Level: master

Course title: Modelling of the physical processes in the atmosphere II

Status: elective

ECTS: 9

Requirements: none

Learning objectives

Students upgrades knowledge about modelling of near surface flow, transport of moisture, heat and momentum inside vegetation. Students get informed about local and nonlocal convective mixing and aggregation of parameters in surface schemes above nonhomogeneous surfaces. After graduation, students are well-educated experts prepared for practical work, with high level of understanding of the essentials of atmospheric physics and the state of art in the field.

Learning outcomes

Ability to understand and analyze processes in the Earth-atmosphere system and competence for current problems in modelling atmospheric processes. Students are prepared for using the known solutions in new problems as well as using the models for surface process parameterization and parameters aggregation. Finally, one is qualified to work in various scientific institutes, agricultural institutes and institutes for monitoring and environmental protection. One has the ability for independent work and further improvements.

Syllabus

Modelling of the transport of moisture, heat, and momentum within the vegetation by using “K theory”. Equation for the wind profile within vegetation. Direct and indirect way for calculation of the coefficient of turbulent transport within vegetation. Parametrization of short wavelength and long wavelength within vegetation.

Modelling of the turbulence. Schemes having prognostic equations for the second order moments. Dimensional analysis of the equations for the second order moments. Properties and modelling of the motion in the close vicinity of the ground. Local schemes. Transilient theory. Nonlocal schemes of asymmetric mixing. Nonlocal diffusion (TKE) scheme. One-dimensional model of the atmospheric boundary layer.

Parametrization of wet processes. Adjustment schemes. Wet and dry convective adjustment. Bets-Miler-Janjić scheme. Schemes with mass flux. Explicit calculation of large scale rainfalls.

Aggregation of parameters in surface schemes above inhomogeneous surfaces. Aggregation of aerodynamic parameters. Aggregation of albedo. Aggregation of surface fluxes. Schmid paradox. Equation of energy balance and fluxes parametrization above nonhomogeneous surfaces. The phenomenon of deterministic chaos in equations in surface schemes. Parametrization of UV radiation. Components of the model. Forecasting the ozone contents.

Weekly teaching load				Other:
Lectures: 4	Exercises: 4	Other forms of teaching:	Student research:	