

Module Handbook Meteorology Master 2015 (M.Sc.)

SPO 2015

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KIT DEPARTMENT OF PHYSICS



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1 Introduction to the Study Guide

This module handbook is the relevant document describing the structure and the contents of the Master's degree program in Meteorology, and thus provides helpful information and guidance for the studies. The degree program and its subjects and modules are described in detail, thus providing the necessary information for planning an interdisciplinary course of studies tailored to each student's personal interests and needs.

The first section Study Guide specifies the organization of the degree program and further formalities in addition to the general regulations for the Study and Examination.

A key function of the module handbook is the collection of module descriptions (Section 2) and course descriptions (Section 3), which provide information on the requirements and recommendations.

In addition to this module handbook, the university calendar and possibly announcements of the institutes inform about further details, for example, on times and places of lectures and classes.

Please note, that only the German version of the Regulation for the Study and Examination ("Studien- und Prüfungsordnung", SPO) is legally binding. The translated version is for the purpose of information only.

2 Qualification Goals

The graduates of the Master's program in Meteorology know and understand the scientific fundamentals of meteorology and climatology, and have deepened them in the areas of the climate system, atmospheric processes as well as applied and experimental meteorology. This also includes aspects of atmospheric composition and thus of trace gases and aerosols. They have well-founded knowledge of programming techniques, numerical methods, computer simulations and data analysis, and have the ability to explain and at least partly apply complex atmospheric measurements in the laboratory, field and from satellite. They are familiar with mechanisms of the climate system and climate change. They know the relevance of meteorological phenomena such as extreme weather events, air pollution and climate change for society, nature and economy as well as for geoscientific neighboring disciplines, and can discuss and debate them. They also have detailed knowledge in a scientific elective.

Based on the acquired knowledge, the graduates correctly classify facts and thematic areas, and have the ability to solve – or develop approaches to solve – complex problems of the atmospheric and environmental sciences in an analytical-theoretical, computer-based or experimental way. They have the ability to deduce relationships from measured or modeled data, to formulate models, to derive predictions and to concretely test them, and thus to verify or falsify them. In addition, they can apply meteorological knowledge to research-related questions and are able to solve technical problems using the methods of the subject, also employing computer programs.

The graduates furthermore have sound methodological skills with regard to clear presentation and structuring of scientific findings and research results in written and spoken texts, and are proficient in didactically appealing presentation techniques. They can work independently and have extensive communication and organizational skills, including sound knowledge of scientific English. They are able to acquire new knowledge and insights as needed and thus to achieve a broadening or deepening of their knowledge. They have learned to reflect on their actions, and to recognize and evaluate the social and ethical aspects of meteorological research and application.

The distinctiveness of the Master's program in Meteorology compared to other universities lies in the broad range of aspects of meteorology covered as well as the strong research relevance. A successful completion of the Master's program in Meteorology is an excellent foundation for a PhD in Meteorology or in related disciplines, and enables an applied or researching professional activity, i.a. in the field of weather forecasting, earth observation, satellite-based remote sensing and the compilation of environmental reports as well as in atmospheric research institutions and in the insurance and energy industries.

3 Curriculum

3.1 Program Structure | Subjects

The degree program in *Meteorology* comprises 120 credits corresponding to the European Credit Transfer System (ECTS) and is divided into the subjects

- Atmosphären- und Klimaprozesse (Atmospheric and Climate Processes) (24 ECTS)
- Angewandte und Experimentelle Meteorologie (Applied and Experimental Meteorology) (24 ECTS)
- Wahlpflichtbereich (Compulsory Electives) (8 ECTS)
- Überfachliche Qualifikationen (Soft Skills) (4 ECTS)
- Wissenschaftliches Arbeiten: (Scientific Work: Specialization Phase) (30 ECTS)
- Masterarbeit (Master's Thesis) (30 ECTS)
- Additional Subjects (max. 30 ECTS)

Atmospheric and Climate Processes

This is one of two core meteorological subjects comprising two large modules on Components of the Climate System (12 ECTS, see chapter 2.1.) and Atmospheric Processes (12 ECTS, see chapter 2.2.).

Applied and Experimental Meteorology

This is one of two core meteorological subjects comprising two large modules on *Experimental Meteorology* (14 ECTS, see chapter 2.3.) and *Applied Meteorology* (10 ECTS, see chapter 2.4.).

Compulsory Electives

The study can be complemented by electives to individualize the degree program. These could thus be modules from related disciplines such as Physics, Geoecology, Geophysics, Mechanical Engineering, or Applied Geo sciences.

Examples of possible *Compulsory Elective Modules* from other disciplines are listed in section II chapter 5. All subject-specific modules, for which an examination has not already been taken, can be chosen.

Scientific Work: Specialization Phase

Students carry out an interdisciplinary *Study Project*, for which 30 ECTS are credited. The project prepares students for independent scientific working and writing, and introduces skills in project management. The *Study Project* focuses on the topic of the subsequent *Master's Thesis* and serves as a preparation for the scientific work. In addition to the competence in reading and understanding scientific literature, the students acquire abilities for independent work and critical evaluation of results in the context of the literature.

Master's Thesis

This module is intended to provide students with in-depth aspects of scholarly writing and presentation. Building on the results from the Specialization Phase, students further advance their own research project to finally write a Master's Thesis. The written scientific work includes a summary of the state of the literature, presentation of the goals, methods used and the results obtained as well as a discussion of the knowledge gained and the remaining open questions.

More information about the modules *Specialization Phase* and *Master's Thesis* is provided in the Guidelines to Master's Thesis in section 4.

3.2 Program

The masters degree program in Meteorology deepens and extends the essential scientific qualifications obtained in the Bachelor's program in a research-oriented way. Consolidation occurs in the areas of Theoretical Meteorology and Numerical Weather Prediction, Climatology, Remote Sensing and Data Analysis as well as in Atmospheric Chemistry and Aerosols, while extensions take place in the area of Applied Meteorology. A comprehensive practical course familiarizes the graduates with methods of modern atmospheric measurements in the laboratory and field. With the completion of the Master's thesis, the graduates have demonstrated that they are capable of applying scientific knowledge and methods to independently solve complex research problems. In addition, they acquired detailed skills in an elective from a wide range of other natural sciences.

For details, see graphic on following page.

Graphic Course Program M.Sc. Meteorology (SPO 2015)

Course Program M.Sc. Meteorology (SPO 2015)

1		2		3		4	
Middle Atmosphere in The Climate System 2L	2L+1E	Cloud Physics 2L+1E	Remote Sensing of Atmospheric State Variables 2L+1E	Meteorological Hazards* 2L	Specialization Phase: Scientific Concept Development	Master's Thesis	Master's Thesis Fach Masterarbeit (Master's Thesis)
Seminar on IPCC Assessment Report 2S	2L+1E	Atmospheric Aerosols 2L+1E	Advanced Meteorological Practical Course 5P	Turbulent Diffusion 2L+1E			
Tropical Meteorology 2L+1E	2L	Atmospheric Radiation 2L	Field Trip 2F	Advanced Numerical Weather Prediction 2L			
Climate Modeling & Dynamics with ICON 2L+1E	2L	Energetics 2L	Integrate d Atmospheric Measurements 2L	Methods of Data Analysis 2L+1E			
Climate Change* 2L	2L	Module Exam Atmospheric Processes Oral Examination 12 ECTS	Module Exam Experimental Meteorology Oral Examination 14 ECTS	Energy Meteorology 2L			
Ocean-Atmosphere Interactions 2L	2L	Elective 1 Exam 4 ECTS	Elective 2 Exam 4 ECTS	Module Exam Applied Meteorology Oral Examination 10 ECTS			
Module Exam Components of the Climate System Oral Examination 12 ECTS	2 ECTS	Soft Skills	Soft Skills	* Lectures are offered only Irregularly			
30 ECTS	30 ECTS	30 ECTS	30 ECTS	30 ECTS			
Components of The Climate System Fach Atmosphäre- und Klimaprozesse (Atmosphere and climate processes)	Atmospheric Processes 2 ECTS	Experimental Meteorology Fach Angewandte und Experimentelle Meteorologie (Applied and experimental meteorology)	Applied Meteorology 2 ECTS	Specialization Phase Fach Wissenschaftliches Arbeiten (Scientific Work)			
<p>Informationen über den Umfang der zu belegenden Kurse in den Modulen finden Sie im aktuellen Modulhandbuch. Information regarding the amount of courses you have to enrol in the modules; you can find in the current Module Handbook. http://www.imk-tro.kit.edu/english in the category Study and Teaching.</p>							

Abbreviations: Lectures (L), Exercises (E), Seminar (S), Field Trip (F), Practical Course (P), Credits corresponding to the European Credit Transfer System (ECTS). Module Examinations are highlighted in bold. In addition, oral or written examinations may be required in elective courses.

5 Excerpts from the Regulation for the Study and Examination (SPO)

5.1 Regular Period of Study, Organization of Study, Credits (§3, SPO)

- (1) The regular period of study shall be four semesters.
- (2) The curriculum of the program is divided into subjects, the subjects into modules, and the modules are divided into courses. The subjects and their scopes are defined in Article 19. Details are outlined in the module manual.
- (3) The workload envisaged for passing courses and modules is expressed in credits. The criteria for assigning credits correspond to the European Credit Transfer System (ECTS). One credit corresponds to a workload of about 30 hours. Usually, the credits shall be distributed equally over the semesters.
- (4) The coursework and examinations required for the successful completion of the study are measured in credits and amount to a total of 120 credits.
- (5) Upon prior announcement, the courses may also be offered in English.

5.2 Module Examinations, Coursework and Assessments (§4, SPO)

- (1) The master's examination shall consist of module examinations. Module examinations shall consist of one or several controls of success ("Erfolgskontrollen"). Controls of success shall consist of coursework ("Studienleistungen") and assessments ("Prüfungsleistungen").
- (2) Assessments are:
 - Written examinations,
 - oral examinations, or
 - examinations of another type.
- (3) Coursework shall be written, oral, or practical work that is usually accomplished by students simultaneously to the taught courses. The master's examination must not be completed by a coursework.
- (4) At least 70% of the module examinations shall be graded.
- (5) In case of complementary contents, module examinations of several modules may be combined (par. 2, nos. 1-3).

5.3 Registration for and Admission to Module Examinations and Courses (§5, SPO)

- (1) To participate in module examinations, students shall register online on the Students Portal for the corresponding controls of success. In exceptional cases, registration can be made in writing to the Students Office or another institution authorized by the latter. For controls of success, registration deadlines may be specified by the examiners. Registration of the master's thesis is outlined in the module manual.
To get help with the Campus System visit <https://www.sle.kit.edu/imstudium/videtutorials-campus.php> (currently available only in German language) or ask the *student counseling* via [Mail](#).
- (2) For admission to an examination in an elective module, students shall submit – together with their registration for the examination – a binding declaration relating to their choice of the module and its assignment to a subject prior to the first examination in this module. At the request of the student to the examination committee, the choice or assignment can be changed later. If an examination procedure in a module has already started, the choice of elective or assignment to a subject can only be changed after its completion.

- (3) Admission to a control of success shall be granted to students, who
 - are enrolled in the Master's Program in Meteorology at KIT; with the admission of students on leave being limited to examinations, and to students, who
 - can prove that they meet the requirements for admission to a control of success outlined in the module manual and
 - can prove that their entitlement to an examination in the Master's Program in Meteorology has not been lost.
- (4) According to Article 30, par. 5, LHG (Landeshochschulgesetz), admission to individual mandatory courses may be restricted. The examiner shall decide on the selection of students, who have registered in due time before the deadline given by the examiner, taking into account the study progress made by these students and taking into consideration Article 13, par. 1, clauses 1 and 2, if the surplus of registrations cannot be reduced by other or additional courses. In the case of identical study progress, further criteria shall be specified by the KIT departments. The result shall be announced to the students in due time.
- (5) Admission shall be refused, if the conditions outlined in pars. 3 and 4 are not fulfilled. Admission may be refused, if a control of success that was required for admission to this Master's Program was already passed in a KIT bachelor's program. This shall not apply to premature master's examinations ("Mastervorzug"). Admission to these shall be approved explicitly according to clause 1.

5.4 Execution of Controls of Success (§6, SPO)

- (1) Controls of success shall be performed simultaneously to the taught courses, usually while conveying the contents of the individual modules or shortly afterwards.
- (2) The type of control of success (Article 4, par. 2, nos. 1 – 3, par. 3) shall be specified by the examiner of the respective course depending on the contents of the course and teaching objectives of the module. The type of controls of success, their frequency, sequence, weighting, and the determination of the module grade, if applicable, shall be announced in the module manual six weeks prior to the start of the lecturing period at the latest. The examiner and student may change the type of examination and the examination language later on. In the former case, Article 4, par. 4 has to be observed. When organizing examinations, the needs of students with a disability or chronic disease shall be considered according to Article 13, par. 1. Article 13, par. 1, clauses 3 and 4 shall apply accordingly.
- (3) In case of an unreasonably high examination workload, a written examination may also be passed orally or an oral examination may also be passed in writing. This modification shall be announced six weeks prior to the examination at the latest.
- (4) In case of courses in the English language (Article 3, par. 5), the corresponding controls of success can be executed in this language. Article 6, par. 2 shall apply accordingly.
- (5) Written examinations (Article 4, par. 2, no. 1) shall usually be evaluated by an examiner according to Article 17, pars. 2-4. If an evaluation is made by several examiners, the grade shall be the arithmetic mean of the individual evaluations. If the arithmetic mean does not correspond to any of the grade levels defined in Article 7, par. 2, cl. 2, the grade shall be rounded to the next higher or lower grade level. In case of equal distance to the next higher and lower levels, the grade shall be rounded to the next higher grade level. The evaluation procedure shall not exceed six weeks. Written examinations shall last at least 60 and not more than 300 minutes.

- (6) Oral examinations (Article 4, par. 2, no. 2) shall be performed and evaluated as group or individual examinations by several examiners (examining board) or by one examiner in the presence of an assessor. Prior to determining the grade, the examiner shall consult the other examiners of the examining board. Oral examinations shall usually last at least 15 minutes and not more than 60 minutes per student.

Major details and results of the *oral examination* shall be minuted. The result of the examination shall be announced to the student directly after the oral examination.

Students who intend to take the same examination in a later semester shall be admitted to oral examinations as an observer depending on the space available and upon approval of the examinee. They shall not be admitted to the consultation of the examining board and the announcement of the examination results.

- (7) For *examinations of another type*, (Article 4, par. 2, no. 3), appropriate deadlines and submission dates shall be specified. Proper description of the task and adequate documentation shall ensure that the examination passed can be credited to the student. Major details and results of the control of success shall be minuted.

During *oral examinations of another type*, an assessor shall be present in addition to the examiner, who shall also sign the minutes together with the examiner.

Theses or papers to be written for *an examination of another type* shall be provided with the following declaration:

“Ich versichere wahrheitsgemäß, die Arbeit selbstständig angefertigt, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde.”

„I herewith declare that the present thesis/paper is original work written by me alone and that I have indicated completely and precisely all aids used as well as all citations, whether changed or unchanged, of other theses and publications.”

If the thesis/paper does not contain this declaration, it shall not be accepted. Major details and results of such a control of success shall be minuted.

5.5 Controls of Success by a Multiple Choice Test (§6a, SPO)

It is outlined in the module manual whether and to what extent controls of success can be made by a multiple choice test.

5.6 Repetition of Examinations, Ultimate Failure (§8, SPO)

- (1) Students may repeat once a written examination that has not been passed (Article 4, par. 2, no. 1). In case a repeated written examination is given the grade of “nicht ausreichend” (5.0, failed), an oral reexamination shall take place soon after the date of the failed examination. In this case, the grade of this examination may not be better than “ausreichend” (4.0, sufficient).
- (2) Students may repeat once an oral examination that has not been passed (Article 4, par. 2, no. 2).
- (3) Repeated examinations according to paragraphs 1 and 2 shall correspond to the first examination in terms of contents, scope, and type (oral or written). At request, exceptions may be approved by the responsible examination committee.
- (4) Examinations of another type (Article 4, par. 2, no. 3) can be repeated once.
- (5) Coursework can be repeated several times.

- (6) An examination shall ultimately not be passed, if the oral reexamination according to par. 1 was evaluated with the grade of "nicht ausreichend" (5.0, failed). The examination also shall ultimately not be passed, if the oral examination according to par. 2 or the examination of another type according to par. 4 was evaluated twice with the grade of "nicht bestanden" (failed).
- (7) The module shall ultimately not be passed, if an examination required for passing the module is ultimately not passed.
- (8) A second repetition of the same examination according to Article 4, par. 2 shall be possible in exceptional cases at the request of the student only ("Antrag auf Zweitwiederholung" - application for a second repetition). As a rule, the application shall be submitted in writing to the examination committee within two months after announcement of the grade.
The examination committee shall decide on the first application of a student for a second repetition. If the examination committee dismisses the application, a member of the Presidential Committee shall decide. Upon comment of the examination committee, a member of the Presidential Committee shall decide on further applications for a second repetition. If the application is accepted, the second repetition shall take place on the next but one examination date at the latest. Paragraph 1, clauses 2 and 3 shall apply accordingly.
- (9) Repetition of a passed examination shall not be permitted.
- (10) In case a Master's thesis has been granted the grade "nicht ausreichend" (5.0, failed), it can be repeated once. A second repetition of the Master's thesis shall be excluded.

5.7 Loss of the Entitlement to an Examination (§9, SPO)

In case coursework or an examination required according to the present Regulations for Study and Examination is ultimately not passed or the master's examination, including potential repetitions, is not passed completely by the end of the examination period of the seventh semester, the entitlement to examination in the Master's Program in Meteorology shall expire, unless the student is not responsible for having exceeded the deadline. The decision on extending the deadline and on exceptions from the deadline regulations shall be made by the examination committee taking into account the activities listed in Article 32, par. 6, LHG at the request of the student. This request shall be made in writing usually six weeks prior to the expiry of the deadline.

5.8 Deregistration, Absence, Withdrawal (§10, SPO)

- (1) Students can revoke their registration for *written examinations* until the issue of the examination tasks without having to indicate any reasons (deregistration). Deregistration can be made online on the Students Portal by 12 pm on the day before the examination or in justified exceptional cases with the Students Office during office hours. If the deregistration is addressed to the examiner, the latter shall ensure that the deregistration is documented in the Campus Management System.
- (2) In case of *oral examinations*, deregistration shall be declared to the examiner at least three working days before the date of examination. Withdrawal from an oral examination less than three working days before the date of examination shall be possible under the conditions outlined in par. 5 only. In principle, withdrawal from oral reexaminations in the sense of Article 9, par. 1 shall be possible under the conditions of par. 5 only.
- (3) Withdrawal from *examinations of another type* and from *coursework* shall be subject to the provisions given in the module manual.
- (4) An examination shall be deemed to have been "nicht ausreichend" (5.0, failed), if the student fails to be present at the examination without a good reason or if she/he

withdraws from the examination after its start without a good reason. The same shall apply, if the master's thesis is not submitted within the period envisaged, unless the student is not responsible for having exceeded the deadline.

- (5) The reason given for withdrawal after the start of the examination or absence shall be notified immediately, credibly, and in writing to the examination committee. In case of sickness of the student or of a child cared for by the student alone or of a relative in need of care, submission of a medical certificate may be required.

5.9 Maternity Leave, Parental Leave, Assumption of Family Obligations (§12, SPO)

- (1) At the student's request, the maternity protection periods as defined by the Act on the Protection of the Working Mother (Mutterschutzgesetz, MuSchG), as amended, shall be considered. The required evidence shall be enclosed with this request. The maternity protection periods suspend any deadline according to the present examination regulations. The duration of maternity protection shall not be included in the deadline given.
- (2) At request, the deadlines of parental leave shall be considered according to the valid legislation (Bundeselterngeld- und Elternzeitgesetz (Parental Benefit and Parental Leave Act – BEEG)). Four weeks prior to the desired start of the parental leave period at the latest, the student shall inform the examination committee in writing about the time when she/he wishes to be on parental leave. The required evidence shall be enclosed. The examination committee shall then check whether the legal prerequisites would justify an employee's claim for parental leave and inform the student immediately of the result and the new times of examination. The period of work on the Master's thesis may not be interrupted by parental leave. In this case, the thesis shall be deemed to have not been assigned. After expiry of the parental leave period, the student shall receive a new subject that is to be dealt with within the period defined in Article 14.
- (3) At request, the examination committee shall decide on the flexible handling of examination deadlines according to the provisions of the Act of Baden-Württemberg on Universities and Colleges (LHG), if students have to assume family obligations. Paragraph 2, clauses 4 to 6 shall apply accordingly.

5.10 Students with a Disability or Chronic Disease (§13, SPO)

- (1) When organizing degree programs and examinations, the needs of students with a disability or chronic disease shall be considered. In particular, students with a disability or chronic disease shall be granted preferred access to courses with a limited number of participants and the order for passing certain courses shall be adapted to their needs. According to the Federal Equality Act (Bundesgleichstellungsgesetz, BGG) and Vol. 9 of the Social Code (SGB IX), students are disabled, if their bodily function, mental capacity, or emotional health most probably deviates from the state typical of the age for a period longer than six months and, hence, their participation in social life is impaired. At the request of the student, the examination committee shall decide on the existence of conditions outlined in clauses 2 and 3. The student shall submit the required evidence for this purpose.
- (2) If a student provides evidence of a disability or chronic disease, as a result of which she/he is not able to pass examinations completely or partly within the planned time or in the form envisaged, the examination committee may permit examinations within other time periods or in another form. In particular, disabled students shall be permitted to use the required aids.

- (3) In case students provide evidence of a disability or chronic disease, as a result of which they are not able to attend courses regularly or to pass the required coursework or examinations as outlined in Article 19, the examination committee may permit at the student's request passing of certain coursework and examinations after the expiry of the deadlines given in the present Regulations for Study and Examination.
- (4) Examples of possible compensations of disadvantages:
- Modified form of exams, for instance oral exams instead of written exams, and vice versa
 - Conducting exams in a separate room
 - Allowing necessary utilities and assistance, e.g. sign language interpreter
 - Additional breaks during time-limited exams
 - Extension of the periods between exams

5.11 Master's Thesis (§14, SPO)

The *Master's Thesis* is an independent scientific study and includes the theoretical and/or experimental work on a complex problem. Students deal with the current state of research and apply the expertise and scientific methods acquired during the studies. They can document, discuss and evaluate the obtained results. Furthermore, they can present and defend the essential findings. The topic of the *Master's Thesis* depends on the subject area chosen for the thesis.

- (1) For admission to the master's thesis module, module examinations worth 70 credits must have been passed successfully. In particular, module examination in the subject of "Wissenschaftliches Arbeiten" (Scientific Work) must have been passed successfully. At the request of the student, the examination committee shall decide on exceptions.
- (1a)** 30 credits are assigned to the master's thesis module. It consists of the master's thesis and a presentation. The presentation shall be given four weeks after submission of the master's thesis at the latest.
- (2) The master's thesis topic can only be given out by university teachers ("Hochschullehrer(in)", habilitated scientists, and leading scientists ("leitende(r) Wissenschaftler(in)") according to Article 14, par. 3, clause 1, KITG. In addition, the examination committee can authorize other examiners to give out the topic according to Article 17, pars. 2-4. The student shall be given the possibility of making proposals for the topic. If the master's thesis is to be written outside of the KIT Department of Physics, the approval of the examination committee shall be required. The master's thesis may also be accepted in the form of group work, if the contribution of the individual student to be evaluated in the examination can be distinguished clearly based on objective criteria and if the requirement outlined in par. 4 is fulfilled. In exceptional cases, the chairperson of the examination committee shall take care of the student receiving a topic for the master's thesis within four weeks after her/his request. In this case, the topic is issued by the chairperson of the examination committee.
- (3) The subject, task, and scope of the master's thesis shall be limited by the supervisor such that it can be handled with the workload outlined in par. 4.
- (4) The master's thesis shall demonstrate that the student is able to deal with a problem of her/his subject area in an independent manner and within a limited period of time using scientific methods. The scope of the master's thesis shall correspond to 30 credits. The maximum duration of work on the thesis shall amount to six months. The subject and task shall be adapted to the scope envisaged. The examination committee shall specify in which

languages the master's thesis can be written. At the request of the student, the examiner can permit the master's thesis to be written in a language other than German.

- (5) When submitting the master's thesis, the student shall assure in writing that the thesis is original work by her/him alone and that she/he has used no sources and aids other than indicated, marked all citations in word and content, and observed the Rules of KIT for Safeguarding Good Scientific Practice, as amended. If this declaration is not contained, the thesis will not be accepted.

The wording of the declaration may be:

“Ich versichere wahrheitsgemäß, die Arbeit selbständig verfasst, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde sowie die Satzung des KIT zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet zu haben.”

“I herewith declare that the present thesis is original work written by me alone and that I have indicated completely and precisely all aids used as well as all citations, whether changed or unchanged, of other theses and publications, and that I have observed the Rules of KIT for Safeguarding Good Scientific Practice, as amended.”

If the declaration is not true, the master's thesis shall be evaluated “nicht ausreichend” (5.0, failed).

- (6) The time of giving out of the topic of the master's thesis shall be recorded in the files of the examination committee by the supervisor and the student. The time of submission of the master's thesis shall be recorded in the files of the examination committee by the examiner. The student shall be allowed to return the topic of the master's thesis once only within the first month of the period of work on the thesis. At the justified request of the student, the examination committee may extend the time of work on the thesis given in par. 4 by three months at the maximum. If the master's thesis is not submitted in time, it shall be deemed to have been “nicht ausreichend” (failed, 5.0), unless the student is not responsible for this failure.
- (7) The master's thesis shall be evaluated at least by one university teacher (“Hochschullehrer(in)”) or leading scientist (“leitende(r) Wissenschaftler(in)”) according to Article 14, par. 3, clause 1, KITG and another examiner. Usually, one of the examiners is the person who gave out the thesis topic according to par. 2. In case of deviating evaluations of both persons, the examination committee shall fix the grade of the master's thesis within the limits of the evaluations of both persons. It may also appoint another expert. The evaluation period shall not exceed eight weeks after submission of the master's thesis.

5.12 Additional Achievements (§15, SPO)

- (1) Up to 30 further credits may be acquired in courses offered by KIT (additional achievements, "Zusatzleistungen"). Articles 3 and 4 of the examination regulations shall remain unaffected. These additional achievements shall not be considered when calculating the final and module grades. The credits not considered when determining the module grade shall be listed as additional achievements in the transcript of records. At the student's request, additional achievements shall be indicated in the master's certificate and marked as additional achievements. Additional achievements shall be listed with the grades outlined in Article 7.
- (2) The student shall declare a module examination an additional achievement when registering for this examination. At the student's request, allocation of the module can be changed later on.

5.13 Transferable Skills (Soft Skills) (§15a, SPO)

Apart from scientific qualifications, KIT attaches high importance to transferable skills. These skills of 4 credits shall be part of the Master's Program in Meteorology. Transferable skills may be achieved additively or integratively.

A wide range of interdisciplinary qualifications is offered by

- the [House of Competence \(HOC\)](#)
- the [Sprachenzentrum \(language center\)](#)
- the Center [for Cultural and General Studies \(ZAK\)](#)

5.13 Recognition of Coursework and Examinations as well as of Study Periods (§18, SPO)

- (1) Coursework and examinations completed, as well as study periods passed, in study programs at state or state-recognized universities and universities of cooperative education of the Federal Republic of Germany or at foreign state or state-recognized universities shall be recognized at the request of the student, if the competencies acquired do not differ considerably from the achievements or degrees to be replaced. For this, no schematic comparison, but an overall analysis shall be made. As regards the scope of a coursework to be recognized, the principles of the ECTS shall be applied.
- (2) The student shall submit the documents required for recognition. Students newly enrolled in the Master's Program in Meteorology shall submit the application together with the documents required for recognition within one semester after enrollment. If documents are not available in the German or English language, an officially certified translation may be required. The examination committee shall bear the burden of proving that the application does not meet the recognition requirements.
- (3) If achievements from outside of the KIT are recognized, they are listed as "anerkannt" (recognized) in the certificate. If grades exist, they shall be taken as is in case of comparable grade scales and shall be included in the calculation of module grades and the final grade. In case of incomparable grade systems, the grades can be converted. In the absence of grades, the note "bestanden" (passed) shall be entered.
- (4) When recognizing coursework and examinations passed outside of the Federal Republic of Germany, the equivalence agreements adopted by the Conference of Ministers of Education and the German Rectors' Conference as well as agreements concluded within the framework of university partnerships shall be considered.
- (5) Knowledge and skills acquired outside of the university system shall be recognized, if they are equivalent to the coursework and examinations to be replaced in terms of contents and

level and if the institution, where the knowledge and skills were acquired, has a standardized quality assurance system. Recognition may be refused in parts when more than 50% of the university's study program is to be replaced.

- (6) The examination committee (§16, SPO) shall be responsible for recognition. To determine whether a considerable difference in the sense of par. 1 exists, the responsible subject representatives shall be heard. Depending on the type and scope of coursework and examinations to be recognized, the examination committee shall decide on admission to a higher semester.

5.14 Accomplishments obtained outside of the Higher Education System

Accomplishments made outside of the higher education system, as for example vocational training, can be accredited if the acquired competences contribute to the qualification goals of the Master's program. Recognition is requested with the respective form of the examination committee.

The examination committee verifies to which extent the acquired knowledge and capabilities can be recognized, and which parts of the program they can replace. At maximum, 50 % of the university education can be replaced. The form for recognition must be submitted to the study advisor, who will transfer it to the examination committee and the "Studierendenservice".

5 Modules

M

5.1 Module: Applied Meteorology (Met-AngM2-1) [M-PHYS-100954]

Responsible: Prof. Dr. Joaquim José Ginete Werner Pinto

Organisation: KIT Department of Physics

Part of: [Applied and Experimental Meteorology](#)

Credits	Recurrence	Language	Level	Version
10	Each summer term	English	4	3

Mandatory			
T-PHYS-109142	Methods of Data Analysis	0 CR	Ginete Werner Pinto, Knippertz
T-PHYS-109143	Applied Meteorology (Module Exam)	10 CR	Kunz
Election block: Compulsory Electives Applied Meteorology (between 2 and 3 items)			
T-PHYS-109139	Advanced Numerical Weather Prediction	0 CR	Knippertz
T-PHYS-109140	Meteorological Hazards	0 CR	Kunz
T-PHYS-109141	Energy Meteorology	0 CR	Emeis, Ginete Werner Pinto
T-PHYS-108610	Turbulent Diffusion	0 CR	Kunz

Competence Certificate

Prerequisite: Coursework ("Studienleistung")

For type of Coursework see Course description ("Teilleistungsbeschreibung")

→ successful completion of the prerequisites entitles to exam

Examination: Assessment ("Prüfungsleistung")

T-PHYS-109143 Applied Meteorology (Module Exam)

Oral exam (approx. 60 minutes) in accordance with § 4 (2) No. 2 SPO Master's Meteorology

Competence Goal

The students can professionally explain essential aspects of application aspects of meteorology and assign them to specific application areas. They are capable to describe the functionality of a modern weather forecasting system in detail and are able to predict potential for extreme events and their impact on the population and the insurance industry depending on the region and the season. The students are capable to derive the Impact on air pollution and generating regenerative energy from weather information. They are capable of analyzing meteorological data using statistical and computer-based methods.

Module grade calculation

Grade of the oral exam.

Content

This module aims to give students an overview of important applications of meteorology in areas such as weather forecasting and warning, insurance and energy industry, air quality and data analysis. In particular, the module deals with the following aspects:

- **Methods of data analysis** that are widely used in the Geosciences and particularly in meteorology / climate research are presented (e.g., statistical methods, correlation analyzes, least-squares (linear, multi-linear, and nonlinear regression), principal component analysis, Fourier analysis)
- Methods of **numerical weather prediction** (hydrodynamic equation systems, spectral approximation methods, differential approximation on irregular lattices, statistical data assimilation methods, operational aspects of weather forecasting) (**not offered in SS2020**)
- **Meteorological natural hazards** (extreme events, extra tropical and tropical cyclones, convection, thunderstorms, super cells, tornadoes, convective storm gusts, derechos, hail, climate change and extreme events) (**not offered in SS2020**)
- **Energy meteorology** (fundamentals of the energy system, application of meteorological expertise in the energy industry, in particular for the integration of renewable energies wind power, solar energy and hydro power, deepening of individual meteorological aspects of particular relevance)
- Dispersion of atmospheric constituents (relevant trace gases, diurnal cycles of emissions and concentrations, temperature and flow evolution in the lower atmosphere, **turbulent diffusion**, turbulence parameterization, chemical conversion processes, numerical models)

Recommendation

Basic knowledge in statistics are helpful.

Workload

Presence time in lectures, exercises: 90 hours

Preparation / follow-up: 90 hours

Exam preparation: 120 hours

M

5.2 Module: Atmospheric Processes (Met-AtPr1-1) [M-PHYS-100952]

Responsible: Prof. Dr. Corinna Hoose
Organisation: KIT Department of Physics
Part of: Atmospheric and Climate Processes

Credits	Recurrence	Language	Level	Version
12	Each winter term	English	4	4

Mandatory			
T-PHYS-107694	Cloud Physics	0 CR	Hoose
T-PHYS-107695	Energetics	0 CR	Fink
T-PHYS-108938	Atmospheric Aerosols	0 CR	Möhler
T-PHYS-107696	Atmospheric Radiation	0 CR	Höpfner
T-PHYS-108939	Atmospheric Processes (Module Exam)	12 CR	Hoose

Competence Certificate

Prerequisite: Coursework ("Studienleistung")

For type of Coursework see Course description ("Teilleistungsbeschreibung")

→ successful completion of the prerequisites entitles to exam

Examination: Assessment ("Prüfungsleistung")

T-PHYS-108939 Atmospheric Processes (Module Exam)

Oral exam (approx. 60 minutes) in accordance with § 4 (2) No. 2 SPO Master's Meteorology

Competence Goal

The students can name essential processes in the atmosphere and explain these using physical and chemical laws. In particular, they are capable of explaining structure and dynamics of different cloud systems and estimating the micro physical processes in clouds or calculating them directly for idealized conditions. In addition, the students are capable of mathematically evaluating the radiation transport in the atmosphere and describe the importance of radiation processes for the structure of the atmosphere, for climate change and for the measurement of different atmospheric variables. They can also explain the chemical structure and the composition of the aerosols in the troposphere and the stratosphere on the basis of the atmospheric physico-chemical processes and transformations. The students are able to understand the chemical and physical causes of stratospheric ozone hole and its future development, know the main aerosol-cloud processes and are familiar with the *Köhler theory* and the classical nucleation theory.

Module grade calculation

Grade of the oral exam

Content

This module aims to give students an overview of important convey physical and chemical processes in the atmosphere. in the Special includes:

Cloud Physics (phenomenology, cloud dynamics of stratiform and convective clouds, microphysics of warm and cold clouds, collision and coalescence, primary and secondary ice formation, condensational and depositional growth)

Energetics (mean meridional circulation, stationary and transient eddies; basic forms, budget equations and transport processes of energy in the atmosphere; principle of available potential energy; Lorenz cycle: energy reservoirs and transformation processes, eddy and thermally driven jets (EP flux vectors))

Atmospheric aerosols (Gas particle processes (kinetics, diffusion, condensation), Aerosol properties (diffusion, coagulation, sedimentation, impaction), Aerosol thermodynamics (chemical potential, solubility, Crystallization), aerosol cloud processes (Köhler theory, Einukleation))

Atmospheric radiation (basic quantities of electromagnetic radiation, atmospheric radiative transfer, boundary conditions, reflection, emission, molecular spectroscopy, line broadening, scattering, optical phenomena, radiation parametrization in atmospheric models, radiation budget, climate change, remote sensing)

Workload

Presence time in lectures, exercises: 113 hours

Preparation / follow-up: 87 hours

Exam preparation: 160 hours

M**5.3 Module: Basics of Estimation Theory and its Application in Geoscience Remote Sensing (GSchApplGeoRS) [M-BGU-103422]**

Responsible: Prof. Dr. Jan Cermak
Prof. Dr.-Ing. Stefan Hinz

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: [Required Electives](#)

Credits	Recurrence	Language	Level	Version
8	Each summer term	German	4	1

Mandatory			
T-BGU-106821	Basics of Estimation Theory, Prerequisite	1 CR	Hinz
T-BGU-106633	Data Analysis in Geoscience Remote Sensing Projects, Prerequisite	2 CR	Cermak
T-BGU-106822	Basics of Estimation Theory and its Application in Geoscience Remote Sensing	5 CR	Cermak, Hinz

M

5.4 Module: Components of the Climate System (Met-KKli1-1) [M-PHYS-100951]

Responsible: Prof. Dr. Andreas Fink
Organisation: KIT Department of Physics
Part of: Atmospheric and Climate Processes

Credits	Recurrence	Language	Level	Version
12	Each winter term	English	4	6

Mandatory			
T-PHYS-108933	Components of the Climate System (Module Exam)	12 CR	Fink
Election block: Compulsory Electives (between 3 and 5 items)			
T-PHYS-107692	Seminar on IPCC Assessment Report	0 CR	Ginete Werner Pinto, Hoose, Ludwig
T-PHYS-107693	Tropical Meteorology	0 CR	Knippertz
T-PHYS-108928	Climate Modeling & Dynamics with ICON	0 CR	Ginete Werner Pinto, Voigt
T-PHYS-108931	Middle Atmosphere in the Climate System	0 CR	Höpfner, Sinnhuber
T-PHYS-108932	Ocean-Atmosphere Interactions	0 CR	Fink

Competence Certificate

Prerequisite: Coursework ("Studienleistung")

For type of Coursework see Course description ("Teilleistungsbeschreibung")

→ successful completion of the prerequisites entitles to exam

Examination: Assessment ("Prüfungsleistung")

T-PHYS-108933 Components of the Climate System (Module Exam)

Oral exam (approx. 60 minutes) in accordance with § 4 (2) No. 2 SPO Master's Meteorology

Competence Goal

The students can explain essential components of the climate system and their physical properties. They are capable of explaining causes of climate change competently, present them and discuss them critically. Students can name and explain climate monitoring systems and explain the basic principles of climate models.

The students can designate essential processes in the atmosphere and ocean and explain them with physical and chemical laws. They are able to analyze and interpret climate and weather data on the basis of diagnostic methods. In addition, they can competently present and discuss learned or self-developed scientific findings.

Module grade calculation

Grade of the oral exam.

Content

This module aims to give students an overview of important components of the climate system, their physical and chemical backgrounds and their temporal and spatial changes.

This includes lectures, course work, computer and modelling classes on individual components of the climate system (e.g. tropics, polar regions, ocean, middle atmosphere) and on climate dynamics and change.

Recommendation

Basic knowledge about the climate system is helpful.

Annotation

In the module *Components of the climate system* courses (C) are offered with lectures (L) and exercises (2L1E) and lectures without exercises (2L). Registration for this examination is only possible if courseworks have been made in a sufficient amount. There are different ways to do this:

- 2C with 2L1E and 2C with 2L

Workload

Presence time in lectures, exercises: 120 hours

Preparation / follow-up: 120 hours

Exam preparation: 120 hours

M

5.5 Module: Computer Vision and GIS [M-BGU-102757]

Responsible: Prof. Dr.-Ing. Stefan Hinz
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [Required Electives](#)

Credits	Language	Level	Version
9	German	4	1

Mandatory			
T-BGU-101681	Introduction to GIS for Students of Natural, Engineering and Geo Sciences	3 CR	Rösch, Wursthorn
T-BGU-103541	Introduction to GIS for Students of Natural, Engineering and Geo Sciences, Prerequisite	3 CR	Rösch, Wursthorn
T-BGU-101732	Image Processing and Computer Vision	4 CR	Weidner

M

5.6 Module: Computer Vision and Remote Sensing [M-BGU-102759]

Responsible: Prof. Dr. Jan Cermak
Dr.-Ing. Uwe Weidner

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: [Required Electives](#)

Credits 8	Recurrence Each winter term	Language German	Level 4	Version 2
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Mandatory			
T-BGU-105725	Introduction into Classification Methods of Remote Sensing	4 CR	Weidner
Election block: Computer Vision and Remote Sensing (between 1 and 2 items as well as 4 credits)			
T-BGU-101732	Image Processing and Computer Vision	4 CR	Weidner
T-BGU-106333	Remote Sensing of a Changing Climate, Prerequisite	1 CR	Cermak
T-BGU-106334	Remote Sensing of a Changing Climate, Examination	3 CR	Cermak
T-PHYS-108283	Wildcard	4 CR	
T-PHYS-108284	Wildcard	4 CR	
T-PHYS-108285	Wildcard	4 CR	
T-PHYS-108286	Wildcard	4 CR	

M

5.7 Module: Experimental Meteorology (Met-ExpM2-1) [M-PHYS-100953]

Responsible: Prof. Dr. Christoph Kottmeier
Organisation: KIT Department of Physics
Part of: Applied and Experimental Meteorology

Credits	Recurrence	Language	Level	Version
14	Each summer term	English	4	4

Mandatory			
T-PHYS-109133	Remote Sensing of Atmospheric State Variables	0 CR	Orphal, Sinnhuber
T-PHYS-109135	Advanced Practical Courses	0 CR	Kottmeier
T-PHYS-109136	Field Trip	0 CR	Kottmeier
T-PHYS-109137	Experimental Meteorology (Module Exam)	14 CR	Kottmeier
T-PHYS-109902	Integrated Atmospheric Measurements	0 CR	Kottmeier

Competence Certificate

Prerequisite: Coursework ("Studienleistung")

For type of Coursework see Course description ("Teilleistungsbeschreibung")

→ successful completion of the prerequisites entitles to exam

Examination: Assessment ("Prüfungsleistung")

T-PHYS-109137 Experimental Meteorology (Module Exam)

Oral exam (approx. 60 minutes) in accordance with § 4 (2) No. 2 SPO Master's Meteorology

Competence Goal

The students can explain the functionality of modern meteorological measuring methods and measuring principles and name their possible uses. This is especially true for remote sensing, advanced in-situ, trace gas and aerosol measurements. The students are able to build and execute experiments in the lab or in the field according to instructions, to record and evaluate data scientifically founded and then interpret and present the results.

Module grade calculation

Grade of the oral exam

Content

This module is intended to provide students with an overview of modern measurement methods in meteorology and practical aspects of application. In particular, this includes:

- **remote sensing** (physical basics, radiation transfer, inverse methods, basics of satellite remote sensing, techniques and applications),
- radar techniques (scattering and absorption of electromagnetic waves, radar equation, radar reflectivity factor and rain rate, technical aspects, radar beams in a stratified medium, wind information from Doppler radar data) and laser processes (properties and propagation of light, basics of the laser, functional principles of laser remote sensing, technical structure of lidar systems, overview of common lidar measuring methods, space-based lidar systems) as **integrated atmospheric measurements**.
- In addition, the module provides the students with an insight into and **practical experience** with modern measuring methods, such as those used in research at KIT and other institutions, on the basis of the internship and the excursion.

Workload

Presence time in lectures, exercises: 57 hours

Attendance time in excursion and practicals 100 hours

Preparation / follow-up: 143 hours

Exam preparation: 120 hours

M

5.8 Module: Fluid Mechanics and Turbulence (bauEX209-FMTURB) [M-BGU-101876]**Responsible:** Prof. Dr. Olivier Eiff**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences**Part of:** Required Electives

Credits	Recurrence	Language	Level	Version
9	Each winter term	German/English	4	4

Election block: Electives 1 (1 item as well as 6 credits)			
T-BGU-106612	Advanced Fluid Mechanics	6 CR	Eiff
T-BGU-110841	Fluid Mechanics of Turbulent Flows	6 CR	Uhlmann
Election block: Electives 2 (1 item as well as 3 credits)			
T-BGU-110411	Flow Measurement Techniques	3 CR	Gromke
T-BGU-103563	Building and Environmental Aerodynamics	3 CR	Gromke

Competence Certificate

One examination has to be taken in one of the 'Teilleistungen' 'Fluid Mechanics of Turbulent Flows' or 'Advanced Fluid Mechanics' and one other examination in one of the 'Teilleistungen' 'Flow Measurement Technique' oder 'Building- and Environmental Aerodynamics'. The learning controls depend on the selected 'Teilleistungen' (s. 'Teilleistungen').

Competence Goal

The studierenden are able to explain basic terms and concepts in the field of fluid mechanics with appropriate terminology and attribute them to physical laws. They are familiar with examples of application, modelling and measurement.

Module grade calculation

grade of the module is the weighted average of the partial examinations from compulsory elective block 1, Advanced Fluid Mechanics or Fluid Mechanics of Turbulent Flows, and compulsory elective block 2, Flow Measurement Techniques or Gebäude- und Umweltaerodynamik.

Prerequisites

none

Content

see German version

Recommendation

basics in Mathematics and Hydromechanics;

prior knowledge in programming with Matlab is helpful for the course "Fluid Mechanics of Turbulent Flows"

Annotation

The courses are mainly offered in English as from winter term 2019/20.

M

5.9 Module: Geoecology [M-BGU-103398]

Responsible: Prof. Dr. Wolfgang Wilcke
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [Required Electives](#)

Credits	Recurrence	Language	Level	Version
8	Each winter term	German	3	2

Mandatory			
T-BGU-107487	Geomorphology and Soil Science	7 CR	Wilcke
T-BGU-107486	Field Course Soil Science	1 CR	Wilcke

Prerequisites

None

Annotation

None

M

5.10 Module: Geological Hazards and Risk [M-PHYS-101833]

Responsible: Dr. Ellen Gottschämmer
Organisation: KIT Department of Physics
Part of: [Required Electives](#)

Credits	Recurrence	Language	Level	Version
8	Each winter term	English	4	5

Mandatory			
T-PHYS-103525	Geological Hazards and Risk	8 CR	Gottschämmer

Competence Certificate

Active and regular attendance of lecture and practicals. Project work (graded).

Competence Goal

The students understand basic concepts of hazard and risk. They can explain in detail different aspects of earthquake hazard, volcanic hazard as well as other geological hazards, can compare and evaluate those hazards. They have fundamental knowledge of risk reduction and risk management. They know methods of risk modelling and are able to apply them.

Module grade calculation

Project work will be graded.

Prerequisites

none

Content

- Earthquake Hazards
 - Short introduction to seismology and seismometry (occurrence of tectonic earthquakes, types of seismic waves, magnitude, intensity, source physics)
 - Induced seismicity
 - Engineering seismology, Recurrence intervals, Gutenberg-Richter, PGA, PGV, spectral acceleration, hazard maps
 - Earthquake statistics
 - Liquefaction
- Tsunami Hazards
- Landslide Hazards
- Hazards from Sinkholes
- Volcanic Hazards
 - Short introduction to physical volcanology
 - Types of volcanic hazards
- The Concept of Risk, Damage and Loss
- Data Analysis and the use of GIS in Risk analysis
- Risk Modelling - Scenario Analysis
- Risk Reduction and Risk Management
- Analysis Feedback and Prospects in the Risk Modelling Industry

Workload

- 60 h: active attendance during lectures and exercises
- 90 h: review, preparation and weekly assignments
- 90 h: project work

Learning type

4060121 Geological Hazards and Risk (V2)

4060122 Übungen zu Geological Hazards and Risk (Ü2)

Literature

Literature will be provided by the lecturer.

M

5.11 Module: Geophysical analysis of natural hazards [M-PHYS-103336]

Responsible: Dr. Ellen Gottschämmer
Organisation: KIT Department of Physics
Part of: [Required Electives](#)

Credits	Recurrence	Language	Level	Version
8	Each summer term	English	4	3

Mandatory			
T-PHYS-103553	Introduction to Volcanology, Prerequisite	3 CR	Gottschämmer
T-PHYS-103644	Introduction to Volcanology, Exam	1 CR	Gottschämmer
T-PHYS-107673	Seminar on Recent Topics of Risk Science	4 CR	Gottschämmer

Competence Certificate**Introduction to Vulcanology**

Active and regular attendance of lecture and practicals, presentation of a volcano in a short (10 – 15 minute) talk with slides, submission of a scientific essay about their presentation, approx. 8-10 pages, which will be graded.

Seminar on recent topics of risk science

Preparation and presentation of a talk based on a scientific publication, critical discussion of the scientific results.

Competence Goal**Introduction to Vulcanology**

The Students know and understand the basic concepts of physical volcanology. They are able to classify volcanoes by their tectonic location, can discriminate between different eruption types and describe different volcanic edifices with respect to their tectonic environment. They understand the concept of volcanic hazard and risk and are able to apply it. They can explain the physics of volcanic monitoring methods and know about their advantages and disadvantages. They gained insight into numerical modelling tools and can name several applications. The students understand the impact of volcanic eruptions on climate and know both, presently as well as historically active volcanoes and their prominent eruptions.

The students have gained an overview about active volcanoes and recent eruptions and are able to summarize the main characteristics and scientific achievements about one volcano of their choice in a 10-15 minute talk. They are able to discuss and answer questions related to their subject. They can summarize their research about the volcano of their choice in a scientific essay (8-10 pages).

Seminar on recent topics of risk science

The students understand scientific literature regarding current topics of natural hazards and risk. They can summarize a selected topic, describe and explain the main idea to their fellow students in an oral presentation (30-40 minutes). They know how to structure and present a scientific talk. They are able to understand the topics presented by their fellow students, discuss and analyze the content critically. They are able to compare those research results and evaluate the content critically.

Module grade calculation

The grade of the module results from grade of of the scientific essay of "Introduction to Vulcanology".

Content**Introduction to Vulcanology**

- Introduction, Overview
- Volcanoes and Plate Tectonics
- Magma and Volcanic Deposits
- Eruption types
- Volcanic Edifices
- Volcanic Hazard and Risk
- Volcano Monitoring
- Volcano Seismology
- Numerical Modelling of Volcanic Products
- Historic Eruptions
- Volcanoes and Climate

Seminar on recent topics of risk science

The students will read and discuss current literature about current topics of natural hazards and risk.

Learning type

4060251 Introduction to Vulcanology (V1)

4060252 Exercises to Introduction to Vulcanology (Ü1)

4060254 Seminar über aktuelle Fragen aus der Risikoforschung (S2)

Literature

Literature will be provided by the lecturer.

M

5.12 Module: GIS and Geo Data Infrastructures [M-BGU-102760]

Responsible: Prof. Dr.-Ing. Stefan Hinz
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [Required Electives](#)

Credits	Language	Level	Version
10	German	4	1

Mandatory			
T-BGU-101681	Introduction to GIS for Students of Natural, Engineering and Geo Sciences	3 CR	Rösch, Wursthorn
T-BGU-103541	Introduction to GIS for Students of Natural, Engineering and Geo Sciences, Prerequisite	3 CR	Rösch, Wursthorn
T-BGU-101756	Geo Data Infrastructures and Web Services	1 CR	Hinz, Wursthorn
T-BGU-101757	Geodata Infrastructures and Web-Services, Prerequisite	3 CR	Hinz, Wursthorn

M

5.13 Module: GIS and Remote Sensing [M-BGU-102758]

Responsible: Prof. Dr.-Ing. Stefan Hinz
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [Required Electives](#)

Credits	Language	Level	Version
9	German	4	1

Mandatory			
T-BGU-105725	Introduction into Classification Methods of Remote Sensing	4 CR	Weidner
T-BGU-101681	Introduction to GIS for Students of Natural, Engineering and Geo Sciences	3 CR	Rösch, Wursthorn
T-BGU-103541	Introduction to GIS for Students of Natural, Engineering and Geo Sciences, Prerequisite	3 CR	Rösch, Wursthorn

M

5.14 Module: Informatics for Meteorology Students [M-INFO-102980]

Responsible: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: [Required Electives](#)

Credits	Language	Level	Version
8	German	4	2

Election block: Informatics for Meteorology Students (at least 1 item as well as at least 8 credits)			
T-INFO-101345	Parallel Computer Systems and Parallel Programming	4 CR	Streit
T-INFO-101298	Distributed Computing	4 CR	Streit
T-INFO-102061	Mobile Computing and Internet of Things	5 CR	Beigl
T-INFO-101305	Big Data Analytics	5 CR	Böhm
T-INFO-101497	Database Systems	4 CR	Böhm
T-INFO-101275	Visualization	5 CR	Dachsbacher

M

5.15 Module: Master Thesis (Met-MMAr4-1) [M-PHYS-100956]

Responsible: Prof. Dr. Corinna Hoose
Organisation: KIT Department of Physics
Part of: [Master Thesis](#)

Credits	Recurrence	Language	Level	Version
30	Each term	German/English	4	2

Mandatory			
T-PHYS-109616	Master's Thesis	30 CR	

Competence Certificate**Module examination: Assessment ("Prüfungsleistung")**

Written report (Master's thesis) and presentation (SPO §14 (1a)) in accordance with § 14 SPO Master's Meteorology evaluated by at least one professor, one habilitated scientist of the KIT-Faculty of Physics or one leading scientist in accordance with § 14 Abs. 3 para. 1 KITG and one other examiner. The overall assessment will be recorded in a written report.

The evaluation period shall not exceed eight weeks upon submission of the Master's thesis.

Competence Goal

Students can independently develop and carry out a scientific work. To this end, they deal with the latest state of research and apply the knowledge and the methods acquired during studies. They can discuss and evaluate the obtained results and present them in writing as well as defend the work in a presentation.

The students are able to work on a coherent problem from their field of study independently and in a limited time according to scientific methods and then present the knowledge gained in a written paper and in a presentation in an understandable and precise manner and to discuss it competently.

Module grade calculation

The overall grade results from the evaluation of the thesis. This includes the final presentation.

Prerequisites

Students have successfully completed modules with a minimum of 70 ECTS credits, especially the module *Specialization Phase* must be successfully completed. (SPO §14)

Modeled Conditions

The following conditions have to be fulfilled:

- You need to earn at least 40 credits in the following fields:
 - Applied and Experimental Meteorology
 - Atmospheric and Climate Processes
 - Interdisciplinary Qualifications
 - Required Electives
- The module [M-PHYS-100955 - Specialisation Phase](#) must have been passed.

Content

After choosing a subject area and topic at the beginning of the module *Specialization Phase* and preparing their thesis, the students start their original scientific study. The Master's Thesis includes the theoretical and/or the experimental work on a complex problem using scientific methods.

It is possible to conduct the project in cooperation with external partners, for example an external research institution or an institution from the professional background.

Recommendation

Attendance of the Karlsruhe Meteorological Colloquium and the departmental seminars (IMK-TRO, IMK-ASF, IMK-AAF).

Annotation

The maximum duration of the Master thesis is six months.

Workload

Presence on Presentations: 20 hours

Preparation of the presentation: 40 hours

Master's Thesis: 840 hours

M

5.16 Module: Modern Theoretical Physics for Teacher Students [M-PHYS-101664]

Responsible: Studiendekan Physik
Organisation: KIT Department of Physics
Part of: [Required Electives](#)

Credits	Recurrence	Language	Level	Version
8	Each winter term	German	4	1

Mandatory			
T-PHYS-103203	Modern Theoretical Physics for Teacher Students - Prerequisite	0 CR	Klinkhamer
T-PHYS-103204	Modern Theoretical Physics for Teacher Students	8 CR	Klinkhamer

Prerequisites

none

M**5.17 Module: Modern Theoretical Physics I, Quantum Mechanics I [M-PHYS-101707]**

Responsible: Studiendekan Physik
Organisation: KIT Department of Physics
Part of: [Required Electives](#)

Credits	Recurrence	Language	Level	Version
8	Each summer term	German	4	1

Mandatory			
T-PHYS-102317	Modern Theoretical Physics I, Quantum Mechanics 1, Prerequisite 1	4 CR	Mühlleitner
T-PHYS-105134	Modern Theoretical Physics I, Quantum Mechanics 1	4 CR	Studiendekan Physik

Competence Certificate

See components of this module

Prerequisites

none

M**5.18 Module: Module Wildcard Electives [M-PHYS-103403]****Organisation:** University**Part of:** Required Electives**Credits**
8**Recurrence**
Each term**Language**
German**Level**
4**Version**
1

Election block: Wildcard (at least 1 item)			
T-PHYS-106794	Wildcard	2 CR	
T-PHYS-106795	Wildcard	3 CR	
T-PHYS-106796	Wildcard	4 CR	
T-PHYS-106797	Wildcard	5 CR	

Prerequisites

None

M

5.19 Module: Physics of Planetary Atmospheres [M-PHYS-104488]

Responsible: Prof. Dr. Thomas Leisner
Organisation: KIT Department of Physics
Part of: [Required Electives](#)

Credits	Recurrence	Language	Level	Version
10	Each winter term	English	4	2

Mandatory			
T-PHYS-109177	Physics of Planetary Atmospheres	8 CR	Leisner
T-PHYS-109180	Exam on Physics of Planetary Atmospheres	2 CR	Leisner

Competence Certificate

Prerequisite: Coursework ("Studienleistung")

For type of Coursework see Course description ("Teilleistungsbeschreibung")

→ successful completion of the prerequisites entitles to exam

Examination: Assessment ("Prüfungsleistung")

T-PHYS-109180 Exam on Physics of Planetary Atmospheres

Exam (approx. 60 minutes, oral, written or otherwise) in accordance with § 4 (2) SPO Master's Meteorology

Competence Goal

The students acquire the basic knowledge of atmospheric physics.

On the basis of concrete case studies from current research, the students learn to understand the concepts and are empowered to apply the learned methods independently.

Emphasis is placed on the basic physical and chemical principles, so that knowledge can be generally applied to planetary atmospheres and not limited to the earth. This is supported by correspondingly created exercises.

One focus is the experimental methods of atmospheric remote sensing.

Methods Learning:

- Understanding the basics of atmospheric physics
- Acquisition of the ability to present a current research topic independently as well as in a team
- Acquisition of the ability to apply the concepts and experimental methods in an experimental
To implement a master's thesis

Module grade calculation

Grade is earned through the associated exam (oral, written or otherwise).

Prerequisites

None

Content

The topics covered include a general introduction to the field of work with its fundamental questions, theoretical concepts and experimental methods.

One of the focal points is radiation transport in atmospheres, which is of central importance for the energy budget as well as for remote sensing. Clouds and aerosols are a central factor in many planetary atmospheres, their nucleation and their properties are treated in generalized form.

Recommendation

Basic knowledge of physics, physical chemistry and fluid dynamics at Bachelor level

Workload

240 hours consisting of attendance times (60 hours), follow-up of the lecture incl.

Exam preparation and editing exercises (180 hours).

Learning type

Lectures (2 Ch) and Exercises (2Ch)

Literature

Raymond T. Pierrehumbert: Principles of Planetary Climate, Cambridge Univ. Press, 2010

Augustin Sanchez-Lavega: An Introduction to Planetary Atmospheres, Taylor&Francis, 2010

Frédéric J. Pont: Alien Skies: Planetary Atmospheres from Earth to Exoplanets, Springer, 2014

K. N. Liu: An introduction to atmospheric radiation, Academic Press, 2010

M

5.20 Module: Specialisation Phase (Met-Spph3-1) [M-PHYS-100955]

Responsible: Prof. Dr. Corinna Hoose
Prof. Dr. Peter Knippertz

Organisation: KIT Department of Physics

Part of: [Research Work](#)

Credits	Recurrence	Language	Level	Version
30	Each term	German/English	4	4

Mandatory			
T-PHYS-109617	Scientific Concept Development	30 CR	

Competence Certificate**Module examination: Coursework (“Studienleistung”)**

Examination of other type in accordance to §4(2) No. 3 SPO Master’s Meteorology:

Final presentation (20-25 minutes) in the *Seminar on Specialization Phase*, followed by a short discussion with the audience (15 minutes). Afterwards a short feedback meeting with the examiners and the supervisor about the progress and next steps will take place.

Please notice that the seminar only takes place within the semester on Wednesday (15:45 – 17:15 pm) in Bldg. 30.23, Room 13-2. To get a seminar slot, please contact Kathi Maurer (student advisor) via [E-Mail](#).

Competence Goal

Students are able to work on a meteorological or interdisciplinary research project using scientific methods.

They can, with guidance, plan, structure, prepare, conduct, and document a study. They can select appropriate methods for the solution of the given problem.

Students are able to work self-organized and structured. They possess skills in the field of project management and presentation, both orally and in writing.

Prerequisites

Students need to have successfully completed all four module exams in the subjects *Atmospheric and Climate Processes* and *Applied and Experimental Meteorology*.

Soft skills and complementary elective can still be incomplete.

Content

Conducting a meteorological, interdisciplinary project work. This may be of a theoretical and/or experimental type. The focus is on the development of conclusions using scientific methods, project management and presentation of the results.

Students are invited to make suggestions for topics.

It is possible to conduct the project in cooperation with external partners.

Workload

Independent scientific work: 820 hours

Preparation Lecture and presence in the accompanying seminar: 80 hours

6 Courses

T

6.1 Course: Advanced Fluid Mechanics [T-BGU-106612]

Responsible: Prof. Dr. Olivier Eiff

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: [M-BGU-101876 - Fluid Mechanics and Turbulence](#)

Type	Credits	Recurrence	Version
Written examination	6	Each term	1

Events					
SS 2020	6221701	Advanced Fluid Mechanics	4 SWS	Lecture / Practice (VÜ)	Eiff
Exams					
WS 19/20	8244106612	Advanced Fluid Mechanics		Prüfung (PR)	Eiff

Competence Certificate

written exam, 90 min.

Prerequisites

none

Recommendation

none

Annotation

none

T**6.2 Course: Advanced Numerical Weather Prediction [T-PHYS-109139]**

Responsible: Prof. Dr. Peter Knippertz
Organisation: KIT Department of Physics
Part of: [M-PHYS-100954 - Applied Meteorology](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Prerequisites
none

T

6.3 Course: Advanced Practical Courses [T-PHYS-109135]

Responsible: Prof. Dr. Christoph Kottmeier
Organisation: KIT Department of Physics
Part of: [M-PHYS-100953 - Experimental Meteorology](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Events					
SS 2020	4052103	Advanced Meteorological Practical Course	5 SWS	Practical course (P)	Kottmeier, Wagner, Höpfner, Kohler

Competence Certificate

Timely delivery and confirmation of the internship evaluation.

Prerequisites

None

Below you will find excerpts from events related to this course:

V

Advanced Meteorological Practical Course

4052103, SS 2020, 5 SWS, Language: English, [Open in study portal](#)

Practical course (P)

Content

Available experiments include:

- atmospheric measurements with gliders (IMK-TRO)
- surface energy balance (IMK-TRO)
- infrared spectroscopy (IMK-ASF)
- AIDA cloud and aerosol chamber (IMK-AAF)

T

6.4 Course: Applied Meteorology (Module Exam) [T-PHYS-109143]

Responsible: Prof. Dr. Michael Kunz
Organisation: KIT Department of Physics
Part of: [M-PHYS-100954 - Applied Meteorology](#)

Type	Credits	Recurrence	Version
Oral examination	10	Each summer term	2

Exams				
WS 19/20	7800069	Applied Meteorology (Module Exam)	Prüfung (PR)	Kunz

Competence Certificate

The awarding of 10 credits will take place after passing the oral exam (see module description).

Prerequisites

It is only possible to register for the examination if the academic achievement "methods of data analysis" and further study achievements have been achieved to a sufficient degree.

Modeled Conditions

The following conditions have to be fulfilled:

1. You have to fulfill one of 2 conditions:
 1. The course [T-PHYS-109141 - Energy Meteorology](#) must have been passed.
 2. The course [T-PHYS-109139 - Advanced Numerical Weather Prediction](#) must have been passed.
2. The course [T-PHYS-109142 - Methods of Data Analysis](#) must have been passed.
3. The course [T-PHYS-108610 - Turbulent Diffusion](#) must have been passed.

T

6.5 Course: Atmospheric Aerosols [T-PHYS-108938]

Responsible: Dr. Ottmar Möhler
Organisation: KIT Department of Physics
Part of: [M-PHYS-100952 - Atmospheric Processes](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each winter term	1

Events					
WS 19/20	4052041	Atmospheric Aerosols	2 SWS	Lecture (V)	Möhler
WS 19/20	4052042	Exercises to Atmospheric Aerosols	1 SWS	Practice (Ü)	Möhler, Kaufmann
Exams					
WS 19/20	7800083	Atmospheric Aerosols (Prerequisite)		Prüfung (PR)	Hoose

Prerequisites

None

Below you will find excerpts from events related to this course:

V

Atmospheric Aerosols4052041, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)****Content**

Gas particle processes (kinetics, diffusion, condensation), aerosol properties (diffusion, coagulation, sedimentation, impaction), aerosol thermodynamics (chemical potential, solubility, crystallization), aerosol cloud processes (Köhler theory, ice nucleation).

V

Exercises to Atmospheric Aerosols4052042, WS 19/20, 1 SWS, Language: English, [Open in study portal](#)**Practice (Ü)****Content**

Following the lecture.

T

6.6 Course: Atmospheric Processes (Module Exam) [T-PHYS-108939]

Responsible: Prof. Dr. Corinna Hoose
Organisation: KIT Department of Physics
Part of: [M-PHYS-100952 - Atmospheric Processes](#)

Type	Credits	Recurrence	Version
Oral examination	12	Each term	1

Exams				
WS 19/20	7800039	Examination on Atmospheric Processes (Module Exam)	Prüfung (PR)	Hoose

Prerequisites

All module courses must be passed.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-PHYS-107694 - Cloud Physics](#) must have been passed.
2. The course [T-PHYS-107696 - Atmospheric Radiation](#) must have been passed.
3. The course [T-PHYS-107695 - Energetics](#) must have been passed.
4. The course [T-PHYS-108938 - Atmospheric Aerosols](#) must have been passed.

T

6.7 Course: Atmospheric Radiation [T-PHYS-107696]

Responsible: Dr. Michael Höpfner
Organisation: KIT Department of Physics
Part of: [M-PHYS-100952 - Atmospheric Processes](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each winter term	1

Events					
WS 19/20	4052071	Atmospheric Radiation	2 SWS	Lecture (V)	Höpfner
Exams					
WS 19/20	7800106	Atmospheric Radiation (Prerequisite)		Prüfung (PR)	Hoose

Prerequisites

none

Below you will find excerpts from events related to this course:

V

Atmospheric Radiation4052071, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)****Content**

- Relevance: Weather/Climate, Chemistry, Remote Sensing
- Short history of light
- Properties of electromagnetic radiation
- Radiometric quantities
- The electromagnetic spectrum
- Boundary conditions: Sun, Earth's surface; reflection and emission
- Radiative transfer in the thermal infrared region: black body radiation, local/non-local thermodynamic equilibrium, transmission, radiative transfer, application in remote sensing
- Molecular spectroscopy, line-broadening
- Radiative transfer in the UV/Visible: absorption and scattering by particles
- Single scattering properties: Rayleigh, Mie-approximations
- Optical phenomena: rainbows, halos
- Radiative transfer with multiple scattering: why are clouds white?, two-stream approximation
- Radiative budget, climate engineering

T

6.8 Course: Basics of Estimation Theory and its Application in Geoscience Remote Sensing [T-BGU-106822]

Responsible: Prof. Dr. Jan Cermak
Prof. Dr.-Ing. Stefan Hinz

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: [M-BGU-103422 - Basics of Estimation Theory and its Application in Geoscience Remote Sensing](#)

Type	Credits	Recurrence	Version
Oral examination	5	Each summer term	1

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-BGU-106821 - Basics of Estimation Theory, Prerequisite](#) must have been passed.
2. The course [T-BGU-106633 - Data Analysis in Geoscience Remote Sensing Projects, Prerequisite](#) must have been passed.

T**6.9 Course: Basics of Estimation Theory, Prerequisite [T-BGU-106821]**

Responsible: Prof. Dr.-Ing. Stefan Hinz
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [M-BGU-103422 - Basics of Estimation Theory and its Application in Geoscience Remote Sensing](#)

Type	Credits	Recurrence	Version
Completed coursework	1	Each summer term	1

T

6.10 Course: Big Data Analytics [T-INFO-101305]

Responsible: Prof. Dr.-Ing. Klemens Böhm
Organisation: KIT Department of Informatics
Part of: [M-INFO-102980 - Informatics for Meteorology Students](#)

Type	Credits	Recurrence	Version
Oral examination	5	Each winter term	1

Events					
WS 19/20	24114	Big Data Analytics	3 SWS	Lecture (V)	Böhm
Exams					
WS 19/20	7500087	Big Data Analytics		Prüfung (PR)	Böhm

T

6.11 Course: Building and Environmental Aerodynamics [T-BGU-103563]

Responsible: Dr.-Ing. Christof-Bernhard Gromke
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [M-BGU-101876 - Fluid Mechanics and Turbulence](#)

Type	Credits	Recurrence	Version
Oral examination	3	Each term	1

Events					
WS 19/20	6221905	Gebäude- und Umweltaerodynamik	2 SWS	Lecture / Practice (VÜ)	Gromke
Exams					
WS 19/20	8244103563	Building and Environmental Aerodynamics	Prüfung (PR)		Gromke

Competence Certificate

oral exam, appr. 30 min.

Prerequisites

none

Recommendation

none

Annotation

none

T

6.12 Course: Climate Modeling & Dynamics with ICON [T-PHYS-108928]

Responsible: Prof. Dr. Joaquim José Ginete Werner Pinto
Dr. Aiko Voigt

Organisation: KIT Department of Physics

Part of: [M-PHYS-100951 - Components of the Climate System](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each winter term	1

Events					
WS 19/20	4052151	Climate Modeling & Dynamics with ICON	2 SWS	Lecture (V)	Ginete Werner Pinto, Voigt
WS 19/20	4052152	Exercises to Climate Modeling & Dynamics with ICON	1 SWS	Practice (Ü)	Ginete Werner Pinto, Voigt, Choudhary, Lentink
Exams					
WS 19/20	7800087	Climate Modeling & Dynamics with ICON (Prerequisite)		Prüfung (PR)	Fink, Ginete Werner Pinto

Competence Certificate

Successful participation in the exercises.

Prerequisites

None

Below you will find excerpts from events related to this course:

V

Climate Modeling & Dynamics with ICON

4052151, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)

Content

Introduction to the ICON model, baroclinic life cycles, cloud impact on large-scale circulation of the atmosphere, climate change response of extra tropical jet stream, aerosol impact on tropical rain belts.

Numerical modeling and analysis of climate and climate change (climate system, conceptual models for processes and feedback, chaotic dynamic systems, numerical climate models (EMICS, Global models, regional models), (statistical) analysis methods.

V

Exercises to Climate Modeling & Dynamics with ICON

4052152, WS 19/20, 1 SWS, Language: English, [Open in study portal](#)

Practice (Ü)

Content

Following the lecture.

T

6.13 Course: Cloud Physics [T-PHYS-107694]

Responsible: Prof. Dr. Corinna Hoose
Organisation: KIT Department of Physics
Part of: [M-PHYS-100952 - Atmospheric Processes](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each winter term	1

Events					
WS 19/20	4052081	Cloud Physics	2 SWS	Lecture (V)	Hoose
WS 19/20	4052082	Exercises to Cloud Physics	2 SWS	Practice (Ü)	Hoose, NN
Exams					
WS 19/20	7800105	Cloud Physics (Prerequisite)		Prüfung (PR)	Hoose

Prerequisites
none

Below you will find excerpts from events related to this course:

V

Cloud Physics

4052081, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)

Content

Phenomenology, cloud dynamics of stratiform and convective clouds, micro physics of warm and cold clouds, collision and coalescence, primary and secondary ice formation, condensation and depositional growth.

V

Exercises to Cloud Physics

4052082, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)

Practice (Ü)

Content

Following the lecture.

T

6.14 Course: Components of the Climate System (Module Exam) [T-PHYS-108933]

Responsible: Prof. Dr. Andreas Fink

Organisation: KIT Department of Physics

Part of: [M-PHYS-100951 - Components of the Climate System](#)

Type	Credits	Recurrence	Version
Oral examination	12	Each winter term	2

Exams				
WS 19/20	7800045	Components of the Climate System (Module Exam)	Prüfung (PR)	Fink

Competence Certificate

The allocation of 12 credits takes place after passing the oral exam (see module description).

Modeled Conditions

The following conditions have to be fulfilled:

1. The following conditions have to be fulfilled:
 1. You have to fulfill 2 of 3 conditions:
 1. The course [T-PHYS-108931 - Middle Atmosphere in the Climate System](#) must have been passed.
 2. The course [T-PHYS-108932 - Ocean-Atmosphere Interactions](#) must have been passed.
 3. The course [T-PHYS-107692 - Seminar on IPCC Assessment Report](#) must have been passed.
 2. The course [T-PHYS-107693 - Tropical Meteorology](#) must have been passed.
 3. The course [T-PHYS-108928 - Climate Modeling & Dynamics with ICON](#) must have been passed.

T

**6.15 Course: Data Analysis in Geoscience Remote Sensing Projects,
Prerequisite [T-BGU-106633]****Responsible:** Prof. Dr. Jan Cermak**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences**Part of:** [M-BGU-103422 - Basics of Estimation Theory and its Application in Geoscience Remote Sensing](#)

Type	Credits	Recurrence	Version
Completed coursework	2	Each summer term	1

T

6.16 Course: Database Systems [T-INFO-101497]

Responsible: Prof. Dr.-Ing. Klemens Böhm
Organisation: KIT Department of Informatics
Part of: [M-INFO-102980 - Informatics for Meteorology Students](#)

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	24516	Datenbanksysteme	2 SWS	Lecture (V)	Böhm, Mülle
SS 2020	24522	Übungen zu Datenbanksysteme	1 SWS	Practice (Ü)	Böhm, Mülle
Exams					
WS 19/20	7500189	Database Systems		Prüfung (PR)	Böhm

T

6.17 Course: Distributed Computing [T-INFO-101298]**Responsible:** Prof. Dr. Achim Streit**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-102980 - Informatics for Meteorology Students](#)

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2400050	Distributed Computing	2 SWS	Lecture (V)	Streit, Krauß, Kühn
Exams					
WS 19/20	7500172	Distributed Computing		Prüfung (PR)	Streit

T 6.18 Course: Energetics [T-PHYS-107695]

Responsible: Prof. Dr. Andreas Fink
Organisation: KIT Department of Physics
Part of: [M-PHYS-100952 - Atmospheric Processes](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each winter term	1

Events					
WS 19/20	4052131	Energetics	2 SWS	Lecture (V)	Fink
Exams					
WS 19/20	7800107	Energetics (Prerequisite)		Prüfung (PR)	Hoose

Prerequisites
none

Below you will find excerpts from events related to this course:

V Energetics

4052131, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)

Content

Mean meridional circulation, stationary and transient eddies; basic forms, budget equations and transport processes of energy in the atmosphere; principle of available potential energy; Lorenz cycle: energy reservoirs and transformation processes, eddy and thermally driven jets (EP flux vectors).

Table of content:

- Literature & Learning goals
- The Climate System
- Basic Equations of the Climate System
- Decomposition of the general circulation
- Radiation budget and energy transports
- Consequences of the radiation and surface energy budgets
- Atmospheric water budget
- Atmospheric and oceanic energy budget
- Concept of „Available Potential Energy (APE)“

T

6.19 Course: Energy Meteorology [T-PHYS-109141]

Responsible: Prof. Dr. Stefan Emeis
Prof. Dr. Joaquim José Ginete Werner Pinto

Organisation: KIT Department of Physics

Part of: [M-PHYS-100954 - Applied Meteorology](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Irregular	1

Events					
SS 2020	4052191	Energy Meteorology	2 SWS	Lecture (V)	Emeis, Schroedter-Homscheidt, Ginete Werner Pinto

Prerequisites

None

Below you will find excerpts from events related to this course:

V

Energy Meteorology

4052191, SS 2020, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)**Content**

- Overview Energy Meteorology
- Physical basics – Wind energy
- Physical basics of energy supply
- Economic basics of energy supply
- Onshore and offshore wind parks
- Wind energy siting – complex terrain
- Physical basics – Solar energy
- Tracking and concentrating solar systems
- Wind measurements
- Radiation forecasts
- Wind energy – yield forecasts
- Climate change & energy system
- Community energy meteorology and where to work

T

6.20 Course: Exam on Physics of Planetary Atmospheres [T-PHYS-109180]

Responsible: Prof. Dr. Thomas Leisner
Organisation: KIT Department of Physics
Part of: [M-PHYS-104488 - Physics of Planetary Atmospheres](#)

Type	Credits	Recurrence	Version
Examination of another type	2	Each winter term	1

Exams				
WS 19/20	7800092	Physics of Planetary Atmospheres (Exam)	Prüfung (PR)	Leisner

Prerequisites

None

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-PHYS-109177 - Physics of Planetary Atmospheres](#) must have been passed.

T

6.21 Course: Experimental Meteorology (Module Exam) [T-PHYS-109137]

Responsible: Prof. Dr. Christoph Kottmeier
Organisation: KIT Department of Physics
Part of: [M-PHYS-100953 - Experimental Meteorology](#)

Type	Credits	Recurrence	Version
Oral examination	14	Each summer term	2

Competence Certificate

The allocation of 12 credits takes place after passing the oral exam (see module description).

Prerequisites

In the Module "Experimental Meteorology" all offered courses must be passed.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-PHYS-109133 - Remote Sensing of Atmospheric State Variables](#) must have been passed.
2. The course [T-PHYS-109135 - Advanced Practical Courses](#) must have been passed.
3. The course [T-PHYS-109136 - Field Trip](#) must have been passed.
4. The course [T-PHYS-109902 - Integrated Atmospheric Measurements](#) must have been passed.

T

6.22 Course: Field Course Soil Science [T-BGU-107486]

Responsible: Prof. Dr. Wolfgang Wilcke
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [M-BGU-103398 - Geoecology](#)

Type	Credits	Recurrence	Version
Completed coursework	1	Each summer term	1

Events					
SS 2020	6111077	Bodenkundliche Geländeübung	1 SWS	Practice (Ü)	Velescu
Exams					
SS 2020	8262101508	Field Course Soil Science		Prüfung (PR)	Velescu

Prerequisites

None

Recommendation

None

Annotation

None

T

6.23 Course: Field Trip [T-PHYS-109136]

Responsible: Prof. Dr. Christoph Kottmeier
Organisation: KIT Department of Physics
Part of: [M-PHYS-100953 - Experimental Meteorology](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Events					
SS 2020	4052263	Field Trip	2 SWS	Excursion (EXK)	Mohr, Kunz

Competence Certificate

Lectures on specific topics about the excursion

Prerequisites

None

Below you will find excerpts from events related to this course:

V

Field Trip

4052263, SS 2020, 2 SWS, Language: English, [Open in study portal](#)

Excursion (EXK)**Content**

The course comprises a one-week excursion to research institutes and observatories in Germany and neighbouring countries.

T

6.24 Course: Flow Measurement Techniques [T-BGU-110411]

Responsible: Dr.-Ing. Christof-Bernhard Gromke
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [M-BGU-101876 - Fluid Mechanics and Turbulence](#)

Type	Credits	Recurrence	Expansion	Version
Oral examination	3	Each term	1 terms	1

Events					
WS 19/20	6221907	Flow Measurement Techniques	2 SWS	Lecture / Practice (VÜ)	Gromke
Exams					
WS 19/20	8244110411	Flow Measurement Techniques		Prüfung (PR)	Gromke

Competence Certificate

oral exam, appr. 30 min.

Prerequisites

none

Recommendation

none

Annotation

none

T

6.25 Course: Fluid Mechanics of Turbulent Flows [T-BGU-110841]

Responsible: Prof. Dr.-Ing. Markus Uhlmann
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [M-BGU-101876 - Fluid Mechanics and Turbulence](#)

Type	Credits	Recurrence	Version
Oral examination	6	Each term	1

Events					
SS 2020	6221806	Fluid Mechanics of Turbulent Flows	4 SWS	Lecture / Practice (VÜ)	Uhlmann

Competence Certificate

oral exam, appr. 45 min.

Prerequisites

none

Recommendation

none

Annotation

none

T

6.26 Course: Geo Data Infrastructures and Web Services [T-BGU-101756]

Responsible: Prof. Dr.-Ing. Stefan Hinz
Dr.-Ing. Sven Wursthorn

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: [M-BGU-102760 - GIS and Geo Data Infrastructures](#)

Type	Credits	Recurrence	Version
Oral examination	1	Each summer term	2

Events					
SS 2020	6026204	Geodateninfrastrukturen und Webdienste	1 SWS	Lecture (V)	Wursthorn
SS 2020	6026205	Geodateninfrastrukturen und Webdienste, Übung	2 SWS	Practice (Ü)	Wursthorn

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-BGU-101757 - Geodata Infrastructures and Web-Services, Prerequisite](#) must have been passed.

T

6.27 Course: Geodata Infrastructures and Web-Services, Prerequisite [T-BGU-101757]

Responsible: Prof. Dr.-Ing. Stefan Hinz
Dr.-Ing. Sven Wursthorn

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: [M-BGU-102760 - GIS and Geo Data Infrastructures](#)

Type	Credits	Recurrence	Version
Completed coursework	3	Each summer term	1

Events					
SS 2020	6026204	Geodateninfrastrukturen und Webdienste	1 SWS	Lecture (V)	Wursthorn
SS 2020	6026205	Geodateninfrastrukturen und Webdienste, Übung	2 SWS	Practice (Ü)	Wursthorn

Prerequisites

none

T

6.28 Course: Geological Hazards and Risk [T-PHYS-103525]

Responsible: Dr. Ellen Gottschämmer
Organisation: KIT Department of Physics
Part of: [M-PHYS-101833 - Geological Hazards and Risk](#)

Type	Credits	Recurrence	Version
Examination of another type	8	Each winter term	2

Events					
WS 19/20	4060121	Geological Hazards and Risk	2 SWS	Lecture (V)	Gottschämmer, Daniell
WS 19/20	4060122	Exercises on Geological Hazards and Risk	2 SWS	Practice (Ü)	Gottschämmer, Daniell
Exams					
WS 19/20	7800114	Geological Hazards and Risk		Prüfung (PR)	Gottschämmer

T

6.29 Course: Geomorphology and Soil Science [T-BGU-107487]

Responsible: Prof. Dr. Wolfgang Wilcke
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [M-BGU-103398 - Geoecology](#)

Type	Credits	Recurrence	Version
Written examination	7	Each summer term	1

Events					
WS 19/20	6111061	Geomorphologie und Bodenkunde	2 SWS	Lecture (V)	Norra, Wilcke
WS 19/20	6111066	Geomorphologie und Bodenkunde	1 SWS	Practice (Ü)	Velescu
SS 2020	6111071	Böden Europas	2 SWS	Lecture (V)	Wilcke

Prerequisites

None

Recommendation

None

Annotation

None

T

6.30 Course: Image Processing and Computer Vision [T-BGU-101732]

Responsible: Dr.-Ing. Uwe Weidner
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [M-BGU-102757 - Computer Vision and GIS](#)
[M-BGU-102759 - Computer Vision and Remote Sensing](#)

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	6042101	Image Processing and Computer Vision, Lecture	2 SWS	Lecture (V)	Weidner
WS 19/20	6042102	Image Processing and Computer Vision, Exercises	1 SWS	Practice (Ü)	Weidner

Competence Certificate

The assessment consists of a oral exam (ca. 30 min). according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik.

Prerequisites

The parts T-BGU-106333 und T-BGU-106334 must not have started.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-BGU-106333 - Remote Sensing of a Changing Climate, Prerequisite](#) must not have been started.
2. The course [T-BGU-106334 - Remote Sensing of a Changing Climate, Examination](#) must not have been started.

T

6.31 Course: Integrated Atmospheric Measurements [T-PHYS-109902]

Responsible: Prof. Dr. Christoph Kottmeier
Organisation: KIT Department of Physics
Part of: [M-PHYS-100953 - Experimental Meteorology](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Events					
SS 2020	4052131	Integrated Atmospheric Measurements	2 SWS	Lecture (V)	Kottmeier

Competence Certificate

Short presentation on selected contents must be held.

Prerequisites

None

Below you will find excerpts from events related to this course:

V

Integrated Atmospheric Measurements

4052131, SS 2020, 2 SWS, [Open in study portal](#)

Lecture (V)**Content**

Brief Introduction to advanced atmospheric observation techniques like eddy covariance measurements, Doppler Lidar, Doppler Radar and aircraft measurements. Principle and objectives of Integrated Observation. Examples of Integrated Observation from Polar Research, Convection Studies and Orographic Flow analysis.

T**6.32 Course: Introduction into Classification Methods of Remote Sensing [T-BGU-105725]**

Responsible: Dr.-Ing. Uwe Weidner
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: [M-BGU-102758 - GIS and Remote Sensing](#)
[M-BGU-102759 - Computer Vision and Remote Sensing](#)

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

T

6.33 Course: Introduction to GIS for Students of Natural, Engineering and Geo Sciences [T-BGU-101681]

Responsible: Dr.-Ing. Norbert Rösch
Dr.-Ing. Sven Wursthorn

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: [M-BGU-102757 - Computer Vision and GIS](#)
[M-BGU-102758 - GIS and Remote Sensing](#)
[M-BGU-102760 - GIS and Geo Data Infrastructures](#)

Type	Credits	Recurrence	Version
Written examination	3	Each winter term	1

Events					
WS 19/20	6071101	Einführung in GIS für Studierende natur-, ingenieur- und geowissenschaftlicher Fachrichtungen, V/Ü	4 SWS	Lecture / Practice (VÜ)	Rösch, Wursthorn
Exams					
WS 19/20	8280101681	Introduction to GIS for Students of Natural, Engineering and Geo Sciences		Prüfung (PR)	Rösch, Wursthorn

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-BGU-103541 - Introduction to GIS for Students of Natural, Engineering and Geo Sciences](#), Prerequisite must have been passed.

T

6.34 Course: Introduction to GIS for Students of Natural, Engineering and Geo Sciences, Prerequisite [T-BGU-103541]

Responsible: Dr.-Ing. Norbert Rösch
Dr.-Ing. Sven Wursthorn

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: [M-BGU-102757 - Computer Vision and GIS](#)
[M-BGU-102758 - GIS and Remote Sensing](#)
[M-BGU-102760 - GIS and Geo Data Infrastructures](#)

Type	Credits	Recurrence	Version
Completed coursework	3	Each winter term	1

Events					
WS 19/20	6071101	Einführung in GIS für Studierende natur-, ingenieur- und geowissenschaftlicher Fachrichtungen, V/Ü	4 SWS	Lecture / Practice (VÜ)	Rösch, Wursthorn
Exams					
WS 19/20	8280101681	Introduction to GIS for Students of Natural, Engineering and Geo Sciences		Prüfung (PR)	Rösch, Wursthorn
WS 19/20	8280103541	Introduction to GIS for Students of Natural, Engineering and Geo Sciences		Prüfung (PR)	Rösch, Wursthorn

T

6.35 Course: Introduction to Volcanology, Exam [T-PHYS-103644]**Responsible:** Dr. Ellen Gottschämmer**Organisation:** KIT Department of Physics**Part of:** [M-PHYS-103336 - Geophysical analysis of natural hazards](#)

Type	Credits	Version
Examination of another type	1	1

Events					
SS 2020	4060251	Introduction to Volcanology	1 SWS	Lecture (V)	Gottschämmer, Rietbrock
SS 2020	4060252	Exercises to Introduction to Volcanology	1 SWS	Practice (Ü)	Gottschämmer, Rietbrock
Exams					
SS 2020	7800044	Introduction to Volcanology, exam		Prüfung (PR)	Gottschämmer

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-PHYS-103553 - Introduction to Volcanology, Prerequisite](#) must have been passed.

T

6.36 Course: Introduction to Volcanology, Prerequisite [T-PHYS-103553]**Responsible:** Dr. Ellen Gottschämmer**Organisation:** KIT Department of Physics**Part of:** [M-PHYS-103336 - Geophysical analysis of natural hazards](#)

Type	Credits	Version
Completed coursework	3	1

Events					
SS 2020	4060251	Introduction to Volcanology	1 SWS	Lecture (V)	Gottschämmer, Rietbrock
SS 2020	4060252	Exercises to Introduction to Volcanology	1 SWS	Practice (Ü)	Gottschämmer, Rietbrock
Exams					
SS 2020	7800043	Introduction to Volcanology, Studienleistung		Prüfung (PR)	Gottschämmer

T

6.37 Course: Master`s Thesis [T-PHYS-109616]**Organisation:** KIT Department of Physics**Part of:** [M-PHYS-100956 - Master Thesis](#)

Type	Credits	Recurrence	Version
Final Thesis	30	Each term	1

Exams				
WS 19/20	7800080	Master's Thesis	Prüfung (PR)	Knippertz

Prerequisites

see module information or module handbook

Final Thesis

This course represents a final thesis. The following periods have been supplied:

Submission deadline 6 months**Maximum extension period** 3 months**Correction period** 8 weeks

This thesis requires confirmation by the examination office.

T

6.38 Course: Meteorological Hazards [T-PHYS-109140]

Responsible: Prof. Dr. Michael Kunz
Organisation: KIT Department of Physics
Part of: [M-PHYS-100954 - Applied Meteorology](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	3

Competence Certificate

None

Prerequisites

None

Recommendation

Knowledge from the module Introduction to Meteorology is required.

Annotation

None

T

6.39 Course: Methods of Data Analysis [T-PHYS-109142]

Responsible: Prof. Dr. Joaquim José Ginete Werner Pinto
Prof. Dr. Peter Knippertz

Organisation: KIT Department of Physics

Part of: [M-PHYS-100954 - Applied Meteorology](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Events					
SS 2020	4052171	Methods of Data Analysis	2 SWS	Lecture (V)	Ginete Werner Pinto, Lerch
SS 2020	4052172	Exercises to Methods of Data Analysis	1 SWS	Practice (Ü)	Ginete Werner Pinto, Lerch, Ehmele

Competence Certificate

Successful participation in the exercises.

Prerequisites

None

Below you will find excerpts from events related to this course:

V

Methods of Data Analysis

4052171, SS 2020, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)

Content

1. Basics
2. Significance testings
3. Regression
4. Time series
5. Fourier wavelet analysis
6. Spatial analysis
7. Clustering
8. Machine Learning
9. Summary

V

Exercises to Methods of Data Analysis

4052172, SS 2020, 1 SWS, Language: English, [Open in study portal](#)

Practice (Ü)

Content

Following the lecture.

T

6.40 Course: Middle Atmosphere in the Climate System [T-PHYS-108931]

Responsible: Dr. Michael Höpfner
Dr. Miriam Sinnhuber

Organisation: KIT Department of Physics

Part of: [M-PHYS-100951 - Components of the Climate System](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Irregular	1

Events					
WS 19/20	4052061	Middle Atmosphere in the Climate System	2 SWS	Lecture (V)	Höpfner, Sinnhuber
Exams					
WS 19/20	7800008	Middle Atmosphere in the Climate System (Prerequisite)		Prüfung (PR)	Fink

Prerequisites

None

Below you will find excerpts from events related to this course:

V

Middle Atmosphere in the Climate System

4052061, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)

Content

- History of science of the middle atmosphere (MA)
- Mean state of the MA: temperature, wind, chemical composition
- Radiation: sun, radiative transfer, energy budget, photolysis
- Measurements: in-situ/remote sounding, ground-based, airborne/balloon, satellite
- Aerosols: stratospheric background aerosol layer, volcanic enhancement, polar stratospheric clouds, polar mesospheric clouds, meteoric dust
- Chemistry: general concepts, global ozone layer, polar ozone chemistry
- Dynamics: fundamental description, meridional circulation, equatorial circulation, waves and tides, stratospheric warmings, tracer and age-of-air, upper troposphere/lower stratosphere, cross-tropopause transport
- Coupling and climate: chemistry-climate coupling, trends,

T

6.41 Course: Mobile Computing and Internet of Things [T-INFO-102061]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: [M-INFO-102980 - Informatics for Meteorology Students](#)

Type	Credits	Recurrence	Version
Oral examination	5	Each winter term	1

Events					
WS 19/20	2400051	Mobile Computing and Internet of Things	2+1 SWS	Lecture / Practice (VÜ)	Beigl, Exler
Exams					
WS 19/20	7500042_03-03-20	Mobile Computing and Internet of Things		Prüfung (PR)	Beigl
WS 19/20	7500042_05-05-20	Mobile Computing and Internet of Things		Prüfung (PR)	Beigl
WS 19/20	7500042_09-04-20	Mobile Computing and Internet of Things		Prüfung (PR)	Beigl
WS 19/20	7500042_11-02-20	Mobile Computing and Internet of Things		Prüfung (PR)	Beigl
WS 19/20	7500042_11-05-20	Mobile Computing and Internet of Things		Prüfung (PR)	Beigl
WS 19/20	7500042_19-11-19	Mobile Computing and Internet of Things		Prüfung (PR)	Beigl
WS 19/20	7500042_20-01-20	Mobile Computing and Internet of Things		Prüfung (PR)	Beigl
WS 19/20	7500042_20-02-20	Mobile Computing and Internet of Things		Prüfung (PR)	Beigl
WS 19/20	7500042-02-04-20	Mobile Computing and Internet of Things		Prüfung (PR)	Beigl
SS 2020	7500107	Mobile Computing and Internet of Things		Prüfung (PR)	Beigl

T

6.42 Course: Modern Theoretical Physics for Teacher Students [T-PHYS-103204]**Responsible:** Prof. Dr. Frans Klinkhamer**Organisation:** KIT Department of Physics**Part of:** [M-PHYS-101664 - Modern Theoretical Physics for Teacher Students](#)

Type	Credits	Recurrence	Version
Oral examination	8	Each winter term	1

Events					
WS 19/20	4012131	Moderne Theoretische Physik für Lehramtskandidaten	4 SWS	Lecture (V)	Klinkhamer
WS 19/20	4012132	Übungen zu Moderne Theoretische Physik für Lehramtskandidaten	2 SWS	Practice (Ü)	Klinkhamer, Emelyanov
Exams					
WS 19/20	7800078	Modern Theoretical Physics for Teacher Students		Prüfung (PR)	Klinkhamer, Gieseke

Prerequisites

successful completion of the exercises

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-PHYS-103203 - Modern Theoretical Physics for Teacher Students - Prerequisite](#) must have been passed.

T

6.43 Course: Modern Theoretical Physics for Teacher Students - Prerequisite [T-PHYS-103203]

Responsible: Prof. Dr. Frans Klinkhamer

Organisation: KIT Department of Physics

Part of: [M-PHYS-101664 - Modern Theoretical Physics for Teacher Students](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each winter term	1

Events					
WS 19/20	4012131	Moderne Theoretische Physik für Lehramtskandidaten	4 SWS	Lecture (V)	Klinkhamer
WS 19/20	4012132	Übungen zu Moderne Theoretische Physik für Lehramtskandidaten	2 SWS	Practice (Ü)	Klinkhamer, Emelyanov
Exams					
WS 19/20	7800077	Modern Theoretical Physics for Teacher Students - Prerequisite		Prüfung (PR)	Klinkhamer

Prerequisites

none

T

6.44 Course: Modern Theoretical Physics I, Quantum Mechanics 1 [T-PHYS-105134]

Responsible: Studiendekan Physik

Organisation: KIT Department of Physics

Part of: [M-PHYS-101707 - Modern Theoretical Physics I, Quantum Mechanics I](#)

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	4010141	Moderne Theoretische Physik I (Theorie D, Quantenmechanik I)	4 SWS	Lecture (V)	Mühlleitner
SS 2020	4010142	Übungen zu Moderne Theoretische Physik I	2 SWS	Practice (Ü)	Mühlleitner, Liebler

Competence Certificate

Oral exam, approx. 45 min

Prerequisites

successful completion of the exercises

T

6.45 Course: Modern Theoretical Physics I, Quantum Mechanics 1, Prerequisite 1 [T-PHYS-102317]

Responsible: Prof. Dr. Milada Margarete Mühlleitner

Organisation: KIT Department of Physics

Part of: [M-PHYS-101707 - Modern Theoretical Physics I, Quantum Mechanics I](#)

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	1

Events					
SS 2020	4010141	Moderne Theoretische Physik I (Theorie D, Quantenmechanik I)	4 SWS	Lecture (V)	Mühlleitner
SS 2020	4010142	Übungen zu Moderne Theoretische Physik I	2 SWS	Practice (Ü)	Mühlleitner, Liebler

Competence Certificate

Course achievement, successful completion of the exercises

Prerequisites

none

T

6.46 Course: Ocean-Atmosphere Interactions [T-PHYS-108932]

Responsible: Prof. Dr. Andreas Fink
Organisation: KIT Department of Physics
Part of: [M-PHYS-100951 - Components of the Climate System](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Irregular	1

Events					
WS 19/20	4052121	Ocean-Atmosphere Interactions	2 SWS	Lecture (V)	Fink, van der Linden
Exams					
WS 19/20	7800067	Ocean-Atmosphere Interactions (Prerequisite)		Prüfung (PR)	Fink

Prerequisites

None

Below you will find excerpts from events related to this course:

V

Ocean-Atmosphere Interactions4052121, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)****Content**

- Literature
- Learning goals
- Physical and chemical properties of the upper ocean layers
 - Properties of ocean waters
 - Salinity content and density
 - Temperature distribution in the ocean
 - Horizontal salinity distribution in the ocean
 - Vertical salinity distribution
 - Horizontal and vertical density distribution
 - Characteristic water masses in the oceans
 - Dissolved gases in the ocean
 - Molecular transport
 - Properties of humid air
 - Ocean surface and its immediate environment
- Wind-driven ocean surface currents
 - Equation of motion
 - Ekman's solution of the equation of motion
 - Mass transport associated with the Ekman current
 - Up-welling in the ocean
 - Sverdrup regime
 - Westerly boundary current: Stommel's contribution
 - Munk's solution
- Ocean waves
 - Generation of ocean waves by wind
 - Description of ocean waves
 - Global view on ocean wave climates
 - Ocean wave modeling
 - Ocean wave measurements
- Summary

T

6.47 Course: Parallel Computer Systems and Parallel Programming [T-INFO-101345]

Responsible: Prof. Dr. Achim Streit

Organisation: KIT Department of Informatics

Part of: [M-INFO-102980 - Informatics for Meteorology Students](#)

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	24617	Parallel computer systems and parallel programming	2 SWS	Lecture (V)	Streit, Häfner
Exams					
WS 19/20	7500241	Parallel computer systems and parallel programming		Prüfung (PR)	Streit

T

6.48 Course: Physics of Planetary Atmospheres [T-PHYS-109177]

Responsible: Prof. Dr. Thomas Leisner
Organisation: KIT Department of Physics
Part of: [M-PHYS-104488 - Physics of Planetary Atmospheres](#)

Type	Credits	Recurrence	Version
Completed coursework	8	Each winter term	2

Events					
WS 19/20	4052161	Physics of Planetary Atmospheres	2 SWS		Leisner, Reddmann, Sinnhuber
WS 19/20	4052162	Exercises to Physics of Planetary Atmospheres	2 SWS	Practice (Ü)	Leisner, Duft
Exams					
WS 19/20	7800091	Physics of Planetary Atmospheres (Prerequisite)		Prüfung (PR)	Leisner

Competence Certificate

- If this module is part of the Specialization or Compulsory Subject, credits are earned through the associated exam (oral, written or otherwise).
- Otherwise, the exercises, computer exercises, internships or, if necessary, graduation lectures must be successfully completed.

Prerequisites

None

Recommendation

Basic knowledge of physics, physical chemistry and fluid dynamics at Bachelor level.

Annotation

240 hours consisting of attendance times (60 hours), follow-up of the lecture incl. Exam preparation and editing exercises (180 hours).

Below you will find excerpts from events related to this course:

V

Physics of Planetary Atmospheres4052161, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)**Content**

The module gives a broad introduction into the formation and properties of planets and their atmospheres and tries to constrain possible planetary atmospheres by applying fundamental principles of physics. In this respect, the module will focus on the planetary atmospheres in our solar system. Moreover, recently developed methods for the remote sensing of extra solar planets are introduced and the current understanding of their atmospheres is presented. A focus is the energy budget of planetary atmospheres, where clouds play a central role. Their formation and growth will be covered in a generalized fashion.

V

Exercises to Physics of Planetary Atmospheres4052162, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)**Practice (Ü)**

Content

Following the lecture.

T

6.49 Course: Remote Sensing of a Changing Climate, Examination [T-BGU-106334]

Responsible: Prof. Dr. Jan Cermak

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: [M-BGU-102759 - Computer Vision and Remote Sensing](#)

Type	Credits	Recurrence	Version
Oral examination	3	Each winter term	1

Events					
WS 19/20	6043106	Satellite Climatology: Remote Sensing of a Changing Climate, Lecture	2 SWS	Lecture (V)	Cermak
WS 19/20	6043107	Satellite Climatology: Remote Sensing of a Changing Climate, Exercises	1 SWS	Practice (Ü)	Cermak
Exams					
WS 19/20	8296106334	Remote Sensing in a Changing Climate, Examination		Prüfung (PR)	Cermak

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-BGU-106333 - Remote Sensing of a Changing Climate, Prerequisite](#) must have been passed.
2. The course [T-BGU-101732 - Image Processing and Computer Vision](#) must not have been started.

T

6.50 Course: Remote Sensing of a Changing Climate, Prerequisite [T-BGU-106333]

Responsible: Prof. Dr. Jan Cermak

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: [M-BGU-102759 - Computer Vision and Remote Sensing](#)

Type	Credits	Recurrence	Version
Completed coursework	1	Each winter term	1

Events					
WS 19/20	6043107	Satellite Climatology: Remote Sensing of a Changing Climate, Exercises	1 SWS	Practice (Ü)	Cermak
Exams					
WS 19/20	8296106333	Remote Sensing in a Changing Climate, Prerequisite		Prüfung (PR)	Cermak

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-BGU-101732 - Image Processing and Computer Vision](#) must not have been started.

T

6.51 Course: Remote Sensing of Atmospheric State Variables [T-PHYS-109133]

Responsible: Prof. Dr. Johannes Orphal
Dr. Björn-Martin Sinnhuber

Organisation: KIT Department of Physics

Part of: [M-PHYS-100953 - Experimental Meteorology](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Events					
SS 2020	4052151	Remote Sensing of Atmospheric State Variables	2 SWS	Lecture (V)	Orphal, Sinnhuber
SS 2020	4052152	Exercises to Remote Sensing of Atmospheric State Variables	1 SWS	Practice (Ü)	Orphal, Sinnhuber

Competence Certificate

More than 50% of the points from the exercises must be achieved.

Prerequisites

None

Below you will find excerpts from events related to this course:

V

Remote Sensing of Atmospheric State Variables

4052151, SS 2020, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)

Content

- physical basics
- radiation transfer
- inverse methods
- basics of satellite remote sensing
- techniques and applications

V

Exercises to Remote Sensing of Atmospheric State Variables

4052152, SS 2020, 1 SWS, Language: English, [Open in study portal](#)

Practice (Ü)

Content

Following the lecture.

T

6.52 Course: Scientific Concept Development [T-PHYS-109617]**Organisation:** KIT Department of Physics**Part of:** [M-PHYS-100955 - Specialisation Phase](#)

Type	Credits	Recurrence	Expansion	Version
Completed coursework	30	Each term	1 terms	1

Events					
SS 2020	4052904	Seminar on Specialization Phase	2 SWS	Seminar (S)	Kottmeier, Hoose, Ginete Werner Pinto, Fink, Kunz, Orphal, Leisner, Braesicke
Exams					
WS 19/20	7800070	Scientific Concept Development		Prüfung (PR)	Knippertz

Prerequisites

see module information or module handbook

Modeled Conditions

You have to fulfill one of 4 conditions:

1. The module [M-PHYS-100951 - Components of the Climate System](#) must have been passed.
2. The module [M-PHYS-100952 - Atmospheric Processes](#) must have been passed.
3. The module [M-PHYS-100953 - Experimental Meteorology](#) must have been passed.
4. The module [M-PHYS-100954 - Applied Meteorology](#) must have been passed.

Below you will find excerpts from events related to this course:

V

Seminar on Specialization Phase4052904, SS 2020, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)****Content**

In the Seminar on Specialization Phase students present their final theses in the context of the TL T-PHYS-109617 "Scientific Concept Development" (Master)

The Seminar on Specialization Phase takes place every Wednesday from 15:45 - 17:15 during the lecture period. The registration takes place by mail to katharina.maurer@kit.edu

T

6.53 Course: Seminar on IPCC Assessment Report [T-PHYS-107692]

Responsible: Prof. Dr. Joaquim José Ginete Werner Pinto
Prof. Dr. Corinna Hoose
Patrick Ludwig

Organisation: KIT Department of Physics

Part of: [M-PHYS-100951 - Components of the Climate System](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Irregular	1

Events					
WS 19/20	4052194	Seminar on IPCC Assessment Report	2 SWS	Advanced seminar (HS)	Ginete Werner Pinto, Ludwig
Exams					
WS 19/20	7800084	Seminar on IPCC Assessment Report		Prüfung (PR)	Fink

Competence Certificate

Study of a chapter of the current IPCC report with subsequent presentation (~ 20-25 min) and submission of a written summary (1 page).

Below you will find excerpts from events related to this course:

V

Seminar on IPCC Assessment Report

4052194, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)

Advanced seminar (HS)**Content**

Causes of climate change and paleoclimate (external and internal influence factors on the climate, results and structure of simple climate models with and without feedbacks, radiation effect and importance of greenhouse gases, results of model projections of the global climate, IPCC process structure and importance for the life on earth).

The objectives of this Seminar are to provide an overview of the last IPCC Report (currently 2013) and to develop scientific presentation and discussion skills.

T

6.54 Course: Seminar on Recent Topics of Risk Science [T-PHYS-107673]**Responsible:** Dr. Ellen Gottschämmer**Organisation:** KIT Department of Physics**Part of:** [M-PHYS-103336 - Geophysical analysis of natural hazards](#)

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	1

Events					
WS 19/20	4060284	Seminar über aktuelle Themen aus der Risikoforschung (Literaturseminar)	2 SWS	Seminar (S)	Gottschämmer
Exams					
WS 19/20	7800109	Seminar on recent questions about risk science		Prüfung (PR)	Gottschämmer

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-PHYS-105113 - Geophysical Risk Seminar](#) must not have been started.

T

6.55 Course: Tropical Meteorology [T-PHYS-107693]

Responsible: Prof. Dr. Peter Knippertz
Organisation: KIT Department of Physics
Part of: [M-PHYS-100951 - Components of the Climate System](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Irregular	2

Events					
WS 19/20	4052111	Tropical Meteorology	2 SWS	Lecture (V)	Knippertz
WS 19/20	4052112	Exercises to Tropical Meteorology	1 SWS	Practice (Ü)	Knippertz, Maier-Gerber
Exams					
WS 19/20	7800085	Tropical Meteorology (Prerequisite)		Prüfung (PR)	Fink

Competence Certificate

Students must achieve 50% of the points on the exercise sheets.

Below you will find excerpts from events related to this course:

V

Tropical Meteorology

4052111, WS 19/20, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)**Content**

Dynamics and climate of the Tropics (tropical circulation, Hadley and Walker cells, monsoons, El Niño, equatorial waves, Madden-Julian Oscillation, easterly waves, tropical cyclones, tropical squall lines).

V

Exercises to Tropical Meteorology

4052112, WS 19/20, 1 SWS, Language: English, [Open in study portal](#)

Practice (Ü)**Content**

Following the lecture.

T

6.56 Course: Turbulent Diffusion [T-PHYS-108610]

Responsible: Prof. Dr. Michael Kunz
Organisation: KIT Department of Physics
Part of: [M-PHYS-100954 - Applied Meteorology](#)

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	4

Events					
SS 2020	4052081	Turbulent Diffusion	2 SWS	Lecture (V)	Hoshyaripour, Hoose
SS 2020	4052082	Exercises to Turbulent Diffusion	1 SWS	Practice (Ü)	Hoshyaripour, Hoose, Bruckert

Competence Certificate

After a short introduction, the students independently conduct model simulations with ICON-ART. The results are prepared, evaluated for specific questions and analyzed and presented to the group at the end of the semester.

Prerequisites

Erfolgreiche Teilnahme an den Übungen.

Below you will find excerpts from events related to this course:

V

Turbulent Diffusion

4052081, SS 2020, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)**Content**

1. Life cycle of air pollutants
2. Relevant processes and substances
3. Quantification of trace substances
4. Emissions
5. Turbulence and averaging
6. The diffusion equation
7. Chemical Transformations
8. Aerosol dynamics
9. Atmospheric models: ICON-ART modeling system
10. Parametrisation of turbulent fluxes
11. Aerosol and radiation
12. Aerosol and clouds

V

Exercises to Turbulent Diffusion

4052082, SS 2020, 1 SWS, Language: English, [Open in study portal](#)

Practice (Ü)**Content**

After a short introduction, the students independently conduct model simulations with ICON-ART. The results are prepared, evaluated with regard to relevant questions, analyzed and presented in the group exercises.

T

6.57 Course: Visualization [T-INFO-101275]

Responsible: Prof. Dr.-Ing. Carsten Dachsbacher
Organisation: KIT Department of Informatics
Part of: [M-INFO-102980 - Informatics for Meteorology Students](#)

Type	Credits	Recurrence	Version
Oral examination	5	Each summer term	1

Events					
WS 19/20	24183	Visualisation	2 SWS	Lecture (V)	Dachsbacher
SS 2020	2400175	Visualisierung	2 SWS	Lecture (V)	Rapp, Dachsbacher

T 6.58 Course: Wildcard [T-PHYS-106796]**Organisation:** University**Part of:** [M-PHYS-103403 - Module Wildcard Electives](#)

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	1

T 6.59 Course: Wildcard [T-PHYS-108283]**Organisation:** University**Part of:** [M-BGU-102759 - Computer Vision and Remote Sensing](#)

Type	Credits	Version
Examination of another type	4	1

T 6.60 Course: Wildcard [T-PHYS-106794]**Organisation:** University**Part of:** [M-PHYS-103403 - Module Wildcard Electives](#)

Type	Credits	Version
Examination of another type	2	1

T 6.61 Course: Wildcard [T-PHYS-106795]**Organisation:** University**Part of:** [M-PHYS-103403 - Module Wildcard Electives](#)

Type	Credits	Recurrence	Version
Examination of another type	3	Each term	1

T 6.62 Course: Wildcard [T-PHYS-108284]**Organisation:** University**Part of:** [M-BGU-102759 - Computer Vision and Remote Sensing](#)

Type	Credits	Version
Examination of another type	4	1

T 6.63 Course: Wildcard [T-PHYS-106797]**Organisation:** University**Part of:** [M-PHYS-103403 - Module Wildcard Electives](#)

Type	Credits	Recurrence	Version
Examination of another type	5	Each term	1

T 6.64 Course: Wildcard [T-PHYS-108286]**Organisation:** University**Part of:** [M-BGU-102759 - Computer Vision and Remote Sensing](#)

Type	Credits	Version
Completed coursework	4	1

T 6.65 Course: Wildcard [T-PHYS-108285]**Organisation:** University**Part of:** [M-BGU-102759 - Computer Vision and Remote Sensing](#)

Type	Credits	Version
Completed coursework	4	1