

**Mode of Delivery:** Lecture

**Prerequisites:** MET 4301 or MET 5311, MET 4302 or MET 5312, MET 4420 or MET 5425, MET 4450 or MET 5451, or instructor permission

**Credit Hours:** 3

**Course Description:**

This course covers atmospheric convection, considering both the local properties of individual clouds or convective systems and the ensemble properties of convection and its global implications. Topics include: Rayleigh-Benard convection, radiative-convective equilibrium, stratocumulus-trade cumulus transition, deep precipitating convection, convective organization, and modeling of convection.

**Learning Objectives:** At the completion of this course, students will be able to:

1. Understand of convective flows and interactions between convection and the environment, from both conceptual and quantitative perspectives
2. Apply simple models, like radiative-convective equilibrium, to explain basic properties of climate
3. Develop critical reading skills of contemporary literature on convective processes

**Resources:** There is no required textbook, but you may find these to be helpful resources:

- *Atmospheric Convection*, by Kerry A. Emanuel. Oxford University Press, pp. 592, February 17, 1994. ISBN: 978-0195066302.
- *Clouds and Climate: Climate Science's Greatest Challenge*, edited by A. Pier Siebesma, Sandrine Bony, Christian Jakob, and Bjorn Stevens. Cambridge University Press, pp.409, 2020. ISBN: 978-1-107-06107-1, doi: 10.1017/9781107447738.
- Stevens, B. (2005): Atmospheric Moist Convection, *Annu. Rev. Earth Planet. Sci.*, 33, 605-643, doi:10.1146/annurev.earth.33.092203.122658.
- Romps, D. (2020): Theory of tropical moist convection. In: *Fundamental aspects of turbulent flows in climate dynamics*. Edited by Freddy Bouchet, Tapio Schneider, Antoine Venaille, Christophe Salomon: Oxford University Press, doi: 10.1093/oso/9780198855217.003.0001.

**Assessment:**

- Participation: 5%
- Homework Assignments: 50%
- Mid-term Exam: 20%
- Presentation of paper about convective processes from peer-reviewed literature: 25%

**Course Content:**

1. Weeks 1-3: Preliminaries & Dry Convection
  - Review of dry thermodynamics and buoyancy
  - Convection from local sources (plumes & thermals)
  - Rayleigh-Benard Convection
  - Dry convective boundary layers

2. Weeks 4-8: Moist Convection
  - Review of moist thermodynamics and stability
  - Radiative-convective equilibrium
  - Stratocumulus convection
  - Shallow cumulus convection
  - Deep cumulus convection
  - Slantwise convection
3. Weeks 9-12: Interaction with environment & large-scale flows
  - Quasi-equilibrium vs. triggered convection
  - Squall lines, mesoscale convective systems
  - Self-aggregation of deep convection
  - Organization of shallow convection
4. Weeks 13-14: Modeling of convection
  - Cloud-resolving modeling
  - Cumulus parameterization
5. Week 15: Student Presentations

### Grading Scale:

Specific points-based schemes used to mark individual assignments will be discussed as appropriate at the time of assignment. Participation will be assessed based on class attendance and asking/answering questions during class discussion (precise assessment may vary by instructor, but one possible standard is that full participation credit requires attending all classes and asking at least one question during the student presentations in week 15). Grading standards may vary by instructor, this is a sample standard:

Grade	Range	Grade	Range	Grade	Range
–	–	A	94% to 100%	A-	90% to 93%
B+	87% to 89%	B	84% to 86%	B-	80% to 83%
C+	77% to 79%	C	74% to 76%	C-	70% to 73%
D+	67% to 69%	D	64% to 66%	D-	60% to 63%
–	–	F	59% and below	–	–

- A- to A: Demonstrates a deep understanding of material. Exhibits a high level of insight and originality.
- B- to B+: Demonstrates a sound understanding of material and some level of insight and originality. Few errors.
- C- to C+: Demonstrates a sufficient understanding of material. Moderate errors. Little insight or originality.
- D- to D+: Demonstrates little understanding of material. Many errors. No insight or originality.
- F: Makes an insufficient attempt to complete required work. Demonstrates a serious lack of understanding of material.

### University Attendance Policy:

Excused absences include documented illness, deaths in the family, and other documented crises, call to active military duty or jury duty, religious holy days, and official University

activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid written excuse. Consideration will also be given to students whose dependent children experience serious illness.

### **Academic Honor Policy:**

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of student's academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to ". . . be honest and truthful and . . . [to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at <http://fda.fsu.edu/academic-resources/academic-integrity-and-grievances/academic-honor-policy>)

### **Academic Success:**

Your academic success is a top priority for Florida State University. University resources to help you succeed include tutoring centers, computer labs, counseling and health services, and services for designated groups, such as veterans and students with disabilities. The following information is not exhaustive, so please check with your advisor or the Department of Student Support and Transitions to learn more.

### **Americans with Disabilities Act:**

Florida State University (FSU) values diversity and inclusion; we are committed to a climate of mutual respect and full participation. Our goal is to create learning environments that are usable, equitable, inclusive, and welcoming. FSU is committed to providing reasonable accommodations for all persons with disabilities in a manner that is consistent with academic standards of the course while empowering the student to meet integral requirements of the course. Students with disabilities needing academic accommodation should:

- (1) register with and provide documentation to the Office of Accessibility Services; and
- (2) request a letter from the Office of Accessibility Services to be sent to the instructor indicating the need for accommodation and what type; and,
- (3) meet (in person, via phone, email, skype, zoom, etc...) with each instructor to whom a letter of accommodation was sent to review approved accommodations.

Please note that instructors are not allowed to provide classroom accommodations to a student until appropriate verification from the Office of Accessibility Services has been provided. This syllabus and other class materials are available in alternative format upon request. For more information about services available to FSU students with disabilities, contact:

Office of Accessibility Services  
874 Traditions Way  
108 Student Services Building  
Florida State University  
Tallahassee, FL 32306-4167  
(850) 644-9566 (voice)  
(850) 644-8504 (TDD)  
oas@fsu.edu

<https://dsst.fsu.edu/oas>

### **Confidential Campus Resources:**

Various centers and programs are available to assist students with navigating stressors that might impact academic success. These include the following:

- **Victim Advocate Program**, University Center A. Rm. 4100. (850) 644-7161. Available 24/7/365. Office Hours: M-F 8-5. <https://dsst.fsu.edu/vap>
- **Counseling and Psychological Services**: Florida State University's Counseling and Psychological Services (CAPS) primary mission is to address psychological needs and personal concerns, which may interfere with students' academic progress, social development, and emotional well-being. The following in-person and virtual (tele-mental health) services are available to all enrolled students residing in the state of Florida:
  1. Individual therapy
  2. Group therapy
  3. Crisis intervention
  4. Psychoeducational and outreach programming
  5. After hours crisis-hotline
  6. Access to community providers for specialized treatment

Call 850-644-TALK (8255) for more information about how to initiate services.

Counseling and Psychological Services, 250 Askew Student Life Center. 942 Learning Way. (850) 644-TALK (8255). Walk-in and Appointment Hours: M-F 8 am - 4 pm. <https://counseling.fsu.edu>

- **University Health Services**: Services at UHS are available to all enrolled students residing in Florida. The mission of University Health Services (UHS) is to promote and improve the overall health and well-being of FSU students. UHS provides a coordinated continuum of care through prevention, intervention, and treatment. Services include general medical care, priority care, gynecological services, physicals, allergy injection clinic, immunizations, diagnostic imaging, physical therapy, and a medical response unit. The Center for Health Advocacy and Wellness (CHAW) assists students in their academic success through individual, group, and population-based health and wellness initiatives. Topics include wellness, alcohol and other drugs, hazing prevention, nutrition and body image, sexual health, and power based personal violence prevention. For more information, go to <https://uhs.fsu.edu>.

University Health Services, Health and Wellness Center. 960 Learning Way. Tallahassee, FL 32306. Hours: M-f, 8am - 4 pm. (850) 644-6230. <https://uhs.fsu.edu>

### **Free Tutoring from FSU:**

On-campus tutoring and writing assistance is available for many courses at Florida State University. For more information, visit the Academic Center for Excellence (ACE) Tutoring Services' comprehensive list of on-campus tutoring options - see <http://ace.fsu.edu/tutoring> or contact [tutor@fsu.edu](mailto:tutor@fsu.edu). High-quality tutoring is available by appointment and on a walk-in basis. These services are offered by tutors trained to encourage the highest level of individual academic success while upholding personal academic integrity.

### **Syllabus Change Policy:**

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

**Statement on HB233 Recording:**

In this class, consistent with state law and university policy, students are permitted to make recordings of class lectures for personal use only. As noted, sharing, posting, or publishing classroom recordings may subject you to honor code violations and legal penalties associated with theft of intellectual property and violations of other state laws. Moreover, students and educators have expressed concern that recording classroom activities may negatively impact the learning experience for others, especially in classes that involve questions, discussion, or participation. To protect a learning environment in which everyone feels free to experiment with ideas, we ask you to refrain from recording in ways that could make others feel reluctant to ask questions, explore new ideas, or otherwise participate in class. Students must monitor their recordings so that they do not include participation by other students without permission. Students with disabilities will continue to have appropriate accommodations for recordings as established by the Office of Accessibility Services.