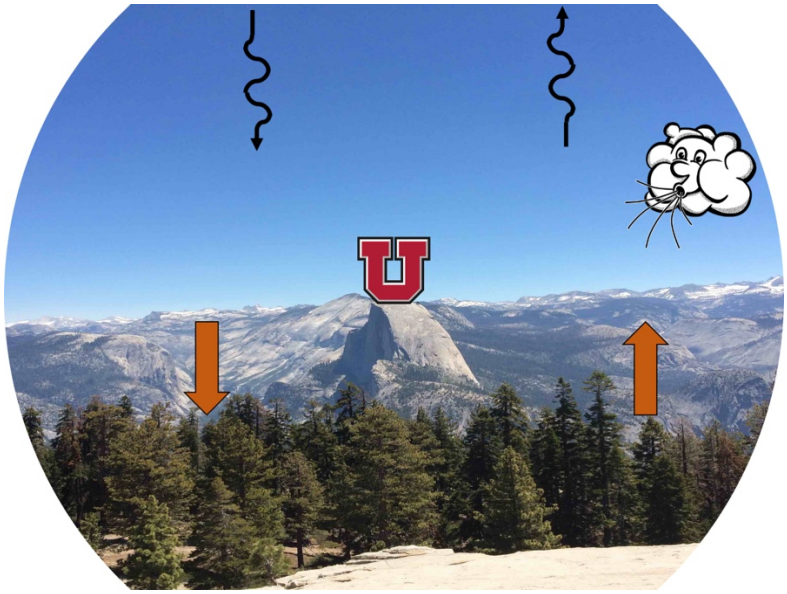
ATMOS 6240: Land-Atmosphere Interactions

Fall Term 2023

Department of ATMOSPHERIC SCIENCES
MINES AND EARTH SCIENCES | THE UNIVERSITY OF UTAH

Syllabus Version: July 30th, 2023



Course Description:

The land and the atmosphere are two key components of planet Earth. They interact in different ways, at various timescales, to affect the climate, weather, and the air that we breathe in. In fact, we spend almost all of our time at the interface between the land and the atmosphere (except for the few astronauts among us). At this interface, energy, momentum, and mass are exchanged constantly. Of particular societal and scientific interest are fluxes of water, carbon, and pollutants. We will examine how the atmosphere impacts such fluxes, and how such fluxes, in turn, affect the atmosphere. The class combines lectures, computer labs, and perusal of the primary literature to arrive at a multi-faceted understanding of land-atmosphere interactions.

Prerequisites:

- *College-level physics and calculus*
- *Eagerness to learn!*

Scheduled class time:

Mondays and Wednesdays: 1:25pm to 2:45pm in WBB 711

Instructor

John C. Lin
Professor, Dept. of Atmospheric Sciences
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Phone: (801)581-7530
Office: 721 WBB

Office Hours

Since this is a small, graduate-level class, no set office hours will be scheduled. However, you are encouraged to email the instructor to set up custom office hours—whether in person or via Zoom.

Required Materials

Materials required for this course are:

- Personal computer (preferred) or access to computer lab
- R installed on the computer (Link)

Ensure you have these ahead of time as they will be required to complete assignments and activities throughout the course.

Course Objectives

- Learn about physical models of the land surface and the atmosphere, and how they are coupled
- Get experience in developing computer models to describe phenomena at the land-atmosphere interface and simulating them numerically to understand the essential physics
- Read the primary literature (i.e., scientific papers) on the relevant topics
- Practice oral presentation skills by carrying out presentations to the class
- Opportunity to carry out a mini project to answer specific scientific question(s)

Topics that Will be Covered in Class

1) Global energy balance models
2) Gaia Hypothesis and Daisyworld
3) Energy balance at land surface
4) Coupled land surface-atmospheric boundary layer models
5) Effect of land use change
6) Land-atmosphere carbon exchange
7) Air quality-relevant pollutant emissions
8) Urban air quality and pollutant emissions

Computer-based Modelling and Data analysis skills:

This course will introduce the students to modelling and data analysis using R (`www.r-project.org`). R is a fully-functional, free, and open-source software that runs on multiple platforms (e.g., Mac OS, Windows, Linux). Furthermore, R is gaining in popularity due to the powerful data analysis packages that have been contributed by users all over the world. This course will incorporate computer labs in which students will gain "hands on" experience in learning and exploring geoscience phenomena using models constructed in R. The data analysis component will allow students to carry out statistical and time series analyses using measurements or output from other models.

Grading

You grade will be comprised of the following:

Problem Sets:	30%
Oral Presentations:	20%
Final Project (written):	50%

Late Assignments

Assignments are expected to be submitted on-time. If you cannot make the submission deadline, you are expected to contact the instructor ahead of the deadline and to provide an explanation.

Textbook

No official textbook. The lectures and the accompanying notes will serve as the core of the course.