Level: bachelor

Course title: Dynamical meteorology II

Status: obligatory

ECTS: 4

Requirements: Dynamical meteorology I

Learning objectives

Main aim of this course is to introduce students familiar with equations of hydrodynamic of the atmosphere and wave motions in homogeneous and stratified atmosphere. In addition, one becomes familiar with various approximations about state of the atmosphere and atmospheric instability.

Learning outcomes

After the course, student should have developed the ability to use technical literature and to analyze different solutions, finding the best solution. One has the ability to understand dynamical processes in atmosphere and to use mathematical and numerical methods for its modelling. One should be qualified to do scientific research in meteorological institutes and prepared for independent work and further professional improvement.

Syllabus

Theoretical instruction

Curvilinear coordinates. Vector operators in the orthogonal curvilinear coordinate systems. The equations of hydrodynamics of the atmosphere. The equations of motion in a spherical coordinate system. Spherical approximation of the Earth and the maintenance of absolute angular momentum. Shallow and traditional approximations. Various other approximations. The equations for shallow water. Hydrostatic coordinate systems. Wave motion in a homogeneous atmosphere. Solutions in the waveform. Gravitational waves. Inertial oscillations. Gravitational-inertial waves. Wave solutions for the case of two spatial variables. Group velocity. Rossby waves. Rossby and gravitational- inertial waves. Energy changes and geostrophic movement in a homogeneous atmosphere. Energy changes in shallow water. Prevailing attitude in wave energy solutions. Amplitude ratio of divergence and vorticity of wind. Propagation of wave energy.

Wave motion in the stratified atmosphere. The equations of disturbance of calm stratified atmosphere. Some simple solutions of disturbance equations of stratified atmosphere. The equations of disturbance of calm isothermal atmosphere.

Analysis of the wave solutions on the diagnostic diagram. The assumption of non-compressibility in the equation of continuity.

Hydrostatic approximation. Justification of approximations in fundamental equations.

Instabilities in the atmosphere. Barotropic instability. Geostrophic movement of I type. Baroclinic instability.

Practical instruction:

Exercises

Weekly teaching load				Other:
Lectures: 2	Exercises: 1	Other forms of teaching:	Student research:	