Stand: 30. March 20 um 11:25

Module Catalogue Part (b)

for the Master Program in Geoscience, with majors in Geology, Geophysics and Mineralogy/Petrology at the University of Potsdam

Content

Module descriptions of the Master programs

(1) Master Program in Geoscience majoring in Geology
(2) Master Program in Geoscience majoring in Geophysics
(3) Master Program in Geoscience majoring in Mineralogy/Petrology

Explanation

This manual provides information about the structural organization of the Master program (see §30, §36 as well as appendices 1-5 of the Ordnung „Geowissenschaften"), the description of the individual modules (including responsible party, courses of study, learning aims, course contents etc.). The responsible party as well as additional listed persons are entitled to examine students. The module code provided consists of a combination of letters reflecting the structural organization of the Master program as well as a sequential number. The following abbreviations are used here:

MScP	Masterstudium Pflichtmodul (Required Module)
MGEP	Masterstudium Vertiefungsrichtung Geologie Pflichtmodul (Required Module, major Geology)
MGPP	Masterstudium Vertiefungsrichtung Geophysik Pflichtmodul (Required Module, major Geopysics)
MMPP	Masterstudium Vertiefungsrichtung Mineralogie/Petrologie Pflichtmodul (Required Module, major Mineralogy/Petrology)
MWP	Masterstudium Wahlpflichtmodul (Elective Module, chosen from a given list)
MW	Masterstudium Wahlmodul (Elective Module)

The current offer as well as the relevant dates for each Module are available in the course catalog of the University. Examination dates and other relevant information will be announced at PULS (https://puls.uni-potsdam.de/) and at the beginning of each individual module and are available at Moodle2 (https://moodle2.uni-potsdam.de).

Module title	**MScP01 Project Practical**
Responsible party	Prof. Dr. M. Wilke , Prof. Dr. J. Tronicke, apl. Prof. Dr. M. Trauth
Additional teaching staff	Department teaching staff
Semester	3
Language	German/ English (by arrangement)
Exam/Grading	Written report (not graded)
Credit points	12
Number of participants	Unlimited
Recommended Back-ground	None
Course Type	Practical training
Educational goals	In-depth practical knowledge in selected areas of geosciences. Studying and practicing presentation techniques
Module contents	Supervised field-, industrial, laboratory or computer-internship in a chosen field of geosciences. Preparation and presentation of the achieved results
Workload	360 h total workload (30 h x 12 LP = 360 h) 280 h (35 days) Supervised internship 24 h internship search and application 40 h preparation of internship report 14 h preparing presentations 2 h seminar presentation
Teaching materials	Special materials on the website of the course
Literature	-

Module title	**MScP02 Seminar/Colloquium Geosciences**
Responsible party	apl. Prof. Edward Sobel, PhD
Additional teaching staff	apl. Prof. Dr. U. Altenberger, Prof. Dr. B. Bookhagen, Prof. Dr. E. Eibl, apl. Prof. Dr. F. Krüger, Prof. Dr. M. Mutti, Prof. Dr. P. O'Brien, Prof. M. Strecker, PhD, apl. Prof. Dr. M. Trauth, Prof. Dr. J. Tronicke, Prof. Dr. M. Wilke, Lehrkörper des Instituts
Semester	1, 2 and 3 (Part I); 1, 2 or 3 (Part 2); 2 or 3 (Part 3)
Language	German/ English (by arrangement)
Exam/Grading	Module exam: presentation of a master's project outline in a research group seminar (not graded). Qualification coursework: weekly comments on lectures of invited speakers in the colloquium (online, in groups)
Credit points	6
Number of participants	Unlimited
Recommended Background	None
Course Type	Colloquium, discussions and research group seminar
Educational goals	Understanding complex interrelationships in the Earth System
Module contents	Actual research topics from the field of geosciences.
Workload	180 h total workload (30 h x 6 LP = 180 h) 30 h Colloquium and discussions (in a semester) 30 h Preparation of comments about the colloquium lectures (online) 30 h Research group seminar (during two semesters) 90 h Preparation and presentation of the master's project outline
Teaching materials	Lectures
Literature	Material for the course is provided on the course internet page

Module title	**MScP03 Master Project**
Responsible party	apl. Prof. Dr. Martin Trauth, Prof. Dr. Jens Tronicke
Additional teaching staff	Department teaching staff
Semester	3, 4 (Part I); 4 (Part II)
Language	German/English (by arrangement)
Exam/Grading	Written Master thesis, passed oral presentation
Credit points	30
Number of participants	Unlimited
Recommended Back-ground	None
Course Type	Own work, scientific work under direction in the field and in the laboratories (good scientific praxis, safety reasons), Colloquium/Seminar
Educational goals	Understanding complex interrelationships in Earth Systems
Module contents	Part I: MSc Project Part II: Presentation of the MSc project
Workload	900 h total workload (30 h x 30 LP = 900 h) 840 h MSc project 40 h Preparation of MSc project presentation and presentation within the Master Projects Colloquium
Teaching materials	Presentations
Literature	-

Module title	**MGEP04 Geodynamics and Neotectonics**
Responsible party	Prof. M. Strecker, PhD
Additional teaching staff	S. Riedl, additional department teaching staff
Semester	1 or 2
Language	English
Exam/Grading	Written exam and/or final class report based on field project
Credit points	6
Number of participants	25
Recommended Back-ground	Fundamental knowledge in the Earth sciences (BS equivalent)
Course Type	Lecture, practicals in the classroom and in the field
Educational goals	Understanding the geodynamic characteristics of plate boundaries and continental interiors; principles of landscape evolution; evaluation of seismically and tectonically active regions
Module contents	The module provides an introduction into the field of neotectonics and highlights the synergies with related disciplines. Different geodynamic environments will be introduced and the characteristics of tectonic stress fields in the Earth's crust will be discussed in combination with typical structural and geologic features. In addition, the course investigates the couplings between tectonics, climate and surface processes.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and practicals 40 h field practicals 95 h own reading, exercises and preparation for the exam
Teaching materials	Scientific articles, books, materials posted on the course website
Literature	Burbank, D., Anderson, R., 2011, Tectonic Geomorphology, Academic Press; Yeats, Sieh and Allen, 1997, The Geology of Earthquakes, Oxford University Press; additional materials will be posted on the course website

Module title	**MGEP05 Sedimentary Basins**
Responsible party	Prof. Dr. M. Mutti
Additional teaching staff	Department teaching staff
Semester	1 (or 2 for the field practical)
Language	Deutsch/Englisch,
Exam/Grading	Written or oral exam, Essay
Credit points	6
Number of participants	25
Recommended Back-ground	Fundamental concepts regarding depositional processes and stratigraphy
Course Type	Lecture, practicals in the classroom and in the field
Educational goals	Advanced knowledge of depositional processes and basin-fill stratigraphy
Module contents	Students will acquire in-depth knowledge of the methods of basin analysis, with a particular focus on carbonate systems. The role of subsidence, sea-level fluctuations and climate changes in affecting basin-fill stratigraphy will be discussed. During practicals, students will acquire knowledge of the prin-ciples of basin- fill and the processes controlling different environments of deposition and their spatial distribution.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and practicals 135 h Own reading, exercises and preparation fort the exam
Teaching materials	Books and reading materials of the internet pages of the department
Literature	Allen, P.A., Allen, J. R. , 2005, Basin analysis: principles and applications, Blackwell. Tucker, M., 1991, Carbonate Sedimentology, Blackwell. See also course website

Module title	**MGPP03 Theory of elastic waves**
Responsible party	Prof. M. Weber, apl. Prof. Dr. F. Krüger
Additional teaching staff	Department teaching staff
Semester	1
Language	German/ English (by arrangement)
Exam/Grading	Written or oral exam or homework (by arrangement)
Credit points	6
Number of participants	Not limited
Recommended Back-ground	None
Course Type	Lecture, exercise
Educational goals	Understanding of the theoretical fundamentals of excitation, propagation and conversion of seismic body waves in simple layered media.
Module contents	Starting from basic laws of elastodynamics the excitation and propagation of seismic body waves in homogeneous and layered media is presented. Furthermore reflection and conversion of compressional and shear waves at boundaries and the implications for waveforms is given.
Workload	Total workload 180 h (30 h x 6 ECTS = 180 h) 45 h lecture and exercise 135 h follow-up and preparation of exam
Teaching materials	Teaching material can be found on the internet page
Literature	Müller, G., Theory of elastic waves, Samisdat Verlag, GFZ Aki, K. and P.G. Richards: Quantitative seismology – theory and methods, 2nd edition, University Science Books Landau, L.D. And E.M. Lifschitz: Elastizitätstheorie, Akademie Verlag, Berlin, 1977. Sommerfeld, A.: Mechanik der deformierbaren Medien, Akad. Verlagsgesell-schaft, Leipzig, 1964. Kennett, B.L.N.: The seismic wave field (2 volumes), Cambridge University Press, Cambridge, 2002

Module title	**MGPP04 Geophysical Inversion: Theory and Applications**
Responsible party	Dr. M. Ohrnberger
Additional teaching staff	Dr. H. Paasche, Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Oral or written exam or term paper (by arrangement)
Credit points	6
Number of participants	Unlimited
Recommended Background	Fundamentals in mathematics and geophysics as taught in modules 'Mathematik I' and 'Mathematik II' and modules 'Grundlagen Allgemeine Geophysik' and 'Grundlagen Angewandte Geophysik' (BSc Geowissenschaften).
Course Type	Lectures and exercises
Educational goals	Understanding of underlying concepts of (non-)linear inversion theory like intrinsic connection between observables of an experiment (data) and abstract model of real world given as (eventually simplified) description of the problem's physics and its driving parameters. Enabling the student to find/develop appropriate tools for tackling practical inversion problems and to explore problems arising from characteristics of chosen inversion algorithms.
Module contents	Discrete linear inversion theory: Concept of length measures for minimizing prediction errors and/or solution length of a problem. Concept of generalized inverse Problem of non-uniqueness non-linear inversion problems: Linearization of problem directed and undirected search algorithms. Applications: Model discretization and effects on solution Model regularization Concept of experimental design Local and global inversion procedures.
Workload	180 h Total Workload (30 h x 6 LP = 180 h) 67,5 h Lectures and Exercises 112,5 h Post-preparation time (homework) and preparation for exam
Teaching materials	Lecture and exercise materials on institute's moodle platform. Programming tasks and computer exercises.
Literature	Menke, W., Geophysical Data Analysis: Discrete Inverse Theory, Rev. ed., International Geophysics Series, Vol 45, Academic Press, New York

Module title	**MMPP03 Advanced petrology and geochemistry I**
Responsible party	Valby van Schindel
Additional teaching staff	Department teaching staff
Semester	1
Language	German/Englisch (by arrangement)
Exam/Grading	Module examination: written examination about lectures and exercises
Credit points	6
Number of participants	Unlimited
Recommended Back-ground	-
Course Type	Lectures, exercises, homework
Educational goals	Application of the fundamentals of petrology and geochemistry, principles of thermodynamics and petrological phase theory, modeling of melts and solid-state reactions in the pressure-temperature space
Module contents	Fundamentals of thermodynamics, phase relations in igneous systems, over-view of experimental petrology, activity models, geothermometry
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h follow-up and preparation
Teaching materials	Textbooks, exercise sheets
Literature	Philpots & Ague 2009, Principles of Igneous and Metamorphic Petrology, 2nd Edition, Cambridge

Module title	**MMPP04 Advanced Petrology and Geochemistry II**
Responsible party	Prof. Dr. P. O'Brien
Additional teaching staff	Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Essay, lecture-free period
Credit points	6
Number of participants	-
Recommended Back-ground	Advanced petrology and geochemistry I
Course Type	Lectures and practicals
Educational goals	With the aid of macro- and microscopic properties and analyses of major and trace elements and isotopes students can explain the evolution of crystalline rocks with scientific argumentation.
Module contents	Kinetics and disequilibrium, order and rate of reaction, activation energy, material transport, diffusion, crystal growth, reaction textures, theoretical and practical aspects of isotopes in the Earth system, crust–mantle development, problems in isotope geology and analysis
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h follow-up and preparation
Teaching materials	Books, worksheets, computer exercises
Literature	Lasaga A.C. , Kinetic theory in the Earth Sciences (Princeton) White, W.M. (Cornell University), Geochemistry (online

Module title	**MGMWP01 Field School A**
Responsible party	Prof. M. Strecker, PhD
Additional teaching staff	apl. Prof. Dr. U. Altenberger, Dr. G. Zeilinger, Department teaching staff
Semester	1 oder 2
Language	German/ English (by arrangement)
Exam/Grading	Report (not graded)
Credit points	6
Number of participants	limited
Recommended Back-ground	Profound knowledge in tectonics, paleoclimatology, petrology and sedimen-tology
Course Type	Field school
Educational goals	Recognition and characterization of tectonically controlled landforms and sedimentary environments; evaluation of geodynamic settings using petrological observations; characterization and kinematic evaluation of fault systems; recognition and characterization of paleoclimate archives; differen-tiation of climatic and tectonic forcing in landscape and sedimentary basin evolution; assessing tectonics, climate, biosphere and surface-process rela-tionships
Module contents	The participants will learn how to correctly interpret and assess fault zones in different environments. This process will be aided by using aerial photogra-phy and satellite imagery and detailed field inspection. The focus of this course will alternate between climate and tectonics-related problems and petrological issues. Complex fault zones will be analyzed and geodynamic interpretations will be made based on structural and geological observations; an additional aspect of this course is the identification and interpretation of paleoclimate- related phenomena in the field.
Workload	180 h Total Workload (30 h x 6 LP = 180 h) seminar, report, field work
Teaching materials	Maps, satellite imagery, specific scientific papers, material on the course website
Literature	Material will be posted on the course website

Module title	**MGEWP02 Field School B: Sedimentary Basins**
Responsible party	Prof. Dr. Maria Mutti, Dr. S. Tomas
Additional teaching staff	Department teaching staff
Semester	1 or 2
Language	English
Exam/Grading	Seminar presentation and field report (not graded)
Credit points	6
Number of participants	Max 25
Recommended Back-ground	Fundamental concepts of sedimentology, stratigraphy and general geology, good mapping and field skills.
Course Type	Field exercise and Seminar
Educational goals	Application of mapping field methods, interpretation of complex sedimentological and stratigraphic structures. Writing a concise field report.
Module contents	Stratigraphic sequences and properties of sedimentary rocks, advanced interpretation of sedimentary rocks in the field, principles of basin analysis, influence of geological processes in the biosphere (e.g. paleoclimate, mass extinctions, sea-level fluctuations, environmental changes).
Workload	180 h Total workload (30 h x 6 LP = 180 h) 20 h Seminar and preparation of Seminar presentation 100 h field exercise 60 h writing of mapping report
Teaching materials	Textbooks, presentations, exercises, rock and mineral samples, geological maps and additional material from the course website
Literature	Stow, D.A.V., 2005, Sedimentary Rocks in the Field: A Color Guide, Elsevier.

Module title	**MGEW01 Scientific Communication**
Responsible party	Prof. Dr. M. Mutti
Additional teaching staff	Department teaching staff
Semester	1 or 3
Language	English
Exam/Grading	Examination: Oral presentation or written report
Credit points	6
Number of participants	10
Recommended Back-ground	-
Course Type	Seminar, Practicals, Homework
Educational goals	Presentation of own research results
Module contents	This Seminar offers the possibility to learn how to present scientific results of internships and Master Projects as well as to be introduced into new and ongoing research projects of the Department in the areas of sedimentology and stratigraphy. The quality of the presentations and/or the reports will be discussed and suggestions for improvement will be made.
Workload	180 h total workload (30 h x 6 LP = 180 h)
Teaching materials	Course materials on the website of the course, publications, presentations of the participants, PowerPoint presentations, reports
Literature	

Module title	**MGEW02 Modern Carbonate Environments**
Responsible party	Dr. Sara Tomás, Dr. J. Kallmeyer, Prof. Dr. M. Mutti
Additional teaching staff	Department teaching staff
Semester	1, every two years
Language	German/ English (by arrangement)
Exam/Grading	Seminar presentation
Credit points	6
Number of participants	Not limited
Recommended Back-ground	Fundamental concepts in Geology. Attendance to the course Sedimentary Basins is recommended.
Course Type	Lectures, Seminar, Presentations by the students, Fieldtrip
Educational goals	Presentation of scientific results and discussions related to the topic Modern Carbonates
Module contents	Carbonate depositional environments as well as physical and biological processes, involve in the formation of sedimentary rocks. The participants will present research topics based on international scientific papers. The pre-sented talks will be discussed by all participants. Following, the quality of the talk and discussion will be evaluated.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h own reading and preparation for the exam
Teaching materials	Books and reading materials of the internet pages of the department, Publica-tions, Power Point presentations
Literature	Tucker, M., 1991, Carbonate Sedimentology, Blackwell

Module title	**MGEW03 Petroleum Geology**
Responsible party	Prof. Dr. M. Mutti, Dr. Robert Ondrak, Dr. Gerd Winterleitner
Additional teaching staff	Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Oral/written exam
Credit points	6
Number of participants	
Recommended Back-ground	Participation in Module Sedimentary Basins
Course Type	Lecture, Exercises, Practical
Educational goals	Introduction to Petroleum Geology. Knowledge of basic concepts in integrated basin analysis, including reservoir characterization, source rocks and organic geochemistry of petroleum, hydrocarbon migration and traps, presentation of own work related to the topic .
Module contents	This course will provide an overview over the geological conditions and processes that lead to the development of petroleum reservoirs. Students will become familiar with the key definitions used in Exploration Geology as well as with commonly used exploration methods. In this course, participants will be shown how multi-disciplinary (geophysical and geological) data are used to develop 3D numerical models that integrate the characteristic relations between the sedimentary basin fill and petroleum generation and migration.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h own pre- and post-reading, exercises, and exam preparation
Teaching materials	Course notes, Scientific literature, Exercise sheets
Literature	Richard C. Selley, 1998, Elements of Petroleum Geology, Academic Press. Petroleum Geoscience - From Sedimentary Environments to Rock Physics, 2015, Knut Bjorlykke (Ed.) Springer Verlag Petroleum and Basin Evolution - Insights from Petroleum Geochemistry, Geology and Basin Modeling, 1997, D. H. Welte, B. Horsfield, D.R. Baker (Eds.) Springer Verlag Fundamentals of Basin Modeling and Petroleum Systems Modeling, 2009, Thomas Hantschel, Armin Kauerauf, Springer Verlag Basin Analysis: Principles and Application to Petroleum Play Assessment, 2013, Ph. A. Allen, J. R. Allen, Wiley Principles of Sedimentary Basin Analysis, 2000, A. D. Miall, Springer Verlag Sedimentary Basins, 2000, G. Einsele, Springer Verlag

Module title	**MGEW04 Events in Earth History**
Responsible party	Prof. Dr. M. Mutti, Dr. S. Tomas
Additional teaching staff	Department teaching staff
Semester	1, every two years
Language	German/English (by arrangement)
Exam/Grading	Seminar talk and written/oral exam
Credit points	6
Number of participants	Unlimited
Recommended Back-ground	Fundamental concepts of stratigraphy and sedimentology
Course Type	Lectures, exercises, student oral presentations
Educational goals	Advanced knowledge in stratigraphy, Earth History and sedimentology. Skills in oral presentation and scientific discussion
Module contents	Students will acquire knowledge in events in Earth´s history and their impact on the geo- and biosphere (e.g. climate change, mass extinctions); students will give oral presentations, which will be discussed.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h own pre- and post-reading, exercises, and exam preparation
Teaching materials	Reading materials on the internet pages of the institute.
Literature	Kiessling, W., Flügel, E., Golonka, J., 2002, Phanerozoic Reef Patterns, SEPM Spec. Publ., Courtillot, V.E., Renne, P.R., 2003, On the ages of flood basalt events, C.R. Geosciences.

Module title	**MGEW05 Advanced Sedimentary Petrology**
Responsible party	Dr. S. Tomás
Additional teaching staff	Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Written or oral exam with practical interpretation of thin sections regarding the contents of the lectures and exercises
Credit points	6
Number of participants	20
Recommended Back-ground	Attendance to the course Introduction to Sedimentary Petrology. Attendance to the course Sedimentary Basins is recommended.
Course Type	Lectures, exercises, practical
Educational goals	Analysis of Sedimentary rocks with thin sections and other techniques
Module contents	In this course students will acquire knowledge of Petrography and Sedimentary rocks, with a particular focus on Carbonate rocks. The criteria to characterize the petrophysical properties as well as paleoenvironments, biogenic components and/or diagenetic processes of these rocks will be explained.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h own reading and preparation for the exam
Teaching materials	Books and reading materials of the internet pages of the department, Exercise
Literature	Flügel, E., 2004, Microfacies of Carbonate Rocks, Springer Verlag

Module title	**MGEW06 Subsurface Hydrology**
Responsible party	Prof. Dr. S. Oswald
Additional teaching staff	
Semester	
Language	
Exam/Grading	
Credit points	
Number of participants	
Recommended Back-ground	
Course Type	
Educational goals	
Module contents	
Workload	
Teaching materials	
Literature	

Module title	**MGEW07 Geological 3D-Modeling**
Responsible party	Prof. Dr. Maria Mutti
Additional teaching staff	Dr. M. Cacace, Department teaching staff, external academics
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Written or oral exam, report
Credit points	6
Number of participants	14
Recommended Back-ground	Participation in Modules Sedimentary Basins, Special Topics in Basin Analysis and basic understanding of basin analysis
Course Type	Lecture, Practicals
Educational goals	Conceptual preparation, planning, execution and report on a modelling pro-ject
Module contents	This course gives an overview on different modelling concepts and basic tools for integrated basins analysis. A first block-course will provide an in-troduction to geological 3D-modelling with Petrel or other Software, possi-bilities to use these tools for visualization of field data or for reservoir mod-elling. The second block course is focused on the integration of different types of data into lithosphere-scale 3D structural models. Characteristic structural relations between sediment fill, crust and lithosphere for different basin types and effects on the thermal field and the isostatic state are evalu-ated.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and Exercises 135 h preparation, review and exam preparation
Teaching materials	Books, materal available online, practice sheets
Literature	-

Module title	**MGEW08 Special Topics in Basin Analysis**
Responsible party	Prof. Dr. M. Mutti, Dr. S. Tomas,
Additional teaching staff	Dr. M. Cacace, Department teaching staff, external academics
Semester	1
Language	German/ English (by arrangement)
Exam/Grading	Written/oral examination, homework
Credit points	6
Number of participants	
Recommended Back-ground	Basic knowledge on sedimentary basins
Course Type	lectures/exercises, seminar
Educational goals	Knowledge of basic concepts for integrated basin analysis, presentation of own work related to the topic.
Module contents	This course gives an overview on different dynamic aspects of sedimentary basins, including modelling concepts and basic tools for integrated basins analysis. To predict the occurrence of geo-resources and to sustainably use the latter, it is important to understand the geodynamic aspects of sedimentary basins on different spatial and temporal scales. Contents of the lectures/exercises include characteristic structural relations between sediment fill, crust and lithosphere for different basin types and effects on the thermal field and the isostatic state; discussion of different rift models, basics of structural and subsidence analysis, internal versus external deformation mechanisms (halokinetics versus regional tectonics), seismic interpretation of typical structural examples and integration of different types of data. The seminar opens the possibility to present own results in the frame of internships, master-, diploma- or PhD theses but also to join new or ongoing research projects in the sedimentology and stratigraphy. The seminar entails a concluding discussion of the presented work with suggestions for improvements.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and Exercises 135 h preparation, review and exam preparation
Teaching materials	Books, material available online, practice sheets
Literature	-

Module title	**MGEW09 Advanced Remote Sensing**
Responsible party	Prof. Dr. L. Guanter
Additional teaching staff	Dr. K. Segl
Semester	2
Language	English
Exam/Grading	Successful elaboration of projects incl. written reports & final exam
Credit points	6
Number of participants	20
Recommended Back-ground	Basic IT/programming knowledge
Course Type	Lectures on fundamentals and methods in optical remote sensing and hands-on image processing exercises
Educational goals	The students must acquire basic knowledge of the current scenario of optical remote sensing for land applications. The students must develop the skills to interpret and evaluate optical remote sensing data with existing remote sens-ing software packages. The students must be able to implement data process-ing methods for the retrieval and visualization of geophysical information from optical remote sensing images.
Module contents	Overview of current satellite-based optical instruments and measurement principles for land monitoring. Data processing and information extraction techniques in optical remote sensing: atmospheric and geometric correction, image classification, multi-temporal analysis. Practical use of optical remote sensing for applications such as assessment of vegetation condition, land cover mapping, and hazard monitoring.
Workload	180 h total workload (30 h x 6 LP = 180 h) 22.5 h lectures in optical remote sensing (2 SWS, 1.5 h/week for 15 weeks; 22.5 h hands-on exercises (2 SWS, 1.5 h/week for 15 weeks.); 135 h preparatory efforts for lectures, exercises and homework and exam
Teaching materials	Lecture materials (via Internet); textbooks; publications; modern computer pools with advanced software modules; datasets from various sources with different relevant content.
Literature	Remote Sensing in Geology, B.S. Siegal and A.R. Gillespie, J. Wiley & Sons. Imaging Spectrometry, Basic Principles and Digital Processing, Freek D. van der Meer, Kluwer Academic Publisher

Module title	**MGEW10 From Source to Sink: Sedimentary Systems in Orogens and Rifts**
Responsible party	apl. Prof. E. Sobel, PhD, Prof. Dr. T. Schildgen
Additional teaching staff	Prof. M. Strecker, PhD
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Exam and/or exercises based on the content of the lectures. Students must achieve at least 60% of the points in order to take the exam. Points are based on the exercises and a seminar presentation.
Credit points	6
Number of participants	15
Recommended Back-ground	None
Course Type	Lectures and guided seminars and/ or exercises
Educational goals	Understanding and linking mass transport at both the source (orogen and rift) as well as the sink (sedimentary basins) over a range of spatial and temporal scales.
Module contents	During this course, students will learn about quantifying chemical and physical erosion in the source area, sedimentary basin analysis, and methods to quantify links between the source and the sink. Specific topics will include cosmogenic nuclide analysis, thermochronology, basin analysis, mass balance approaches and provenance analysis.
Workload	180 h Total Workload (30 h x 6 LP = 180 h) 45 h Lectures and exercises 135 h Reading and solving exercises in order to comprehend material
Teaching materials	Material for the course is provided on the course internet page.
Literature	

Module title	**MGEW11 Advanced Geologic Mapping Course**
Responsible party	Dr. G. Zeilinger
Additional teaching staff	Department teaching staff
Semester	2
Language	German and/or English
Exam/Grading	Seminar presentation and field report
Credit points	6
Number of participants	max 20
Recommended Back-ground	Advanced mapping skills, knowledge in petrology and geology.
Course Type	Field exercise and seminar
Educational goals	Detailed mapping and interpretation of complex structures in strongly de-formed regions and writing of a concise mapping report.
Module contents	Training in a new area and application of methods in structural geology and petrology in the field and during data analysis; independent mapping of complex geological and tectonic structures in strongly deformed regions; sample collection for structural analysis, preparation of a professional report.
Workload	180 h Total workload (30 h x 6 LP = 180 h) 20 h Seminar and preparation of Seminar presentation 100 h field exercise 60 h writing of mapping report
Teaching materials	Textbooks, presentations, exercises, rock and mineral samples, geological maps and additional material from the course website.
Literature	-

Module title	**MGEW12 Biogeochemistry**
Responsible party	Dr. D. Sachse, Dr. J. Kallmeyer
Additional teaching staff	Department teaching staff
Semester	2
Language	German/English by arrangement
Exam/Grading	Oral Exam and/or exercises and/or report and/or seminar presentation
Credit points	6
Number of participants	limited (10) due to lab space constraints
Recommended Back-ground	Basic knowledge in chemistry
Course Type	Laboratory block practical (2 weeks, during semester break after winter semester) including lectures (1.5 h) and seminar (0.75 h) during summer semester
Educational goals	Basic Understanding of the feedbacks between biological and geological processes. Introduction into the Biomarker Concept and Introduction into important biogeochemical methods.
Module contents	The module teaches the basics about global biogeochemical cycles during the present and the reconstruction of biogeochemical cycles during the geological past. In this module we provide an introduction into the most important concepts and models and also study specific problems using case studies. During the seminar we exclusively review case studies when we discuss publications from the literature. In the laboratory practical course we use a diverse set of organic geochemical and biogeochemical tools to study a specific example.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and exercises 135 h Reading and solving exercises in order to comprehend material
Teaching materials	Books, peer-reviewed publications, material provided on the web page of the module, exercises
Literature	Rollinson, 2007, Early Earth Systems, Blackwell Engel, Macko, 1993, Organic Geochemistry, Plenum Killops & Killops 2008, Introduction to Organic Geochemistry, Blackwell

Module title	**MGEW13 Paleoclimate Dynamics**
Responsible party	Dr. S. Kaboth-Bahr, apl. Prof. Dr. M. Trauth
Additional teaching staff	apl. Prof. Dr. B. Diekmann, Department teaching staff
Semester	Optional
Language	German/ English (by arrangement)
Exam/Grading	Written report and presentation
Credit points	6
Number of participants	Unlimited
Recommended Back-ground	Bachelor Course on Paleoclimate
Course Type	Lectures and Exercises
Educational goals	- Overview and critical assessment of paleoclimate and paleoenvironmental archives as well as selected environmental and climate proxies (geochemical and isotopic, mineralogical and paleontological proxies). - Knowledge of access and application of international palaeoclimatic databases, data comparisons and data presentation - Independent, problem-oriented scientifically work, predominantly in groups.
Module contents	This lecture provides a basic for understanding the factors and processes that initiated fundamental changes within the world oceans throughout the geological past. The following topics are covered: - Introduction to Marine Geology - The role of the Ocean in the Climate system - Archives and proxies of paleoceanography - Changes of the world oceans on orbital to decadal timescales during the Cenozoic - Continental climate change derived from marine archives - Marine pollution and resources - News in paleoceanography
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h follow-up preperation
Teaching materials	Special materials on the website of the course
Literature	Hillaire-Marcel, C. and De Vernal, A. (2007) (eds.) Proxies in Late Cenozoic Paleoceanography. Developments in Marine Geology 1, Elsevier, Amsterdam, 843 S.

Module title	**MGEW14 Practical in Quaternary Geology and Paleoclimatology**
Responsible party	apl. Prof. Dr. A. Brauer
Additional teaching staff	teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	not graded
Credit points	6
Number of participants	Limited
Recommended Back-ground	None
Course Type	Field and lab practical
Educational goals	Use of quaternary geological field and lab methods, paleoclimatic interpretation of sediment profiles
Module contents	This module combines an introduction to the regional geology of Northeastern Germany and to various analytical techniques for paleoclimatic investigations of quaternary sediments. A lake sediment core from a recent lake or from a paleolake outcrop in Northeastern Germany will be described and analyzed with several non-destructive scanning techniques. In addition, samples will be taken for detailed facies analyses using, for example, grain size analyses, organic and inorganic carbon determination and microscopic techniques. The data will be interpreted and documented in a report and presented in a group seminar.
Workload	180 h total workload (30 h x 6 LP = 180 h) 10 h preparation of field work 10 h field work 60 h lab work 100 h interpretation, report writing and oral presentation of the results in a group seminar
Teaching materials	Sampling in the field (e.g. lake coring), lab materials, student presentation of results
Literature	Bradley, R.S., 2014, Paleoclimatology: Reconstructing Climates of the Quaternary. 3rd edition, Academic Press, San Diego. Lowe, J.J. and Walker, M.J.C. (1997): Reconstructing Quaternary environments.2nd edition; Longman Group Ltd. Ruddiman, W.F., 2014, Earth's Climate: Past and Future. 3rd Edition, Palgrave Macmillan

Module title	**MGEW15 Permafrost Landscapes**
Responsible party	Dr. J. Strauss
Additional teaching staff	Dr. J. Lenz, Dr. B. Biskaborn, Dr. P.P. Overduin, Dr. S. Wetterich
Semester	1 or 3
Language	German and/or English
Exam/Grading	Written exam, oral exercise
Credit points	6
Number of participants	30
Recommended Back-ground	no
Course Type	Lecture on the formation and degradation of Permafrost Landscapes. Seminar partly conducted by students on special topics and lead by lecturers, including exercises (practice-type).
Educational goals	Students acquire advanced knowledge of the principles of the formation and properties of permafrost, including its critical reflection, and evaluation of permafrost in the context of climate change. Students can describe the land-scape development of permafrost regions and develop scenarios of how the permafrost region has changed in the past and may change in the future. Students know which methods and techniques for the study of permafrost characteristics and dynamics on various spatial and temporal scales are ap-plied. Students are able to perform specific and multidisciplinary discussions on permafrost related topics. Students are able to provide constructive feed-back to presentations and discussions. Students are able to evaluate scientific publications, including preparation and explanation to an audience.
Module contents	This module gives an overview and insights of the formation and degrada-tion of permafrost during the last glacial and interglacial cycle. The basic features of freezing and thawing processes of frozen ground and the related energy, water and element fluxes are explained. The complex relationship between these fluxes and the emission of greenhouse gases is covered, with a special focus on processes related to climate change. Typical permafrost landscapes and their degradation along with Arctic warming are studied. The consequences of warming permafrost landscapes on the environment and on infrastructure will be shown. Specific topics will be prepared and presented by the students in oral exercises.
Workload	180 h Total workload (30 h x 6 LP = 180 h) 45 h Lecture and seminar 135 h Homework and preparation of the exam
Teaching materials	Textbooks, articles, material provided in the internet
Literature	French, H.M., 2007, The Periglacial Environment. 3rd edition. Longman, Harlow, 341 pages

Module title	**MGEW16 Special Applications in the Geoinformation Systems**
Responsible party	Dr. G. Zeilinger
Additional teaching staff	Department teaching staff
Semester	3
Language	German/ English (by arrangement)
Exam/Grading	presentation and report
Credit points	6
Number of participants	Unlimited
Recommended Back-ground	Knowledge in Geoinformation Systems
Course Type	Seminar and exercises
Educational goals	The module provides the participants with skills in designing and managing geologically related GIS – Projects, ideally related to the Master or PhD
Module contents	Main topics are: design of GIS-database, GIS content management, data distribution with GIS-servers, integration of modeling results in GIS, analyses of river networks and geomorphic parameters, analysis of structural data, remote sensed imagery interpretation and digital elevation model extraction, integration of LIDAR data and utilization of geological 3D models in immersive visualization environments.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises (4 SWS, 3 h/Week. 15 Weeks) 55 h post processing of exercises 70 h Seminar and preparation of Seminar presentation 10 h writing of report
Teaching materials	Textbooks, material from the courses website, modern computers with GIS-software, common geoscientific data sets
Literature	-

Module title	**MGEW17 Tectonophysics and Rheology**
Responsible party	Prof. Dr. G. Dresen
Additional teaching staff	Department teaching staff
Semester	3
Language	German/English (By arrangement)
Exam/Grading	Oral exam, written exam or homework
Credit points	6
Number of participants	unlimited
Recommended Back-ground	-
Course Type	Lectures, exercises, lab visiting
Educational goals	Introduction to deformation processes operating in the Earth's crust and pper mantle
Module contents	In this module we will discuss the relation between stresses and the resulting deformation of rocks: (1) We will first introduce important deformation mechanisms such as brittle fracture and frictional sliding. We will introduce constitutive equations and failure criteria for rocks. Specifically we will dis-cuss aspects of reservoir mechanics such as wellbore stability, hydro fractur-ing and stimulation. Finally we present an overview of laboratory tests and introduce concepts of wellbore design.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h review and exam preparation
Teaching materials	Textbooks, material available online, modern computers with remote sensing software, typical geoscience data sets
Literature	-

Module title	**MGEW18 Fundaments of geoscientific data analysis**
Responsible party	apl. Prof. Dr. M. Trauth
Additional teaching staff	Department teaching staff
Semester	3 and 4 (starting with short course in February or March, ending in July)
Language	German/English (by arrangement)
Exam/Grading	Coursework as prerequisite for admission to the exam: Report on practical experiments and exercises. Module exam: Oral presentation (15 minutes) and written report on data analysis project.
Credit points	6
Number of participants	Unlimited
Recommended Back-ground	It is recommended to participate in the modules of mathematics.
Course Type	Lectures and exercises.
Educational goals	Independent planning and implementation of a project for geoscientific data analysis.
Module contents	Introduction to the programming environment MATLAB, data types and methods overview, univariate statistics, bivariate statistics, regression analysis, resampling schemes, time series analysis, signal processing, statistics of spatial and directional data, analysis of digital elevation models, interpolation, image processing and analysis, processing and georeferencing of satellite images, multivariate statistics, graphical user interfaces, programming with MATLAB.
Workload	180 h Total Workload (30 h x 6 LP = 180 h) 30 h Short course (1 wk in February or March) 30 h Exercises (weekly, during summer semester) 60 h Reading and homework (during summer semester) 60 h Project work and preparing presentation and report (in July)
Teaching materials	Textbooks, course materials on the website of the course, typical data from the geosciences.
Literature	Trauth, M.H. (2015) MATLAB Recipes for Earth Sciences – Fourth Edition. Springer, 427 p., Supplementary Electronic Material, Hardcover, ISBN: 978-3-662-46244-7.

Module title	**MGEW19 Terrestrial Palaeoecology**
Responsible party	Prof. Dr. U. Herzschuh
Additional teaching staff	Dr. Laura Epp, Dr. K. Stoof-Leichsenring
Semester	1-4
Language	German/ English (by arrangement)
Exam/Grading	Preparation and oral presentation a poster (15 min)
Credit points	6
Number of participants	10
Recommended Back-ground	None
Course Type	Lectures, practicals/ exercises, guided seminaries
Educational goals	Understanding ecosystem changes in time and space. Knowledge of fundamental paleoecological concepts and methods. Introduction to work with lake sediment cores. Expand softs kills for preparation and presentation of talks and posters, as well as planning, preparing and presenting a case study.
Module contents	Within this module the students will gain an understanding of ecosystem ecosystems with focusa on the late Pleistocene and Holocene. Students will be introduced to general laboratory methods used in paleoecology and paleo/environmental genetics, and will use these methods in the lab. During the two-week block course, a lacustrine core will be investigated as a case study. Two methodological approaches will be followed: 1) Microscopic analyses of pollen, diatoms and plant macro fossils will be performed to reconstruct the vegetation and diatom assemblages. 2) Analyses of sedimentary DNA of plants and diatoms will be performed using standard methods (DNA extraction from sediments, PCR, gel electrophoresis) and DNA sequence data will be either generated or analysed to identify plants and diatoms. These combined approaches will be used for a reconstruction of environmental history. Through preparatory work (literature based), as well as work in the small groups, the students will acquire and improve their skills in preparation and presentation of talks and posters.
Workload	180 h total workload (30 h x 6 LP = 180 h)
Teaching materials	20 h lectures
Literature	10 h seminaries

Module title	**MGEW20 Groundwater Modelling**
Responsible party	Prof. Dr. S. Oswald
Additional teaching staff	
Semester	
Language	
Exam/Grading	
Credit points	
Number of participants	
Recommended Back-ground	
Course Type	
Educational goals	
Module contents	
Workload	
Teaching materials	
Literature	

Module title	**MGEW21 Planetary Remote Sensing**
Responsible party	PD Dr. G. Arnold
Additional teaching staff	Dr. R. Haus
Semester	1 or 3
Language	German/English, b.a.
Exam/Grading	Oral examination, lecture or thesis, written test
Credit points	6
Number of participants	20
Recommended Back-ground	Basic knowledge in remote sensing methods
Course Type	Lecture, study of special literature, independent practicing and supervised training, tutorial. Successful realization of a scientific project including a written summary.
Educational goals	Understanding of scientific methods, principles, and instruments for planetary remote sensing; application of these methodologies for exploration of the inner planetary system. Successful realization of a scientific project including a written summary.
Module contents	The module procures knowledge of physical and methodical fundamentals in planetary remote sensing with applications to the inner Solar system. These include photo-geologic studies of planetary surfaces by means of passive and active techniques, spectrophotometric surface composition analyses, gamma/neutron spectroscopy, studies of particles and fields (magnetic fields), and investigations of planetary atmospheres. Planetary remote sensing instruments and their operation modes are introduced. The lecture will be complemented by a full-day excursion to DLR, Berlin-Adlershof to illustrate different applications in planetary remote sensing. Post-processing of excursion topics trains competences in computer supported evaluation of planetary data. It promotes independent work in data handling, and gives insight into processes of design, development and operation of cameras and spectrometers for planetary remote sensing.
Workload	180 h Total workload (30 h x 6 LP = 180 h) 22,5 h Planetary Remote Sensing (2 SWS, 1,5 h/week. in 15 weeks.), 11,25 h Excursion to DLR and post-processing (6 h/excursion, 5,5 h post-processing), 36,25 h Evaluation and catching up lecture material provided, 11,25 h Tutorials, 20 h Preparation for test, 22,5 h Preparation for homework assignments or preparation for a lecture/ presentation, 45 h Preparation for module exam
Teaching materials	Textbooks, lecture notes, modern electronic computer systems, remote sensing software, planetary data sets.
Literature	Theory of Reflectance and Emittance Spectroscopy, Hapke B., Cambridge University Press. Physics and Chemistry of the Solar System, Lewis J. S., Elsevier Academic Press., Further literature will be announced during the lecture.

Module title	**MGEW22 Geomicrobiology**
Responsible party	Prof. Dr. D. Wagner
Additional teaching staff	external lecturers
Semester	2
Language	Deutsch/English
Exam/Grading	Examination of the individual modular components as follows: Lecture: exam; Seminar: presentation/handout; Practical Course: laboratory
Credit points	6
Number of participants	unlimited, practical course 6
Recommended Back-ground	basic knowledge in Geology, Biology and Geochemistry
Course Type	Lecture (2 SWS), Seminar (1 SWS), Practical Course (1 week between se-mesters)
Educational goals	Basic understanding of microbial life in geological environments. Condition and limitation of life (processes) in sedimentary deposits. Importance for global biogeochemical cycles. Basic principles of microbiology and geology to study life in geological environments. Introduction to the major microbio-logical methods
Module contents	Basic knowledge of geomicrobiology in terrestrial deposits are taught: This course provides an introduction to the world of microorganisms, their impor-tance in global biogeochemical cycles and biological-geological interactions in relevant habitats. This knowledge will be deepened in the seminar based on selected case studies from the literature. In the practical course techniques to study microorganisms will be applied to a specific example.
Workload	180 h in total (30 h x 6 LP = 180 h) 60 h lecture / seminar + pratical course 120 h preparation and post processing
Teaching materials	Online handouts and online information on literature, text books, student contributions, manual for practical course
Literature	Madigan M.T. et al., 2008, *Brock* Biology of Microorganisms. Prentice-Hall, London; Ehrlich H.L., 2009, Geomicrobiology, CRC Press, Boca Raton; Riding R.E. & Awramik S.M., 2010, Microbial Sediments, Springer, Berlin; Madsen E.L. 2008, Environmental Microbiology, Blackwell, Malden

Module title	**MGEW23 Quantitative basis of the analysis of natural hazards**
Responsible party	Prof. Dr. O. Korup
Additional teaching staff	Department teaching staff
Semester	2
Language	German/Englisch, on agreement
Exam/Grading	Presentation, Graded Online Apps
Credit points	6
Number of participants	15
Recommended Background	Basic knowledge in geosciences, mathematics, physics, and the topics covered in BScW19 Natural Disasters
Course Type	Seminar, labs
Educational goals	To be capable of applying the mathematical basics for objectively assessing natural hazards; to be able to solve problems drawing on selected applied examples
Module contents	From the 1-in-100-yr flood to extreme events; What is Bayesian statistics good for?; Natural hazards and data science in the 21st century; Business as usual for natural hazards consultants; Using Open Source Tools (R, Python) in Data Science efficiently
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Seminar and exercises 135 h Follow up measures and running documentation in online apps
Teaching materials	Scientific articles, numerical problems, text books, and material on the course
Literature	See material on course webpage

Module title	**MGEW24 Groundwater in deep geologic systems and its relevance with regard to geo-resources**
Responsible party	Dr.-Ing. Thomas Kempka
Additional teaching staff	Prof. Dr. M. Kühn, Staff from GFZ
Semester	3. Semester
Language	German or English (by agreement and as required)
Exam / Grading	Module exam: Oral exam, written test or written report about the contents of lectures and exercises. Study achievements: Admission to module exam will be granted to those who achieved cumulative study activities. These are gained through active participation in the exercises and written tests.
Credit points (ECTS)	6
Number of participants	Unlimited (maybe restricted for exercises and computer hands-on part)
Recommended Back-ground	General knowledge in geology, mathematics, chemistry and physics and the successful participation in courses MGEW06 and MGEW20.
Course type	Lecture, practice and hands-on computer exercise.
Educational goals	Fundamental understanding of the role of groundwater and its impacts on the formation and utilisation of georesources in deep geological systems with specific focus on quantitative assessments by means of analytical and numerical simulation models, representing the processes fluid and heat flow, mass transport, chemistry and mechanics.
Module contents	This module provides basic expertise for a holistic view of deep groundwater systems. Groundwater flow and fluid-rock interactions are discussed to qualitatively and quantitatively describe the formation and utilisation of geo-resouces (e.g., geothermics, gas storage, mineral and hydrocarbon deposits). Quantitative assessments are undertaken with the help of analytical and numerical models, which are elaborated under guidance by the students (programming language Python, prior knowledge not required). Essential mathematical basics are recapped in a comprehensive manner and the application of the Finite Difference Method for the development of numerical simulation models is elaborated by means of numerous programming examples.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 hours lectures and exercises. 20 hours hands-on computer exercise (in the period of the exam and practical training after the lectures). 115 h for post-processing and exam preparation.
Teaching materials	Scientific papers, textbooks, online resources (moodle), computer exercises.
Literature	Ingebritsen, Sanford, Neuzil (2006) Groundwater in Geologic Processes, Cambridge University Press.

Module title	**MGEW25 Geohazards – Advanced**
Responsible party	Prof. O. Korup, PhD
Additional teaching staff	Department teaching staff
Semester	4
Language	German/English (depending on demand)
Exam/Grading	Presentation, Project Report
Credit points	6
Number of participants	15
Recommended Back-ground	Solid knowledge in geosciences and computational skills; BScW19 'Natural Disasters' would be an asset; also recommended for students of geogovern-ance
Course Type	Seminar with computer labs
Educational goals	To be competent in methods of quantitative and objective hazard assess-ments; estimation of uncertainties; models and prediction; decision support in natural hazard and risk appraisals
Module contents	How natural are natural disasters in the Anthropocene? How can we identify partly man-made disasters? Which sedimentary and biogeochemical cycles have been disturbed to the point that disasters are partly human-induced? Which data and methods can we use to show this?
Workload	180 h Total Work Load (30 h x 6 LP = 180 h) 45 h Seminar + labs 90 h Post-seminar work and preparations for the presentation 45 h project report
Teaching materials	Scientific papers, text books, data and codes on Moodle2
Literature	Bryant, E. Natural Hazards. Cambridge University Press, 2004.

Module title	**MGEW26 Coastal Dynamics**
Responsible party	Prof. Dr. Hugues Lantuit
Additional teaching staff	Teaching staff
Semester	3
Language	English
Exam/Grading	Written Exam (60%); Oral Presentation (40%)
Credit points	6
Number of participants	Max. 20
Recommended Back-ground	Basics of algebra
Course Type	Lecture and seminar
Educational goals	The students will acquire basic understanding of coastal geomorphology and coastal processes and will be able to understand the methods to use in specific cases. The students will learn the theory as well as the different methods used in the measurement of sediment transport and coastline dynamics and will be provided with an overview of coastal management frameworks. With these competences, the students will be able to plan a study on coastal movement and be able to plan the tasks associated with it.
Module contents	The lecture will focus on the following topics: Coastal classifications; Shoreline definitions; Tectonics and coasts; Coastal landforms; Sea level change / Bruun rule; Wave theory; Littoral sediment budgets and cells; Wave energy and energy flux; Wave refraction and wave breaking; Wave set-up, set-down and run-up; Shoreface profiles; Cross-shore sediment transport; Nearshore currents; Longshore currents; Coastal engineering and coastal protection; Coastal biogeochemistry – natural carbon and nutrient influx; – anthropogenic fluxes and eutrophication; Coasts and climate change - adaptation and mitigation strategies; Legal statuses of coastal systems; Coastal conservation; Integrated Coastal Zone Management (ICZM); Legal statuses of coastal systems; Mangrove coasts; Coral coasts; Polar coasts; Dune systems; Barrier systems; Salt marshes; The seminar will deal with methods and certain application examples: Shoreface profile adjustment scenario; Wave refraction prediction; Wave run-up calculations; coastal management.
Workload	180 h total workload 60h lectures and seminar 120h course preparation
Teaching materials	Presentations, literature, material of the lecture on the webpage of the lecture, seminar presentations
Literature	Davidson-Arnott, R.G.D., 2009. Introduction to Coastal Processes and Geomorphology Cambridge University Press, Cambridge, England.

Module title	**MGEW27 Applied Remote Sensing (ARS)**
Responsible party	
Additional teaching staff	
Semester	
Language	
Exam/Grading	
Credit points	
Number of participants	
Recommended Back-ground	
Course Type	
Educational goals	
Module contents	
Workload	
Teaching materials	
Literature	

Module title	**MGEW28 Geoinformation systems, natural hazards and natural risks**
Responsible party	Dr. Wolfgang Schwanghart
Additional teaching staff	Prof. Oliver Korup, PhD
Semester	1 or 2
Language	German/English
Exam/Grading	Projects, presentation
Credit points	6
Number of participants	20
Recommended Back-ground	Fundamental knowledge in the geosciences and GIS (BS equivalent)
Course Type	Lecture, practicals in the classroom
Educational goals	Students will know the basic methods of spatial analysis and prediction in the context of natural hazards and risk analysis. Students will be able to work with a geographic information system (ArcGIS, QGIS, etc.) in a self-contained way. Students will be able to apply the learnt methods and will be able to interpret and evaluate their results. Students will be able to study complex research questions in the context of natural hazards and risks alone and in a team and will be able to visualize, present and communicate the results of their work.
Module contents	The module provides an introduction into the application of geographic information systems (GIS) in the analysis of natural hazards and risks. Besides studying a number of different types of natural hazards such as tropical cyclones, landslides and floods, the course will cover methods of spatial analysis and prediction using real world datasets and project works. These methods include spatial queries, spatial statistics, interpolation and geostatistics, analysis of digital terrain models, and analysis and classification of optical remote sensing imagery.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and practicals 135 h own reading, exercises and project works
Teaching materials	Scientific articles, books, materials posted on the course website
Literature	de By, R.A. (ed.) 2004. Principles of geographic information systems : an introductory textbook. Enschede, ITC, 2004. ITC Educational Textbook Series 1, ISBN: 90-6164-226-4.

Module title	**MGEW29 Geomorphology and Earth Surface Dynamics**
Responsible party	Prof. Dr. N. Hovius
Additional teaching staff	Dr. J. Turowski, Prof. Dr. T. Schildgen, Dr. D. Sachse
Semester	2 oder 4
Language	English
Exam/Grading	Written exam and short project report
Credit points	6
Number of participants	–
Recommended Back-ground	–
Course Type	Lectures, practicals, short reading project, seminars
Educational goals	To understand the operation of key geomorphic processes working on Earth's surface, their response to external drivers, the way they interact to shape land-scapes and move sediment from source to sink, and their effect on litho-spheric deformation and global biogeochemical cycles.
Module contents	The module considers the physics and chemistry of Earth surface processes responsible for production and transfer of sediment. These processes are in-troduced separately, but special attention is paid to links and feedbacks be-tween them. The influence of tectonic, climatic and biological processes and events on landscapes and geomorphic activity is examined, and the effects of erosion and deposition of surface materials on mountain building, basin for-mation and filling, atmospheric composition and ecosystem dynamics and biological productivity explored. This is done with help of observational con-straints and practical examples.
Workload	180 h Total workload (30 h x 6 LP = 180 h) Lectures, exercises, reading project, seminar, preparation for the exam or writing of report
Teaching materials	Scientific articles, text book, some lecture and practical materials posted on course website.
Literature	Burbank, D., Anderson, R., 2011, Tectonic Geomorphology, Academic Press; Yeats, Sieh and Allen, 1997, The Geology of Earthquakes, Oxford University Press; additional materials will be posted on the course website

Module title	**MGEW30 Advanced Geoscientific Data Analysis**
Responsible party	Dr. Norbert Marwan
Additional teaching staff	apl. Prof. Dr. Martin H. Trauth, Dipl.-Phys. Nadine Berner, Dr. G. Zeilinger, Dr. W. Schwanghart
Semester	2 or 4
Language	Englisch/Deutsch n.V.
Exam/Grading	Project on advanced geoscientific data analysis
Credit points	6
Number of participants	18
Recommended Back-ground	Participation in the modules “Grundlagen der geowissenschaftlichen Daten-analyse “ or “Numerische Methoden in den Geowissenschaften“
Course Type	Lectures & Exercises
Educational goals	Efficient scientific software development and reliable and safe application of advanced and modern concepts for geoscientific data analysis
Module contents	MATLAB, Octave, Python; Code maintenance, toolboxes and packages, version/revision control; programming techniques (e.g., matrix manipulation, control flow, advanced I/O, parallel programming); numerical methods (e.g., root finding, iterative solutions, numerical integration); frequentist statistics (e.g., hypothesis testing, Monte-Carlo approach); Bayesian statistics (e.g., inference on model/process parameters, Bayesian Networks, Kalman Filter); nonlinear data analysis (e.g., independent component analysis, recurrence plots, complex networks); analysis of spatio-temporal data (e.g, watershed segmentation, Hugh transformation, terrain analysis); analyzing data with gaps and irregular sampling. All topics are illustrated with examples from geosciences.
Workload	180 h Total Workload (30 h x 6 LP = 180 h) 40 h Lectures and exercises 40 h Reading 60 h Homework 40 h Project work and preparation of a presentation
Teaching materials	Textbooks, course materials on the website of the course, typical data from the geosciences.
Literature	Trauth, M.H. (2015) MATLAB Recipes for Earth Sciences – Fourth Edition. Springer, 429 p., Supplementary Electronic Material, Hardcover, ISBN: 978-3-662-46244-7.

Module title	MGEW31 Advanced digital data analysis of remote sensing data
Responsible party	
Additional teaching staff	
Semester	
Language	
Exam/Grading	
Credit points	
Number of participants	
Recommended Back-ground	
Course Type	
Educational goals	
Module contents	
Workload	
Teaching materials	
Literature	

Module title	**MGEW32 Planetary Physics**
Responsible party	PD Dr. G. Arnold
Additional teaching staff	Dr. D. Kappel
Semester	2 or 4
Language	German/English, b.a.
Exam/Grading	Oral examination, lecture or thesis, written test
Credit points	6
Number of participants	20
Recommended Back-ground	Basic knowledge in remote sensing methods
Course Type	Lecture, study of special literature, independent practicing and supervised training, tutorial
Educational goals	Understanding principles of planetary physics and planetology; studying the of the outer planetary system. Successful realization of a scientific project including a written summary.
Module contents	The module procures knowledge in planetary physics and comparative planetology and gives insights into the current state of the planetary system. It transmits fundamental knowledge to the outer planetary system and exoplanets. Principles of planetary physics are imparted. Models of planetary genesis and evolution are derived from actual data. The lecture will be complemented by a full-day excursion to DLR, Berlin-Adlershof to illustrate different applications in planetary remote sensing. Post-processing of excursion subjects trains competences in computer supported evaluation of planetary data. It promotes independent work in data handling, and gives insight into processes of design, development and operation of cameras and spectrometers for planetary remote sensing.
Workload	180 h Total workload (30 h x 6 LP = 180 h) 22,5 h Planetary Physics (2 SWS, 1,5 h/week. in 15 weeks.), 11,25 h Excursion to DLR and post-processing (6 h/excursion, 5,5 h post-processing), 36,25 h Evaluation and catching up lecture material provided, 11,25 h Tutorials, 20 h Preparation for test, 22,5 h Preparation for homework assignments, or preparation for a lecture/ presentation, 45 h Preparation for module exam
Teaching materials	Textbooks, lecture notes, modern electronic computer systems, remote sensing software, planetary data sets.
Literature	Physics and Chemistry of the Solar System, Lewis J. S., Elsevier Academic Press., and further literature will be announced during the lecture.

Module title	**MGPWP01 Geophysical Practicals: Laboratory**
Responsible party	apl. Prof. Dr. F. Krüger, Dr. E. Lück, Dr. N. Nowaczyk
Additional teaching staff	Department teaching staff
Semester	1
Language	German/ English (by arrangement)
Exam/Grading	Successful accomplishment of 6 laboratory practicals including oral test and reporting of results.
Credit points	6
Number of participants	Limited (< 20)
Recommended Back-ground	Basic knowledge in general and applied geophysics is advantageous.
Course Type	Practical
Educational goals	Application of geophysical analysis techniques to solve selected advanced problems of geophysics under laboratory conditions.
Module contents	6 advanced practicals from different fields of geophysics under controlled laboratory conditions (seismic wavefield analysis and potential methods).
Workload	Total workload 180 h (30 h x 6 ECTS = 180 h) 48 h accomplishment of practicals 132 h preparation and writing of reports.
Teaching materials	Teaching material can be found on the internet page
Literature	-

Module title	**MGPWP02 field cource Applied Geophysics**
Responsible party	Dr. Erika Lück
Additional teaching staff	Prof. Dr. J. Tronicke, Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Written report (not graded)
Credit points	6
Number of participants	Unlimited
Recommended Back-ground	Fundamental knowledge and understanding in geophysics as taught in the modules Introduction to Geophysics, Introduction to Applied Geophysics, and Advanced Applied Geophysics (see Bachelor Geosciences, University
Course Type	Practical, Exercise
Educational goals	This module aims on deepening the understanding with regard to the practical principles of various geophysical methods, their field applications, and typical data processing steps.
Module contents	Within the field course typical a problem from hydrology, geology, environmental engineering or archaeology will be addressed. For a given target, different geophysical techniques (e.g., direct-current electrics, electromagnetics, ground-penetrating radar, geomagnetics or seismic methods) will be employed in the field. In the second part of this module, the focus is on computer-based processing and interpretation of all gathered data using standard inversion, modeling, and processing software.
Workload	180 h total workload (30 h x 6 CP = 180 h) 50 h field work 50 h Supervised data processing 80 h pre-course preparation and revision, preparing a written report
Teaching materials	Specific teaching materials are provided.
Literature	

Module title	**MGPW01 Seismic Hazard Analysis**
Responsible party	Prof. Dr. F. Cotton, apl. Prof. Dr. F. Krüger
Additional teaching staff	Department teaching staff
Semester	3
Language	English
Exam/Grading	Oral exam, written test or written report
Credit points	6
Number of participants	Unrestricted
Recommended Back-ground	None
Course Type	Lectures, exercises, project
Educational goals	Understanding of all essential components of modern probabilistic seismic hazard analysis.
Module contents	Hazard related properties of seismic sources, the propagation medium, and of site effects. Hazard integral. Monte Carlo techniques. Treatment of uncer-tainties.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and exercises 135 h Follow up measures and preparation for exam
Teaching materials	Text books and material on the course website.
Literature	e. g. McGuire, R., 2004, Seismic Hazard and Risk Analysis, EERI, 2004

Module title	**MGPW02 Digital Seismology**
Responsible party	Dr. H. Vasyura-Bathke
Additional teaching staff	Department teaching staff
Semester	2
Language	English
Exam/Grading	Oral exam, written test or written report
Credit points	6
Number of participants	Unrestricted
Recommended Back-ground	None
Course Type	Lectures, exercises, project
Educational goals	Understanding of the fundamentals of digital signal processing and system theory related to seismic recordings. Design of analog and digital filters. De-convolution of seismograms.
Module contents	seismology, systems and filters. Fourier-, Laplace- and Z-transform. Transfer function, frequency response, impulse response function. Convolution, de-convolution, disrectization, AD conversion, seismogram simulation.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and exercises 135 h Follow up measures and preparation for exam
Teaching materials	Text books and material on the course website.
Literature	Scherbaum, F., 2002, Of poles and Zeros, Springer Verlag.

Module title	**MGPW03 Potential Field Methods**
Responsible party	Dr. E. Lück
Additional teaching staff	Department teaching staff
Semester	1
Language	German/ English (by arrangement)
Exam/Grading	Written Exam
Credit points	6
Number of participants	Unlimited
Recommended Back-ground	Fundamental knowledge and understanding in geophysics as taught in the modules Introduction to Geophysics, Introduction to Applied Geophysics, and Advanced Applied Geophysics (see Bachelor Geosciences, University Potsdam)
Course Type	Lecture, Exercise
Educational goals	The aim of this module is to deepen the understanding of potential field methods in applied geophysics (gravity and magnetic methods as well as geothermics) with a focus on the physical fundamentals as well as on the applicability in typical exploration problems.
Module contents	The course covers theoretical and physical fundamentals, methods for explo-ration, instrumentation, simulation, field data processing and interpretation. During field exercise the students will practice the techniques, process their own data and generate a model for the test site.
Workload	180 h total workload (30 h x 6 CP = 180 h) 45 h lectures and exercises 22.5 h home studies (ca. 1.5 h/week lecture accompanying) 22.5 h 2-3 days field-/laboratory-/computer exercise during semester break 90 h revision and exam preparation (partly during semester break)
Teaching materials	Specific teaching materials are provided.
Literature	Militzer, H., Werber, F., 1984, Angewandte Geophysik: Band 1 Gravimetrie und Magnetik Band 2 Geoelektrik, Geothermik, Radiometrie, Aerogeophy-sik, Springer Verlag

Module title	**MGPW04 Seismic Methods**
Responsible party	Prof. Dr. J. Tronicke
Additional teaching staff	Dr. Niklas Allroggen, Department teaching staff
Semester	1
Language	German/ English (by arrangement)
Exam/Grading	Written exam
Credit points	6
Number of participants	Unlimited
Recommended Back-ground	Fundamental knowledge in general and applied geophysics as taught in the modules Introduction to Geophysics, Introduction to Applied Geophysics, and Advanced Applied Geophysics (see Bachelor Geosciences, University Potsdam)
Course Type	Lecture, Exercise
Educational goals	This module aims on deepening the understanding with regard to the theoretical and practical principles of various seismic methods and their application to typical geological and engineering problems.
Module contents	This module covers the theoretical and physical background as well as the variety of different seismic methods typically applied in the field. This includes the discussion of data acquisition, processing, and interpretation. In addition to reflection seismics, this module also covers refraction, borehole and surface-wave seimic methods. In the practical exercises the methods will be exemplary employed, which also includes processing and interpretation of gathered data.
Workload	180 h total workload (30 h x 6 CP = 180 h) 45 h lectures and exercises 22.5 h home studies (ca. 1.5 h/week lecture accompanying) 22.5 h 2-3 days field-/laboratory-/computer exercise during semester break 90 h revision and exam preparation (partly during semester break)
Teaching materials	Specific teaching materials are provided.
Literature	Sheriff, E.G., Geldart, L.P., 1995, Exploration Seismology (2nd Edition), Cambridge University Press; Butler, D.K., 2006, Near-surface Geophysics, Society of Exploration Geophysicists (SEG); Knödel, K., Krummel, H., Lange, G., 1997, Handbuch zur Erkundung des Untergrundes von Deponien und Altlasten: Band 3 Geophysik, Springer

Module title	**MGPW05 Electrical and Electromagnetic Methods**
Responsible party	Dr. J. Guillemoteau
Additional teaching staff	Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Written exam
Credit points	6
Number of participants	Unlimited
Recommended Back-ground	Fundamental knowledge in general and applied geophysics as taught in the modules Introduction to Geophysics, Introduction to Applied Geophysics, and Advanced Applied Geophysics (see Bachelor Geosciences, University Potsdam)
Course Type	Lecture, Exercise
Educational goals	This module aims on deepening the understanding with regard to the theo-retical and practical principles of various electrical and electromagnetic methods and their application to typical geological and engineering prob-lems.
Module contents	This module covers standard geophysical methods ranging from direct-current geoelectrics to low- and high-frequency electromagnetics. This in-cludes discussion of the fundamental physical principles, data acquisition, and processing strategies as well as typical applications of the different methods. In the practical exercises the methods will be exemplary employed in the field, which also includes processing and interpretation of gathered data.
Workload	180 h total workload (30 h x 6 CP = 180 h) 45 h lectures and exercises 22.5 h home studies (ca. 1.5 h/week lecture accompanying) 22.5 h 2-3 days field-/laboratory-/computer exercise during semester break 90 h revision and exam preparation (partly during semester break)
Teaching materials	Specific teaching materials are provided.
Literature	Knödel, K., Krummel, H., Lange, G., 1997, Handbuch zur Erkundung des Untergrundes von Deponien und Altlasten: Band 3 Geophysik, Springer But-ler, D.K., 2006, Near-surface Geophysics, Society of Exploration Geophysi-cists (SEG)

Module title	**MGPW06 Special Topics in Theoretical Geophysics**
Responsible party	apl. Prof. Dr. F. Krüger
Additional teaching staff	Prof. Dr. M. Weber, Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Oral or written exam or homework (by arrangement)
Credit points	6
Number of participants	Not limited
Recommended Back-ground	Basic knowledge in general geophysics, mathematics, physics is advanta-geous.
Course Type	Lecture, exercise
Educational goals	Understanding of advanced problems in seismic source or wave theory.
Module contents	Theoretical description of surface waves, kinematic and dynamic of ruptures in elastic media.
Workload	180 h Total workload (30 h x 6 LP = 180 h) 45 h lecture and exercise 135 h follow-up and preparation for exam
Teaching materials	Teaching material can be found on the internet page
Literature	Aki and Richards, Quantitative Seismology

Module title	**MGPW07 Special Topics in Applied Geophysics**
Responsible party	Prof. Dr. J. Tronicke
Additional teaching staff	Dr. E. Lück, Dr. J. Guillemoteau, Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Written exam, oral exam or homework
Credit points	6
Number of participants	Unlimited
Recommended Back-ground	Fundamental knowledge in general and applied geophysics as taught in the modules Introduction to Geophysics, Introduction to Applied Geophysics, and Advanced Applied Geophysics (see Bachelor Geosciences, University Potsdam).
Course Type	Lecture, Exercise and/or seminar
Educational goals	This module aims on deepening the understanding in selected and current topics in Applied Geophysics.
Module contents	Current topics, methods, and applications of applied geophysical research and practice.
Workload	180 h total workload (30 h x 6 CP = 180 h) 45 h lectures and exercises 45 h home studies (ca. 1.5 h/week lecture accompanying) 90 h revision and exam preparation (partly during semester break)
Teaching materials	Specific teaching materials are provided.
Literature	Selected literature will be provided.

Module title	**MGPW08 Array Seismology**
Responsible party	Dr. M Ohrnberger
Additional teaching staff	Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Oral or written exam or term paper (by arrangement)
Credit points	6
Number of participants	unlimited
Recommended Back-ground	Basic knowledge of seismology as taught in module BScW21 seismology (BSc Geowissenschaften).
Course Type	Lectures, Exercises and Practicals/Excursion.
Educational goals	Understanding basic concept of array methods (delay- and sum). How does the array geometry influence the characteristics of an array? Practical guides for array-design (experimental layout) and instrumentation. Acknowledge main advantages of array methods and explore their potential in different application domains.
Module contents	Basic characteristics of an array (array vs. network) „delay-and-sum“ – beamforming methods wavenumber resolution and spatial aliasing frequency-wavenumber methods spatial autocorrelation methods high-resolution array methods
Workload	180 h Total workload (30 h x 6 LP = 180 h) 45 h Lectures and Exercises 135 h Post-preparation time (homework) and preparation for exam
Teaching materials	Lecture and exercise materials on institute's moodle platform. Computer exercises.
Literature	Set of fundamental publications regarding array seismology: Aki, 1957, Burg,1964, Capon, 1969, Schmidt, 1986, Zywicki, 2001, Rost & Thomas, 2002; Text Books: a) S. Unnikrishna Pillai, 1989, Array Signal Processing, New York: Springer; b) Van Trees, Optimum Array Processing, Wiley, 2002. + others

Module title	**MGPW09 Special topics in observational seismology**
Responsible party	apl. Prof. Dr. F. Krüger
Additional teaching staff	Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Written or oral exam or homework (by arrangement)
Credit points	6
Number of participants	Not limited
Recommended Back-ground	Basic knowledge in general geophysics and seismology are an advantage.
Course Type	Lecture, exercise
Educational goals	Successful interpretation of seismograms and application of passive analysis techniques to modern seismological data.
Module contents	The module conveys to the participants fundamentals to interpret seismo-grams of different types of seismic sources acting in different distance ranges. Furthermore an overview regarding modern techniques of passive seismology (among others receiver function analysis, anisotropy analysis of shear wave splitting). To analyze complex wavefields software packages to calculate full wavefield synthetics are used by the students.
Workload	180 h Total workload (30 h x 6 LP = 180 h) 45 h lecture and exercise 135 h follow-up and preparation for exam.
Teaching materials	Teaching material can be found on the internet page
Literature	Lay and Wallace, Modern global Seismology, Academic Press; Kennett, The seismic Wavefield, Cambridge Univ. Press

Module title	**MGPW10 Stress Field of the Earth's Crust**
Responsible party	apl. Prof. Dr. A. Zang
Additional teaching staff	Department teaching staff
Semester	1
Language	German/English (by arrangement)
Exam/Grading	Oral exam, written exam or homework
Credit points	6
Number of participants	unlimited
Recommended Back-ground	Mathematics I +II, Physics I + II, Geosciences I + II
Course Type	Lecture, Exercise
Educational goals	Understanding the stress field of the earth's crust in a local, geomechanical and global, plate-tectonic context
Module contents	This course aims to give a holistic approach to the state of stress in the Earth's crust and its application to local and global tectonics. The first part of this course is the very foundation of rock mechanics, and introduces mechanical stress, fracture criteria and simple crustal stress models. The second part deals with stress measuring methods in practice today and is divided logically into borehole and core-based methods. Naturally, the more commonly accepted methods like overcoring, hydraulic fracturing, and borehole breakouts, are given added emphasis. The last part describes stress profiles through the Earth's crust obtained in recent international field projects to investigate earthquake ruptures and fracture processes in energy technologies (geologic repositories, geothermal energy and shale gas extraction). Local stress data from drillings are related to regional tectonic stresses and the World Stress Map (WSM).
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and Exercises 135 h preparation, review and exam preparation
Teaching materials	Black board, text books, material available online, video lecture material, datasets of the Word Stress Map
Literature	Zang A, Stephansson O (2010) Stress Field of the Earth's Crust. Springer-Verlag. ISBN: 978-1-4020-8443-0

Module title	**MGPW11 Earth's magnetic field and physics of the upper atmosphere**
Responsible party	Prof. Dr. C. Stolle
Additional teaching staff	Dr. Achim Morschauser
Semester	2
Language	German or English
Exam/Grading	written exam or report
Credit points	6
Number of participants	min 5 - max 15
Recommended Back-ground	Fundamentals in mathematics and geophysics, BSc in geophysics, physics, mathematics, or similar
Course Type	lectures, exercises, practicals
Educational goals	Basic description of the shape and variation of the geomagnetic field. Name the main sources of the magnetic field amplitudes and its variability. Basic understanding of empirical magnetic field modelling and mathematical methods that are used, interpret magnetic signatures to derive the geometry and strength of their source electric currents. Explain the basics of physics in the upper atmosphere. Introduction into observing the magnetic field.
Module contents	The Earth's magnetic field protects us from solar and cosmic particle radiation and has been important for many societal aspects as navigation. It originates to 95% from convections in the outer liquid core. Other sources come from the lithosphere, from electric currents in the upper atmosphere and near Earth space, and from ocean currents. This course gives an overview of our current understanding of the Earth magnetic field, its sources and evolution. The course includes a description of the different contributions to magnetic field measurements as well as the introduction and interpretation of relevant data sets from ground and satellites. Standard mathematical techniques for data analysis will be introduced. This includes relevant methods for global modelling of the Earth's magnetic field. Basic physics describing the formation and behavior of the upper atmosphere and ionosphere are introduced, as well as a basic understanding on how electric currents are created in near Earth Space. Those currents are part of the space weather system, and, during active times, called magnetic storms. The course includes practicals at the Geomagnetic Observatory Niemegk.
Workload	180 h Total 52 h Lectures, Exercises and Practicals 128 h self reading, post- and preparation time and preparation for exam
Teaching materials	Lecture and exercise materials on institute's moodle platform or provided by the lecturer. Programming tasks and computer exercises.
Literature	Student's notes during the lecture G. Backus, Foundations of Geomagnetism, Cambridge University Press, 1996. G. W. Prölss, Physics oft he Earth's Space Environment. Springer Berlin Heidelberg New York, 2004. Michael C. Kelley, The Earth's Ionosphere. Second edition. Elsevier, 2009.

Module title	**MGPW12 Earthquake sources and fracture processes in seismology and volcanology**
Responsible party	Prof. Dr. T. Dahm
Additional teaching staff	Department teaching staff
Semester	2-4
Language	German/English (By arrangement)
Exam/Grading	Oral exam, written exam or homework
Credit points	6
Number of participants	unlimited
Recommended Back-ground	MSc students, PhD students
Course Type	Lectures, computer exercises
Educational goals	Introduction to rupture processes in seismology and volcanology. This includes stability criteria for earthquake rupture, slope instability and fluid-injections. Understanding of stress fields induced by deformation sources. Understanding of wave radiation from point and extended earthquake sources as well as volcanic sources. Students will develop and apply codes to calculate and analyze stress and to estimate source parameter.
Module contents	The module is intended to provide an integrated view of plate tectonic processes with aspects of continuum and micromechanics relevant for rock deformation over a broad range of scales. Failure criteria, point sources, extended sources, shear dislocation, single force and moment tensor solutions, static and dynamic displacement and deformation, nearfield, far field, crack problems, intrusion problems, kinematic and dynamic rupture, earthquake types.
Workload	180 h total work load (30 h x 6 LP = 180 h) 45 h lecture and exercises 135 h review and exam preparation
Teaching materials	Textbooks, material available online, work sheets
Literature	Lecture notes

Module title	**MGPW13 Introduction to Bayesian networks for geoscientists**
Responsible party	Dr. K. Vogel
Additional teaching staff	Department teaching staff
Semester	3
Language	German/English, on agreement
Exam/Grading	Written test or written report
Credit points	6
Number of participants	20
Recommended Back-ground	Basic knowledge in probability theory and programming, and topics covered in MGEW23 Quantitative basis of the analysis of natural hazards
Course Type	Lectures, seminar, exercises
Educational goals	Understanding of the basics of Bayesian networks, ability to apply and learn simple Bayesian networks in/for natural hazard assessments
Module contents	Fundamentals of Bayesian networks, including basic principles of Bayesian statistics and graph theory; application of Bayesian networks for natural hazard assessments and consideration specific arising problems in this context
Workload	180 h total work load (30 h x 6 LP = 180 h) 45 h Lectures and exercises 135 h Follow up measures and preparation exam
Teaching materials	Exercise material, text books and material on the course
Literature	See material on the course website

Module title	**MMPW01 Introduction to Geochronology**
Responsible party	apl. Prof E. Sobel, PhD, apl Prof Dr. R. Romer, Dr. M. Sudo
Additional teaching staff	Department teaching staff
Semester	1
Language	German/ English (by arrangement)
Exam/Grading	Exam based on the content of the lectures and exercises.
Credit points	6
Number of participants	unlimited
Recommended Back-ground	none
Course Type	Lectures and guided seminars and/ or exercises
Educational goals	The goal is to be able to evaluate a broad spectrum of geochronologic data, as well as relevant methods for calculating ages and rates of geologic processes.
Module contents	Concepts and applications of geochronologic methods to tectonics and petrology. Dating methods may include: fission track, U-Th/He, 40Ar/39Ar, Radiocarbon, U/Pb, etc. Explanation of chronologic correlation methods. The module combines practical exercises with analytical methods and theoretical
Workload	180 h Total Workload (30 h x 6 LP = 180 h) 45 h Lectures and exercises 135 h Reading and solving exercises in order to comprehend material
Teaching materials	Material for the course is provided on the course internet page.
Literature	-

Module title	**MMPW02 Advanced methods in geochronology**
Responsible party	Dr. M. Sudo, Dr. V. van Schijndel
Additional teaching staff	Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Homework
Credit points	6
Number of participants	10
Recommended Back-ground	Basic knowledge on isotope geochemistry
Course Type	Lecture, exercises, practice and seminar
Educational goals	The students will learn to independently acquire and evaluate geochronological data and evaluate these datasets for geological topics.
Module contents	This module provide following deeply applied knowledge on geochronology: In- situ analysis, laser ablation, isotopic analysis and interpretation of calculated ages or isochron diagrams by mass spectrometry.
Workload	180 h Total workload (30 h x 6 LP = 180 h) 45 h Lectures and exercises 135 h Preparation and review
Teaching materials	Textbook, Exercise sheets
Literature	

Module title	**MMPW03 Advanced Geodynamics**
Responsible party	PD Dr. M. Riedel
Additional teaching staff	
Semester	1
Language	German/ English (by arrangement)
Exam/Grading	Homework
Credit points	6
Number of participants	-
Recommended Back-ground	Basic knowledge on numerical methods (eg. BSCW04 "Numerical methods in geophysics)
Course Type	Lectures, exercises, lab work, seminar
Educational goals	Assessment of numerical solutions to geodynamic processes, e.g. plate tectonics with respect on consequences (Earth quakes, tsunamis), physical and mathematical formulation of relevant phenomena and prerequisites for a quantitative description or solution
Module contents	Based on the basics (energy conservation, impulse, mass, viscose mantle convection, viscoelastic deformation of the lithosphere, effects of phase transitions) numerical methods shall be presented and explained (finite differences, spectral methods and methods of finite elements) to gain a quantitative view of observed geodynamic processes
Workload	180 h Total workload (30 h x 6 LP = 180 h 45 h Lectures and exercises 135 h Preparation and review
Teaching materials	-
Literature	Turcotte, D.L., Schubert, G., 1982, Geodynamics – Applications of continuum physics to geological problems, J. Wiley & Sons, New York, pp. 450

Module title	**MMPW04 Deformation, reactions and texture**
Responsible party	apl. Prof. Dr. U. Altenberger
Additional teaching staff	Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Written exams or homework
Credit points	6
Number of participants	
Recommended Back-ground	none
Course Type	Lecture with practicals
Educational goals	This course imparts the skills to interpret complex metamorphic rocks and textures therein under the light of their pressure-, temperature- and deformation
Module contents	The course focuses on the understanding of the connections between rheology, mineral reactions and the resulting observable textures in metamorphic rocks. The aim is to enable the students to extract geodynamic information from deformed metamorphic rocks from outcrop to thin section scale.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h follow-up and preparation
Teaching materials	Predominantly lecture with homework practicals, Special materials on the website of the course , thin sections, rock samples
Literature	Passchier, C. W., Trouw, R. A. J., 2005. Microtectonics. Springer, Berlin; Philpots & Ague 2009. Principles of Igneous and Metamorphic Petrology, 2nd Edition, Cambridge; Vernon R.H. 2004. A practical guide to rock mikrostructure. Cambridge Universitiy Press

Module title	**MMPW05 Applied methods in Mineralogy & Petrology**
Responsible party	Prof Dr. P. O'Brien
Additional teaching staff	Dr. Ch. Günter, Department teaching staff
Semester	2
Language	German/ English (by arrangement)
Exam/Grading	Lab report (not graded)
Credit points	6
Number of participants	7 groups à 2 students
Recommended Back-ground	Modul BScW16 "Umwelt- und Analytische Geochemie" is recommended
Course Type	Practical exercises, self-study
Educational goals	Strengthen the analytical skills to specific modern analytical devices: e.g. electron microprobe, scanning electron microscope, Raman spectrometer etc.
Module contents	Advanced introductory lectures on the specific analytical equipment, training for independent work on the devices, conduct its own analysis
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h follow-up and preparation
Teaching materials	Instructions and practical implementation of analytical work
Literature	Lecture notes

Module title	**MMPW06 Geosciences Teaching in preservation of historical monuments**
Responsible party	apl. Prof. Dr. U. Altenberger, Prof. Dr. S. Laue, Dr. M. Ziemann
Additional teaching staff	teaching staff
Semester	3
Language	German/ English (by arrangement)
Exam/Grading	Lab report and home-work
Credit points	6
Number of participants	Practice: maximum 8
Recommended Background	Module MMPW05 "Practical methods in Mineralogy & Petrology" is recommended
Course Type	Lectures, exercises, practical
Educational goals	Introduction into the functioning of natural scientists in the conservation and restoration as well as in the analysis of object samples. Learning the basics of conservation and restoration (Technology and Ethics)
Module contents	The module provides an introduction and overview of every aspect of geoscientific conservation: Stone Conservation, composition and properties, both damaging and preservative materials, historic building materials and colorants. Methods of stone conservation. (Micro-) chemical and physical detection methods
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h follow-up and preparation
Teaching materials	Predominantly lecture with homework practicals. Special materials on the website of the course , samples of salt, pigments etc.
Literature	

Module title	**MMPW07 Special Topics in Minerology and Petrology A**
Responsible party	Prof. Dr. Max Wilke
Additional teaching staff	Department teaching staff
Semester	1
Language	German/English
Exam/Grading	Written exams or homework
Credit points	6
Number of participants	
Recommended Back-ground	none
Course Type	Lecture, practical and seminar
Educational goals	Lernziele: In-depth knowledge for construction of models of petrological, geochemical and geophysical processes.
Module contents	The module provides different in-depth and applied knowledge in a given subject. The contents are taught interdisciplinary in the areas of mineralogy, petrology, geochemistry and geophysics.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h follow-up and preparation
Teaching materials	Predominantly lecture and home studies
Literature	Special materials on the website of the course

Module title	**MMPW08 Special Topics in Mineralogy and Petrology B**
Responsible party	Prof Dr. Max Wilke
Additional teaching staff	PD Dr. Philipp Weis, Dr. M. Sudo, teaching staff of mineralogy/petrology group
Semester	2 or 4
Language	German/English
Exam/Grading	Written exams or homework
Credit points	6
Number of participants	-
Recommended Back-ground	-
Course Type	Lecture, practical and seminar/excursion
Educational goals	In-depth knowledge for construction of models of petrological, geochemical and geophysical processes.
Module contents	The module provides different in-depth and applied knowledge in a given subject. The contents are taught interdisciplinary in the areas of mineralogy, petrology, geochemistry and geophysics.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h follow-up and preparation
Teaching materials	Predominantly lecture and home studies
Literature	None

Module title	**MMPW09 Special Topics in Mineralogy and Petrology C**
Responsible party	apl. Prof. Dr. U. Altenberger
Additional teaching staff	Members of the mineralogy/petrology group
Semester	2 or 4
Language	German/English (by arrangement)
Exam/Grading	Written exams or homework
Credit points	6
Number of participants	Unlimited. Excursions can be limited to 15 participants
Recommended Back-ground	Basics in mineralogy and petrology
Course Type	Lecture, practical and seminar/excursion
Educational goals	Understanding of processes in metamorphic petrology.
Module contents	The module provides an in-depth overview in metamorphic processes.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h lectures and exercises 135 h follow-up and preparation
Teaching materials	Predominantly lecture and home studies as well as outcrops
Literature	Lecture notes

Module title	**MGEWX01 Phylogenetics in Evolution and Ecology**
Responsible party	Dr. Faysal Bibi (Museum für Naturkunde)
Additional teaching staff	Prof. Dr. Johannes Müller (Museum für Naturkunde) Prof. Dr. Bodo Bookhagen
Semester	Summer Semester, two-week block course
Language	English
Exam/Grading	Completion of daily exercises and final class presentation
Credit points	6
Number of participants	8 (16 total divided between Biology and Geology - more than 8 possible by waiting list)
Recommended Back-ground	Core knowledge in den Bio / Geosciences (BS)
Course Type	Lectures and practical work in class
Educational goals	To understand how phylogenetic analysis proceeds, the different types of data involved, the different approaches involved in obtaining a phylogenetic tree, and how trees may be used to test evolutionary hypotheses.
Module contents	An intensive, hands-on introduction to phylogenetic analytical methods as applied to evolutionary and ecological approaches, with an emphasis on paleontological data. Topics covered include parsimony and Bayesian analytical methods, the combined use of morphological and molecular data, and molecular divergence estimates using fossils. We will make use of specimen collections in the Museum für Naturkunde.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and practicals 135 h own reading, exercises and preparation for the exam
Teaching materials	Scientific articles and materials posted on the course website, open-access software (e.g. BEAST, Mesquite, TNT)
Literature	-

Module title	**MGEWX02 Volcanic and tectonic deformation: Processes, detection methods and interpretation**
Responsible party	PD Dr. Thomas R. Walter
Additional teaching staff	Birger Lühr, Mehdi Nikkhoo, Jackeline Salzer
Semester	1 oder 2
Language	German or English
Exam/Grading	Written exam and/or final class report based on field project
Credit points	6
Number of participants	20
Recommended Back-ground	Fundamental knowledge in the Earth sciences (BS equivalent)
Course Type	Lecture, practicals in the classroom and in the field
Educational goals	Understanding the deformation processes occurring in volcanic and tectonic settings, as well as interactions thereof; learn the principles of deformation measurements from remote sensing and field stations with applications examples, and the interpretation of deformation data in experimental and computational models.
Module contents	The module provides an introduction into volcanic and tectonic deformation processes, with special cross-discipline emphasizes that include geologic field observations, geodetic monitoring technologies and geophysical interpretation tools. Processes related to gravity tectonics, spreading, body forces, magma tectonics, dike emplacements and cooling, and faulting related deformation will be discussed. In addition, the course investigates the couplings between volcanoes and tectonic processes.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and practicals 135 h own reading, exercises and preparation for the exam
Teaching materials	Scientific articles, books, materials posted on the course website
Literature	Segall, P. 2010, Earthquake and Volcano Deformation, Princeton University Press, 456 pp.; Dzurisin, D. 2006, Volcano Deformation, Springer Verlag, 256pp.; additional materials will be posted on the course website

Module title	**MGEWX03 Crustal deformation measured with radar satellite interferometry (InSAR)**
Responsible party	Dr. Sabrina Metzger, Dr. H. Vasyura-Bathke
Additional teaching staff	Teaching staff
Semester	1 (WiSe)
Language	English
Exam/Grading	Lab Portfolio, Presentation, oral exam
Credit points	6
Number of participants	min 5 - max 15
Recommended Background	Fundamentals in geophysics and signal analysis (BSc Geosciences) Fundamentals in using the command line or shell and Matlab, or the willingness to learn it
Course Type	lectures, exercises, practicals
Educational goals	The student knows the technique, application, advantages and limits of InSAR data processing. He/She knows how the data are recorded and which processing steps are needed to create tectonic deformation maps, which he/she then can adequately interpret and simulate with simple source models. Using InSAR case studies, the student knows how to analyze spatial (2D) data (statistics, filtering, sampling, Fourier analysis etc.). The student deepens his/her knowledge of the use of the command line, shell scripting and MATLAB.
Module contents	Synthetic aperture radar interferometry (InSAR) is becoming a more and more popular method to observe deformation of the Earth's surface for scientific and industrial applications. The high spatial resolution and accuracy of InSAR complements fields studies significantly. In this block course we discuss the theoretical aspects of SAR and SAR data processing and get hands-on-experience with case studies. We discuss the concept and signal type of a radar antenna, different application fields, advantages and limits of InSAR and get familiar with the processing steps starting from raw data to the final deformation maps (focussing, co-registration, geocoding, filtering, multi-looking, coherence, unwrapping etc.). Via student presentations we will learn more about different InSAR-methods (time-series analysis, point scatterer, pixel tracking etc.) and find out how to discriminate deformation from unwanted signal caused by atmosphere, topography, missing orbit information, unwrapping errors etc. and how to interpret the obtained results. The last part of the lecture deals with the potential sources of deformation (mainly tectonic, also anthropogenic or gravitational) and how we can model these sources using established models (dislocations and point sources).
Workload	180 h work load in total: 40 h Lectures + 40 h post processing 32 h series of Presentation and preparation 68 h Compilation of a lab portfolio and preparation for exam
Teaching materials	Lecture and exercise materials on moodle Case studies and exercises on the computer

Literature	Lecture and exercise material on moodle, complemented by student notes Hanssen, R. (2001), Radar Interferometry: Data and Error analysis Ferretti, A. (2007), InSAR Principles: Guidelines for SAR Interferometric Processing and interpretation Ferretti, A. (2014), Satellite InSAR data – Reservoir modelling from Space Segall, P. (2010), Earthquake and volcano Deformation Massonnet, D. and Feigl, K. L. (1998), Radar Interferometry and its application to changes in the earth's surface

Module title	**MGEWX04 Paleo and rock magnetics**
Responsible party	PD Dr. Norbert Nowaczyk
Additional teaching staff	
Semester	1
Language	German/English (by arrangement)
Exam/Grading	Presentation and Written report
Credit points	6
Number of participants	8
Recommended Back-ground	None
Course Type	Lecture, practical
Educational goals	Providing an overview of paleo- and mineral magnetism. Learning of data acquisition and analytical techniques
Module contents	Overview of geomagnetic field variations from geomagnetic storms to super-chrons, Magneto-mineralogy, Paleomagnetism and Plate tectonics, Magneto-stratigraphy, Environmental magnetism, Performing standard data acquisi-tion and analysis procedures in paleo- and mineral magnetism. Preparation of a report on performed analyses. Presentation of a selected topic in paleo- or rock magnetism
Workload	180 h total workload (30 h x 6 LP = 180 h) 30 h Lecture 60 h Practical (block course) 60 h follow-up and preparation 30 h written report
Teaching materials	Teaching material can be found on the internet page
Literature	Butler: PALEOMAGNETISM: Magnetic Domains to Geologic Terranes (free online book) Tauxe: Lectures in paleomagnetism (free online book)

Module title	**MGEWX05 Fundamentals of geothermics of the Earth's crust**
Responsible party	Dr. Sven Fuchs
Additional teaching staff	Dr. Ben Norden
Semester	1 or 3 (lecture during the semester, block course during the lecture free period)
Language	German / English (by arrangement)
Exam/Grading	Written examination about the contents of the lecture and a written report about the block course
Credit points	6
Number of participants	max. 25
Recommended Background	Fundamental knowledge in the Earth sciences (BSc equivalent)
Course Type	Lecture with accompanied exercises in classroom, one-week block course with laboratory training, field measurements and hands-on course (incl. geothermal modelling)
Educational goals	Knowledge and understanding of thermal rock properties, their variation and of thermal processes governing the thermal structure of the crust for the evaluation of thermal aspects relevant to geodynamic processes and the utilization of the subsurface.
Module contents	The module provides an introduction into heat transfer processes relevant within the Earth's crust, enabling the students to understand the evolution of heat and temperature in the crust. Beside the theoretical and physical background, methods for the determination of thermo-physical properties are presented and discussed. These include aspects of data acquisition as well as the processing of the data and the interpretation of thermal properties in terms of geodynamic processes and the utilization of the subsurface. The lecture will be complemented by practical exercises based on real sample data. Finally, the one-week block course comprises two days of laboratory work, one day of field measurements and two days hands-on training in data evaluation and thermal modeling.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures 40 h Block course: laboratory work, field measurements, hands-on training 85 h Reading, reporting and preparation for the exam
Teaching materials	Scientific articles, books, materials posted on the course website
Literature	Beardsmore, G. R. and J. P. Cull (2001). Crustal Heat Flow: A Guide to Measurement and Modelling. Cambridge, University Press Haenel, R., L. Rybach and L. Stegena (1988). Handbook of terrestrial heat-flow density determination. Dordrecht, Kluwer Academic Publishers. Turcotte, D. L. and G. Schubert (2002). Geodynamics. Cambridge, Cambridge University Press.

Module title	**MGEWX06 Advanced Topics of Visualization and Communication Methods**
Responsible party	Prof. J. Braun, PhD
Additional teaching staff	
Semester	Summer Semester
Language	English
Exam/Grading	Examination will take place in the form of • two written documents to be handed in during and at the end of the course (70% of final mark) • realization of a web-based product (blog, web page, etc.) to be assessed/evaluated in part by the other students (30% of final mark)
Credit points	6
Number of participants	25
Recommended Background	Fundamental knowledge in the Earth sciences (BSc equivalent)
Course Type	Lecture, discussion and practicals in the classroom
Educational goals	To enable students to share, explain and promote in written English their work as experts in the field of Remote Sensing, geoInformation and Visualiation to a broad range of audiences.
Module contents	Preparation and realization of written works in English in a broad range of contexts, including • Analysis of the intended readership and the objective of the written work • Choice of a medium to support objective • Development of a structure and style, depending on the public, medium and other circumstances • The mechanics of writing in English • Redaction of several pieces of written material (scientific report, papers to be published, research proposal, blog, CV, etc.)
Workload	180 h total workload (30 h x 6 LP = 180 h) 30 h Lectures and practicals 150 h own reading, exercises and preparation for the exam
Teaching materials	Teaching notes, articles and examples posted on the course website
Literature	Relevant literature will be posted on the course website

Module title	**MGEWX07 Modellierung von Struktur and Dynamik der Lithosphäre**
Responsible party	Dr. Sascha Brune, Dr. Judith Sippel
Additional teaching staff	Anne Glerum, Dr. Antoine Jacquey, Cameron Spooner
Semester	1
Language	Englisch / Deutsch, n.V.
Exam/Grading	Übung mit schriftlichem Bericht und/oder Vortrag
Credit points	6
Number of participants	Bis zu 20
Recommended Back-ground	keine
Course Type	Vorlesungen und Übungen (semesterbegleitend und als Blockkurs)
Educational goals	Verständnis grundlegender Ansätze in der numerischen Geodynamik, Beckenmodellierung, 3D-Datenintegration, plattentektonische Rekonstruktionen. Praktische Erfahrung in geodynamischer Modellierung und Beckenanalyse mit modernsten Werkzeugen.
Module contents	Der erste Teil dieses Kurses mit wöchentlichen Vorlesungen/Übungen bietet eine Einführung in die geodynamische Modellierung mit folgenden Themen: Einführung in Kontinuumsmechanik, plattentektonische Rekonstruktionen, numerische Modellierungstechniken und ihre Anwendung in der Deformation der festen Erde auf Becken-, Plattengrenzen-, und globaler Skala. Der zweite Teil wird als Blockveranstaltung mit Vorlesungen und Übungen in den Semesterferien nach dem Wintersemester abgehalten. Thematisiert werden verschiedene plattentektonische Konfigurationen weltweit (Rifts, passive Kontinentalränder, Orogene und Vorlandbecken), wo geologische und geophysikalische Daten in 3D Dichte- und thermische Modelle der Lithosphäre integriert wurden.
Workload	180 h Gesamtarbeitsaufwand (30 h x 6 LP = 180 h) 15 h Vorlesungen während des Semesters 15 h Übungen während des Semesters 15 h Vorlesungen (Blockkurs) 15 h Übungen (Blockkurs) 120 h Vorbereitung, Nachbereitung und Erstellung von Bericht
Teaching materials	Lehrbücher, und online verfügbares Material
Literature	Turcotte, D.L., and Schubert, G., 2002, Geodynamics: Cambridge University Press. Bangerth, W., Dannberg, J., Gassmöller, R., and Heister, T., 2017, ASPECT: Advanced Solver for Problems in Earth's ConvecTion: Computational Infrastructure for Geodynamics, http://www.math.clemson.edu/~heister/manual.pdf. Spiegelman, M., 2004, Myths and methods in modeling: Columbia University Course Lecture Notes, available online at http://www.ldeo.columbia.edu/~mspieg/mmm/course.pdf. Allen, Philip A., and John R. Allen. Basin analysis: Principles and application to petroleum play assessment. John Wiley & Sons, 2013.

Module title	**MGEW33 Special topics in geology A: Geodynamics, Climate and Biodiversity - Processes and Interactions**
Responsible party	Dr. Guillaume Dupont-Nivet, Prof. M. Strecker, PhD
Additional teaching staff	Dr. René Dommain, teaching staff
Semester	1 or 3
Language	English
Exam/Grading	Written exam or written report
Credit points	6
Number of participants	
Recommended Background	Fundamental knowledge in the Earth sciences (BS equivalent)
Course Type	Lecture and seminar
Educational goals	Understanding principles of evolutionary biology, phylogenesis and paleobiogeography. Understanding geodynamic and paleogeographic reconstructions in context of tectonic processes, landscape evolution, dating of sediment records and climate proxies; understanding and discussing models of global climate and biological evolution.
Module contents	The module will examine coupled geodynamic and Earth-Surface processes that impact environmental conditions on different spatial and temporal scales in a broad multidisciplinary approach: (1) Cenozoic geodynamic and tectonic processes; (2) biological evolution and speciation and (3) Paleoenvironmental and fossil records of changing climate and biodiversity. The module includes lectures and case studies of major tectonic systems and their associated biodiversity hotspots (Andes, Tibetan-Himalayan orogen, East African Rift System, Australasia, etc.) and short oral student contributions with a subsequent discussion forum. Students will learn about new developments in bio-geoscience interactions with a long-term, global perspective, and apply these concepts in the context of the far-reaching impacts of global change and anthropogenically driven species extinction and environmental change.
Workload	180 h total workload (30 h x 6 LP = 180 h) 45 h Lectures and seminars 135 h own reading, exercises, preparation for the seminars, written report
Teaching materials	Scientific articles, books, materials posted on the course website, computer programs.
Literature	Evolution D.J. Futuyma and M. Kirkpatrik (Fourth Edition); Earth's Climate Past and Future W. F. Ruddiman (Second Edition); additional material for the course is provided on the course internet page

Module title	**MGPWX01 Seismotectonics**
Responsible party	Dr. S.-K. Kufner (GFZ Potsdam)
Additional teaching staff	-
Semester	1 (WS 2017/18)
Language	German or English (as required)
Exam/Grading	Short presentation and report
Credit points	6
Number of participants	Max. 15
Recommended Background	Lecture 'Grundlagen der Geophysik + Signalanalyse' (or equivalent knowledge) Basic knowledge in seismology Basic programming skills in shell script and python (or the willingness to acquire these)
Course Type	Lecture, practical exercises (partly computer based)
Educational goals	The student gets to know different methods of seismological probing of the earth's crust and lithosphere (earthquake location, moment tensor solution, receiver functions, different forms of seismic tomography, shear wave splitting), knows their respective strengths and weaknesses and can judge the robustness of results obtained with them. He/she will be shown an overview of seismological signatures of different tectonic settings (such as rift, craton, subduction zone, hotspot, collisional orogen), and is able to interpret/associate results from above-mentioned techniques to one or several of these settings. This interpretation is practiced with computer-based case studies, where graphic illustration of obtained results will also be performed.
Module contents	This course is mainly aimed at students of geophysics but students of related geoscientific disciplines are welcome as well. The main topic of the module will be the tectonic interpretation of seismological results, i.e. the question what a distribution of moment tensors, seismic velocities etc. actually means. To reach this goal, there will first be a quick overview of different seismological inversion and imaging techniques. Results and images obtained with these methods will be discussed and their robustness assessed. Then, basic seismological signatures of tectonic processes will be presented. Typical features of different tectonic settings will be covered, and their identification will be practiced with case studies. In the final report (~10 pages, including title and referencing), the student will focus on the description of one specific method or setting based on the data he/she evaluated during the exercises. He/She will present these findings in a short presentation.
Workload	<u>180 h total workload (30 h x 6 LP = 180 h)</u> 40 h lectures 60 h homework and reading 40 h preparation for report 40 h preparation for presentation
Teaching materials	Course work material on website (moodle), computer-based case studies; exercises

Literature	material on course webpage (moodle) students' notes from the lecture useful books: - S. Stein and M. Wysession (2003): An introduction to seismology, earthquakes and earth structure; Blackwell Publishing (especially chapter 5) - C.M.R. Fowler (2005): The Solid Earth; Cambridge University Press

Module title	**MGPWX02 Electromagnetic and Magnetotelluric methods in (applied) Geophysics**
Responsible party	PD Dr. Ute Weckmann
Additional teaching staff	Department teaching staff
Semester	2
Language	German or English, (by arrangement)
Exam/Grading	Essay and/or written exam (by arrangement)
Credit points	6
Number of participants	Not limited
Recommended Background	Fundamental knowledge in general geophysics as taught in modules „Introduction to Geophysics“, „Introduction to applied Geophysics“ and „Advanced applied Geophysics“ (see BSc Geosciences, University Potsdam)
Course Type	Lecture, Exercise, practical training and/or seminar (by arrangement)
Educational goals	This module aims at providing a deeper understanding of electromagnetic depth sounding (Magnetotellurics) and its application to contemporary geodynamic and applied research. At the same time students should obtain an overview of off-shore electromagnetic applications. The practical training imparts knowledge in experiment layout and design, as well as station deployment.
Module contents	Contemporary, selected principled, topics, methods of electromagnetic research und practice
Workload	180 h Total workload (30 h x 6 ECTS = 180 h) 45h lecture and Exercise 45h regular homework (approx. 1,5 h/week lecture accompanying) 90 h follow-up and preparation of exam
Teaching materials	Teaching material will be supplied.
Literature	Selected literature will be supplied.

Modulbezeichnung	**MGPWX03 Analyse seismologischer Signale an aktiven Vulkanen (Vulkanseismologie)**
Verantwortlich	Prof. Dr. E. Eibl
Weitere Lehrpersonen	Lehrkörper des Instituts
Semesterlage	2
Sprache	Deutsch/Englisch, n.V.
Prüfung/Benotung	Mündliche Prüfung, Klausur oder Hausarbeit
Leistungspunkte (ECTS)	6
Teilnehmerzahl	Unbegrenzt
Empfehlungen	Keine
Lehrform	Vorlesung, Übung
Lernziele	Erlernen der Programmiersprache Python und Anwendungs der seismologischen Pakete Obspy und Pyrocko auf verschiedene vulkanseismologische Fragestellungen. Grundverständnis und Anwendung der digitalen Signalverarbeitung am Beispiel seismischer Aufzeichnungen von Vulkanen.
Lehrinhalte	Forschung im Bereich der Vulkanseismologie: Datensammlung mit Seismometern und Rotationssensoren, Datenkonvertierung, typische Arbeitsschritte in der Datenauswertung, Lokalisierung von Signalen, Eventtypen, Automatische Triggersysteme, Filter, Konvolution, Dekonvolution, Fourier-Transformation, Frequenz- und Impulsantwort von System.
Arbeitsaufwand	180 h Gesamtarbeitsaufwand (30 h x 6 LP = 180 h) 45 h Vorlesung und Übung 135 h Nachbereitung und Prüfungsvorbereitung
Medienform	Lehrbücher, Lehrveranstaltungsmaterialien auf der Internetseite der Lehrveranstaltung, Übungsblätter
Grundlegende Literatur	Ausgewählte Literatur wird zur Verfügung gestellt.

Module title	**MMPWX01 Experimental Mineralogy-Petrology**
Responsible party	Prof. M. Wilke
Additional teaching staff	Teaching staff Mineralogie-Petrologie, staff Sektion „Physik und Chemie der Geomaterialien“, GFZ
Semester	3 or 4, offered every semester
Language	German or English
Exam/Grading	2 short presentations, report (not graded)
Credit points	6
Number of participants	4
Recommended Back-ground	Fundamental knowledge in the Earth sciences (BSc), fundamental knowledge in analytical methods
Course Type	Practicals, self-study and seminar
Educational goals	Self-dependent execution of laboratory experiments, enhancement of analytical know-how and skills
Module contents	The module provides an introduction into performing experiments and analytical methods on properties, synthesis and reactions of geomaterials. Motivation and results of the experiments will be presented in short presentations. Experiments, analytical procedures and results will be documented in a written report.
Workload	180 h total workload (30 h x 6 LP = 180 h) 90 h Praktikum 20 h Seminar 70 h pre and post-processing, literature research; report writing
Teaching materials	Scientific articles, textbooks
Literature	Depending on topic, e.g.: Philpotts & Ague: Principles of Igneous and Metamorphic Petrology, Second Edition; Cambridge Univ. Press Literature on analytical methods