

# Aerosol Physics, Chemistry, Clouds & Climate

## ATS772

Spring 2025

Tuesdays and Thursdays @ 11:00 – 12:15 in room 121 ATS West

Instructor: Jeff Pierce <jeffrey.pierce@colostate.edu>, Atmos Main 220  
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TAs: En Li <en.li@colostate.edu>, Atmos Main 221  
Nicole June <nicole.june@colostate.edu>, Atmos Main 222

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

Slack channel: I will create a channel called “ATS772\_SP2025” in the Department of Atmospheric Science workspace and add you all for general homework or understanding questions. Please feel free to contact me and the TA's directly through this Slack workspace as well

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

Class Website: CSU Canvas (<http://canvas.colostate.edu/>)

Recommended textbooks:

“Atmospheric Chemistry and Physics” by Seinfeld and Pandis, 2<sup>nd</sup> ed.  
“A Short Course in Cloud Physics” by Rogers and Yau, 3<sup>rd</sup> 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 5-7 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 amount 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

## **Inclusion statement**

CSU Atmospheric Science is a leading global institution, and as such, all members of our community regardless of race, ethnicity, culture, religion, sexual orientation, gender identity and expression, physical ability, age, socioeconomic status or nationality are welcome as equal contributors. It is my intent that students from all backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that the students bring to this class be viewed as a resource, strength, and benefit. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally, or for other students or student groups.

## **Student resources for outside and inside the classroom**

We want you to be able to fully participate in the learning experience. Student resources for food, financial, and housing security; transportation; child care; health care; violence; and immigration issues are compiled at [basicneeds.colostate.edu](https://basicneeds.colostate.edu).

An additional list of student resources, which includes information on learning/accommodation resources, mental-health resources, student case management, and religious observances is at the following link and QR code: <https://col.st/2FA2g>



## **Class policies**

**ACADEMIC INTEGRITY:** All students are subject to the policies regarding academic integrity found in the 2023 – 2024 General Catalog, found at <http://catalog.colostate.edu/general-catalog/policies/>, and the student conduct code (<https://resolutioncenter.colostate.edu/conduct/code/>). Other information on academic integrity can be found at <https://resolutioncenter.colostate.edu/academic-integrity/>. Examples of academic dishonesty can be found in these sources. 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.

**POLICY ON LATE HOMEWORK ASSIGNMENTS:** Late homework assignments will not be accepted, but I will drop the assignment with the lowest score. However, if there are challenging circumstances, please talk to Jeff.

**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.