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TUD Dresden University of Technology
Faculty of Environmental Sciences

Study Regulations for the consecutive Master's degree program Groundwater and Global Change – Impacts and Adaptation

as of May 5, 2025

On the basis of § 37 para. 1 of the Saxon Higher Education Act (SächsHSG) in the version published on May 31, 2023 (SächsGVBl. p. 329) last amended by Article 2 of the Act of January 31, 2024 (SächsGVBl. p. 83), TUD Dresden University of Technology has issued the following Study Regulations as statutes.

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§ 1
Scope of application

On the basis of the Saxon Higher Education Act (SächsHSG) and the Examination Regulations, these Study Regulations stipulate the objectives, content, structure and organization of the consecutive Master's degree program Groundwater and Global Change – Impacts and Adaptation at TUD Dresden University of Technology.

§ 2
Objectives of the degree program

(1) Upon completion of their studies, students will have in-depth knowledge, insights, and skills in the field of groundwater hydrology and its interrelations with climate and human activities. They will be able to use various tools such as modeling and data analysis to address specific and interdisciplinary issues and research topics in the fields of hydrology, groundwater, and climate, as well as issues of sustainable development and water resource management, water infrastructure, and related topics. In addition, students will be able to critically interpret information, including research results, and classify it in an ethical and sustainable manner. Students will also be able to evaluate different approaches to assessing and managing issues related to groundwater and global change within the context of their possibilities and limitations at various temporal and spatial scales. They will be able to formulate evidence-based solutions and recommendations for challenges related to groundwater and global change. Moreover, students will also have evolved in their personal development and sense of responsibility and will be able to represent and communicate their views, ideas, and research results in writing and orally in an appropriate manner. Furthermore, they will be capable of critical self-reflection and social engagement. Moreover, students will be able to reflect on topics relevant to a pluralistic and open society and put them into context.

(2) Graduates will have a broad professional knowledge and command of current concepts and scientific methods, enabling them, after an appropriate training period in professional practice, to deal with diverse and complex tasks in the field of groundwater hydrology, climate change, and research, such as in water management and nature conservation organizations, government agencies, non-profit organizations, private consulting companies, scientific research institutions and freelance activities both in Germany and abroad. They will also be able to work effectively with interdisciplinary and international teams. Graduates will also be qualified to work as independent experts dealing with groundwater in the context of climate adaptation and global change.

§ 3
Admission requirements

(1) To be admitted to the degree program, candidates must have completed a first degree at a university that qualifies the degree holder for a profession, or a qualification from a state-owned or officially recognized vocational academy in hydraulic engineering, civil engineering, environmental or agricultural engineering, geosciences, environmental sciences, geography, geology, or comparable fields.

(2) Knowledge of English at the B2 level of the Common European Framework of Reference for Language is a prerequisite. Proof thereof is a relevant examination certificate or language certificate. In particular, this can be a certificate of a university degree completed entirely in English or a language certificate such as TOEFL (iBT: 72) or IELTS (5.5).

§ 4
Start and duration of the degree program

(1) The program can be started each winter semester.

(2) The standard period of study is four semesters and includes on-site attendance, independent study and the final examination.

§ 5
Teaching and learning methods

(1) The curriculum is structured in modules. In the individual modules, the course content is taught, consolidated and deepened through lectures, practicals, seminars, practical courses, field trips and independent study.

(2) The individual teaching and learning forms according to para. 1 sentence 2 are defined as follows:

1. Lectures present and discuss the subject areas covered in the modules.
2. Practicals serve to acquire the necessary methodological and subject skills.
3. Seminars enable students to familiarize themselves under supervision in a selected subject area on the basis of specialist literature or other material, to report on the results of their work, to discuss them within the group and to present them in writing.
4. Practical courses serve to apply the course content in a lab and in the field and to acquire further practical skills. They support the connection between theory and practice and explore special topics.
5. Field trips led by academic staff take students to learning venues outside the university and serve to explore relevant subject-specific issues in nature and society, as well as to illustrate the teaching and learning material as concrete water management processes in their spatial and temporal dimensions.
6. Independent study enables students to independently acquire both fundamental and in-depth subject knowledge using various media, such as teaching resources, literature, internet, in individual work or small groups.

§ 6
Structure and organization of the degree program

(1) The program is organized in modules, and features a curriculum organized over three semesters. The fourth semester is dedicated to the preparation of the final thesis including the colloquium. Over two semesters, students must complete coursework and examinations worth a total of 30 credit points each as part of the cooperation with the IHE Delft Institute for Water Education and the Instituto Superior Técnico Universidade de Lisboa in accordance with the cooperation agreement.

(2) The program comprises three compulsory modules and one or two elective compulsory modules worth 10 credit points, which allow students to choose their concentration. The topics available for selection include hydrosciences, aquatic ecology and ecotoxicology, communication and management, numerical methods for hydrosciences, hydrodynamics, ecology, and applied statistics. The selection is binding. Modules can be re-selected; the student must submit a written request to the Examination Office stating the module to be replaced and the newly selected module.

(3) Learning goals, content, teaching and learning methods included, requirements, applicability, frequency, workload, and duration of the individual modules are all listed in the module descriptions (Annex 1).

(4) The courses are held in English.

(5) The appropriate allocation of the modules to the individual semesters, the observance of which makes it possible to complete the program within the standard period of study, as well as the type and scope of the respective courses included, and the number and standard time of the required study achievements and examined assessments are defined in the study schedule attached (Annex 2).

(6) Upon proposal of the Academic Affairs Committee, the Faculty Board may change the range of elective compulsory modules as well as the study schedule. The current selection of elective compulsory modules will be announced in the usual manner at the beginning of the semester. The amended study schedule shall apply to all students who have been informed about this in the usual manner at the beginning of their studies. The Examination Committee shall decide, upon application by the student, on any exceptions to sentence 3.

§ 7
Content of the degree program

(1) Groundwater and Global Change – Impacts and Adaptation is a research-oriented Master's degree program.

(2) The main topics of the international English-language Master's program covers the following six subject area: Hydrological flow systems, groundwater quality and groundwater pollution, groundwater and climate, integrated water resources management (IWRM) and sustainable development, water infrastructure and monitoring, data and modeling. It also includes practice-oriented case studies as well as current topics from fundamental and application-oriented research. Moreover, the degree program includes a combination of theoretical and methodological-practical fundamentals related to groundwater hydrology and its interrelations with the climate and with human activities.

§ 8
Credit points

(1) ECTS credit points document the average workload of the students and their individual study progress. One credit point corresponds to a 30-hour workload. Normally, 60 credit points are awarded per academic year, i.e. 30 credit points per semester. The total workload for the program corresponds to 120 credit points and comprises the teaching and learning methods according to type and scope stipulated in the module descriptions, the study achievements and examined assessments, the final thesis and the colloquium.

(2) The module descriptions indicate the number of credits that can be earned by each module. Credits are awarded upon passing the module examination. § 32 of the examination regulations shall remain unaffected.

§ 9
Academic advisory and counseling service

(1) General advice will be provided by the Central Student Information and Counseling Service at TU Dresden. It covers questions regarding study options, enrollment modalities and general student affairs. Subject-specific guidance during studies will be provided by the Academic Advisory Service of the Hydrosciences department at the Faculty of Environmental Sciences. This subject-specific advisory service assists students with regard to the design of their studies.

(2) At the beginning of the third semester, each student who has not yet provided proof of academic performance shall make use of the subject-specific advisory services.

§ 10
Amendments to module descriptions

(1) In order to adapt them to changed conditions, module descriptions may be amended in a simplified procedure in order to optimize study organization, with the exemption of the fields “Module name,” “Learning goals,” “Content,” “Teaching and learning methods,” “Requirements for earning credit points,” “Credit points and grades” and “Module duration.”

(2) In a simplified procedure, the Faculty Board will adopt the amendments to the module descriptions upon proposal of the Academic Affairs Committee. The amendments must be published in the usual manner.

§ 11
Entry into force and publication

(1) These Study Regulations shall enter into force on the day following their publication in the Official Announcements of TU Dresden.

(2) They apply to all students enrolled in the Master's degree program in Groundwater and Global Change – Impacts and Adaptation in the 2025/2026 winter semester or later.

Issued based on the resolution of the Faculty Board of the Faculty of Environmental Sciences as of March 3, 2025, and the approval of the University Executive Board as of March 25, 2025.

Dresden, May 5, 2025

The Rector
of TUD Dresden University of Technology

Prof. Ursula Staudinger

Annex 1:
Module descriptions

Module name	**Study Project Integrated Water Resources Management (IWRM)**
Module number	UW-MGW 101 (MHSE 09)
Module coordinator	Academic Program Coordinator erasmusmundus.hyd@tu-dresden.de
Learning goals	Students will be able to define and work on a project assignment and report on the status of the project work in stages, both orally and in writing. Students will have the essential skills to independently design, manage, and implement projects and will be able to apply engineering and scientific knowledge in practice.
Content	The module covers tasks and issues from the field of groundwater and global change, the fundamentals of IWRM, and the foundations of project management, presentation, and reporting. Taking into account the interaction of various disciplines, the module also covers proposed solutions to complex hydrological problems.
Teaching and learning methods	Lecture 1 hours per week, practical 1 hour per week, practical course 4 hours per week plus independent study.
Prerequisites	Basic knowledge of hydrological sciences, civil engineering, computer science; advanced mathematical and statistical knowledge.
Applicability	The module is a compulsory module in the Master's degree programs Hydro Science and Engineering, and Groundwater and Global Change - Impacts and Adaptation.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a complex assessment totaling 120 hours. The examination language is English.
Credit points and grades	The module is worth 10 credit points. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each semester.
Workload	The workload comprises 300 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Climate Systems and Climate Modelling**
Module number	UW-MGW 102 (MHSE 27)
Module coordinator	Prof. Matthias Mauder Matthias.Mauder@tu-dresden.de
Learning goals	Students will be able to recognize the complex and scale-dependent relationships between climate system components and describe them using characteristic phenomena. They will also be able to analyze climate data appropriately and apply specific climate models in a scale-appropriate and problem-oriented manner.
Content	The module contains in-depth specialist content on the functioning and methods of describing climate system components, their interactions at all spatial scales and their modelling in climate models. Additional contents of the module include energetic aspects, geological considerations and anthropogenic influences on the climate system, as well as exemplary applications of user-oriented climate models on various spatial scales.
Teaching and learning methods	Lecture 3 hours per week, practical 1 hour per week plus independent study.
Prerequisites	Knowledge of the essential physical processes in the atmosphere and hydrosphere, good prior knowledge of physics and mathematics.
Applicability	The module is a compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation. The module is an elective compulsory module in the Master's degree program Water Security and Global Change, of which two must be chosen. The module is an elective compulsory module in the Master's degree program Hydro Science and Engineering, which must be chosen in accordance with the examination regulations.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a 90-minute written test. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Reading list	Barry, R.G., Hall-McKim, E.A., 2014: Essentials of the Earth's Climate System Bridgman, H. A., Oliver, J.E., 2006: The Global Climate System. Patterns, Processes, and Teleconnections Neelin, J.D., 2011: Climate Change and Climate Modeling Gettelman, A., Rood, R.B., 2016: Demystifying Climate Models. A Users Guide to Earth System Models.

Module name	**Soil Water**
Module number	UW-MGW 103 (MHSE 18)
Module coordinator	Prof. Natalie Orlowski Natalie.Orlowski@tu-dresden.de
Learning goals	Students will be able to measure the soil water balance in different climate zones and under different land use conditions and describe it using models. Students will master strategies for controlling the soil water balance. This will enable them to take into account and incorporate specific aspects of soil water balance in land use management and planning.
Content	The module covers topics related to components of the soil water balance and soil physics, complex influences of land use on soil water reserves and temporal dynamics, case studies on the water balance and its relationship to soil erosion, and the transport of substances with seepage water in different land use systems. The module also focuses on the structure and function of soil water models and topics related to the possible applications of remote sensing as a basis for site assessment and regionalization. Moreover, the module provides an overview of the various options for controlling the soil water balance through irrigation and drainage, methods for measuring soil moisture, and the determination of relevant soil physical parameters.
Teaching and learning methods	Lecture 2 hours per week, practical 1 hour per week, practical course 1 hours per week plus independent study.
Prerequisites	Participants must have basic knowledge of chemistry, physics, biology, and meteorology, as well as in-depth knowledge of soil science at Bachelor's level. Prerequisite literature: Reece et al. (2016) Campbell Biologie. W.E.H. Blum (2007) Bodenkunde in Stichworten. Scheffer-Schachtschabel (2018) Lehrbuch der Bodenkunde.
Applicability	The module is a compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation. The module is an elective compulsory module in the Master's degree program Hydro Science and Engineering, which must be chosen in accordance with the examination regulations.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination consists of a public oral examination lasting 20 minutes as an individual examination and a written examination lasting 90 minutes. The language of the oral examination and the written examination is English.

Credit points and grades	The module is worth 5 credit points. The module grade is calculated from the weighted average grade of the individual examined assessments. The oral examination is weighted three-fold and the written examination seven-fold.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Integrated Water Resources Management**
Module number	UW-MGW 201 (MWW27)
Module coordinator	Prof. Peter Krebs isi@mail.zih.tu-dresden.de
Learning goals	Students will be able to analyze complex management issues, i.e. the management and optimization of water resources. They will be able to evaluate water resource conflicts from the perspective of the stakeholders involved, are familiar with the analysis and modeling of complex water resource systems, and will be able to present their findings in writing and orally in an appropriate scientific manner.
Content	The module covers the challenges and solutions of integrated water resource management (IWRM), the effects of a water resource conflict from the perspective of various decision-makers and interest groups, the systematic approach to model-based decision-making in the IWRM process, the development, calibration, and application of a simulation model for a water resource conflict, and the comparison of scenarios and alternative courses of action.
Teaching and learning methods	Practical 2 hours per week, Field trip 1.5 hours per week plus independent study.
Prerequisites	Students are expected to have basic knowledge of integrated water resource management at Bachelor's level.
Applicability	The module is an elective compulsory module in the Master's degree programs Hydrology, Water Management, Hydrobiology, and Hydro Science and Engineering, which must be chosen in accordance with the annex to the respective examination regulations. The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a seminar paper with a scope of 75 hours. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Water Quality and Water Treatment**
Module number	UW-MGW 202 (MHSE 37)
Module coordinator	Prof. Stefan Stolte Stefan.Stolte@tu-dresden.de
Learning goals	Students will be familiar with important water constituents and understand their significance for water quality. They will know the physical and chemical processes for removing these water constituents, such as bank filtration, deacidification, adsorption on activated carbon, and disinfection.
Content	The module covers water constituents, the significance of water constituents for water quality, and the above-mentioned physical and chemical processes for removing water constituents.
Teaching and learning methods	Lecture 2 hours per week, practical course 2 hours per week plus independent study.
Prerequisites	Participants are expected to have basic knowledge of chemistry, especially hydrochemistry, at Bachelor's level.
Applicability	The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected. The module is an elective compulsory module in the Master's degree program Hydro Science and Engineering, which must be chosen in accordance with the examination regulations.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. If more than 10 students register, the module examination consists of a 90-minute written exam. If up to 10 students register, it consists of a 25-minute non-public oral exam as an individual examination; if so, this will be announced to the registered students in writing at the end of the registration period. A practical course report in the scope of 20 hours is required prior to the examination. The language of the written exam and the oral exam is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Modelling of Wastewater Systems**
Module number	UW-MGW 203 (MHSE 34)
Module coordinator	Prof. Peter Krebs isi@mail.zih.tu-dresden.de
Learning goals	Students will be familiar with the model approaches, will be able to apply them using software suites, and interpret the results. Through group work on a case study, students will be able to apply the methods and independently handle modeling.
Content	The module provides an overview of modeling approaches and simulation tools for modeling wastewater systems. The module covers the precipitation-runoff process in urban areas, flow and transport in sewer systems, retrofit solutions for rainwater management, biological wastewater treatment, and transport and transformation processes in watercourses. The module also covers the analysis of the effects of decentralized rainwater management. This includes setting up and calibrating a settlement hydrological simulation model and applying it to compare different scenarios and alternative options for rainwater management.
Teaching and learning methods	Lecture 2 hours per week, practical course 2 hours per week plus independent study.
Prerequisites	Participants are required to have knowledge of mathematics, hydrobiology, hydrochemistry, and hydromechanics, as well as basic knowledge of wastewater systems and wastewater and sludge treatment at Bachelor's level.
Applicability	The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected. The module is an elective compulsory module in the Master's degree program Hydro Science and Engineering, which must be chosen in accordance with the annex to the examination regulations.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a seminar paper with a scope of 75 hours. The examination language is English.
Credit points and grades	The module is worth 5 credits. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Drinking Water Supply**
Module number	UW-MGW 204 (MHSE 25)
Module coordinator	Prof. André Lerch isi@mailbox.tu-dresden.de
Learning goals	Students will have theoretical knowledge of the processes regularly used in water treatment plants for drinking water purification and distribution. They will be able to roughly design individual process steps and dimension water distribution systems. They will be familiar with the factors that influence water quality during water treatment, distribution, and storage, can assess quality impairments, and propose measures to remedy them.
Content	The module covers the procedures and processes regularly used in water treatment plants for modern drinking water purification from various raw water sources, as well as the planning and design of drinking water distribution systems and their economical operation.
Teaching and learning methods	Lecture 3 hours per week, practical 1 hour per week, field trip 0.5 days plus independent study.
Prerequisites	Students are required to have knowledge of hydrochemistry, scientific and engineering fundamentals of water treatment and distribution, as well as process and plant engineering fundamentals in hydrosystems at Bachelor's level. Prerequisite literature: Sigg & Stumm (2011): Aquatische Chemie; Benjamin (2002): Water Chemistry; Stumm & Morgan (1996): Aquatic Chemistry; Stevenson (1997): Water Treatment Unit Processes; Crittenden et al. (2012): MWH's Water Treatment: Principles and Design; Hendricks (2002): Fundamentals of Water Treatment Unit Processes: Physical, Chemical, and Biological; Anonymous (National Research Council, 2006): Drinking Water Distribution Systems, Assessing and Reducing Risks; Van Zyl (2014): Operation and Maintenance of Water Distribution Systems; Mays (1999): Water Distribution System Handbook.
Applicability	The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected. The module is an elective compulsory module in the Master's degree program Hydro Science and Engineering, which must be chosen in accordance with the annex to the examination regulations.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a 135-minute written test. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.

Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Aquatic Ecology and Ecotoxicology**
Module number	UW-MGW 205
Module coordinator	Prof. Thomas Berendonk limnologie@tu-dresden.de
Learning goals	Students will be able to classify, link, and evaluate all fundamental areas in water ecology, analysis, and ecotoxicology with regard to water protection and the management of water quality and the state of water bodies.
Content	The issues explained and discussed in this module range from the tasks and principles of water protection, physical, chemical, and biological pollution components, the fundamentals of determining and evaluating water constituents such as natural, anthropogenic, and xenobiotic substances, to the requirements for analytical quality assurance, methods, principles, and strategies of ecotoxicology for the assessment of environmental chemicals, assessment of water body status, methods for controlling the water body status, decision-making tools for controlling, planning, and forecasting the water body status.
Teaching and learning methods	Lecture 3 hours per week, practical course 1 hour per week plus independent study.
Prerequisites	Students are required to have basic knowledge of ecology and the structure and function of water bodies as well as the material conversion processes taking place in them at Bachelor's level.
Applicability	The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a 90-minute written examination and a public oral examination of 20 minutes taken as individual examination. The language of the written exam and the oral exam is English.
Credit points and grades	The module is worth 5 credit points. The module grade is calculated from the weighted average grade of the individual examined assessments. The written exam is weighted three-fold and the oral exam seven-fold.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Conflict Management and Communication**
Module number	UW-MGW 206 (UWFMT34)
Module coordinator	Prof. Lukas Giessen Lukas.Giessen@tu-dresden.de
Learning goals	Students will be able to identify, assess, and analyze land use conflicts based on theory. They will be able to select, adapt, and apply methods and instruments for dealing with these conflicts in practice. They will be familiar with the social and communication science fundamentals of conflict management and will be able to apply ethical standards in their work. Students will be able to manage communication processes between conflicting groups of actors.
Content	The module covers - Theories and concepts of verbal and non-verbal communication - Communication as social behavior - Conflicts as part of social systems - Conflict typologies and conflict diagnosis - Conflict management and transformation - Examples and analysis of land use-related conflicts - Strategies for mediation and moderation - Participation in the context of rural development.
Teaching and learning methods	Seminars 4 hours per week plus independent study.
Prerequisites	Students are required to have social science knowledge at Bachelor's level.
Applicability	The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected. The module is an elective compulsory module in the Master's degree program in Tropical Forestry, of which one must be chosen.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a complex assessment totaling 40 hours. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Reading list	Miall, H., et al. (2011) Contemporary conflict resolution: The prevention, management and transformation of deadly conflicts, 3rd ed. Polity Press. Cambridge. Wilkenfeld, J. et al. (2005) Mediating International Crisis. Routledge, New York. Bercovitch, J. (ed) (2002) Studies in international mediation: Essays in honor of Jeffrey Z. Rubin. Macmillian, New York. Kalyvas, S. (2006) The logic of violence in civil wars. Cambridge University Press, Cambridge.

Module name	**Applied Watershed Management**
Module number	UW-MGW 207
Module coordinator	Prof. Jürgen Stamm Juergen.Stamm@tu-dresden.de
Learning goals	Students will be familiar with modeling hydrological and hydraulic processes and sediment transport using advanced software. Through the integration of GIS, remote sensing data, and computer-aided tools, they can analyze the effects of land use, flow behavior, and sediment dynamics and acquire the ability to transform data into actionable insights for sustainable watershed management.
Content	This module covers software-based modeling of hydrological, hydraulic, and sedimentological processes, using GIS for pre-processing and post-processing. Students use HEC-HMS, HEC-RAS, and Basement for water runoff estimation, flow simulation, and sediment transport analysis, including water balance, flood modeling, and erosion dynamics. Scenario-based assessments take climate and land use changes into account. Through practical case studies and hands-on exercises, students acquire skills in simulation, analysis, and sustainable watershed management.
Teaching and learning methods	Lecture 1 hour per week, practical course 2 hours per week plus independent study.
Prerequisites	Students are required to have advanced knowledge of hydrology, hydraulic engineering, and mathematical statistics at Bachelor's level.
Applicability	The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a seminar paper with a scope of 60 hours. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Water Extremes – Risk Assessment and Management**
Module number	UW-MGW 208 (MHSE 23)
Module coordinator	Prof. Jochen Schanze Jochen.Schanze@tu-dresden.de
Learning goals	Students will know about the task components of flood risk management, the underlying scientific concepts, and the relevant methods for managing them.
Content	The module covers the task components of analyzing, assessing, and reducing the risks posed by the natural hazard of flooding, as well as risk management as a process with its institutional context, using the latest international scientific concepts and methods. In detail, the module covers: Exposure and vulnerability analyses for various receptors, e.g. building structures, using remote sensing, geoinformation systems, and field surveys; formal and thematic statistical risk analyses; model-based scenario analyses for climate change and societal change; risk assessments including cost-benefit analyses; biophysical and other measures and instruments for risk reduction; stakeholders, strategies, and legal foundations of risk management.
Teaching and learning methods	Lecture 2 hours per week, practical 6 hours per week plus independent study.
Prerequisites	Students are required to have basic knowledge of water management and flood risk assessment.
Applicability	The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected. The module is an elective compulsory module in the Master's degree program Hydro Science and Engineering, which must be chosen in accordance with the annex to the examination regulations.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a 90-minute written examination and a portfolio of 20 hours. The examination language is English in each case.
Credit points and grades	The module is worth 10 credit points. The module grade is calculated from the weighted average grade of the individual examined assessments. The exam grade is weighted twice and the portfolio grade is weighted once.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 300 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Numerical Methods for Hydrosciences**
Module number	UW-MGW 209 (MHYWI02)
Module coordinator	Prof. Bernhard Vowinckel bernhard.vowinckel@tu-dresden.de
Learning goals	Students will be familiar with various methods for finding numerical solutions to systems of equations that cannot be solved analytically. They will also know examples from hydrosciences where such issues arise. Students will be able to apply numerical methods to issues in hydroscience themselves in order to integrate the underlying partial differential equations in space and time using software they have written themselves, analyze this software for its solution behavior, and present the results.
Content	The module covers issue formulation for hydrosystems, numerical methods for integrating partial differential equations, discretization schemes in space and time, formulation of initial and boundary conditions, interpolation methods, setting up linear equation systems, solution algorithms for such equation systems using self-written software, and independent work on an issue in hydroscience.
Teaching and learning methods	Lecture 2 hours per week, practical 2 hours per week plus independent study.
Prerequisites	Students are required to have knowledge of higher mathematics and physics at Bachelor's level.
Applicability	The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected. The module is an elective compulsory module in the Master's degree programs Hydro Science and Engineering, Water Management, and Hydrology, which must be selected in accordance with the annex to the respective examination regulations.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a seminar combined term paper with a scope of 50 hours. The examination language is German or English, at the student's discretion.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Hydrodynamics**
Module number	UW-MGW 210 (MHSE 20)
Module coordinator	Prof. Reinhard Pohl Reinhard.Pohl@tu-dresden.de
Learning goals	Students will be able to identify non-stationary and special hydromechanical problems, model them using appropriate calculation methods, and describe them qualitatively and quantitatively. Students will be able to independently solve relevant hydromechanical issues and work on them in an interdisciplinary context.
Content	The module covers non-stationary, sudden and gradual changes in water movement under pressure and with a free surface, as well as their description and calculation. It also covers numerical or physical modeling of unsteady flow processes.
Teaching and learning methods	Lecture 1 hours per week, practical 1 hour per week, practical course 2 hours per week plus independent study.
Prerequisites	Participants are required to have knowledge of higher mathematics and physics at Bachelor's level.
Applicability	The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected. The module is an elective compulsory module in the Master's degree program Hydro Science and Engineering, which must be chosen in accordance with the annex to the examination regulations.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a portfolio with a scope of 60 hours. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	**Statistics**
Module number	UW-MGW 211 (MHSE 01)
Module coordinator	Dr. Thomas Petzoldt limnologie@tu-dresden.de
Learning goals	Students will be familiar with statistical methods, analyses, and procedures and will be able to work on problem-oriented questions using statistical methods and procedures using selected software.
Content	The module covers descriptive statistics, discrete and continuous probability distributions, confidence intervals, hypothesis testing, linear and nonlinear regression analysis, variance analysis, and AIC/BIC-based model selection, as well as the fundamentals of time series analysis. It also includes the practical implementation of statistical analyses of data examples from the hydrosciences using a scripting language and the proper interpretation of the results.
Teaching and learning methods	Lecture 2 hours per week, practical 2 hours per week plus independent study.
Prerequisites	Participants are required to have basic knowledge of engineering mathematics, in particular linear equation systems and probability theory, active computer skills, especially in spreadsheets, and basic knowledge of a programming environment at Bachelor's level.
Applicability	The module is a compulsory module in the Master's degree program Hydro Science and Engineering. The module is an elective compulsory module in the Master's degree program Groundwater and Global Change - Impacts and Adaptation, from which modules worth 10 credit points must be selected.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a 90-minute written test. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Annex 2:
Study schedule
including type and scope of the courses in hours per week (SWS) as well as required academic work, the type and design of which can be found in the module descriptions

Module number	Module name	1st semester[1]	2nd semester[1]	3rd semester	4th semester	LP
		V/Ü/S/P/E	V/Ü/S/P/E	V/Ü/S/P/E	V/Ü/S/P/E	
Modules of the compulsory field						
UW-MGW 101	Study Project Integrated Water Resources Management (IWRM)			1/1/0/4/0 PL		10
UW-MGW 102	Climate Systems and Climate Modelling			3/1/0/0/0 PL		5
UW-MGW 103	Soil Water			2/1/0/1/0 2xPL		5
Modules of the elective compulsory field[2]						
UW-MGW 201	Integrated Water Resources Management			0/2/0/0/1.5 PL		5
UW-MGW 202	Water Quality and Water Treatment			2/0/0/2/0 PVL, PL		5
UW-MGW 203	Modelling of Wastewater Systems			2/0/0/2/0 PL		5
UW-MGW 204	Drinking Water Supply			3/1/0/0/0 0.5 day field trip PL		5
UW-MGW 205	Aquatic Ecology and Ecotoxicology			3/0/0/1/0 2xPL		5
UW-MGW 206	Conflict Management and Communication			0/0/4/0/0 PL		5

Module number	Module name	1st semester[1]	2nd semester[1]	3rd semester	4th semester	LP
		V/Ü/S/P/E	V/Ü/S/P/E	V/Ü/S/P/E	V/Ü/S/P/E	
UW-MGW 207	Applied Watershed Management			1/0/0/2/0 PL		5
UW-MGW 208	Water Extremes – Risk Assessment and Management			2/6/0/0/0 2xPL		10
UW-MGW 209	Numerical Methods for Hydrosciences			2/2/0/0/0 PL		5
UW-MGW 210	Hydrodynamics			1/1/0/2/0 PL		5
UW-MGW 211	Statistics			2/1/0/0/0 PL		5
					Final thesis	25
					Colloquium	5
LP		**30**	**30**	**30**	**30**	**120**

V Lecture (*Vorlesung*)
Ü Practical (*Übung*)
S Seminar (*Seminar*)
P Practical course
E Field trip (*Exkursion*)
SWS Hour(s) per week
PVL Preliminary academic work
PL Examined assessment (*Prüfungsleistung*)
LP Credit points

[1] As part of the cooperation agreement with the IHE Delft Institute for Water Education and Instituto Superior Técnico Universidade de Lisboa, students are required to commence their studies at one of the cooperation partners and, after the first year of study, continue and, if applicable, complete their studies at TUD Dresden University of Technology.

[2] One or two modules totaling 10 credit points must be selected.