ATMOSPHERIC SCIENCES 360 SPRING 2019
ATMOSPHERIC INSTRUMENTATION

Taught by: Pat Arnott. Office hours Wed 1 pm - 3 pm, RM 213 Leifson Physics and by appointment.

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Course Administration: http://www.patarnott.com/atms360/ and Canvas.

Time and Place: Tues / Thurs 7:30 am until 8:45 am, Room 113 of Leifson Physics.

Course reading material will be delivered to students via the website listed above.

Catalog Description: Introduction to atmospheric sensor design, physical principles of measurement, signal processing, and hands-on experience with radiometers, acoustic sounders, radar, lidar and satellite remote sensing methods.

Student Learning Outcomes:

1. Review and learn how to communicate atmospheric science measurements, both in written and oral formats. We will build skills for manipulating and visualizing atmospheric science data sets, and students will have ample opportunities for writing and presenting scientific reports.
2. Students will learn about atmospheric science instruments for measuring wind, pressure, temperature, humidity, solar radiation, infrared radiation, and aerosol properties.
3. Students will learn how to perform atmospheric science case studies for specific events such as high air pollution days or days with strong precipitation.

Course Objectives:

We will systematically move through the steps needed to analyze atmospheric science data, to use and understand instruments, and to develop case studies. The course modules will include examples from the following, as time and instrumentation permits:

1. Introduction to data analysis and visualization using the DRI weather station data sets; Skew T log P plots and their uses and interpretation and comparison with our tethered balloon sounder; ultrasonic anemometers and their uses in quantifying atmospheric turbulence and the 3 components of wind. We will discuss measurement accuracy and precision.
2. Radar acoustic sounder for boundary layer temperature, wind, and RH.
3. Atmospheric solar radiation measurements accomplished with the multiple filter rotating shadowband radiometer (MFRSR), Cimel sunphotometer and NASA Aeronet network, and our custom system for total and diffuse spectral radiation.
4. Atmospheric infrared radiation measurements with our Fourier Transform Infrared Spectrometer for measuring the downwelling spectral IR at the surface.
5. Surface spectral albedo measurements made with our custom spectrometer

based units.

6. Photoacoustic instruments for measuring aerosol light absorption and scattering at solar wavelengths, related to air quality, especially during thermal inversions and wild fires.
7. Discuss the National Weather Service weather radars.

General Description

Atmospheric instruments are needed to study climate, air quality, air motion, clouds, sunlight and infrared radiation, and interfaces such as the atmosphere with the ocean and land. These instruments measure phenomena over a very wide range of sizes from the molecular level, to the planetary scale. Measurements that are used to monitor climate must be very stable and accurate over many years so that subtle changes can be inferred. Economic and sociological decisions are likely to be made in the future based at least somewhat on the story brought forth by these instruments. We will discuss broad categories of instruments in this class covering most of these length and time scales and will also discuss remote sensing, for example, from satellites.

GRADING:

Attendance and participation: 20%.

Attendance and participation is vital for this course; therefore, *each official class meeting where you are expected to attend class will be worth 10 points.* Excused absences need to be worked out beforehand, and it's the student's responsibility to make up any missed classes or events. Certain events and classes will be extremely difficult to make up.

Laboratory write-ups: 60%

Midterm exam and/or presentation: 10%

Final exam and/or presentation: 10%

Semester grades will be given using the following percentage guide:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
90%-100%	89%-89.9%	88%-88.9%	80%-87.9%	79%-79.9%	78%-78.9%	70%-77.9%	69%-69.9%	68%-68.9%	60%-67.9%	59%-59.9%	0-58.9%

Work Together:

I *strongly* suggest that you work together with other students on projects and homework. Find a lab partner or group and take advantage of the synergy provided by group brainstorms. At the same time, each student needs to be fully competent with the skills and knowledge developed in this class.

Special Needs: Any student with a disability needing academic adjustments or accommodations is requested to speak with the Disability Resource Center (Pennington

Student Achievement Center, Suite 230) as soon as possible to arrange for appropriate accommodations.

Academic Success Services:
Your student fees cover use of:
• Math Center (784-4433 or www.unr.edu/mathcenter/)

• Tutoring Center (784-6801 or www.unr.edu/tutoring/)

• University Writing Center (784-6030 or www.unr.edu/writing_center)
These centers support your classroom learning; it is your responsibility to take advantage of their services. Seeking help outside of class helps you develop as a responsible and successful student.

Recording: Surreptitious or covert videotaping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. In those cases, students should understand that their comments during class might be recorded**.**