

SIO 217A

Atmospheric Thermodynamics

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Text: *Thermodynamics of Atmospheres and Oceans* by J. A. Curry & P. J. Webster (1999)

- Chapter 1. Composition, Structure, and State (skip sections 1.2, 1.8, 1.9)
Composition and Vertical Structure. Kinetic-Molecular Model of the Ideal Gas. Equation of State. Hydrostatic Equilibrium.
- Chapter 2. First and Second Laws of Thermodynamics (skip section 2.11)
Work, Heat, First Law, Second Law, Heat Capacity, Adiabatic Processes
- Chapter 3. Transfer Processes
Time-dependent Thermodynamics. Radiant Energy. Radiative Transfer. Diffusive Transfer Processes. Turbulent Transport.
- Chapter 4. Thermodynamics of Water (skip sections 4.5, 4.6)
Molecular Structure and Properties of Water. Phase Equilibria. Atmospheric Humidity Variables.
- Chapter 5. Nucleation (skip sections 5.5, 5.6, 5.7)
Surface Tension. Droplet Nucleation. Droplet Growth. Ice Formation.
- Chapter 6. Moist Thermodynamic Processes in the Atmosphere
Isobaric Cooling. Evaporation of Water. Adiabatic, Isobaric Mixing. Saturated Adiabatic Cooling. Ice Phase. Conserved Moist Thermodynamic Variables. Thermodynamic Diagrams
- Chapter 7. Static Stability of the Atmosphere
Stability Criteria. Stability of a Saturated Atmosphere. Processes Producing Changes in Stability
- Chapter 8. Cloud Characteristics and Processes
Cloud Classification and Characteristics. Precipitation Processes. Radiative Transfer in a Cloudy Atmosphere. Fogs, Stratus, and Stratocumulus Clouds. Cumuliform Clouds.
- Chapter 12. Global Energy and Entropy Balances
Planetary Radiation Balance. Global Heat Engine. Entropy and Climate. Global Hydrologic Cycle
- Chapter 13. Thermodynamic Feedbacks in the Climate System (skip sections 13.6, 13.7)
Introduction to Feedback and Control Systems. Water Vapor Feedback. Cloud-radiation Feedback. Snow/ice-albedo Feedback.