

# ATMOSSC 5950, ATMOSPHERIC THERMODYNAMICS

Autumn Semester 2021, 3 units, Call number: 11160

Lectures: MWF 9:35-10:30 AM, Derby Hall 140

**Instructor:** Prof. Jialin Lin

**Email:** lin.789@osu.edu This is the best way to reach me.

**Telephone:** 614-292-6634

**Office Hours:** Friday 3-5pm, Zoom link will be sent later

## Reference Books:

“Atmospheric Thermodynamics: Elementary Physics and Chemistry” by G. North and T. Erukhimova, Cambridge University Press.

“An Introduction to Atmospheric Radiation” (2<sup>nd</sup> ed.) by K. N. Liou, Academic Press.

“Atmospheric Convection” by K. Emanuel, Oxford University Press.

## Course Objectives:

The basic objective of this course is to provide students with knowledge of the fundamentals of atmospheric thermodynamics. Thermodynamics deals with the processes that transfer energy and thermodynamic processes help to create and change atmospheric systems. Knowledge of the basic principles of thermodynamics and their interactions will facilitate students' comprehension of meteorological processes that determine the weather and climate of the Earth. Understanding thermodynamic processes is critical to accurate assessment of the current state of the atmosphere and to accurate evaluation of the output from numerical models of weather and climate. The four specific objectives of this course are: (1) to understand the basic principles of thermodynamics as they apply to dry air (i.e. air with no water vapor); (2) to understand the effects of the different phases of water on thermodynamic processes; (3) to determine how thermodynamic processes generate the observed structure of the atmosphere; (4) to examine how thermodynamic processes affect the stability of portions of the atmosphere.

## Methods for accomplishing these objectives:

The objectives of the course will be accomplished through the lectures, in-class assignments, research project, and examinations. Determination of your final grade will be as follows:

In-class assignments and homeworks (11 total, will drop your worst score)	30%
Research project (Presentation 20%, Term Paper 20%)	40%
Three midterm exams (15% each, will drop your worst score)	30%

The grading scale is as follows: 100-93% A, 92-90% A-, 89-87% B+, 86-83% B, 82-80% B-, 79-77% C+, 76-73% C, 72-70% C-, 69-67% D+, 66-63% D, 62-60% D-, 59% and below E.

**Academic Misconduct** It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code

of Student Conduct ([http://studentaffairs.osu.edu/info\\_for\\_students/csc.asp](http://studentaffairs.osu.edu/info_for_students/csc.asp)).

**Disability Services** Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>.

**Cell Phones** Like on airplanes, interfere with navigation of the course, therefore, cell phones and pagers must be turned *OFF* during class as they interfere with the navigation of the course.

**Health and safety requirements** All students, faculty and staff are required to comply with and stay up to date on all university safety and health guidance (<https://safeandhealthy.osu.edu>), which includes wearing a face mask in any indoor space and maintaining a safe physical distance at all times. Non-compliance will result in a warning first, and disciplinary actions will be taken for repeated offenses.

**Some Tips for Doing Well:**

1. Pay special efforts to the in-class assignments and homeworks, which will help you to get solid skills in Atmospheric Thermodynamics.
2. Enjoy the research project.
3. Check the course website frequently for updates.
4. Relax and have fun.

The schedule may change, probably only slightly, as the class evolves. Instructor will alert students if/when schedule changes.

## COURSE LECTURE OUTLINE

Date	LECTURE
08/25	Syllabus and course introduction
08/27	Lab 1: Instructions on Research Project
08/30	Introduction: Atmospheric Convection and Extreme Weather/Climate
09/01	Introduction: Observation and Modeling of Atmospheric Convection
09/03	Lab 2
09/06	Labor Day (NO CLASS)
09/08	Introduction: Why is it so difficult to forecast atmospheric convection?
09/10	Lab 3
09/13	Energy
09/15	Vertical Structure
09/17	Lab 4
09/20	Vertical Structure
09/22	Dry Static Energy
09/24	Lab 5
09/27	Potential Temperature
09/29	Skew-T Diagram
10/01	Lab 6
10/04	Midterm 1 Review
10/06	MIDTERM 1
10/08	Lab 7
10/11	Atmospheric Moisture
10/13	Lab 8
10/15	Autumn Break (NO CLASS)
10/18	Ideal Gas Law for Moist Air
10/20	Moist Static Energy
10/22	Lab 9
10/25	Equivalent Potential Temperature
10/27	Entropy
10/29	Lab 10
11/01	Midterm 2 Review
11/03	MIDTERM 2
11/05	Lab 11
11/08	Convective Instability
11/10	Convective Available Potential Energy
11/12	Lab 12
11/15	Convective Available Potential Energy

11/17 Convective Available Potential Energy  
11/19 Lab 13

11/22 Moist Convection in Global Climate Models  
11/24 Thanksgiving Break (NO CLASS)  
11/26 Thanksgiving Break (NO CLASS)

11/29 Lab 14  
12/01 Backup  
12/03 Midterm 3 Review (**Term Paper Due**)

12/06 MIDTERM 3  
12/08 Final Review