

# ICTP DIPLOMA PROGRAMME IN EARTH SYSTEM PHYSICS 2014-15

## SYLLABUS

### **Physics of the Atmosphere** - {12 Lectures = 18 hours} A. Tompkins

1 Revision summary of Dry Thermodynamics

2 Revision summary of Moist Thermodynamics

3 Atmospheric Convection

3.1 A brief reminder of tephigrams

3.2 Introduction

3.3 Atmospheric Stability revisited

3.4 Convection in the atmospheric boundary Layer

3.4.1 Heat capacity of the surface

3.4.2 Structure of the PBL

3.4.3 The laminar layer

3.4.4 Diurnal cycle of the PBL

3.5 Single cell deep convection

3.5.1 Key convective parameters

3.5.2 Convective triggering

3.5.3 Updraught structure and entrainment

3.5.4 Downdraughts

3.6 Organised deep convection

3.7 Summary of convection

4.1 Introduction

4.2 Cloud drop formation

4.2.1 The energy barrier and Kelvin's equation

- 4.3 Diffusional growth .
- 4.4 Terminal velocity of particles .
- 4.5 Collision and coalescence
- 4.6 Ice crystal nucleation
- 4.7 Ice saturation
- 4.8 Ice nucleation mechanisms .
- 4.9 Homogenous nucleation from the liquid phase
- 4.10 Ice crystal growth .
- 4.11 Competition between ice nucleation mechanisms
- 4.12 Aggregation .
- 4.13 Riming
- 4.14 Ice particle fall-speeds .
- 4.15 Ice multiplication
- 5 Radiation
- 5.1 Definitions of the radiative field
- 5.2 Energy balance models of the atmosphere
- 5.3 Sun and Earth Geometry .
- 5.4 Radiation interactions with a slab
- 5.4.1 Direct Radiation
- 5.4.2 Emission from Slab .
- 5.4.3 Scattering from other directions
- 5.5 Absorption by atmospheric gases .
- 5.6 Scattering
- 5.7 Radiation budget of clouds
- 5.8 Summary of Earth,Äôs radiation budget
- 5.9 Climate change .

