SYLLABUS

ATS650 Measurement Systems and Theory Spring Semester 2019

Professor: Michael Bell
Email mmbell@colostate.edu, Phone 970-491-8345
Time and Location: TR 9:00-9:50 AM in ATS 101
Office Hours: TR 10:00 - 10:50 AM, or by appointment
First day of instruction 1/22/19, last day of instruction 5/10/19.

Student Outcomes: Understand the history, operation, and use of meteorological instruments that monitor the atmosphere, with emphasis on practical applications and field experiments. During this course students will develop skills in meteorological instrumentation, remote sensing, and field experimental design and logistics. Students will obtain a theoretical and practical understanding of in situ and remote sensing instruments that are designed to observe key physical characteristics of our atmospheric environment.

Lecture Topics
The course will consist of approximately 1/3 material on in situ instrumentation, 1/3 on remote sensing instrumentation, and 1/3 field experiment design. The final project will integrate all the material in a 'virtual' field experiment where observations are collected from a high-resolution numerical model simulation to test hypotheses and experiment design.

1. Introduction/Course expectations
Why observations are important; the utility of practical experience; the importance of calibration, response time, and error estimation in observations. History of early meteorological instruments. Instrument performance.

2. Temperature: Direct and Indirect Measurements
Thermometer concepts and instruments. Calibration; time response; ventilation.
Radiance, black body, IR temperature sensors. Solar and Earth radiation measurements.

3. Pressure
Barometer concepts and instruments. Importance of calibration and comparison of pressure sensors.

4. Humidity
Water, changes of state, relative and absolute humidity measurement.

5. Rainfall
Rain gauges, rain rate, placement of rain gauges.

6. Winds
Anemometers from surface and aircraft; vector measurement; Importance of time response; distance constant; sonic anemometry.

7. GPS applications for winds and thermodynamics
Ground-based and spaced based approaches.

8. Radiosondes and dropsondes
Sounding instrumentation, calibration, deployment, ascent and descent rates.

9. Research Aircraft
Aircraft specific measurement issues

10. Passive Remote Sensing
Microwave radiometers, basics of satellite instrumentation

11. Active Remote Sensing
Wind Profilers, Radio Acoustic Sounding Systems (RASS), Sodars, lidars, and radars.

12. Field Experiments.
Hypothesis development and experimental design. Site selection and field set-up logistics, data retrieval and analysis.

Text: Course materials will be provided for each lecture. The references below will be used by the instructor to supplement lectures.

References:
Meteorological Measurement Systems, by Fred V. Brock and Scott J. Richardson, Oxford University Press, 2001.
Instructor's Handbook on Meteorological Instrumentation, by Fred V. Brock (Editor) and Carol E. Nicholaidas (Assistant Editor), NCAR/TN-237+IA, 1984.
Federal Meteorological Handbook No. 1 (FMH-1), by OFCM, 1995.

Grading

Class Participation	20% W
Homework	50% W
Final Project	30% W
Total	100%