

# METEOROLOGY 130

## Boundary Layer Meteorology

San José State University

**Spring 2008; Section 1**

TTh, 3:00-4:15 PM

Duncan Hall

Room 614

Web pages:

<http://www.met.sjsu.edu/~clements/met130/>

**Instructor:** Dr. Craig Clements

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**Office hours:** by appointment.

### Course Description and Prerequisites:

This course is designed to introduce the student to the atmospheric boundary layer and its properties. The course will begin with basic concepts and general characteristics. We will then discuss turbulence and begin to develop equations to describe the flows and structure of the boundary layer. We will cover some theoretical aspects, but will concentrate on measurements and analysis to understand how the atmosphere works. Students will learn how to calculate important numbers to better describe the boundary layer. These numbers include Richardson numbers, TKE and most importantly stability which will require a strong emphasis on sounding analyses with data. Other specialized topics will be covered including similarity theory, time series analysis, and special cases including mountain and urban boundary layers, etc.

### Learning objectives

1. To be able to describe the atmospheric boundary layer conceptually using figures and plots.
2. To understand atmospheric turbulence and the turbulent forms of the basic equations for flow and heat.
3. To understand how measurements of the atmospheric boundary layer are made.

### Reading and Textbook

Roland Stull's *An Introduction to Boundary Layer Meteorology*. 1988

### Optional references

R. B. Stull, *Meteorology for Scientists and Engineers*, 2<sup>nd</sup>. Ed. 2000

S. Pal Arya *Introduction to micrometeorology*, 1992

### Assessment

Assessment is designed to determine how well students have achieved the goals of the learning objectives and thus form an important component to the course. Each student will be assessed from a combination of assignments and exams. There will be two midterms and a final exam. The final exam is comprehensive.

Assignments (home work, quizzes)	15%
MATLAB/IDL assignments	20%
Midterm Exam 1	15%
Midterm Exam 2	15%
Project (TBD)	15%
Final Exam	20%
<b>Total</b>	<b>100 %</b>

**Grading Scale:**

- 90-100 = A
- 80-89 = B
- 70-79 = C
- 60-69 = D
- Below 60 = F

A +/- grading system will be used for final grades.

Arrangements for missing a midterm due to medical reasons (a medical certificate will be required) will need to be arranged privately.

**Late assignments will not be accepted.**

Outline and Topics to Cover

**1) Mean Boundary Layer Characteristics**

- Introduction
- Potential Temperature
- Mean profiles
  - Convective
  - Neutral
  - Stable

**2) Basic Statistics used in Boundary Layer Meteorology and Turbulence**

- Turbulence and its spectrum
- Mean and turbulent parts
- Reynolds averaging
- Summation notation
- Stress and friction velocity

### **3) Basic Equations for Turbulent Flow**

- Budget equations
  - heat budget and momentum budgets

### **4) Turbulence Kinetic Energy**

- TKE budget and terms
- Stability concepts
- Richardson number

### **5) Measuring the Boundary Layer**

- Balloons
- Radars
- Sodars
- Towers (micrometeorology)
- Measuring Turbulence
- Sonic anemometry
- Radiometers

### **6) Sounding Profile Analysis**

- Skew-t diagrams
- Other profiles

### **7) Basic Time Series Analysis**

### **8) Similarity Theory and Turbulence Closure**

### **9) Surface Energy Budgets**

### **10) Special Topics**

- a. Mountain boundary layers
- b. Urban boundary layers
- c. Boundary layers modified by wildfires

## **Writing and Plagiarism**

Writing is an extremely important component to any subject knowledge as it communicates that knowledge to other people. Through the use of the internet, plagiarism has become an increasing problem on college campuses. Although it may seem amazing to you, some students believe that completing their homework requires scanning the internet (i.e. Google it), finding the answer and then cutting and pasting their answer into a word file with their name at the top. This is certainly *not* acceptable.

This is one example of plagiarism and is considered unethical behavior at this university. SJSU is a learning institution where the goal is to develop freethinking students who can analyze new concepts and develop their own ideas and opinions. In order to discourage plagiarism, the course will adopt a zero tolerance approach. If submitted work is found to be plagiarized, the student (or students) overall grade will be lowered by 10% and their case will be submitted to the

university judicial board for review. The course will also use turnitin.com ([www.turnitin.com](http://www.turnitin.com)), a plagiarism detection tool, for the course term paper.

**The password and account will be given in class.**

**Plagiarism:** When you assume credit for something that someone else has written, that is stealing at this University.

*Academic integrity statement from Office of Student Conduct and Ethical Development:*

"Your own commitment to learning, as evidenced by your enrollment at San José State University, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Judicial Affairs. The policy on academic integrity can be found at [http://sa.sjsu.edu/judicial\\_affairs/index.html](http://sa.sjsu.edu/judicial_affairs/index.html).

**Campus policy in compliance with the Americans with Disabilities Act:**

If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with DRC to establish a record of their disability.

**Incompletes:**

An "incomplete" will be given for the course only under the following conditions:

1. At least 60% of the course work has been completed **and**
2. *Unexpected* circumstances prevent the completion of the remaining work.

An incomplete will **not** be given to circumvent rules concerning the dropping of courses!

**Cell phones and Laptop computers:**

Students and Instructor will please turn their cell phones **off** or put them on **vibrate mode** while in class. Please **do not** answer your phones in class. Students whose phones disrupt the course and do not stop when requested by the instructor will be referred to the Judicial Affairs Officer of the University. Laptop computers may only be used for taking notes in class, any abuse of laptop use in class will result in banning their use in the classroom for all students.

**Punctuality, etc.:**

Please make every effort to arrive and *be ready for lecture no later 3:03 PM. This is a buffer for those of you who are forecasting.* Be in the lecture seating at this time! Please inform me if you need to leave class early; try to take a seat near the front of the classroom to avoid disruption of the class as you leave.