Atmospheric Boundary Layer							
Type of Module Advanced Module				**Module Code** AM-METABL			
Identification Number MN-GM-METABL	**Workload** 180 h	**Credit Points** 6 CP	**Term** 1. – 3. Semester		**Offered Every** SuSe	**Start** Summer Term Only	**Duration** 1 Semester

1	**Course Types** a) Lectures b) Exercise	**Contact Time** 45 h 30 h	**Private Study** 45 h 60 h	**Planned Group Size** 30

2	**Aims of the module and acquired skills**
	To create understanding of:

- the atmospheric boundary layer and its role in weather and climate;
- turbulent and convective flow;
- the turbulent kinetic energy budget and its use in determining atmospheric stability;
- the interaction between the atmospheric boundary layer and the Earth's surface;
- the closure problem and associated parameterization techniques;
- boundary layer clouds

Acquired skills:

- Describing turbulent flow using perturbed prognostic equations
- Reynolds averaging
- Stability analysis using the dimensionless Richardson number and Obukhov length
- Parameterization of turbulent fluxes using K-theory
- Applying similarity theory to interpret measurements
- Experience with and interpretation of the bulk mixed-layer model
- Programming experience and presentation skills
- Interpretation of measurements of boundary-layer processes

3	Contents of the module
	• Definition of the atmospheric boundary layer
	• Mathematical tools (statistics)
	• Governing equations of turbulent flows
	• Prognostic equations for turbulent fluxes and variances
	• Turbulent kinetic energy, stability and scaling
	• Turbulence closure techniques
	• Boundary conditions and external forcings
	• Mathematical tools (time series analysis)
	• Similarity theory
	• Measurement and simulation
	• The convective mixed layer
	• Stable boundary layer
	• Boundary layer clouds
4	**Teaching Methods** Lectures and exercises. Exercises have a compulsory attendance. In addition a one-day excursion to the JOYCE observational site will be organized to perform and interpret measurements of boundary-layer processes (attendance recommended but not compulsory)
5	**Prerequisites (for the Module)** Formal: None With regard to the contents: Basic knowledge of the governing equations of atmospheric flow; Vector calculus; Linear algebra; Tensor notation
6	**Type of Examination** Written examination (graded).
7	**Credits Awarded** Successful participation in the exercises (50 % of the possible points have to be obtained) and passing of the examination.
8	**Compatibility with other Curricula** • Other modules of equal value can be admitted and announced by the examination board after agreement. • Suitable as an elective course for mathematics, physics and geoscience students
9	**Proportion of Final Grade** 6/114
10	**Module Coordinator** R. Neggers

11	**Further Information**
	Recommended Literature:
	Stull; 1988: An Introduction to Boundary Layer Meteorology. Kluwer Academic Publishers. Garratt, J. R., 1992: The Atmospheric Boundary Layer. Cambridge University Press