Aerosol Physics, Chemistry, Clouds & Climate
ATS772

Spring 2024

Mondays and Wednesdays @ 11:00 – 12:15 in room 121 ATS West

Instructor: Jeff Pierce <jeffrey.pierce@colostate.edu>, Atmos 220
http://pierce.atmos.colostate.edu/

TA: En Li <en.li@colostate.edu>, Atmos 221

Office hours: Before or after class upon request, please Slack or email En and/or Jeff.

Slack channel: TBD

Prerequisites: (CHEM 114 and MATH 161) and (PH 122 or PH 142) or permission from instructor.

Class Website: CSU Canvas (http://info.canvas.colostate.edu/login.aspx)

Recommended textbooks:

"Atmospheric Chemistry and Physics" by Seinfeld and Pandis, 2nd ed.
"A Short Course in Cloud Physics" by Rogers and Yau, 3rd ed.

Additional text: "Microphysics of Clouds and Precipitation" by Prupacher and Klett

Objectives: (1) Become well-versed with the major concepts of physics and chemistry of atmospheric aerosols including composition, size, and interaction with radiation and clouds. (2) Develop research-grade models of aerosols, clouds, and radiation that synthesize the above concepts.

Grading:
Participation …..... 10%
Homework (~6-7) ..... 50% total
Project …..... 40%

Homework: There will be an assignment every 1-2 weeks (about 6-7 assignments total). The homework is designed to guide you on your project. The homework and project should be synergistic.

Midterm/Final: There will be no exams in this class.

Project: The project is designed to incorporate much of the aerosol (and aerosol-cloud interactions) phenomena we discuss in class. Students may work individually or in teams, but teams are expected to have a more extensive project. I have a separate hand out to guide you on project topics.

In the last day of class, the individuals/teams will present their project in a

Power Point type presentation describing the results and interesting things that you found.

Grading (grads):

A	90-100%
B	80-89.9%
C	70-79.9%
F	< 70%

Potential topics (I will not be able to cover all of these in the detail that I would like. If you have preferences, please let me know early in the semester):

1. Overview of aerosols

2. Particle/droplet size distributions

3. Single-particle/droplet dynamics

4. Microphysics
    1. Condensation
    2. Coagulation
    3. Aerosol nucleation
    4. Solution of the General Dynamic Equation
    5. Cloud Condensation Nuclei and cloud-droplet activation
    6. Cloud ice

5. Aerosol thermodynamics/chemistry
    1. Inorganic aerosol
    2. Aerosol water uptake
    3. Organic aerosol

6. Optics (for both aerosols and clouds)
    1. Aerosol direct effect
    2. Aerosol indirect effect
    3. Remote sensing instrumentation

7. Aerosol dry deposition

CLASS POLICIES

UNIVERSITY POLICIES: Students are expected to follow the CSU Student Honor Pledge (http://tilt.colostate.edu/integrity/honorpledge/). This course will adhere to the CSU Academic Integrity Policy as found in the General Catalog (http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf) and the Student Conduct Code (http://www.conflictresolution.colostate.edu/conduct-code). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.

POLICY ON COLLABORATION: Students are encouraged to discuss homework assignments. However, each student must complete their own assignment. If I determine that students are simply copying assignments, I will pursue action through the Office of Academic Integrity (http://tilt.colostate.edu/integrity/). Any copying on tests will be similarly not tolerated.

POLICY ON LATE HOMEWORK ASSIGNMENTS: Late homework assignments will not be accepted, but I will drop the assignment with the lowest score.

POLICY ON REMARKING HOMEWORK: Students who disagree with how their assignment, test, or project has been marked should resubmit their work with a written explanation of their concern. The work will be re-evaluated by the instructor in its entirety.