

FDITE172 Microphysics and chemistry of clouds

Description:

Clouds are covering 50-60% of the Earth's surface, hence they play crucial roles, for example, in the radiation budget of the Earth, in the distribution and processing of chemical substances in the atmosphere, and in the water cycle. In this course we will introduce and discuss the main microphysical processes, i.e. those which are occurring in scales below a few meters and few seconds; and the most important chemical processes proceeding in cloud particles.

Topics:

1. Introduction

Earth's radiation balance; cloud classification; cloud particles; saturation; liquid and ice phase; cloud formation processes; thermodynamics

2. Microstructure of clouds

size distributions; formation and role of particles in clouds; aerosol particles, cloud droplets, ice crystals, hail, graupel

3. Phase transition in clouds

homogeneous and heterogeneous nucleation; cloud condensing particles; Kelvin effect

4. Growth processes I – liquid phase

Köhler-equation; diffusional growth; collision and coalescence; drop breakup

5. Growth processes II – ice phase

nucleation; diffusional growth; freezing; melting; secondary ice production

6. Chemistry of cloud elements

PSCs; ozone hole; transport processes; retention during riming; scavenging of aerosol particles and trace gases