Note:
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Curriculum for the **Master's Programme Atmospheric Sciences** at the Faculty of Geo- and Atmospheric Sciences of the University of Innsbruck

Contents

§ 1 Allocation

According to § 54, Para 1 Universities Act 2002, the Master's Programme Atmospheric Sciences is grouped among the studies in the natural sciences.

§ 2 Qualification Profile

(1) Graduates of the Master's Programme Atmospheric Sciences are able to explain, calculate and model key processes of at atmospheric sciences, and the interactions between atmosphere, biosphere and cryosphere. They acquire advanced skills in the three main fields of atmospheric dynamics, atmospheric physics and atmospheric chemistry as well as climate and cryosphere. This provides the basis for specialisation areas in boundary layer meteorology, mountain meteorology, weather forecasts, climate physics, cryosphere, biogeochemistry and hydrometeorology. Advanced skills in numerical modelling, mathematical and statistical methods, experimental methods and programming provide the basis for competences in atmospheric sciences.

(2) Graduates are able to read (natural)scientific contents in English and present for an expert audience. With the integration in university research areas (climate and cryosphere, high-performance computing), they are able to evaluate scientific questions of atmospheric sciences, atmospheric physics and chemistry as well as climate and cryosphere in interdisciplinary connections and to work independently or as part of a team on new issues and solve problems.

(3) Graduates have the competence to autonomously develop their knowledge and skills in the field of atmospheric sciences. They are able to communicate information, ideas, problems and solutions in this field to experts and laypersons.

(4) The study programme provides access to careers in meteorological and hydrological services, weather briefing companies, avalanche warning services, environmental authorities, (re)insurances, national and international research institutions and operational centres, in the fields of climate change and climate impact research, and in interdisciplinary fields of atmospheric sciences.

(5) The completion of the master's programme prepares students for Doctor of Philosophy Programme Atmospheric Sciences or relevant doctoral studies.

§ 3 Scope and Duration

The Master's Programme Atmospheric Sciences covers 120 ECTS-Credits, with a duration of four semesters. One ECTS-Credit is equivalent to a work-load of 25 hours.

§ 4 Admission

(1) Admission to the Master's Programme Atmospheric Sciences is granted for persons with a thematically relevant bachelor's programme or a relevant bachelor's programme at a University of Applied Sciences or other equivalent studies completed at an acknowledged Austrian or non-Austrian post-secondary educational institution.

(2) In any case, the Bachelor's Programme Atmospheric Sciences or Meteorology with a scope of 180 ECTS-Credits at an acknowledged Austrian or non-Austrian post-secondary educational institution count as relevant study programmes. Based on the regulations for admission to masterprograms as defined by the University Act, the Rector's office decides whether other thematically relevant studies completed at an acknowledged Austrian or non-Austrian postsecondary educational institution can be accepted or considered equivalent. In cases where only minor requirements are missing for full equivalency, the Rector's office may require applicants to take additional exams during the Master's Programme to have their degrees acknowledged as equivalent to the requirements stated above.

§ 5 Types of courses and numbers of participants

(1) Courses without continuing performance assessment:

Lectures (VO) are courses held in lecture format. They introduce the research areas, methods and schools of thought for a given subject. No maximum number of participants.

(2) Courses with continuing performance assessment:

1. Introductory seminars (PS) introduce students interactively to scientific literature through the treatment of selected issues. They convey knowledge and methods of academic work. Maximum number of participants: 25
2. Lectures with integrated practical parts (VU) focus on the practical treatment of concrete scientific tasks that are discussed during the lecture parts of the course. Maximum number of participants: 25
3. Excursions with practical elements (EU), conducted outside the premises of the university, serve to demonstrate and deepen course contents through practical experience with concrete scientific tasks. Maximum number of participants: 6

§ 6 Allocation of places in courses with a limited number of participants

In courses with a limited number of participants, course places are allocated as follows:

1. Students for whom the study duration would be extended due to the postponement are to be given priority.
2. If the criteria in No 1 do not suffice, first, students for whom this course is part of a compulsory module are to be given priority, and second, students for whom this course is part of an elective module.
3. If the criteria in No 1 and 2 do not suffice, the available places are drawn by random.

§ 7 Compulsory and Elective Modules

(1) The following compulsory modules with a total of 82.5 ECTS-Credits are to be taken:

1.	**Compulsory Module: Atmospheric Physics and Chemistry**	**h**	**ECTS-Credits**
a	**VU Atmospheric Radiation and Remote Sensing** Radiation, radiation transfer, remote sensing of atmosphere	3	5
b	**VU Atmospheric Chemistry and Biogeochemistry** Stratospheric and tropospheric ozone chemistry; trace gases and aerosols – its transformation in the atmosphere and exchange between the surface of the earth and the atmosphere	3	5
	Total	**6**	**10**
	Objective: Students are able to characterize the physical and chemical processes in the atmosphere. They know how to apply theory and methods of observation in order to explain and observe the physical and chemical state of the atmosphere.		
	Prerequisites: none		

2.	Compulsory Module: Climate and Cryosphere	h	ECTS-Credits
a.	**VU Physics of the Climate System** Drive of the climate system, energy and material cycles, coupled ocean and atmosphere dynamics, anthropogenic climate change	3	5
b.	**VU Cryosphere of the Climate System** Physical fundamentals in order to understand the concepts of treatment of the character and change of cryosphere, in particular of glaciers as climate indicators and water reservoirs	3	5
	Total	**6**	**10**
	Objective: Students know the fundamentals of the dynamics of the earth's climate system and understand the most important processes of the climate system as well as the role of cryosphere in the coupled earth system. They know the character of glaciers as climate sensors and water reservoir. They know how to apply this knowledge to concrete issue.		
	Prerequisites: none		

3.	Compulsory module: Atmospheric Dynamics	h	ECTS-Credits
a.	**VU Geophysical Fluid Dynamics** The most important concepts to treat geophysical fluids are introduced and discussed by simple examples. Focus on the understanding of methodology (quasigeostrophic analysis, PV perspective, waves, baroclinic instability) with practical examples	3	5
b.	**VU Mountain Meteorology** Atmospheric processes of complex topography and involved local wind and precipitation phenomena (flow and overflow of obstacles, gravity waves, lee winds, slope winds, valley winds and orographic precipitation)	3	5
	Total	**6**	**10**
	Objective: Students know the most important approaches in the treatment of dynamic issues in the atmosphere and resulting fluid characteristics on all scales. They are able to diagnose the influence of complex topography on atmospheric processes.		
	Prerequisites: none		

4.	Compulsory Module: Boundary Layer Meteorology	h	ECTS-Credits
a.	**VU Boundary Layer Meteorology** Introduction to the theoretical treatment and exchange characteristics of fluid in the planetary boundary layer (turbulence, similarity theory, conversation equation, turbulent kinetic energy, spectres)	3	5
b.	**EU Excursion Atmospheric Sciences** Planning (defining topics, literature research and analysis, experimental planning) and implementation of an atmospheric sciences experiment (in groups), evaluation and analysis of data, creating a report	4	7.5
	Total	**7**	**12.5**

	Objective: Students are familiar with the theoretical treatment of atmospheric processes in the planetary boundary layer and are able to experimentally apply this knowledge.
	Prerequisites: none

5.	**Compulsory Module: Numerical Modeling**	**h**	**ECTS-Credits**
a.	**VU Numerical Modeling of Weather and Climate** Introduction to the development of a weather and climate model as well as the problems of model forcing and data evaluation (theoretical methods and practical computer examples: adiabatic model formulation, parameterization of diabatic processes, data simulation, down scaling, predictability and ensemble prediction)	3	4.5
b.	**VU Climate and Cryosphere Modeling** Concepts of numerical modelling of glaciers (ice dynamics, energy and mass balance)	2	3
	Total	**5**	**7.5**
	Objective: Students know fundamental methods to solve partial differential equations in environmental sciences, development of weather, climate and glacier models as well as issues of forcing the model and data evaluation and are able to model independent solution approaches.		
	Prerequisites: none		

6.	**Compulsory Module: Numerical Methods**	**h**	**ECTS-Credits**
a.	**VO Numerical Methods for Atmospheric Science Models** Introduction to numerical methods for solving partial differential equations with applications in atmospheric sciences	2	3.5
b.	**PS Numerical Methods for Atmospheric Science Models** Implementation of numerical methods for solving partial differential equations with applications in atmospheric sciences	1	1.5
	Total	**3**	**5**
	Objective: Students know methods for solving partial differential equations and know how to apply them to issues of atmospheric sciences.		
	Prerequisites: none		

7.	**Compulsory Module: Weather Forecasting, Statistics and Programming**	**h**	**ECTS-Credits**
a.	**VU Advanced Weather Forecasting** Analysis and forecast methods spatially from micro to global scale and temporarily from minutes to years	2	3.5
b.	**VU Geostatistics** Specific statistical methods to analyse data records from the atmosphere, cryosphere and biosphere	3	5

c.	**VU Scientific Programming** Concepts and application of a higher programming language to computer-generated aspects in atmospheric sciences	2	4
	Total	**7**	**12.5**
	Objective: Students are able to give weather forecasting on time scales from nowcasting to up to one year. In order to solve problems in atmospheric sciences, they can autonomously choose and apply suitable statistical methods and write computer programs.		
	Prerequisites: none		

8.	**Compulsory Module: Reading, Writing and Presenting Scientific Contents**	**h**	**ECTS-Credits**
	PS Reading, Writing and Presenting Scientific Contents Approach to read and communicate results of subject-specific research	2	2.5
	Total	**2**	**2.5**
	Objective: Students master techniques to analyse and discuss scientific literature as well as to present scientific results in written and oral form.		
	Prerequisites: none		

9.	**Compulsory Module: Interdisciplinary Skills**	**h**	**ECTS-Credits**
	Courses from the curricula of other master's and diploma programmes (depending on the availability of free places), which enable in-depth knowledge of the subject matter of atmospheric sciences can be selected freely; possible fields are mathematics, statistics, geosciences, biology, chemistry, physics and other natural scientific subjects, engineering as well as gender aspects.	-	10
	Total	**-**	**10**
	Objective: This module serves to widen the study programme and to acquire additional qualifications.		
	Prerequisites: the prerequisites for registration specified in the relevant curricula do apply.		

10.	**Compulsory Module: Master's Thesis Defense**	**h**	**ECTS-Credits**
	Final oral defense of the Master's Thesis before an examination board		2.5
	Total		**2.5**
	Objective: Reflection of the master's thesis in the general context of the master's programme. In this context, theoretical understanding, methodical fundamentals, presentation of results of the master's thesis and presentation skills are the main focus.		
	Prerequisites: successful completion of all other compulsory and elective modules as well as the master's thesis		

(2) The following elective modules with a total of 10 ECTS-Credits are to be taken.

1.	Elective Module: Advanced Topics in Atmospheric Physics and Chemistry	h	ECTS-Credits
	Courses in terms of advanced topics in atmospheric physics and chemistry	-	5
	Total	**-**	**5**
	Objective: Students have in-depth knowledge and understanding in special fields of atmospheric physics and chemistry.		
	Prerequisites: none		

2.	Elective Module: Advanced Topics in Climate and Cryosphere	h	ECTS-Credits
	Courses in terms of advanced topics in climate and cryosphere	-	5
	Total	**-**	**5**
	Objective: Students have in-depth knowledge and understanding in special fields of climate and cryosphere research.		
	Prerequisites: none		

3.	Elective Module: Advanced Topics in Atmospheric Dynamics	h	ECTS-Credits
	Courses in terms of advanced topics in atmospheric dynamics	-	5
	Total	**-**	**5**
	Objective: Students have in-depth knowledge and understanding in special fields of atmospheric dynamics.		
	Prerequisites: none		

4.	Elective Module: Advanced Topics in Numerical and Statistical Modeling	h	ECTS-Credits
	Courses in terms of advanced topics in numerical and statistical modeling	-	5
	Total	**-**	**5**
	Objective: Students have in-depth knowledge and understanding in special fields of numerical and statistical modeling.		
	Prerequisites: none		

§ 8 Master's Thesis

(1) A master's thesis with a workload of 27.5 ECTS-Credits is to be completed. The master thesis is a scientific piece of work which proves that students are able to apply the theoretical and methodical instruments of the subject area to a particular research question and to reflect on them independently.

(2) The topic of the master's thesis is to be chosen from the fields of the compulsory modules 1–7 and/or elective modules 1–4.

(3) The topic of the master's thesis may only be submitted on positive completion of the module from which the topic is chosen.

(4) Students have the right to propose the topic of the master thesis or to choose it from a number of
proposals.

(5) Students have the right to complete the master's thesis in a foreign language if the supervisor agrees.

(6) It is permissible for several students to work jointly on one single master's thesis topic, on the condition that each individual student's contribution is identified distinctly and can be assessed separately.

§ 9 Examination Regulations

(1) The performance of the modules is assessed by module examinations. Module examinations serve to proof the knowledge and skills covered in one module. With positive assessment of all parts of a module examination, a module is successfully completed.The performance of the courses of a module is assessed by course examinations. Course examinations are

1. examinations which serve to proof the knowledge and skills covered in one course in which course assessment is based on a single examination at the end of the course. The course instructor has to define the method of examination (written and/or oral) and the assessment criteria before the course begins.
2. examinations of courses with continuing performance assessment in which course assessment is based on regular written and/or oral contributions of the participants. The course instructor has to define the method of examination (written and/or oral) and the assessment criteria before the course begins.

(2) The performance of the module „Master's Thesis Defense" is assessed by an oral board examination held by an examination board with three examiners.

§ 10 Teaching Language

The master's programme is offered in English.

§ 11 Academic Degree

Graduates of the Master's Programme Atmospheric Sciences are awarded the academic degree „Master of Science", abbreviated „MSc".

§ 12 Coming into force

The curriculum is effective as of 1 October 2015.

§ 13 Transitional Provisions

(1) This curriculum applies to all students starting the study programme from the winter semester 2015/16.

(2) Regular students who have commenced the Master's Programme Atmospheric Sciences according to the curriculum 2007 (published in the University of Innsbruck Bulletin in the version of 27 April 2007, Issue 44, No 210) before 1 October 2015 are entitled from this point in time onwards to complete the this programme within a maximum of six semesters.

(3) If the Master's Programme Atmospheric Sciences according to the curriculum 2007 is not completed within the specified time according to Para 2 then the curriculum of the Master's Programme Atmospheric Sciences published in the University of Innsbruck Bulletin in the version of 03 June 2015, Issue 61, No 458 will apply. Moreover, students are entitled to change to the curriculum 2015 at any time on a voluntary basis.

(4) The recognition of exams is set out in appendix 1 of this curriculum.

For the Curriculum Committee:	For the Senate:
Univ. Prof. Dr. Christoph Spötl	Univ.-Prof. Dr. Ivo Hajnal

Appendix: Recognition of Exams

Positively assessed exams, taken as part of the Master's Programme Atmospheric Sciences at the University of Innsbruck according to the curriculum 2007 (published in the version of the University of Innsbruck Bulletin from 27 April 2007, Issue 44, No 210, in the relevant version) will be recognised according to § 78 Para 1 Universities Act 2002 as equal towards the Master's Programme Atmospheric Sciences according to the curriculum 2015 (published in the version of the University of Innsbruck Bulletin from 03 June 2015, Issue 61, No 458) as follows:

Positively assessed exams	**Type h**	**ECTS-Credits**	**Recognition as**	**Type h**	**ECTS-Credits**
Atmospheric Boundary Layer	VO2	3.5	Boundary Layer Meteorology	VU3	5
Atmospheric Radiation Processes	VO2	4	Atmospheric Radiation and Remote Sensing	VU3	5
Numerical Methods in Physics	VO2	4.5	Numerical Methods for Atmospheric Science Models	VO2	3.5
Mathematical Methods in Physics	PS2	3	Numerical Methods for Atmospheric Science Models	PS1	1.5
Physical Glaciology	VO2	3.5	Cryosphere of the Climate System	VU3	5
Physical Climatology	VO2	4	Physics of the Climate System	VU3	5
Scientific Computer Programming	VU3	5.5	Scientific Programming	VU2	4
Fundamentals of Scientific Working	PS1	2	Reading, Writing and Presenting Scientific Contents	PS2	2.5
Geophysical Fluid Dynamics	VO3	5	Geophysical Fluid Dynamics	VU3	5
Atmospheric and Pollutants Chemistry AND Remote Sensing of the Atmosphere	VO1 VU2	1.5 4.0	Atmospheric Chemistry and Biogeochemistry	VU3	5
Mountain Meteorology	VO2	3.5	Mountain Meteorology	VU3	5
Advanced Weather Forecasting	VU2	5	Advanced Weather Forecasting	VU2	3.5
Module 10 Glacial Field Course		7.5	Excursion Atmospheric Sciences	EU4	7.5
Glaciological Modeling	VU2	3.5	Climate and Cryosphere Modeling	VU2	3
Module 12 Alpine Meteorological Field Course		7.5	Excursion Atmospheric Sciences	EU4	7.5
Alpine Meteorological Modeling	VO2	3.5	Numerical Modeling of Weather and Climate	VU3	4.5
Module 14 Numerical Methods A		7.5	Elective module 4 Advanced Topics in Numerical and Statistical Modeling		5

Module 15 Numerical Methods B		7.5	Elective module 4 Advanced Topics in Numerical and Statistical Modeling		5
Module 16 Electronic Data Processing and Databases		7.5	Elective module 4 Advanced Topics in Numerical and Statistical Modelling		5
Module 17 Paleoclimate		7.5	Elective module 2 Advanced Topics in Climate and Cryosphere		5
Module 18 Advanced Atmosphere Dynamics			Elective module 3 Advanced Topics in Atmospheric Dynamics		5
Module 19 Advanced Mountain Meteorology		7.5	Elective module 3 Advanced Topics in Atmospheric Dynamics		5
Module 20 Satellites and Remote Sensing		7.5	Elective module 1 Advanced Topics in Atmospheric Physics and Chemistry		5
Module 21 Polar Meteorology		7.5	Elective module 1 Advanced Topics in Atmospheric Physics and Chemistry		5

For exams not covered here, the same amount of ECTS-Credits as in compulsory module 9 „Interdisciplinary Skills" do apply.