General Circulation CLIMATE 524

Meeting Details

- Location: 1012 EECS
- Time: 9:00-10:20 am Tu-Th
- Professor: Adriana Bailey (she|her), abaileyr@umich.edu

Course Overview

This is an introductory graduate-level course designed to give you the analytical tools to start investigating the processes that maintain the general circulation of Earth's atmosphere and transport energy and mass poleward.

The first half of the course will focus on the zonally symmetric features of the circulation, covering topics such as the atmosphere as a heat engine and balance requirements for angular momentum and energy. The second half of the course will focus on zonally asymmetric features, touching upon wave trains, extratropical blocking, tropical monsoons, and major modes of climate variability. We will also explore the effects of climate change on these circulation features and consider how simple theory paired with observations can help us evaluate the fidelity of state-of-the-art General Circulation Models.

We will work extensively with reanalysis (ERA5) output and also use weekly readings and structured discussions of scientific literature to enhance our understanding of course topics.

Textbook

The Atmospheric General Circulation by Wallace, Battisti, Thompson, and Hartmann (2024), available online through the university library:
https://search.lib.umich.edu/catalog/record/99187779743906381

Learning Goals

After taking this course, students should be able to describe the balance requirements met by the general circulation of Earth's atmosphere, to recognize key features of the general circulation and describe their first-order response to CO_2-forcing, and to manipulate reanalysis output to map out these features on different spatiotemporal scales. Students should also be able to describe a range of analytical approaches used in historical and modern scientific works to study the atmospheric general circulation.

Participation Expectations

This course is designed for in-person learning and to be flexible enough for students to help chart its direction. For each topic covered, students can expect the following approximate schedule:

- Introduction of key concepts and motivation

- Instructor-led presentation of mathematical definitions, relevant theories, and figures
- Student-led presentation and instructor-facilitated discussion of 1-2 scientific papers
- Collaborative work on in-class problems and/or practical applications (e.g. graphing transient eddies in ERA5)

Each student can expect to lead one or two scientific paper presentations throughout the term and to participate actively in weekly paper discussions. Students are also expected to work collaboratively on in-class problems/activities, which will form the basis for weekly homework assignments.

Grading

- 60% scientific paper presentations and weekly practical assignments
- 35% final project based on student choice
- 5% contributions to the class learning community