ICTP DIPLOMA PROGRAMME IN EARTH SYSTEM PHYSICS 2015-16

SYLLABUS

Earth System Thermodynamics - {12 Lectures = 18 hours} F. Kucharski & F. Solmon

Books:
Emanuel, K.A. Atmospheric convection.
De Groot, S. R. and P. Mazur Non-Equilibrium Thermodynamics
J. Dutton The Ceaseless Wind

Atmospheric Thermodynamics

1 Thermodynamic state and state variables
energy, first law; Gibbs equation; thermodynamics potentials;
second law; thermodynamics equilibrium; multicomponent systems;
hydrostatic equation

2 Application to dry air; ideal gas law; daltons law; partial pressures;
entropy of mixing; dependency of internal energy of Temperature; Potential
Temperature; entropy of dry air; specific heat capacities

3 Atmospheric convection; stability; Brunt-Vaisala frequency;
lapse rate; dry adiabatic lapse rate

4 Moist atmospheric thermodynamics; Virtual Temperature;
specific heat of moist air; Clausius Claperon Equation;
evaporation parameterization; ways to saturation

5 Moist stability; moist enthalpy, moist entropy;
equivalent potential temperature; moist static stability; moist adiabate

6 Some useful energy quantities; dry static energy; moist static energy;
CAPE, CIN, Exergy

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.