EAS 4470/6532 – Large-scale Atmospheric Circulation

Course Information

- **Instructor** Jie He (jie.he@eas.gatech.edu)
- **Course number** EAS 4470/6532
- **Term** Fall 2026
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Course description

The tropics is often considered as the driver of the atmospheric general circulation, exporting the excess energy it receives to higher latitudes. It hosts some of the most complex and impactful climate phenomena. For example, the strongest natural variations of climate, the El Niño and the Southern Oscillation, occur in the equatorial Pacific Ocean. The largest seasonal variation of the hydroclimate is associated with the monsoons, which are deeply embedded within the tropics.

The course is designed to introduce the phenomenology and dynamics of large-scale atmospheric variations in the tropical regions having time scales of a month and longer. It complements the other dynamic courses at Georgia Tech that focus primarily on the mid-latitude regions.

Course objectives / approved course learning outcomes

Using papers from the scientific literature, the course overviews the basic characteristics, underlying physics, and status of several large-scale atmospheric phenomena. Students also learn by experimenting with an atmospheric circulation model. Topics include the Inter-Tropical Convergence Zone, the Madden Julian Oscillation, the El Niño-Southern Oscillation, and the Monsoons.

Required course materials

Misra, V. (2023). *An Introduction to Large-Scale Tropical Meteorology*. Springer Nature.
Li, T., & Hsu, P. C. (2018). *Fundamentals of tropical climate dynamics*. Cham: Springer.
N-Krishnamurti, T., Stefanova, L., & Misra, V. (2013). *Tropical Meteorology: An Introduction*. Springer.

Grading policy and weighting

Homework (40%)

Close to the end of each chapter, 2-3 peer-reviewed papers covering specific topics will be assigned. All students are required to write a 1-page report (single space) containing a summary, thoughts, and questions about each paper.

Papers will be discussed in class led by a two-to-three-member group (usually consisting of a mixture of graduate students and undergraduate students). The group will start the discussion with a 30-min presentation that goes over the background, method, results, and implications of the paper. All group members are required to present. Presenters will be graded on content and scientific merit (60%), speaking style and delivery (20%), and visual (20%). After the presentation, the presenting group will lead the discussion and address questions by the instructor and students. All students are required to prepare themselves to participate in the discussion.

Project (60%, required for graduate students)

The graduate students will be divided into groups to investigate specific topics on tropical climate by reviewing scientific literature and using a simplified global atmospheric model developed by Prof. Mingfang Ting at U. Columbia. The model simulates atmospheric responses to modifications in topography, diabatic heating, and temperature and is suitable for investigating a range of issues discussed in class. Each group will choose a research topic, survey the relevant literature, design a modeling experiment and analyze the results. The project will be presented at the end of semester. The presentation should follow the format of a typical research seminar that includes background and motivation, method, results, conclusions, and discussion.
Students will be guided on account registration on ICE/PACE (where they will conduct the experiments), porting and running the model, and basic experimental setups.
ICE Orientation
Getting Started with ICE
Shared directory: /storage/ice-shared/eas6532

Exam (60%, required for undergraduate students)

The undergraduate students are required to take an exam at the end of semester. The exam is closed book and covers all chapters. The exam contains four questions designed to test students' fundamental knowledge on the subject.

- Grading scale: A(90-100), B(80-89.99), C(70-79.99), D(60-69.99), F(below 60).

Attendance policy

Attendance is not monitored.

Additional criteria for successful completion of the course

Not applicable.

Academic honesty / academic integrity statement

Students in this course are expected to uphold the highest standards of academic integrity as defined by the Georgia Institute of Technology *Honor Code*. All submitted work must represent your own efforts unless collaboration is explicitly permitted.

Academic misconduct includes, but is not limited to, cheating, plagiarism, unauthorized collaboration, fabrication or falsification of data, and facilitating dishonesty by others. The use of unauthorized resources—including solution manuals, online answer repositories, or unapproved AI tools—on assignments or exams is prohibited.

Unless otherwise specified, you may discuss general approaches to coursework with peers, but all submitted work must be completed independently and written in your own words. Any external sources, including published materials or digital tools, must be properly cited.

Suspected violations will be reported to the Georgia Tech Office of Student Integrity and may result in academic and disciplinary sanctions consistent with Institute policies.

By enrolling in this course, you acknowledge your responsibility to understand and comply with these standards.

Statement about acceptable student conduct

Students in this course are expected to adhere to the standards of academic integrity and personal conduct established by the Georgia Institute of Technology. All students must comply with the policies outlined in the Student Code of Conduct and the Honor Code.

Academic misconduct—including, but not limited to, cheating, plagiarism, unauthorized collaboration, or falsification of academic records—is strictly prohibited. Any suspected violations will be reported to the Office of Student Integrity and may result in disciplinary action.

Students are also expected to contribute to a respectful and inclusive learning environment. Disruptive behavior, harassment, or discrimination of any kind will not be tolerated and will be addressed in accordance with Institute policies.

By remaining enrolled in this course, students acknowledge their responsibility to understand and comply with these expectations.

Statement about services offered through the Office of Disability Services

Georgia Tech Office of Disability Services (ODS) collaborates with students, faculty, and staff to create an inclusive learning environment for students with documented disabilities. ODS provides a range of services, including academic accommodations, consultation, and advocacy support, to ensure equal access to educational opportunities.

Students seeking accommodations must register with ODS and obtain an accommodation letter. Once approved, students are responsible for communicating their accommodation needs with the instructor in a timely manner so that appropriate arrangements can be made.

For more information about available services or to begin the registration process, please contact the Office of Disability Services directly.

Core IMPACTS statement

Not applicable.