Alternative course guide

Master Earth Sciences: Term 1

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Onderwijscommissie der U.A.V.

Content

Introduction

This is the course guide made by students of the Education Committee of the U.A.V. It serves as an alternative to the official course guide. Here you can read the students' positive and negative experiences, whether their courses fitted their track or not, and important points from the evaluations, like the work load. The alternative course guide is updated every period by the U.A.V.'s Education Committee. It is not complete yet, but we hope you can nevertheless use it to make better choices for your master's program.

In this guide, all the possible subjects of the first period of the Master programme Earth Sciences can be found. Underneath each subject is a personal account of a particular student's experience and reason for choosing the course.

From 2016-onwards it is possible to have a subject package that does not comply with a particular track (also known as a *recommended study path*), but rather a combination of various elements of each track. You are invited to literally think 'outside the track box'; take a look at subjects outside your study path, or even program. Within the first month of starting your master, a rough outline of how you are going to fill in the next coming two years needs to be sent to the coordinator.

Timeslot A

Structure and Composition of the Earth's Interior

Overview

Period	1	Course code	GEO4-1401
Timeslot	A	Mean rating last year	8.6
Teacher	Prof. Dr. Arwen Deuss	Mean workload last year	16-20 hours
Contact	A.F.Deuss@uu.nl	Success rate last year	100%

Acquired knowledge and skills

You will learn the main ideas on the composition and structure of the Earth's interior and on which facts/theories these are based. You will be introduced to the different perspectives of a geochemist and a geophysicist and get acquainted with the approach in modelling chemical and geophysical constraints of the Earth's Interior. You will work with an already existing program and investigate how different parameters (temperature, pressure, chemical composition) affect the model. By figuring this out yourself you get a very good basic understanding as to why scientists nowadays believe the geophysical and chemical constraints of the earth's interior are balanced, and what these ideas are based upon. Moreover, you learn how to review literature with a very critical attitude, even though you are not an expert on the topic.

This course illustrates very well what scientific geophysics is and teaches you how to gain a critical attitude towards scientific papers in general. This could be also interesting for other tracks, like *Basins, orogens and the crust-lithosphere system.*

Assessment, structure and work load

The course contains introduction lectures about physical, mathematical and chemical principles of the earth's interior, modelling exercises (25%), a presentation of an in-depth paper (25%) and a final exam (50%). The modelling and presentation occur in teams of two. The presentation includes a discussion in class about the quality of the paper. For the exam, you have to study all the papers discussed and know all the main findings/arguments. This is a lot of work, however, you are expected to read the papers before they are presented so you can participate in the discussion, so the work load is not focused just before the exams but spread over the entire course. Overall, the workload is balanced if you keep up with everything.

Experiences

Teaching from Arwen is well-structured and well-presented. The modelling project lasted about four weeks, with useful guidance from Arwen. The outline of the assignment was clear. The hardest aspect of the module was reading and understanding the literature, of which there was approximately 14 papers. However, discussion and understanding of these papers was spread out over 6 weeks during which you will present at least one (presenting more than one paper resulted in extra credit). The final exam was based entirely on presenting the arguments and conclusions of most of the papers in an essay format. Feedback and supports from Arwen is excellent.

Advanced Structural-Metamorphic Petrology and Mineralogy

Overview

Period	1	Course code	GEO4-1435
Timeslot	A	Mean rating last year	7.5
Teacher	Herman van Roermund	Mean workload last year	16-20 hours
Contact		Success rate last year	

In the academic year 2017-2018 this course will not be available

Acquired knowledge and skills

Knowledge: first encounter with high pressure metamorphism, insight in PTt-paths and various laboratory techniques and apparatuses used for studying metamorphic rocks

Skills: mineral recognition, both under the microscope as in hand samples, something that is lacking in the bachelor. The description on Osiris is very adequate. I found this course valuable for my track.

Assessment, structure and work load

Lectures and practical sessions. A large variety of assignments given during practical sessions had to be handed in all together at the end of the course to be graded. The assignments were related to real-life research situations, which made them realistic. The course ended with a final test. If you don't work structurally at home to finish the assignments, you will have a peak load at the end.

Experiences

The information on the slides was structured, but the lecture skills of the teacher were not. However, he is an expert and provides good guidance during practical sessions. Since everything must be handed in in the end of the course, there is no immediate feedback on the practical assignments, except if you explicitly ask for it.

Microbes and Biogeochemistry

Overview

Period	1	Course code	GEO4-1440
Timeslot	A	Mean rating last year	8
Teacher	Jack Middelburg and Martin Thullner	Mean workload last year	10-15 hours
Contact	j.b.m.middelburg@uu.nl	Success rate last year	

Acquired knowledge and skills

Knowledge: This is quite a chemical-orientated course. It focuses on the pathways of the main elements present in the ocean and how biogeochemical processes interact with this. The course also has a biological aspect in which you learn different types of microbiological organisms such as bacteria/ plankton and archaea ect.

Skills: You gain a more in-depth picture of the biogeochemical processes happening in the oceans and ocean sediments.

Assessment, structure and work load

The workload of this course is average, although the information density is quite high. Every week you have lectures (often 3 or 4 hours a day!) and near the end of the period there are a few computer practicals too. The assessment of the course is as follows: Term paper (15%); presentations (15%); final examination (70%).

Experiences

It was nice to learn more about microbes / microbiology in an aquatic setting as, even though as a paleoclimatologist/chemist you may easily forget this, they play a major role in biogeochemical processes taking place in the sediment!

River and Delta Systems

Overview

Period	1	Course code	GEO4-4436
Timeslot	A	Mean rating last year	7.4
Teacher	Gilles Erkens, Martin Kleinhans, B van Maanen	Mean work load last year	16-20 hours
Contact	b.vanmaanen@uu.nl	Success rate last year	71%

***The academic year 2016-2017 is the first year that this course will be called 'River and Delta Systems' instead of 'Fluvial Systems'.**

N.B. for the track *Coastal Dynamics and Fluvial System*s this course is highly recommended due to the importance of the subject; it is considered to be one of the core courses for this track.

Acquired knowledge and skills

Acquire integrated physics-, geomorphology- and sedimentary-based understanding of the formation and dynamics of rivers and deltas. Gain insight into fluvial processes (e.g. sediment transport, avulsion) and associated (Quaternary) deposits.
Acquire basic data analysis and modelling skills (MATLAB).

Assessment, structure and work load

The course consists of lectures and practicals, and has a high work load. This can feel like a burden at times, but this guarantees that you learn a lot. MATLAB assignments follow each other in rapid succession. Code, brief presentation and written abstract add up to 35%, group presentation and extended abstract of delta project add to 30% and the exam counts for 35% of the total course mark.

Experiences

The MATLAB manual for these exercises is very well done, which made the introduction to modelling a positive experience. Lectures given by different teachers provided a nice amount of variety.

Timeslot B

Paleoceanography and Climate Variability

Overview

Period	1	Course code	GEO4-1405
Timeslot	B	Mean rating last year	7.1
Teacher	Gert Jan Reichart	Mean workload last year	21-25 hours
Contact	g.j.reichart@uu.nl	Success rate last year	16 out of 22

Acquired knowledge and skills

Knowledge: Understanding the (paleo)ocean circulation during different climatic regimes, and the related proxy variability. The bachelor course paleoceanography focused more on the basics of understanding the ocean system. About how the physical and the chemical components of the ocean work. This master course is more applied to different climatic regimes.
Skills: improved Excel skills (computer practical).

Assessment, structure and work load

Two days in the week you have two hours of lectures, followed by a two hour computer practical about the lecture subject. You have to hand in these practicals every week, which will be graded. There is a final exam which count for 70% of your grade. Because you have to hand in the practical every week, the workload is quite evenly distributed.

Experiences

The course is well organized. Lucas Lourens and Martin Ziegler also gave some lectures. The structure of lectures followed by computer practicals about the same topic works really good. There was also enough guidance during the practicals and you received every week feedback on your previous assignment.

Data-processing and Inverse Theory

Overview

Period	1	Course code	GEO4-1415
Timeslot	B	Mean rating last year	7.3
Teacher	prof. dr. J.A. Trampert	Mean workload last year	21-25 hours
Contact	j.a.trampert@uu.nl	Success rate last year	12 out of 24

Acquired knowledge and skills

Understanding the fundamental concepts of data processing and inverse theory, and being able to apply these.

Geophysics often requires the analysis of measured data. Raw data can hide the specific information one is interested in and prior data processing is necessary. You will review the fundamentals of geophysical data processing, starting with a detailed description of how to sample continuous functions, then progressing to the corresponding discrete Fourier transform. The important concept of convolution and linear filter theory will be presented. Simple linear inverse theory will be discussed and the classical least squares and minimum norm problem will be introduced, with particular emphasis on single value decomposition. You will learn how to design optimal filters using basic inverse theory. During the course and computer practicals, examples will be taken from various fields of geophysics.

For students looking to refresh their background knowledge the website *http://www.thefouriertransform.com/* is very useful.

Assessment, structure and work load

The total course mark is based on a report on the computer practicals (30%) and a final written exam (70%). This is course is considered very time consuming. It is split up into two parts filter-and-signal processing theory as well as inverse theory, which don't really go together.

Experiences

Without a doubt a difficult course, but both interesting and useful. A high level of mathematical ability is necessary, specifically being able to integrate and differentiate exponential, Ln, trigonometric functions and by-parts quickly will allow you to follow lectures. Being able to code in MATLAB is necessary for practicals (but many students learnt during the course and did OK). Inverse theory for most was challenging to understand but rewarding once grasped. Lecturing was of a high quality but feedback during the course from Jeannot was minimal, although a PhD student was very useful during the practicals (thanks Maria!). Immediately after the summer break this course will challenge your memory of mathematics.

Land Surface Hydrology

Overview

Period	1	Course code	GEO4-4404
Timeslot	B	Mean rating last year	6.9
Teacher	Dr. Rens van Beek	Mean work load last year	21-25 hours
Contact	r.vanbeek@uu.nl	Success rate last year	79%

*** Principles of Groundwater flow (GEO4-1434) and Land Surface Hydrology are obligatory for master students within the Hydrology track. Either, or both, courses are often required for subsequent hydrology courses. Land Surface Hydrology is also part of the second year of the master Water Science and Management. The book: S. Dingman Physical Hydrology, 2nd Edition (ISBN: 978-1-57766-561-8) is also obligatory**

Acquired knowledge and skills

Knowledge: After an introduction of the global hydrological cycle, the course focuses on the hydrology within a catchment. Students learn several ways to describe the conversion of precipitation to runoff and storage. Ways to separate base flow from quick flow are discussed, as well as ways to describe the propagation of a flood wave (routing). Also there is a lecture on water management (interpret stream flow data for design purposes).
Skills: Students learn to analyse and interpret precipitation and runoff data. Also students learn ways to describe these data mathematically to make runoff forecasts. A small chapter is spent on errors and uncertainties. A lot of exercises are done with Excel, and some basic modelling with PC Raster.

Assessment, structure and work load

The course is well divided into different ways to obtain the knowledge. There are lectures, practicals (not graded) and computer practicals with Excel (not graded). For one lecture students have to read two papers and discuss them. Students have to write a paper based on literature and a report of a model they made themselves. Overall, the work load is evenly divided. Only the work load at the end of the course is high, because the deadline for the model report is close to the final exam. But the teacher is willingly to improve this.

Experiences

Students think the course is of high value for their track. The course evaluations state the teacher is very committed to help the students with the exercises or their model. This is good, because the modelling is independent and students have to find out how to make/adapt the model themselves, without some introduction lectures.
The reviews on the book are not very good. There is a lot of information, the main issues are hard to recognize. The reader is fine.
The feedback on the papers is late (after the final exam), but very specific. The final exam is of a high level, you really should practice old exams.

Timeslot C

Petrological and Geochemical Evolution of the Earth

Overview

Period	1	Course code	GEO4-1403
Timeslot	C	Mean rating last year	8.6
Teacher	Prof. Dr. P Mason	Mean workload last year	16-20 hours
Contact	p.mason@uu.nl	Success rate last year	85%

***The academic year 2016-2017 is the first year that this course will be called 'Petrological and Geochemical Evolution of the Earth' instead of 'Magmatic Processes'. The course was restructured and taught by Paul Mason from 2015. It now focusses less on magmatics and more on different aspects of geochemistry, such as the onset of life and plate tectonics.**

Acquired knowledge and skills

Gain knowledge about the geochemical and petrological evolution of the Earth throughout its entire history from the Hadean to recent times. Radiogenic and stable isotope systems are used to pinpoint the origin of life on Earth; magmatic and geochemical evidence provides an indication as to the onset of plate tectonics.

Learn how to interpret textural, mineralogical, chemical and isotopic data from igneous and sedimentary rocks collected from ancient environments. If you're lucky you might get a glimpse of the meteorite Allende.

Discuss scientific literature and learn how to critically assess and evaluate competing arguments, and present this to the class in groups.

Assessment, structure and work load

Lectures, practical sessions on petrography (with a possible microscope exam) and presentations. Teams of 3 or 4 students pick a controversial geochemical topic and present this. After the presentation, there is a class discussion. In addition, the students need to write an individual 2-page extended essay on said topic. The course ended with a final exam, which was relatively difficult as many topics are covered, but a certain amount of questions on the exam are to choose from.

Experiences

The microscopy practicals were very useful, but the amount of supervision was low. The presentations are interesting as everyone can pick their own topic. The didactic quality of Paul Mason is rated very high. The topics are thought as interesting by the students.

The two guest lecturers, Inge-Loes ten Kate and Leo Kreigsman, provide an introduction (two lectures and two practicals each) to the course content, giving more diversity in teaching style and methodology.

This course is one of the most highly-rated courses of the year.

Aquatic and Environmental Geochemistry

Overview

Period	1	Course code	GEO4-1439
Timeslot	C	Mean rating last year	7.5
Teacher	Dr. M.Wolthers Dr. T. Behrends	Mean workload last year	21-25 hours
Contact	M.Wolthers@uu.nl	Success rate last year	

No entry requirements and the course is also not an entry requirement for another course.

Acquired knowledge and skills

Knowledge: The course is about the processes (equilibrium) that control the composition of different water bodies. The processes are: acid base reactions, redox reactions, solubility of solids, metal speciation in aqueous solution, distribution of compounds between different phases and the adsorption of ions and organic compounds at the solid-liquid interface.
Basic knowledge of equilibrium thermodynamics is useful (course: Physical Chemistry GEO2-1202)
Skills: You also learn how to work with MINEQL 4.6, which is a chemical equilibrium speciation model.

Assessment, structure and work load

Every (other) week a new topic is started. The topics are: acid base chemistry, metal speciation, redox chemistry, reactions at solid water interfaces (adsorption), heterogeneous reactions (between difference phases: gas water equilibrium, solid solution equilibrium). So there is a nice structure. There are two projects, with the first bigger than the last, each counting 20% to the final course grade. The reports are about assignments that need to be done by MINEQL 4.6.

Experiences

The lectures are written on the blackboard. This means that the slides only have pictures and graphs on them without any text. So it is clever to be present at the lectures and to make notes!
At the beginning of every new topic you will get a handout with questions that will be answered and the different subjects that will be told. This is nice when preparing for the exam, you know what will be expected from you and it is nice when preparing for the exam.

Tip 1.) You may use two A4 sheets with notes during the exam. Use them good, write so many things on it as you can. It really helps remembering the subject matter and you do not need to learn anything by hard.
Tip 2.) Look at the older exams they all have the same structure and topics, so take that advantaged!

Statistics and Data Analysis in Physical Geography

Overview

Period	1	Course code	GEO4-4412
Timeslot	C	Mean rating last year	7.6
Teacher	Prof. dr. ir. F.C. van Geer & dr. ir. G. Sterk	Mean workload last year	16-20 hours
Contact	g.sterk@uu.nl	Success rate last year	>90%

Acquired knowledge and skills

Knowledge: extended knowledge about statistical procedures for spatial dataset and elementary statistics

Skills: different statistical procedures in Excel and R, basic data management and analytical skills for statistical problems. This course is considered a supporting course for this track but is very useful for all tracks due to the widespread use of statistics in scientific research.

Assessment, structure and work load

The course consists of lectures followed by practicals and assignment. The practicals are compulsory, but the grade of the course is determined by two equally important tests. The work load was a bit low and students spend on average ±11 hours per week.

Experiences

The course is considered to be somewhat less inspirational compared to other courses. However, all students that did this course, both in the recent and less recent years, are very positive about the extremely practical use of the skills obtained in this course. It is a recommendation for most students for the knowledge about statistics that is a bit underrepresented in the bachelor and other courses of Earth Sciences.

Timeslot D

Reflection Seismics & Petroleum Systems

Overview

Period	1	Course code	GEO4-1441
Timeslot	D	Mean rating last year	7.1
Teacher	Dr. L.C. Matenco Dr. W.W.W. Beekman Guest lecturers	Mean workload last year	16-20 hours
Contact	L.C.Matenco@uu.nl	Success rate last year	29 out of 29

Acquired knowledge and skills

The main focus of the Reflection Seismics part of this course lies on the understanding of the evolution of a sedimentary basin in terms of tectonic and depositional sequences using reflection seismics and the integration of well logs. The Petroleum System part focusses on the geological concepts that control the occurrence of petroleum resources and how they relate to sedimentary basin evolution. Reflection seismics are also used in this part. A short introduction behind the economics of the petroleum industry and the oil price is given as well.

Assessment and work-load

The course work consists of ~10 seismic cross sections which need to be interpreted and a small report is constructed for each. This part has by far the highest workload. The Petroleum Systems (2nd half) part of the course has a final exam on the theories behind the creation of petroleum systems.

Experiences

The level of the course in Amsterdam is regarded to be quite low, whereas the level in Utrecht is very high. Also, the connection between the course in Amsterdam and Utrecht is not optimal.

Principles of Groundwater Flow

Overview

Period	1	Course code	GEO4-1434
Timeslot	D	Mean rating last year	8.2
Teacher	prof. dr. R.J. Schotting	Mean workload last year	16-20
Contact	r.j.schotting@uu.nl	Success rate last year	-

*** Principles of Groundwater flow (GEO4-1434) and Land Surface Hydrology are obligatory for master students within the Hydrology track. Either, or both, courses are often required for subsequent hydrology courses. Land Surface Hydrology is also part of the second year of the master Water Science and Management. The book: S. Dingman Physical Hydrology, 2nd Edition (ISBN: 978-1-57766-561-8) is also obligatory**

Acquired knowledge and skills

The course gives a good overview of the basic principles to quantify flow of water through saturated porous media. All different subjects (porous media properties, flow equations, field tests etc.) are given on Osiris. A difference between Osiris and the actual course is that no attention is paid to solute transport and there is no excursion to a groundwater remediation site (this excursion is part of the course Hydrogeological Transport Phenomena GEO4-1433).
Many applications of the obtained knowledge are discussed. An introduction to the groundwater modelling program Modflow is given by Amir Raoof. The main skill you obtain is to set up and work out groundwater equations for different situations. Mathematics (differentials, super position principle etc.) is important during the whole course.

Assessment, structure and work load

Lectures cover the main part of the course. There are no practicals; students exercise by making their homework. Each part of the homework contributes to the final grade. Every homework exercise has the same weighing, while the homework assignments in the end of the course take more time than the first couple of homework assignments. The workload at the end of the course is therefore higher than in the first weeks of the course. Next to the tutorials, there are some Modflow classes and an excursion to the drinking water company Oasen. No presentation, no papers to read or to write.
Students following Principles of Groundwater Flow have very different backgrounds. Students who do the track Hydrology from the master Earth Surface and Water often have a bachelor Earth Sciences. They followed Water in Geo-processes and Physical Hydrology, have a good background and know mathematics well. For them, the work load is quite low and the learning curve is slow. The larger part of the students is from the master Water Science and Management. Their background and knowledge of mathematics (from Wageningen, Environmental Studies, HBO etc.) is often not sufficient. Ruud Schotting gives extra math classes. However, still the work load for them is very high. The difference between the math levels of the students makes the lectures hard: too slow for one part, while the other part thinks it's too difficult. The exam accounts for 75% of the grade, the homework 25%.

Experiences

In the course evaluations, students react very enthusiastic about the teacher. Students like the examples from reality. In the end of the course, old exams are part of the homework, which helps students to exercise and prepare for the final exam. Feedback is sometimes insufficient.Introduction to Marine Sciences

Introduction to Marine Sciences

Overview

Period	1	Course code	GEO4-1451
Timeslot	D	Mean rating last year	7.1
Teacher	Appie Sluijs	Mean workload last year	21-25
Contact	a.sluijs@uu.nl	Success rate last year	100%

Acquired knowledge and skills:
In this course students will gain a multidisciplinary insight into the marine sciences, including morphology, basin circulation, ecology, element cycling, human influences, and oceanic modelling. The aim of the course is to reach a knowledge and integration level required to follow other MSc courses in marine biology, physics, chemistry, and earth sciences. Moreover, basic insights into issues related to law and policy of the sea will be gained. The various disciplines will be integrated using a project theme case study that will be studied from multiple disciplines and will be presented at the end of the course.

Assessment, structure and work load
The course work consists of Lectures and practicals, including homework exercises which will be graded. The course also contains a Literature study, which is highly appreciated by students. Unlike previous years, students will now take an exam at the end of the course.

Experiences
Students rate the course with a 7.1 and appreciate the feedback to the exercises. It has a higher than average workload, which is a main issue students had with the course in previous years. It contains some difficult topics, such as physics and biology, which can be complex, especially if the student is not familiar with the subject matter

Advanced GIS for Geoscientists

Overview

Period	1	Course code	GEO4-4433
Timeslot	D	Mean rating last year	7.3
Teacher	Drs. M.J. Zeylmans van Emmichoven	Mean workload last year	16-20 hours
Contact	m.j.zeylmansvanemmichoven@uu.nl	Success rate last year	30 out of 34

Acquired knowledge and skills

Knowledge: Practical knowledge about soil erosion and extended knowledge on the theories behind GIS systems.

Skills: thorough experience with spatial analysis in GIS & presenting GIS results both orally and visually

Assessment, structure and work load

The course consists of several supporting lectures and two main assignments with some smaller practicals. The report from one of the main assignments is half of the grade with an exam, concerning theoretical questions, making the other half of the final grade. All practicals have to be finished and there is a fairly strict compulsory attendance. The work load is pretty evenly spread with some more busy weeks just before the deadline as usual.

Experiences

The course is found to be fine with an average of a 7 for the course. Some of the complaints are, like most of the modelling courses, focused on the rather low amount of feedback and long waiting times for the assistance during practical's. The skills of the course are extremely useful and are used in all disciplines within earth sciences.

Outside of timeslot

Subsurface Evaluation for Hydrocarbon Exploration and Development

Overview

Period	1	Course code	GEO4-1505
Timeslot	-	Mean rating last year	8.5
Teacher	W. W. W. Beekman	Mean workload last year	>25
Contact	w.w.w.beekman@uu.nl	Success rate last year	100%

This course can only be taken after GEO4-1441 and GEO4-1517A. It should be noted that this is a full-time 4-week course and that attending all course sessions and site visits is compulsory.

This course focusses on the practices and real-life challenges of the petroleum industry and is partially taught by industry professionals. There are several company visits (EBN, NAM, Shell, Wintershall).

Acquired knowledge and skills:
The course will provide hands-on experience with the exploration-development workflow in subsurface evaluation for oil and gas resources. Students will become acquainted with 3D seismic interpretation as a subsurface exploration and production tool to find hydrocarbons. You'll obtain an overview of workflows in subsurface modelling and understands the impact of different subsurface disciplines for exploration and development and you will have developed skills for pursuing a career in the oil & gas industry.

Assessment, structure and work load
The course includes lectures and group exercises, a computer practical with the Petrel software, a paper presentation and a group presentation on a case study. There is no exam. The workload is high, but this is a full-time course.

Experiences
The course is liked for its practical approach. Students appreciate the didactic quality of the teachers, the company visits, the team work, and the workflow of the course program.