 6 3/6 – 3/10	Non-vegetated surfaces: Water	3.3	Check Software Program
Week 7 3/13 – 3/17	Vegetated Surfaces	4.1, 4.3, 4.4	Compatibility Issues
Week 8 3/27 – 3/31	Inadvertent Climate Modification	8.1, 8.3	Install Sensors
Week 9 4/3 – 4/7			Check Sensors
4/5	**Exam**		
Week 10 4/10 – 4/14			Field Campaign: Energy Balance Measurements
Week 11 4/17 - 4/21			
Week 12 4/24 – 4/28			Analysis of Field Results
Week 13 5/1 – 5/5			**Poster Session**