ICTP DIPLOMA PROGRAMME IN EARTH SYSTEM PHYSICS 2012-2013
Earth System Thermodynamics (ESP-EST)
(12 lectures : 18 hrs)

Books:
Rogers and Yau A short course in cloud physics.
Goody, R. M. Atmospheric radiation: theoretical basis.
Liou, K. An introduction to atmospheric radiation.
Emanuel, K.A. Atmospheric convection.

Atmospheric Thermodynamics

1 Introduction to the atmosphere

2 Dry Thermodynamics

Equation of state: The ideal gas law
The 1st law of thermodynamics
Rules for diï¬M−^@erentiating
Enthalpy and speciï¬M−^Ac heat
Hydrostatic balance
Adiabatic Processes
Potential Temperature
Entropy
Thermodynamic charts
Buoyancy force on a parcel

3 Moist Thermodynamics
Saturation
Other measures of water vapour
Water variables in the liquid and ice state
Specific heat of moist air
Ways of reaching saturation

4 Atmospheric Convection
Shallow convection regimes
Mid−level and upper−level convection
Deep convection
Static stability in a moist environment

Chemical thermodynamics (for earth system studies) :
Structure and reactivity of the elements of the Periodic table, Chemical bonding.
Chemical thermodynamics
- Thermodynamics law, Gibbs free energy and chemical potentials
- Systems in thermodynamical equilibrium :
- Multiphase systems, Henry 's law, Raoult' s law
- Acid - Base reactions, pH determination of natural systems
- Oxydo-reductions and their importance in natural systems
- Kinetic aspects of chemical reactions in the environment.