

## ATS 606 Introduction to Climate - Spring 2025

ATS 606 is an introductory graduate-level course on the climate system. It covers basics of the climatological-mean climate, climate variability and climate change.

### **Instructor:**

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### **TA:**

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### **Department programming TA:**

TBD

### **Office Hours:**

Ying-Ju: Wednesday 1.00-2.30  
Dave: Thursday 11.00-12.00

### **Web:**

Canvas

### **Class Schedule:**

Tuesday / Thursday 10:00-10:50

### **Texts (available online via CSU libraries):**

1) *Global Physical Climatology*, by D.L. Hartmann, Academic Press, 2016, 2nd edition.  
Book can be accessed through the following link (download is free for CSU students/employees):  
<https://www.sciencedirect.com/book/9780123285317/global-physical-climatology>

2) *Atmospheric Science: An Introductory Survey*, by J. M. Wallace and P. V. Hobbs, Second Edition, Academic Press, 483pp.

### **Grading:**

~5-6 homeworks. Each homework will indicate the total points. They will have roughly equal weight. The homeworks will test concepts covered in class, and they will apply those concepts to the development of simple models and analyses of observations.

## **Course Outline (subject to change):**

### **1. The energy balance of the Earth system and atmosphere**

*(read Hartmann Chs. 1-4)*

- Descriptors of radiation
- Blackbody radiation
- Energy balance of the Earth system
- Brief overview of absorption and emission of radiation
- Simple models of radiative equilibrium
- Radiative-convective equilibrium
- Role of clouds in the energy budget
- Cloud feedbacks
- Spatially varying energy budget
- Surface energy balance over ocean and land

### **2. Overview of the atmospheric general circulation**

*(read Hartmann Chs. 6-7)*

Basics:

- Available potential energy
- Thermally driven and thermally damped circulations
- Conservation of angular momentum
- Eddy fluxes

Tropics:

- The Hadley and Walker circulations
- The subtropical jets
- Monsoons

Extratropics

- Stationary waves and transient eddies
- Role of eddy fluxes in the midlatitude circulation
- Summertime monsoonal circulations

Stratosphere

- The extratropical vortex. Sudden warmings. The QBO.

### **3. Overview of the ocean general circulation**

- The wind-driven circulation: Ekman layer; Sverdrup balance; western boundary currents
- The thermohaline circulation

### **4. Introduction to climate change**

- Natural climate forcing and change
- Climate sensitivity and feedbacks
- Anthropogenic climate change

### **5. Climate variability**

- ENSO
- MJO
- Teleconnections
- Zonally-symmetric (annular) variability
- Pacific decadal variability
- Tropical-extratropical interactions
- Atmosphere-ocean interactions
- Paleoclimate