Modulhandbook

Study program:	M Sc Tropical Hydrogeology, Engineering Geology and Environmental Management
Designation of module:	Core Module 1 – Geological and Mineralogical Methods
Abbreviation, if applicable:	CM1
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Geological structures and mapping Mineralogical laboratory techniques
Semester(s):	1st
Person(s) responsible for the module:	Kempe
Lecturer(s):	Kempe, Hinderer, Hoppe, Ferreiro Mählmann
Language:	English
Allocation within the curriculum:	TropHEE
Form(s) of teaching/credit hours:	5 SWS (hours per semester week) 1 SWS lectures, 1 SWS exercises and 3 SWS field excursion all courses for 33 students
Amount of work required:	lectures 1h SWS attendance = 2h self-study exercises 1h SWS attendance = 3h self-study field excursion 1h SWS attendance = 0,5h self-study
Credit points:	10
Preconditions:	
Educational goals/ capabilities to be acquired:	Firm practice of basic methods of geological mapping in the field, constructing spatial structures of geological settings, basic knowledge in laboratory analysis of solid matter of the earth crust
Content:	Geological structures and mapping: Geological mapping, structural field measurements, section drawing, stereographic projection, groundwater levelling, sounding, soil and rock description, drawing of stratigraphic sections. Mineralogical laboratory techniques: Preparation of samples, XRF measurements, REM, ESEM: Physical principles of scanning electron microscopy and X-ray microanalysis, sample preparation, imaging, qualitative and quantitative chemical analysis.
Study and examination performance:	Examination
Media used:	Blackboard, beamer, overhead, exercises with PC
Literature:	Vossmerbäumer, H.: Geologische Karten.- Schweizerbarth, Stuttgart, 1983 Powell, D.: Interpretation geologischer Strukturen durch Karten.- Springer Verlag, Heidelberg, 1994 Maltman, A.: Geological maps – an introduction.- Wiley&Sons, New York, 1990

Study program:	M Sc Tropical Hydrogeology, Engineering Geology and Environmental Management
Designation of module:	Core Module 2 - Hydrogeology
Abbreviation, if applicable:	CM2
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Quantitative methods in hydrogeology Groundwater chemistry and salinization Groundwater in tropical and subtropical areas (humid to arid zones)
Semester(s):	1st
Person(s) responsible for the module:	Hinderer
Lecturer(s):	Schüth, Ebhardt
Language:	English
Allocation within the curriculum:	TropHEE
Form(s) of teaching/credit hours:	8 SWS (hours per semester week) 6 SWS lectures and 2 SWS exercises all courses for 33 students
Amount of work required:	lectures 1h SWS attendance = 2h self-study exercises 1h SWS attendance = 3h self-study field excursion 1h SWS attendance = 0,5h self-study
Credit points:	12
Preconditions:	
Educational goals/ capabilities to be acquired:	Fundamental knowledge of the hydrological cycle, groundwater hydraulics and chemistry with respect to various climatic zones, capability to apply related quantitative methods
Content:	Quantitative methods in hydrogeology: Darcy-flow basics and limits, Steady state and transient flow. hydraulic potential, aquifer parameters, leakage, radial flow and pumping tests, flow in fissured and karstified rocks, density influenced flow, regional groundwater flow, transport equation, diffusion and dispersion, retardation, double porosity, ground water balance, evapotranspiration, runoff, atmospheric and riverine recharge, case studies. Groundwater chemistry and salinization: Processes, chemical evolution and classification, solution and precipitation, CO2 and other gases, geogenic sources: carbonates, sulfates, halite, redox state, acidification, deep groundwaters, ion exchange, heavy metals, salinization by evaporation (irrigation problems), analytical requirements, sampling, representativeness, time variation, spatial variation, on site tests , lab methods, quality standards, drinking water (WHO, EU, US), requirements for irrigation, requirements for industrial use, corrosiveness, case studies. Groundwater in tropical and subtropical areas (humid

	to arid zones): Climatic zones, regional water balances, watershed dynamics, hydrograph analysis, groundwater recharge rates, seasonal fluctuations, fossil groundwater, river bank infiltration, overexploitation, groundwater in coastal areas, regional hydrogeology.
Study and examination performance:	Examination
Media used:	Blackboard, beamer, overhead, exercises with PC
Literature:	Fetter, C. W.; Applied hydrogeology; London, 2000 Deutsch, W. J.; Groundwater geochemistry; Boca Raton, 2003 Kurseman, G.P., De Ridder, N.A.; Analysis and evaluation of pumping test data; ILRI 1991 Schwarzenbach, R.; Environmental organic chemistry; New York, 1993 Fetter, C. W.; Contaminant hydrogeology; Upper Sattle, 1993 Grathwohl, P.; Diffusion in natural porous media; Boston, 1998

Study program:	M Sc Tropical Hydrogeology, Engineering Geology and Environmental Management
Designation of module:	Core Module 3 - Georesources and geohazards
Abbreviation, if applicable:	CM3
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Georesources and geohazards Raw materials Spatial analysis and thematic mapping with GIS
Semester(s):	1st and 2nd
Person(s) responsible for the module:	Hoppe
Lecturer(s):	Hoppe, Hofmann, Simons, Spottke
Language:	English
Allocation within the curriculum:	TropHEE
Form(s) of teaching/credit hours:	6 SWS (hours per semester week) 5 SWS lectures and 1 SWS exercises all courses for 33 students
Amount of work required:	lectures 1h SWS attendance = 2h self-study exercises 1h SWS attendance = 3h self-study
Credit points:	9,5
Preconditions:	
Educational goals/ capabilities to be acquired:	Phenomena and processes triggering geo-resources and geo-hazards are understood. Geology and properties of industrial and ore minerals and their use are known. Ability to introduce geo-aspects into spatial and environmental planning
Content:	Georesources and geohazards: Introduction to

	geohazards (e.g. earthquakes, tsunamis, volcanoes, landslides) and the management of georesources (e.g. raw materials, groundwater reservoirs, soils, geosites). Raw materials: Introduction to the geology of raw materials with focus on industrial minerals and the pit and quarry industry. Geological fundamentals in spatial and environmental planning: Principles of risk management processes and risk and decision analysis techniques. Evaluation of practical examples. Spatial analysis and thematic mapping with GIS: Basic principles of a GIS. The foci are put on the regionalization of data in thematic maps and the use of these maps within complex spatial analyses. Intensive PC-based exercises which enable the participants to elaborate a project at the end of the course.
Study and examination performance:	Examination
Media used:	Blackboard, beamer, overhead, exercises with PC
Literature:	Casale, Ricardo & Claudio Margottini, eds.: Floods and landslides: integrated risk assessment, - 373 S., Berlin – Heidelberg – New York (Springer), 1999. Smith, M.R. & L. Collis, eds.: Aggregates – sand, gravel and crushed rock aggregates for construction purposes. – Special Publication Geological Society Engineering Geology 17 (3rd edition revised by P.G. Fookes, J. Lay, I. Sims, M.E.R. Smith & G. West): 339 S., Bath, UK (Geological Society), 2001. AS/NZS 4360:1999. Risk management. Standards Association of Australia. 12.04.1999. Strathfield NSW, 44p. Bowden, A.R.; Lane, M.R.; Martin, J.H.. Triple Bottom Line Risk Management. – Enhancing Profit, Environmental Performance, and Community Benefits. John Wiley, New York. 314 p., 2001. Bell, Fred, G.: Environmental geology – priciples and practice. – 594 S., Oxford (Blackwell) [0-86542-875-1] (1998).

Study program:	M Sc Tropical Hydrogeology, Engineering Geology and Environmental Management
Designation of module:	Core Module 4 - Engineering Geology
Abbreviation, if applicable:	CM4
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Mechanical properties of soils and rock Stability of slopes and dams Field exercise in hydrogeology and engineering geology
Semester(s):	2nd

Person(s) responsible for the module:	Sass
Lecturer(s):	Sass, Burbaum, Buß, Piepenbrink
Language:	English
Allocation within the curriculum:	TropHEE
Form(s) of teaching/credit hours:	6 SWS (hours per semester week) 4 SWS lectures and 2 SWS exercises all courses for 33 students
Amount of work required:	lectures 1h SWS attendance = 2h self-study exercises 1h SWS attendance = 3h self-study
Credit points:	10,5
Preconditions:	
Educational goals/ capabilities to be acquired:	Basic knowledge of mechanical properties of sediments and rocks with regard to slope and dam stability, basic knowledge of statistical analysis of geo-data.
Content:	Mechanical properties of rocks: Engineering-geological classification of soils and rocks; sampling; laboratory and field investigation; principles of soil and rock mechanics and their properties, e.g. density, grain size, compressive strength etc.. Introduction to laboratory tests: direct shear test, triaxial shear test etc.. Principles of structural geology and introduction into stereographical projection. Field methods and field investigations. Stability of slopes and dams: Types of slopes; sliding surfaces; Stability against sliding; slope failure; rockfall; creep; Slope protection; types of dams, dam failure; filling material; piping, construction principles; Methods of investigation and reporting, principles of planning and surveying. Field exercise in hydrogeology and engineering geology dynamic probing tests, determination of compression modules, small borings via direct push methods, installation of piezometers, , pumping tests, piezometric heads, ground water isolines plots
Study and examination performance:	Examination
Media used:	Blackboard, beamer, overhead, exercises with PC
Literature:	Deutsch, C. V.; GSLIB: geostatistical software library and user's guide; New York, 1998 Isaaks, E. H.; Applied geostatistics; New York, 1989 Goovaerts, P.; Geostatistics for natural resources evaluation; Oxford, 1999 Webster, R.; Geostatistics for environmental scientists; New York, 2001 Chilès, J.-P.; Geostatistics; New York, 1999

Study program:	M Sc Tropical Hydrogeology, Engineering Geology

	and Environmental Management
Designation of module:	Special Module 1 - Soil protection and groundwater quality
Abbreviation, if applicable:	SM1
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Ecology of tropical and subtropical soils Soil protection and soil erosion Groundwater vulnerability and water directives Water analysis
Semester(s):	1st
Person(s) responsible for the module:	Hinderer
Lecturer(s):	Hinderer, Schiedek, Schüth, Thiemeyer, Weinbruch,
Language:	English
Allocation within the curriculum:	TropHEE
Form(s) of teaching/credit hours:	6 SWS (hours per semester week) 4 SWS lectures and 2 SWS exercises all courses for 33 students
Amount of work required:	lectures 1h SWS attendance = 2h self-study exercises 1h SWS attendance = 3h self-study
Credit points:	10
Preconditions:	
Educational goals/ capabilities to be acquired:	Knowledge of various kinds and sources of water contamination and methods to analyse these compounds. Fundamental understanding of soil development and functions of soils with regard to groundwater and soil protection including legal constraints. Fundamental understanding of interactions of soils and sediments with water.
Content:	Ecology of tropical and subtropical soils: The soil profile –soil properties – weathering - soil parent material – climate effects on soils – vegetation and soils - soil water – plant nutrients – soil classification – soil degradation. Soil protection and soil erosion: Sensitivity of soils against man-made impacts, land use practice and soil degradation, measures against soil degradation (e.g. agricultural techniques), controlling factors of erosion, field measurement of erosion, models for the quantification of soil erosion, sediment storage and sediment yield of rivers. Groundwater vulnerability and water directives: Practical aspects of groundwater and soil protection under law in force by the German administration (ministry of the environment, environmental administration and geological survey). Germs in natural waters, origin and persistence, legal constrains. Water analysis: Water sampling in the field, qualitative and quantitative analysis of major anions and cations

	as well as organic compounds in the field and in the laboratory, electronic ion balance, check of plausibility and quality, typing due to classification schemes, conclusion on groundwater flow and residence times.
Study and examination performance:	Examination
Media used:	Blackboard, beamer, overhead, exercises with PC
Literature:	Sumner, M. E.; Handbook of soil science; Boca Raton, 2000 Fanning, O. S.; Soil - morphology, genesis and classification; New York, 1989 Bannick, C.; Bodenschutz und Abfallverwertung; Berlin, 2001 Rosenkranz, D.; Handbuch Bodenschutz (Losebl.-Ausg.); Berlin, 1998 Brady, N. C.; The nature and properties of soil; New York, 1990 Deckers, J. A.; World reference base for soil resources: Introduction; Leuven, 1998 Fitzpatrick, E. A.; An introduction to soil science; Harlow, 1986 Paton, T. R.; Soils: a new global view; London, 1995 White, R. E.; Introduction to the principles and practice of soil science; Oxford, 1987 Höll, K.; Wasser; Berlin, 2002 Schlegel, H. G.; Allgemeine Mikrobiologie; Stuttgart, 1992 Lengeler, J. W.; Biology of the prokaryotes; Stuttgart, 1999

Study program:	M Sc Tropical Hydrogeology, Engineering Geology and Environmental Management
Designation of module:	Special Module 2 - Hydraulic engineering
Abbreviation, if applicable:	SM2
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Design and construction of wells and water plants Integrated water resource management Water supply in urban and rural areas
Semester(s):	1st
Person(s) responsible for the module:	Ebhardt
Lecturer(s):	Ostrowski, Balke
Language:	English
Allocation within the curriculum:	TropHEE
Form(s) of teaching/credit hours:	5 SWS (hours per semester week) 3 SWS lectures and 2 SWS exercises all courses for 33 students
Amount of work required:	lectures 1h SWS attendance = 2h self-study

	exercises 1h SWS attendance = 3h self-study
Credit points:	9
Preconditions:	
Educational goals/ capabilities to be acquired:	Fundamental knowledge of design and construction of wells and water plants in rural and urban areas as well as integrated water resources management.
Content:	Design and construction of wells and water plants: well borings, well materials, installation of casings and screens, pumps, well development, well aging and regeneration, water works. Integrated water resources development and management (IWRDM): Objectives, legal, economic and ecological aspects of IWRDM, multicriteria sustainability assessment - determination of regional water yield based on statistics and modelling - consumptive and non consumptive, conflicting and complementary users - estimation of actual water demand - conjunctive use and management of surface and groundwater resources, overview of technical elements (dams, canals, dikes, etc.) - simulation and optimisation techniques for IWRDM - decision support systems - case studies - group excercise Water supply in urban and rural areas: Surface water storage, reservoirs, artificial groundwater recharge, water harvesting, irrigation techniques, purification plants, groundwater balance, groundwater pollution, groundwater extraction.
Study and examination performance:	Examination
Media used:	Blackboard, beamer, overhead, exercises with PC
Literature:	Balke, K.-D.; Grundwassererschließung; Berlin, 2000 Driscoll, F. G.; Groundwater and wells; St. Paul, 1995 Tholen, M.; Arbeitshilfen für den Brunnenbau; Köln, 1997

Study program:	M Sc Tropical Hydrogeology, Engineering Geology and Environmental Management
Designation of module:	Special Module 3 - Environmental engineering
Abbreviation, if applicable:	SM3
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Geoenvironmental engineering Applied clay mineralogy Laboratory course in engineering geology Geophysics in hydrogeology and engineering geology
Semester(s):	2nd
Person(s) responsible for the module:	Sass
Lecturer(s):	Ferreiro Mählmann, Sass, Buß, Junge, Hornung
Language:	English
Allocation within the	TropHEE

curriculum:	
Form(s) of teaching/credit hours:	6 SWS (hours per semester week) 3 SWS lectures and 3 SWS exercises all courses for 33 students
Amount of work required:	lectures 1h SWS attendance = 2h self-study exercises 1h SWS attendance = 3h self-study
Credit points:	10
Preconditions:	
Educational goals/ capabilities to be acquired:	Fundamentals of methods and designs related to the investigation, monitoring, encapsulation and remediation of contaminated sites including specific recommendations for tropical zones.
Content:	Geoenvironmental engineering: Principles of environment related civil and underground construction and engineering, in situ facilities, waste disposal covers and liners, treatment technologies, in situ methods, theory of mass and flow transport, behaviour of contaminants, properties of waste, contaminated soil and rock, groundwater rehabilitation technologies, special construction feature like horizontal environmental wells, catalysts e.g. Laboratory course in engineering geology: Tests and methods to determine soil and rock mechanical parameters. Practice units in the soil and rock mechanical lab as well as in the geothermal lab. Applied clay mineralogy: Systematic of clay minerals, clay mineral diagenesis, structure transformations, ion exchange, clay minerals and exploration techniques. Geophysics in hydrogeology and engineering geology: Introduction into various methods of applied engineering geophysics: seismics, geoelectrics, electromagnetics, ground penetrating radar, geomagnetic
Study and examination performance:	Examination
Media used:	Blackboard, beamer, overhead, exercises with PC
Literature:	Telford, W. M.; Applied geophysics; Cambridge, 1990 Knödel, K.; Geophysik; Berlin, 1997 Schwarzenbach, R.; Environmental organic chemistry; New York, 1993 Fetter, C. W.; Contaminant hydrogeology; Upper Sattle, 1993 Velde, B.; Introduction to clay minerals; London, 1992 Cotter-Howell, J. D.; Environmental mineralogy; London, 2000

Study program:	M Sc Tropical Hydrogeology, Engineering Geology and Environmental Management

Designation of module:	Special Module 4 – Tools for environmental planning
Abbreviation, if applicable:	SM4
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Remote sensing in geology Geological fundamentals in spatial and environmental planning Geostatistics
Semester(s):	2nd
Person(s) responsible for the module:	Hoppe
Lecturer(s):	Hoppe, Hofmann, Simons, Spottke, Russow
Language:	English
Allocation within the curriculum:	TropHEE
Form(s) of teaching/credit hours:	6 SWS (hours per semester week) 5 SWS exercises and 1 SWS lecture all courses for 33 students
Amount of work required:	lectures 1h SWS attendance = 2h self-study exercises 1h SWS attendance = 3h self-study
Credit points:	9
Preconditions:	
Educational goals/ capabilities to be acquired:	Fundamental knowledge of methods in surveying and remote sensing. Ability to work within a stereoscopic model, to extract quantitative data of aerial photographs, to transfer geological and geographical data into a Geo Information System.
Content:	Remote sensing in geology: Introduction to remote sensing techniques. Exercises with aerial photographs within a stereoscopic model by drawing and interpreting valley systems and geology; determination of quantitative data (e.g. difference in elevation, thickness of bed and strike and slip). Geological fundamentals in spatial and environmental planning: Principles of risk management processes and risk and decision analysis techniques. Evaluation of practical examples. Geostatistics: Basic geostatistic concepts, spatial correlation, semivariogram modelling, local and global estimation, interpolation with kriging, cross validation, PC-based exercises.
Study and examination performance:	Examination
Media used:	Blackboard, beamer, overhead, exercises with PC
Literature:	Webster, R.; Geostatistics for environmental scientists; New York, 2001 Chilès, J.-P.; Geostatistics; New York, 1999 Drury, S.A. (1993): Image interpretation in geology.- 2nd ed., 243 S., London (Allen & Unwin). Miller, V.C. & Miller, F.: Photogeology.- 248 S., New York (McGraw-Hill), 1961. GIS: Esri ArcGIS manuals

Study program:	M Sc Tropical Hydrogeology, Engineering Geology and Environmental Management
Designation of module:	Special Module 5 - Groundwater flow and management
Abbreviation, if applicable:	SM5
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Contaminants in the environment Modelling of groundwater flow and transport Isotope hydrology and dating Tracer techniques
Semester(s):	3rd
Person(s) responsible for the module:	Schüth
Lecturer(s):	Schüth, Struckmeier, Frechen, Rausch
Language:	English
Allocation within the curriculum:	TropHEE
Form(s) of teaching/credit hours:	8 SWS (hours per semester week) 6 SWS lectures and 2 SWS exercises all courses for 33 students
Amount of work required:	lectures 1h SWS attendance = 2h self-study exercises 1h SWS attendance = 3h self-study
Credit points:	10
Preconditions:	
Educational goals/ capabilities to be acquired:	Basic knowledge of hydrogeological and numerical models and tracer methods.
Content:	Contaminants in the environment: Organic contaminants in the environment: Definition, classification, occurrence, chemical-physical parameters. Distribution coefficients: Henry's law constant, Raoult's law, octanol/water partition coefficient Equilibrium sorption: Koc concept, partitioning and pore filling, classification of organic matter Isotherms: Linear isotherm, Freundlich isotherm, Langmuir isotherm, BET isotherm Sorption kinetics: Diffusion, Fick's laws, diffusion coefficients in the gas phase and in water, intraparticlediffusion, tortuosity Simple analytical solutions of mass transfer equations Modelling of groundwater flow and transport: Application of groundwater models - basic concepts of groundwater flow - analytical flow models - numerical flow models - finite difference models / finite element models - explicit/implicit solution of the flow equation - a complete groundwater flow model – 2D-/3D- flow modeling – computer exercises. thermodynamic equilibria in natural waters, ion activity, ion activity

	product, solubility of minerals, speciation, calculation of saturation states, computer programs for equilibrium calculations, kinetics and rate laws, exchange equations. Isotope hydrology and dating: Natural and artificial isotopes, stable isotopes, radiogenic isotopes, groundwater dating techniques Tracer techniques: types of tracers, application of artificial tracers in field tests, analysis of tracer breakthrough curves, tracer mixing models
Study and examination performance:	Examination
Media used:	Blackboard, beamer, overhead, exercises with PC
Literature:	Anderson, M. P.: Applied groundwater modeling.- San Diego, 1992 Chiang, W.-H.: Aquifer simulation model for windows.- Berlin, 1998 Chiang, W.-H.: 3D-Groundwater modeling with PMWIN.- Berlin, 2001 Kinzelbach, W.: Grundwassermodellierung.- Berlin, 1995 Fritz, P.: Handbook of environmental isotope geochemistry.- New York, 1980 Käss, W.: Geohydrologische Markierungstechnik.- Berlin, 1992 Rausch, R.: Introduction to groundwater transport modeling.- Berlin, 2004

Study program:	M Sc Tropical Hydrogeology, Engineering Geology and Environmental Management
Designation of module:	Special Module 7 - Scientific and political project management
Abbreviation, if applicable:	SM6
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Seminar
Semester(s):	3rd
Person(s) responsible for the module:	Hinderer
Lecturer(s):	All lecturers, Sass, Burbaum, Helm,
Language:	English
Allocation within the curriculum:	TropHEE
Form(s) of teaching/credit hours:	4 SWS (hours per semester week) 2 SWS seminar, 1 SWS lectures and 1 SWS exercises all courses for 33 students
Amount of work required:	Seminar, lectures 1h SWS attendance = 2h self-study Exercises 1h SWS attendance = 3h self-study
Credit points:	7
Preconditions:	

Educational goals/ capabilities to be acquired:	Firm project management and practice of data presentation
Content:	Colloquium/Seminar: . Project management: Basics on project management, tools of project management, aspects of contracts and contract management, controlling, practice of data presentation, presentation techniques, rhetoric aspects, personal profiles, soft skills, body language. dress code etc. Parts of the course contents will be acquired in a business game style.
Study and examination performance:	Attendance and participation and seminar like presentations (one thematically randomized 15 min and one spontaneous 8min)
Media used:	Blackboard, beamer, overhead, exercises with PC, video camera
Literature:	

Study program:	M Sc Tropical Hydrogeology, Engineering Geology and Environmental Management
Designation of module:	Special Module 8 – Excursions
Abbreviation, if applicable:	SM7
Sub-heading, if applicable:	
Teaching sessions, if applicable:	Industrial excursions in Germany Applied geosciences of semiarid regions
Semester(s):	3rd
Person(s) responsible for the module:	Hoppe
Lecturer(s):	Hinderer, Hoppe, Schüth, Sass
Language:	English
Allocation within the curriculum:	TropHEE
Form(s) of teaching/credit hours:	11 SWS (hours per semester week) field excursions all excursions for 33 students
Amount of work required:	Field excursion 1h SWS attendance = 0,5h self-study
Credit points:	8
Preconditions:	
Educational goals/ capabilities to be acquired:	Overview of how problems in geosciences and related scientific areas are practically solved in Germany as well as in semi-arid countries, enhancement of theoretical and practical knowledge.
Content:	Industrial excursion Germany: Excursions to areas of water supply, pit and quarry industry, contaminated sites, tunnelling sites, geothermal sites and others. Applied geosciences of semiarid regions: Excursion to a semiarid area to study urban and rural water supply, irrigation, well types, regional groundwater balance

	and flow, water reservoirs, water quality, fossil waters, salt water intrusion, salinisation, protection against soil erosion, river erosion during high floods, desertification.
Study and examination performance:	Report
Media used:	Blackboard, beamer, overhead, exercises with PC
Literature:	Schiedek, T., Hinderer, M., Excursion Guide Tunisia 2002???????, Darmstadt.