

Instructor: Dr. Haiyan Jiang; Email: haiyan.jiang@fiu.edu.
Location: Fully-online (canvas)
Office hours: By appointment through email only. Please communicate with me through emails only (**not the Canvas inbox**). I'll respond within 24-48 hours.

Course overview

This course focuses on the principles and practices of satellite and radar remote sensing as used in the atmospheric sciences. We will survey the basic atmospheric radiation, review the principles of radar and satellite meteorology, and learn imagery interpretation. The course will cover electronic-magnetic frequencies from visible to microwave, descriptions of important satellite orbits and sensors, the retrieval of atmospheric variables from active and passive systems, and basic principles of interpretation. Graduate students will have the opportunity to work on a research-related literature review to increase their ability to utilize remote sensing tools in their research/thesis work. **This course includes 7 modules with 22 lectures and one WxChallenge overview document as your learning materials. There will be WxChallenge competition participation throughout the semester (as two assignments), 5 quizzes, 1 discussion, 1 student feedback survey, 1 mid-term exam, and 1 final exam as assessments for all students. For graduate students, there will be a term paper due by the end of the semester.**

Prerequisite: PHY2048, PHY2049, and General Meteorology (or instructor's permission).

Textbook (Recommended & Optional):

Radar for Meteorologists (Rinehart, 5th edition, 2010; ISBN-13: 978-0965800235)

A First Course in Atmospheric Radiation (Petty, Grant W., 2nd Edition, Sundog Publishing, 2006; ISBN-13:978-0-9729033-1-8)

Supplemental Reference Books:

1. Satellite Meteorology: An Introduction (Kidder and Vonder Haar, Academic Press, 1995)
2. Centimeter & Millimeter Wavelength Radars in Meteorology (Lhermitte, Lhermitte Publications, 2002)
3. Fundamentals of Atmospheric Physics (Salby, M. L., Academic Press, 1997)
4. Atmospheric Science: An Introductory Survey (Wallace, J. M., P. B. Hobbs, Academic Press, 1977 or 2005)

Discussion Forums

Besides the default & optional "introduce yourself" discussion at the beginning of the semester, one discussion assignment will be given in the first module. **This graded and peer-reviewed assignment gives you the opportunity to introduce your academic background and describe your favorite weather system observed by a remote sensing tool.**

Quizzes, Mid-term Exam and Final Exam

Overall, there will be 5 quizzes, one mid-term exam, and one cumulative final exam. Additionally, there will be one student feedback survey quiz given during module 5.

For the quizzes, students will be able to see their scores immediately after each quiz. Students can have multiple attempts for the quizzes; only the highest score before the deadline will be taken.

The mid-term exam will be given in module 5. It contains 50 multiple choice questions. It will be available on Canvas on Friday, Oct. 27, 2023 for 3 hours between 6pm-9pm while you are required to finish it within 1 hour. Students will be able to see their scores immediately after the exam. The full results of the mid-term exam (all of the questions and correct answers) will be available on Nov. 13, 2023 for your final review.

The final exam contains 100 multiple choice questions. It will be available on Canvas on Wednesday, Dec. 6, 2023 for 3 hours between 6pm-9pm while you are required to finish within 2 hours. Students will be able to see their scores immediately after the exam. Students can only have one attempt for both mid-term and final exams.

Assignments

WxChallenge Competition Registration and Participation: Students are required to sign up and participate the nationwide WxChallenge weather forecast competition for 5 cities throughout the semester as provided on the WxChallenge website (<https://www.wxchallenge.com/>). Information about how to sign up and participate online will be given during the 3rd module. Registration and participation are separated into two assignments. These assignments are effort grades. Your total grade will be deducted for how many days you have missed your forecasts from a total of 40 forecasts being available to you (8 days for each city for a total of 5 cities).

Graduate Term Paper (Graduate Students Only): Graduate students are required to do a literature review on a research topic of your choice (better related to your research/thesis/dissertation project). You are required to write a term paper report of 5-10 pages on the literature review. You don't have to include any results of yourself (You absolutely can if you do). Instead, you should just write a background review of this topic. You should read about 5-10 reference papers in this topic, and read them carefully and summarize their research methods & findings. Your paper should be 5-10 pages long (single-spaced, font size 12). Rubric for evaluation will be posted on Canvas.

Late Policy

Please see course calendar below for the detailed available and due dates of the discussion, quizzes, and assignments. Please email me (haiyan.jiang@fiu.edu) if you need to make up. Depending on the specific situation, making-up might cause a lower grade.

Zoom Video Conference

Zoom is a video conference tool that you can use to interact with your professor and fellow students by sharing screens, chatting, broadcasting live video/audio, and taking part in other interactive online activities. We will be utilizing this tool to conduct **Course Q&A and WxChallenge Overview**.

Zoom Meetings will be held on the following dates/time:

- **Meeting 1: Course Q&A and WxChallenge Overview:**
Date/Start Time – End Time TBD during Sep 18-22

Grading

<u>Undergraduate Students:</u>		<u>Graduate Students:</u>	
Student Feedback Survey	3%	Student Feedback Survey	3%
Discussion	5%	Discussion	5%
WxChallenge	12%	WxChallenge	12%
Quiz 1-5	30% (6% each)	Quiz 1-5	30% (6% each)
Midterm Exam	25%	Midterm Exam	25%
Final Exam	25%	Final Exam & Term Paper	25%
Total	100%	Total	100%

Course Calendar

Module Dates	Topics, Readings, & Resources	Activities Due
<p>Module 1 Aug. 21-Sep. 1 (2 weeks)</p>	<p>Lecture 1: Course introduction; overview of remote sensing Lecture 2: Brief history of radar & satellite meteorology</p>	<p>Discussion (your academic background and your favorite weather system observed by a remote sensing tool): Available on Mon. Aug. 21, Due on Fri. Sep. 1, 2023. Quiz 1: Available on Mon. Aug. 21, Due on Fri. Sep.1, 2023. Graduate Term Paper: Available on Mon. Aug. 21, Due on Wed. Dec. 6, 2023.</p>
<p>Module 2 Sep. 4-Sep. 15 (2 weeks)</p>	<p>Lecture 3: Atmospheric Radiation Basics: Solar & IR radiation; wave, frequency, and energy, Flux and intensity Lecture 4: Global Insolation & EM Spectrum</p>	<p>Quiz 2: Available on Mon. Sep. 4, Due on Fri. Sep. 15, 2023</p>
<p>Module 3 Sep. 18-Sep. 29 (2 weeks)</p>	<p>WxChallenge Document: WxChallenge Overview Lecture 5: Emission: Planck function, Wien’s law, Stefan-Boltzmann law, and Rayleigh-Jeans approximation Lecture 6: Absorption: Kirchhoff’s law, Lambert’s law Lecture 7: Scattering</p>	<p>WxChallenge Competition 1 (Registration): available on Mon. Sep. 18, Due on Sun. Sep. 24, 2023 Quiz 3: Available on Sep. 18, Due on Sep. 29, 2023</p>
<p>Module 4 Oct. 2-Oct. 13 (2 weeks)</p>	<p>Lecture 8: Basic radiative transfer equation Lecture 9: Reflection and Refraction Lecture 10: Rayleigh and Mie scattering</p>	<p>Quiz 4: Available on Oct. 2, Due on Oct. 13, 2023</p>
<p>Module 5 Oct. 16-Oct. 27 (2 weeks)</p>	<p>Lecture 11: Radar hardware Lecture 12: Curvature, super, sub-, and standard refraction; Radar equation for point targets Lecture 13: Radar equation for distributed targets Lecture 14: Mid-term Review</p>	<p>Student Feedback Survey Quiz: Available on Oct. 16, Due on Oct. 27, 2023. Mid-term exam: Available on Oct. 27, 2023 at 6pm, Due on Oct. 27, 2023 at 9pm</p>
<p>Module 6 Oct. 30-Nov. 10 (2 weeks)</p>	<p>Lecture 15: Doppler velocity; Interpreting Doppler velocity patterns Lecture 16: Meteorological radar targets (cloud, rain, snow, and brightband) Lecture 17: Z-R relationships, attenuation, hail, and space-borne radar</p>	<p>Quiz 5: Available on Oct. 30, Due on Nov. 13, 2023 (since Nov 10 is a holiday)</p>
<p>Module 7 Nov. 13-Dec. 6 (3 weeks)</p>	<p>Lecture 18: Meteorological satellite orbits Lecture 19: Operational remote sensing in visible, IR, and microwave channels Lecture 20: Satellite image interpretation: distinguishing different image types and weather systems Lecture 21: Satellite image interpretation: identifying clouds Lecture 22: Final review</p>	<p>WxChallenge Competition 2 (Proof of full participation for 5 cities, 40 days of forecasts between Sep. 25-Dec. 8, 2023): available on Nov 13., Due Dec. 8, 2023 Final exam: Available on Wed. Dec. 6, 2023 at 6pm, Due on due Wed. Dec. 6, 2023 at 9pm</p>