

**Satellite and Radar Meteorology  
EAS 4460 (3 Credit Hours)  
Spring 2022**

**Meeting Times:** 9:30 – 10:45 AM MW

**Location:** ES&T L1118

**Course Prerequisites:**

- Physics 2212
- Math 24X3 or 2X52

**Instructor**

Dr. Zachary Handlos

Office: 1251 Ford ES&T Building

Email: zachary.handlos@eas.gatech.edu

Office Hours: 2-3 PM EST MTWF Room 1251 ES&T (or virtual) or by appointment

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**\*\*\*COVID-19 Statement from GT President Ángel Cabrera\*\*\***

“Given the increased transmissibility of the omicron variant, we need to be even more diligent in practicing the protective behaviors that have served us well thus far. So, I am personally asking everyone to do the following:

- Commit 100% to wearing a well-fitting mask while in class or other indoor group settings.
- Test immediately when you return to campus and at least weekly thereafter.
- Get fully vaccinated, including a booster shot (reach out to Stamps Health Services or your own health care provider if you still have questions about the safety and effectiveness of the vaccine).
- Socialize outdoors whenever possible and find creative ways to de-densify events.

I can’t require you to do these things, but I ask you and I count on you to do your part, just as I know you will ask and count on one another to do the same — for your protection and for the protection of everyone around you.”

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**Textbooks (not required but strongly recommended)**

1. Rauber, Robert M., and Stephen W. Nesbitt. *Radar Meteorology: A First Course*, John Wiley & Sons, Incorporated, 2018.
2. Kidder, Stanley Q. and Thomas H. Vonder Haar. *Satellite Meteorology: An Introduction*, Academic Press Limited, 1995.

### **Course Description**

The invention and implementation of satellite and radar technologies during the mid- to late-20<sup>th</sup> century is arguably the most important revolution in meteorology. Satellites have provided us the opportunity to observe regions in real-time that are difficult for humans to establish surface weather station instrumentation, such as the oceans and remote land regions. Radars have helped improve our ability to “nowcast” significant weather events and inform the public of severe and hazardous weather with enough warning time to prepare for destructive consequences. As meteorologist students yourselves, there is no doubt that you have used this type of technology at some point in your undergraduate career and will continue to do so beyond this course.

The goal of this course is to learn about how satellites and radars “work” and to apply these technologies to observing (and even forecasting) hazardous atmospheric phenomena. This will be accomplished by tailoring the material of this course around a combination of theory and a series of “case study” events with emphasis on the application of these technologies.

### **Earth and Atmospheric Science Core Skill Development**

The School of Earth and Atmospheric Sciences at Georgia Tech strives to meet several learning standards for all students within the undergraduate program. These standards, and how they will be achieved in this course, are listed below:

- 1) Demonstrate **quantitative understanding** of satellite and radar meteorology theory
- 2) Develop **critical analysis** and **problem-solving skills** through course exercises and MetEd COMET modules
- 3) Gain **practical experience** with **analyzing, interpreting and communicating** meteorological phenomena through the use of satellite and radar imagery
- 4) Gain appreciation of the **interdisciplinary** nature of atmospheric science through satellite and radar applications
- 5) **Increase breadth of knowledge** within the context of satellite and radar meteorology

### **Grading**

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

- MetEd COMET Modules – 20% of grade
- Practice Problems/Quizzes and WxChallenge – 15% of grade
- Quizzes (6 quizzes; keep top 5) - 25% of grade
- Weather Discussions and Blog – 20% of grade
- Research Paper Project – 20% of grade

### **MetEd COMET Modules (20% of grade)**

Throughout the semester, you will be asked to complete online satellite and radar meteorology modules from the UCAR MetEd COMET program. Modules require reading through online material as well as the completion of a quiz at the end of a module. Your grade for this section of the course will be based on the average of all quizzes completed. You will be allowed unlimited attempts to complete these quizzes.

**Practice Problems/Quizzes and WxChallenge (15% of grade)**

You will be assigned practice problems or practice quizzes focused on applying course lecture and module material towards solving mathematical and “real-world” exercises. You will be graded on providing your best effort and answering all questions. Solutions for any practice problem or practice quiz exercises will be posted to Canvas.

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 dates within this semester. At the completion of forecasting for the semester, you will be asked to complete a short reflection assignment to discuss your forecasting successes and challenges.

**Quizzes (25% of Grade)**

Quizzes will assess your understanding of recently discussed course material. Your lowest quiz grade will be dropped. Due to the drop policy, there will be no makeup quizzes; a missed quiz will result in a "0" score and be considered your "dropped" quiz.

**Weather Discussions and Blog (20% of grade)**

You and one or more classmates will facilitate a weather discussion at least 2 times this semester. This weather discussion will require you to provide an in-depth analysis of the current (and recent past) weather as well as short-term forecasted weather using satellite and radar tools and theory from this course. This will allow you an opportunity to practice applying course material to weather observational analysis and forecasting.

You and your classmates will also contribute weather analysis and forecast discussions to the course blog. More details about the blog post assignments will be revealed in class.

**Research Paper Project (20% of Grade)**

You will write a scientific paper within the context of satellite and radar meteorology that focuses on either 1) a case study of a weather event or 2) is an extensive literature review. You will also give a presentation to the class summarizing your findings in a presentation format analogous to that of presenting at a conference. Your paper and presentation will be expected to follow AMS paper and presentation guidelines (more on this during class).

**Grading Scale**

<b>Grade</b>	<b>Percentage</b>
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 and Makeup Assignments**

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.**

### **Lecture Notes**

I will post all lecture notes/slides from class, the course syllabus and other relevant course information/resources on the course website. This includes any recorded lectures.

### **Extra Credit**

In fairness to all students, *I typically do not offer extra credit* (unless otherwise specified).

### **Cheating**

Cheating will not be tolerated in this course. Cheating includes the following: 1) copying answers from another student, 2) using unauthorized resources to study for course quizzes, which includes the use of electronic devices, 3) posting solutions to course quizzes and assessments on the Internet, and/or 4) any other activity that would be considered “academic misconduct”.

To summarize, do not cheat; it is not worth jeopardizing your future cheating on coursework.

### **Academic Honor Code**

The instructor and students are expected to abide by Georgia Tech’s Academic Honor Code. Plagiarism of any kind (including the reproduction of materials found on the internet) is strictly prohibited and will be reported to the Office of Dean of Students for academic misconduct. The complete text of the Academic Honor Code may be found at:

<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](mailto:dsinfo@gatech.edu)

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

### **Resources:**

#### **Academic Support**

- [Center for Academic Success](#)
  - [1-to-1 tutoring](#)
  - [Peer-Led Undergraduate Study \(PLUS\)](#)
  - [Academic coaching](#)
- Residence Life's [Learning Assistance Program](#)
- [OMED Educational Services](#) - Group study sessions and tutoring programs
- [Communication Center](#) - Individualized help with writing and multimedia projects
- [Academic advisors](#) for your major

## Personal Support

### *Georgia Tech Resources*

- The [Office of the Dean of Students](#) | **404-894-6367** | 2<sup>nd</sup> floor, Smithgall Student Services Building; You also may request assistance [here](#)
- [Counseling Center](#) | **404-894-2575** | Smithgall Student Services Building 2<sup>nd</sup> 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.*
- [Students' Temporary Assistance and Resources \(STAR\)](#)
  - Can assist with interview clothing, food, and housing needs.
- [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\***

<b>Week</b>	<b>Topics</b>	<b>Assignments/Quiz Dates</b>
Week 1 (1/10/22 – 1/14/22)	How do Satellites Work?	Read Ch. 2 and 4 of Kidder
Week 2 (1/17/22 – 1/21/22)	How does Radar Work?	Read Ch. 2 and 3 of Rauber and Nesbitt  <b>Practice Quiz 1</b>
Week 3 (1/24/22 – 1/28/22)	Radiative Transfer - Theory and Satellite Applications	MetEd COMET: Introduction to Electromagnetic and Electro-Optical Propagation  <b>Quiz 1 (1/26)</b>
Week 4 (1/31/22 – 2/4/22)	Radar Ray Path	Read Ch. 4 of Rauber and Nesbitt; practice problems
Week 5 (2/7/22 – 2/11/22)	Radar Equation; Radar Reflectivity Factor	Read Ch. 5 of Rauber and Nesbit  <b>Practice Quiz 2</b>
Week 6 (2/14/22 – 2/18/22)	GOES-R Introduction	MetEd COMET: GOES-R: Benefits of Next-Generation Environmental Monitoring  <b>Quiz 2 (2/16)</b>
Week 7 (2/21/22 – 2/25/22)	GOES-R RGB Satellite Imagery	MetEd COMET: Satellite RGB Composite Imagery and Applications
Week 8 (2/28/22 – 3/4/22)	Satellite and Radar Applications: Jet Streams	MetEd COMET: Satellite Jet Analysis  <b>Practice Quiz 3</b>
Week 9 (3/7/22 – 3/11/22)	Satellite and Radar Applications: Extratropical Cyclones	MetEd COMET: Forecasting Sensible Weather from Water Vapour Imagery

<b>Quiz 3 (3/9)</b>		
Week 10 (3/14/22 – 3/18/22)	Satellite and Radar Applications: Warm Season Convection	<b>Practice Quiz 4</b>
Week 11 (3/21/22 – 3/25/22)	SPRING BREAK	SPRING BREAK
Week 12 (3/28/22 – 4/1/22)	Satellite and Radar Applications: Warm Season Convection	MetEd COMET: Satellite Products for Evaluating Convective Maintenance
<b>Quiz 4 (3/30)</b>		
Week 13 (4/4/22 – 4/8/22)	Satellite and Radar Applications: Warm Season Convection	Case Study Activity/Practice Problems
Week 14 (4/11/22 – 4/15/22)	Satellite and Radar Applications: Tropical Cyclones	MetEd COMET: Introduction to Tropical Meteorology, 2nd Edition, Chapter 2: Tropical Remote Sensing Applications
<b>Practice Quiz 5</b>		
Week 15 (4/18/22 – 4/22/22)	Satellite and Radar Applications: Tropical Cyclones	Dvorak Technique Activity/Practice Problems
<b>Quiz 5 (4/20)</b>		
Week 16 (4/25/22)	Other Satellite and Radar Applications	TBD
<b>QUIZ 6 AND RESEARCH PAPER DEADLINE – WEDNESDAY, MAY 4<sup>TH</sup>, 2022 8:00 – 10:50 AM</b>	<b>QUIZ 6 AND RESEARCH PAPER DEADLINE – WEDNESDAY, MAY 4<sup>TH</sup>, 2022 8:00 – 10:50 AM</b>	<b>QUIZ 6 AND RESEARCH PAPER DEADLINE – WEDNESDAY, MAY 4<sup>TH</sup>, 2022 8:00 – 10:50 AM</b>

\*Course topics subject to change depending on how much time is needed to get through each topic of the course. Note that other readings will be assigned that complement the lecture material as necessary; this potentially includes later chapters in the course textbook not listed above.