

ESS229: Planetary Atmospheres

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Texts: none required

Sections of *Principles of Planetary Climate* by Pierrehumbert will be distributed as needed

Relevant papers from the literature

Other resources:

Atmospheric Science by Wallace & Hobbs

Intro. to Dynamic Meteorology by Holton

Atmospheric & Oceanic Fluid Dynamics by Vallis

Course topics:

Topics will be chosen from two conceptual themes

Planetary Climate

Numerical tools for studying climate

Atmospheric thermodynamics

Pressure, temperature and the ideal gas law

Hydrostatic balance

Heat capacity and energetics (1st Law of Thermodynamics)

Potential temperature, atmospheric stability

Moist air processes

Blackbody radiation

Global energy balance; snowball Earth; climate hysteresis

Gray radiative transfer; radiative-convective equilibrium

The greenhouse and antighreenhouse effects

The runaway greenhouse and nuclear winter

Atmospheric fluid dynamics

Fundamental forces and equations of motion; scale analysis

Coordinate systems; continuity equation

Flows: geostrophic, gradient, inertial and cyclostrophic

Angular momentum and energy budgets

Atmospheric general circulation

Superrotation