

ATS 606 Introduction to Climate - Spring 2019

ATS606 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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Office Hours:

Jingyuan: 1 pm Monday
Dave: 1 pm Wednesday

Web:

Select materials are available via: www.atmos.colostate.edu/~davet/AT606

Class Schedule:

Monday/Wednesday 10:00-10:50 ATS 101

Text:

- 1) *Global Physical Climatology*, by D.L. Hartmann, Academic Press, 2016, 2nd edition. (*required*)
- 2) *Atmospheric Science: An Introductory Survey*, by J. M. Wallace and P. V. Hobbs, Second Edition, Academic Press, 483pp. (*strongly recommended*)

Grading: The course requirements and grading will be approximately as follows:

Homeworks: 60%

Includes analyses of ERAi output and development of a model of radiative equilibrium

Exam one: 20%

Exam two: 20%

Course Outline (subject to change):

1. The energy balance of the Earth system and atmosphere

- Descriptors of radiation
- Blackbody radiation
- Energy balance of the Earth system
- Basics of absorption and emission of radiation
- Models of radiative equilibrium
- Radiative-convective equilibrium
- Role of clouds in the energy budget
- Spatially varying energy budget
- Surface energy balance over ocean and land

2. Overview of the atmospheric general circulation

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