ICTP DIPLOMA PROGRAMME IN EARTH SYSTEM PHYSICS 2012-2013
Physics of the Atmosphere
(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 Physics

5 Radiation
Definitions of the radiative field
Energy balance models of the atmosphere
Sun and Earth Geometry
Radiation interactions with a slab
Direct Radiation
Emission from Slab
Scattering from other directions
Absorption by atmospheric gases
Scattering
Radiation budget of clouds

6 Cloud Physics
Introduction
Cloud drop formation
Diffusional growth
Terminal velocity of particles
Collision and coalescence

Ice crystal nucleation
Ice saturation
Ice nucleation mechanisms
Ice crystal growth
Competition between ice nucleation mechanisms
Aggregation
Riming
Ice particle fall−speeds
Ice multiplication

7 Boundary Layer
Heat capacity of the surface
Structure of the PBL
The laminar layer
Turbulence
Diurnal cycle of the PBL
Surface fluxes of heat and moisture

8 Representing Physics in weather and climate models
Concept of parametrization
Example 1: parametrizations for turbulence
Example 2: parametrizations for radiation transfer
Example 3: parametrizations for convection
Example 4: parametrizations for cloud physics
Kinetic aspects of chemical reactions in the environment.