

ATS 681A4 – Mountain Meteorology Spring 2025

Course description:

Broad overview of the influence of mountains on weather and climate across spatial and temporal scales. Students will be introduced to the conceptual and theoretical foundations related to mountain climates, mountain winds and circulations, characteristics of mountain climates, mountain bioclimatology, and changes in mountain climates. Homework assignments, a term project, and a field experience will provide a practical application of the course material.

Students successfully completing this course will:

1. Understand the global influence of mountains on weather and climate across spatial and temporal scales.
2. Understand the key physical mechanisms that drive micro and mesoscale wind and precipitation processes in mountainous terrain.
3. Understand the bioclimatology and weather hazards related to mountain meteorology.
4. Learn how physical processes in mountainous terrain may change in a warming climate.

The course consists of two classes per week. A short field research experience will be conducted at the Old Man Mountain Retreat Center owned by the University of Northern Colorado (<https://www.unco.edu/living-on-campus/housing/old-man-mountain.aspx>) during the semester in collaboration with a Mountain Meteorology course at UNC. Course topics are listed at the end of this document. A course schedule is available on the class CANVAS website.

Instructor:

Professor Kristen Rasmussen

ATS 402

Email: kristenr@rams.colostate.edu

Office hours: Mondays and Wednesdays from 12-1 pm; ATS 402

Meeting Times:

Mondays and Wednesdays: 11:00 to 11:50 pm, ATS 101

Short field research experience at the Old Man Mountain Retreat Center: 22-23 February 2025

Course Evaluation:

10% Participating in class discussions

50% Homework assignments

40% Term project

Required Reading:

Lecture notes: Available from the course Canvas website. Relevant materials will be provided where needed.

Other Resources:

- Mountain Meteorology: Fundamentals and Applications by C. David Whiteman
- Mountain Weather and Climate by Roger G. Barry
- Cloud Dynamics (second edition) by Robert A. Houze, Jr.

Academic Integrity:

All students are subject to the policies regarding academic integrity found in the General Catalog, found at <http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity>, and the student conduct code (<https://resolutioncenter.colostate.edu/conduct-code/>). Other information on academic integrity can be found on the Learning@CSU website (<http://learning.colostate.edu/integrity/index.cfm>). 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.

Special Needs:

Please see the instructor during the first two weeks of the semester, if you have special learning needs that should be accommodated in this class, and refer to <http://rds.colostate.edu/accommodation-process/> for more information.

List of topics:

Course modules	Lecture topics	Number of classes
Mountain Climates	<ul style="list-style-type: none">• Latitude, altitude, and continentality• Characteristics of mountainous areas• History of research on mountain weather and climate• The general study of mountain weather and climate	2
Climatic characteristics of mountains	<ul style="list-style-type: none">• Energy budgets• Temperature• Clouds and precipitation associated with hills and mountains• Snowpack and hydrology• Avalanche science and safety	7
Mountain winds and circulations	<ul style="list-style-type: none">• Terrain-forced flows: Flow over mountains, mountain waves, flow around mountains, gap flows• Diurnal mountain winds• Dynamic modification• Thermally-induced winds: Slope flows, mountain valley winds, mountain-plain circulations	7
Mountain bioclimatology	<ul style="list-style-type: none">• Human bioclimatology• Weather hazards• Air pollution in mountainous regions• Fire weather and smoke management	5
Changes in mountain climates	<ul style="list-style-type: none">• Climate change impacts on mountain climates• Evidence/mitigation considerations• Snowpack, hydrometeorology, ecology, etc.	5