In this course...

I Brief introduction to the atmosphere

II Overview of the Earth System

III Survey of the atmosphere:
   1 Dynamics
   2 Thermodynamics
   3 Weather systems: Extratropical
   4 Chemistry
   5 Cloud processes
   6 Boundary layer
   7 Radiative transfer
   8 Remote sensing with radar
   9 Weather Systems: High latitude and tropical
   10 Numerical weather prediction
   11 Climate dynamics

IV Useful research tools in atmospheric science
Thermodynamics

I. Ideal Gas Law
II. Moist thermodynamics
III. First Law of Thermodynamics
IV. Thermodynamic diagrams
V. Second Law of Thermodynamics
Thermodynamics

I. Ideal Gas Law
   1. 5 forms
   2. New constants
   3. Virtual temperature

II. Moist thermodynamics
   1. Vapor pressure, mixing ratio, specific humidity
   2. Saturation vapor pressure
   3. Relative humidity, dewpoint temperature

III. First Law of Thermodynamics
   1. Specific heats, enthalphy
   2. Dry and moist static energy
   3. Atmospheric lapse rates

IV. Thermodynamic diagrams

V. Second Law of Thermodynamics
   1. Carnot cycle
Variations with temperature of $e_s$ and $e_{si}$.
Skew T-log p: Dry adiabats
Skew T-log p: Moist adiabats
Skew T-log p: Moist adiabats
Skew T-log p: International Civil Aviation Organization (ICAO) Standard Atmosphere
Skew T-log p
Skew T-log p: Plotting data

Balloons are sent up from specific weather stations around the world at the same time (00 and 12 UTC) each day and report temperature, relative humidity, and wind. The instruments measure barometric pressure, and thus report data at various pressure levels.

**Mandatory levels.** Levels where a report is required: Surface, 1000-mb, 850-mb, 700-mb, 500-mb, 400-mb, 300-mb, 250-mb, 200-mb, 150-mb, 100-mb, 70-mb, 50-mb, 30-mb, 20-mb, 10-mb, 7-mb, 5-mb, 3-mb, 2-mb, 1-mb

**Significant levels.** Levels other than the mandatory levels which are required for the reasonable accurate reproduction of a pressure, temperature, or dewpoint profile. Usually it represents a change in the slope of the profile.
Carnot Cycle

![Diagram of the Carnot cycle showing adiabatic and isothermal processes between points A, B, C, and D on a pressure-volume graph. The cycle consists of two adiabatic processes (AB and CD) and two isothermal processes (BC and DA).](attachment:image)