

Atmospheric Dynamics Practicum
EAS 4656 (1 Credit Hour)
Fall 2023

Lecture Meeting Times: Fridays from 12:30 – 3:15 PM

Lecture Location: L1116 Ford ES&T

Instructor: Dr. Zachary Handlos

Office: 1251 Ford ES&T Building

Office Hours: 10:30 AM – 12 PM Mondays, 1-3 PM Wednesdays or via appointment – in-person or virtual appointments both OK!

Email: zachary.handlos@eas.gatech.edu

TA: Faria Panwala

Office Hours: By appointment

Email: fpanwala3@gatech.edu

EAS 4656 Course Prerequisites:

- MATH 2551
- MATH 2552

Course Description

If you are enrolled within this course, you are already aware of the goals of the course EAS 4655: Atmospheric Dynamics (and are likely enrolled in this course right now). You will quickly learn that the atmospheric dynamics course is highly math and physics intensive. While developing a strong skillset in solving applied math problems within the context of atmospheric science is beneficial to developing your logical skills, often students wonder what the point of doing all this math is for (besides math being fun!). For example, students, including your course instructor when he took dynamics as an undergraduate student, wondered how this type of course was about the atmosphere despite a significant deficiency in weather maps, soundings, etc... While the lecture course cannot remedy this completely, this lab course you provide you opportunities to learn how to interpret meteorological data and apply your newly learned dynamical skills to meteorological observations and forecasts.

Learning Outcomes

The following learning outcomes will be accomplished as a result of successful completion of this course (i.e., passing this course):

- 1) Accurately analyzing and assessing data plotted on weather maps and sounding data
- 2) Editing and debugging, with accuracy, pre-existing computer code to create and analyze weather maps of interest
- 3) Improve communication of atmospheric sciences material through weather discussions
- 4) Quantifying atmospheric dynamics quantities of interest accurately and concisely through practice applied math problems

Grading

Your grade in this course will be based on your performance within the following categories:

- Top 9 of 10 lab assignments – 90% of grade
- WxChallenge – 10% of grade

Labs (90% of Grade)

You will have 10 lab assignments to complete this semester. Your top 9 scores will count towards your final grade (i.e., your lowest lab grade score will be dropped). Labs will provide opportunities to improve your weather analysis and forecasting skills. More details will be discussed with each lab assignment.

For one of the labs, you and 1-2 classmates will lead one weather discussions this semester. The goal of these discussions is to provide you experience with discussing real-time and forecasted weather information, which will require you to apply what you have learned from atmospheric dynamics towards helping the audience understand the “how” and “why” of weather. Being able to effectively communicate scientific information, especially meteorological information, to an audience is vital towards informing people about key weather events (especially when societal decisions depend on weather forecasts!). One person will lead the “observations/past weather” part of the discussion, while the second person will lead the “forecast.” The course instructor will provide more information and resources to use for this discussion assignment.

WxChallenge (10% of Grade)

You will participate within the WxChallenge forecasting competition this semester. This is a national forecasting competition, where participants enter maximum/minimum temperature, maximum wind speed and precipitation values for a forecast city over a two-week period. Prizes are awarded for forecasters that receive the least number of error points.

In this course, you will be required to submit forecasts for all forecasting days for all cities during the competition this semester. At the completion of all 5 forecast cities for this semester, you will write a short reflection summarizing how well you did at forecasting, including discussion of your forecast strategies and how well they worked (or did not work).

Grading Scale

The **grading** for the course is as follows:

Grade	Percentage
A	100 – 90
B	89.99 – 80
C	79.99 – 70
D	69.99 – 60
F	<60

Depending on the distribution of student scores at the end of the course, the scores may be curved to reflect the scale described above (**up to the instructor’s discretion**).

Late Work Policy

An assignment turned in late will be deducted 20% of its total grade for each day it is late after submitted. This policy will only be waived in extreme circumstances (e.g., serious illness, family emergency, COVID-19). **You must contact me at least 24 hours prior to the due date of any assignment if you anticipate any issues with submitting it on time.**

Course Canvas Page

All relevant materials to this course will be posted on Canvas.

Academic Honesty

The best way to learn in this course is to participate in all aspects of the course, celebrate one's accomplishments throughout and to learn from one's mistakes, even at the risk of one's grade not being perfect on every assignment. Participation in activities such as copying answers from another student, using unauthorized resources, including the use of electronic devices or AI tools such as ChatGPT, posting solutions to course assignments and quizzes on the Internet, and/or any other activity that would be considered a method for shortcutting this course will prevent you from truly enjoying the experience that is Atmospheric Dynamics Practicum. Such methods above also lead to the development of habits that are hard to break and may reduce your success beyond class and in the "real world."

Academic Honor Code

The instructor and students are expected to follow Georgia Tech's Academic Honor Code:

<https://policylibrary.gatech.edu/student-affairs/academic-honor-code>

Access and Accommodations

If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Office of Disability Services to explore reasonable accommodations.

The Office of Disability Services can be contacted by:

Phone: **404-894-2563**

Email: dsinfo@gatech.edu

Website: <https://disabilityservices.gatech.edu/>

Resources:

Academic Support

- [Center for Academic Success](#)
 - [1-to-1 tutoring](#)
 - [Peer-Led Undergraduate Study \(PLUS\)](#)
 - [Drop-In Tutoring](#)
- [OMED Educational Services](#) - Group study sessions and tutoring programs
- [Communication Center](#) - Individualized help with writing and multimedia projects
- [Academic Coaching](#)
- [Find Your Advisor](#) for your major

Personal Support

Georgia Tech Resources

- The [Office of the Dean of Students](#) | **404-894-6367**
- [Counseling Center](#) | **404-894-2575** | Smithgall Student Services Building 2nd floor
 - Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, referral services, and crisis intervention.
 - *Students in crisis may walk in during business hours (8am-5pm, Monday through Friday) or contact the counselor on call after hours at 404-894-2204.*
- [Stamps Health Services](#) | **404-894-1420**
- [OMED Educational Services](#) | **404-894-3959**
- [Women's Resource Center](#) | **404-385-0230**
- [LGBTQIA Resource Center](#) | **404 385 4780**

- [Veteran's Resource Center](#) | 404-385-2067
- [Georgia Tech Police](#) | 404-894-2500

National Resources

- The [National Suicide Prevention Lifeline](#) | 1-800-273-8255
 - Free and confidential support 24/7 to those in suicidal or emotional distress
- The [Trevor Project](#)
 - Crisis intervention and suicide prevention support to members of the LGBTQ+ community and their friends
 - Telephone | **1-866-488-7386** | 24 hours a day, 7 days a week
 - [Online chat](#) | 24 hours a day, 7 days a week
 - Text message | Text "START" to **687687** | 24hrs day, 7 days a week

List of Course Topics*

Week	Atmospheric Dynamics Lecture Topics	Practicum Assignment
Week 1 (8/21/23 – 8/25/23)	Calculus, Vectors, Taylor Series Expansion, Other Math Review	Assign Lab 1 – METAR analysis
Week 2 (8/28/23 – 9/1/23)	Lagrangian vs. Eulerian derivatives; Advection	Lab 1 Due Assign Lab 2 – Surface and Upper Level Weather Map Analysis
Week 3 (9/4/23 – 9/8/23)	2D Flow Kinematics	Lab 2 Due Assign Lab 3 – 2D Kinematic Flow Fields
Week 4 (9/11/23 – 9/15/23)	Fundamental Forces – Gravity, PGF; Apparent Gravity	Lab 3 Due Assign Lab 4 Parts 1 and 2 – Soundings
Week 5 (9/18/23 – 9/22/23)	Fundamental Forces – PGF, Friction; Apparent Forces – Centrifugal, Coriolis	Assign Lab 4 Part 3
Week 6 (9/25/23 – 9/29/23)	Atmospheric Mass; Hydrostatic Balance; Thickness Equation; Mass Continuity	Lab 4 Due Assign Lab 5 – NCEP/NCAR Reanalysis webpage
Week 7 (10/2/23 – 10/6/23)	Introduction to Isobaric Coordinates; Mass Continuity in Isobaric Coordinates; Start Equations of Motion	Lab 5 Work Time
Week 8 (10/9/23 – 10/13/23)	FALL BREAK (10/9-10/10); Equations of Motion Continued	Lab 5 Due Assign Lab 6 – Plotting Weather Maps in Python
Week 9 (10/16/23 – 10/20/23)	Equations of Motion – Spherical Coordinates; Scale Analysis	Lab 6 Due Assign Lab 7 – Coriolis Force Assign Lab 9 – WxDiscussion; assign groups and presentation dates
Week 10 (10/23/23 – 10/27/23)	Geostrophic Balance; Geostrophic vs. Ageostrophic Wind	Lab 7 Due Assign Lab 8 – Rotating Tank

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Week 11 (10/30/23 – 11/3/23)	Thermal Wind	Lab 9: WxDiscussion Group A Assign Lab 10 - Case Study
Week 12 (11/6/23 – 11/10/23)	Natural Coordinates	Lab 8 Due Lab 9: WxDiscussion Group B Lab 10 Work Time
Week 13 (11/13/23 – 11/17/23)	Circulation and Vorticity	Lab 9: WxDiscussion Group C Lab 10 Work Time
Week 14 (11/20/23 – 11/24/23)	THANKSGIVING BREAK (11/22-11/24) – NO LAB	THANKSGIVING BREAK (11/24-11/26) – NO LAB
Week 15 (11/27/23 – 12/1/23)	Atmospheric Waves	Lab 9: WxDiscussion Group D Lab 10 Work Time Lab 10 Due

*Course topics subject to change