Alternative course guide

Water Science and Management

Last updated: 02-11-2014

Introduction

This is the course guide made by students of the committee for education of the U.A.V. It serves as an alternative for the official course guide. Here you can read the positive and negative experiences of students, stories of students that tell which course fitted in their track and which didn't, and all important points from the evaluations, for example the work load. The alternative course guide is updated every period by the committee for education of the U.A.V. It is not complete yet, but we hope you nevertheless can use it to make better choices for your master's program.

For the master Water Science and Management there are two possibilities: you follow the pathway Earth Sciences and get a Master's degree in Earth Sciences, or you follow the pathway Environmental Sciences and get a Master's degree in Environmental Sciences. The only difference in courses is in the second period of the first year.

	Year 1			
	Pathway Earth Sciences		pathway Environmental Sciences	
1	Sustainable Development: Integrating perspectives	Principles of Groundwater flow	Sustainable Development: Integrating perspectives	Principles of Groundwater flow
2	Unsaturated zone hydrology *or* Hydrogeological transport phenomena	Ecosystem modeling	Sustainability Science modelling and indicators	Ecosystem modelling
3	Quantitative Water Management	Coastal Zone and River management	Quantitative Water Management	Coastal Zone and River management
4	Water Policy, Governance and law	Drinking Water and Sanitation	Water Policy, Governance and law	Drinking Water and Sanitation

	Year 2			
	Pathway Earth Sciences		Pathway Environmental Sciences	
1	Transdisciplinary Case Study	Land surface hydrology	Transdisciplinary Case Study	Land surface hydrology
2	Graduation Internship (or elective)			
3	Graduation Internship (or elective)			
4	Graduation Internship (or elective)			

Contents

1. Pathway Earth Sciences

1.1 Sustainable development: Integrating perspectives

Overview

Period	1	Course code	GEO4-2301
Timeslot	A + C	Mean rating last year	
Teacher	C.A. Barnes	Mean workload last year	
Contact	c.a.barnes@uu.nl	Success rate last year	

1.2 Principles of groundwater flow

Overview

Period	1	Course code	GEO4-1434
Timeslot	D	Mean rating last year	7.8
Teacher	prof. dr. R.J. Schotting	Mean workload last year	16-20 h
Contact	r.j.schotting@uu.nl AW W234	Success rate last year	-

Book: Charles R. Fitts, Groundwater science. Academic press, June 2002. ISBN 0-12-257855-4. (obligated)
Principles of Groundwater flow and Land Surface Hydrology (GEO4-4404) are “obligated” for master students with the track Hydrology. One of them or both courses are often required for subsequent hydrology courses. Principles of Groundwater flow is also part of the master Water Science and Management.

Acquired knowledge and skills
Knowledge: 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 modeling program Modflow is given by Amir Raoof. Also an excursion to the drinking water company Oasen is part of the program.
Skills: 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 definitely 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 a very different background. 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.

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 definitely helps students to exercise and prepare for the final exam.

1.3 Unsaturated zone hydrology

Overview

Period	2	Course code	GEO4-4417
Timeslot	C	Mean rating last year	7.4
Teacher	dr. M.R. Hendriks prof. dr. ir. M.F.P. Bierkens prof. dr. ir. S.M. Hassanizadeh	Mean workload last year	15 h
Contact	m.r.hendriks@uu.nl Zon 2.03	Success rate last year	100 %

Acquired knowledge and skills
Knowledge: The unsaturated zone is important because of for example groundwater recharge, infiltration and overland flow, for vegetation and agriculture. The course starts with the part of Martin Hendriks which covers the basics of unsaturated zone: soil physics, matric and preferential flow and infiltration. Mark Bierkens continues and discusses the determination of soil physical parameters and unsaturated flow equations. The last lectures by Majid Hassanizadeh are more physical and cover interfacial tension, capillary flow and a critical evaluation of unsaturated flow theories.
Skills: Students learn how to work with soil moisture and infiltration curves, how to work out simple unsaturated flow equations and how to set up force diagrams concerning capillary flow.

Assessment, structure and work load
The course consists of lectures and practicals. Practicals have to be handed in and will be graded. Also students have to do duo presentations. There is a practical with the flow model Hydrus, about which students have to write a report.
The course starts with basics, with is relatively easy for those who followed the BSc course Physical Hydrology. The level increases during the course and at the end of the course the (mathematical) level is high. Most students spend an average of 11-15 hours per week on the course, but also a third says to spend more than 20 hours per week.

Experiences
Students who had the BSc course Physical Hydrology might think the level is too low at the beginning of the course. However, the second part covers new and more difficult subjects. The paper is graded, but the feedback is not much. Overall, the grades are high, probably because the presentations and papers are graded high or the final exam looks like earlier assignments/old exams.

1.4 Hydrogeological transport phenomena

Overview

Period	2	Course code	GEO4-1433
Timeslot	D	Mean rating last year	8.1
Teacher	prof. dr. ir. S.M. Hassanizadeh	Mean workload last year	19
Contact	s.m.hassanizadeh@uu.nl AW W228	Success rate last year	93 %

Book: Mayer, A.S. and S.M. Hassanizadeh, Soil and Groundwater Contamination: Nonaqueous Phase Liquids, American Geophysical Union, 224 pages, June 2005 (ISBN 0-87590-321-7). (recommended)
Book: Fetter, C.W., Contaminant hydrogeology, Macmillan, New York, (2nd ed.). 1999. (recommended)
Required course: AW-Principles of groundwater flow (GEO4-1434).

Acquired knowledge and skills
Knowledge: The course starts with laws about dissolution and volatilization and continues with flow and transport equations: advection, degradation/decay, diffusion, dispersion and adsorption. At the end of the course there is a lecture about transport in the unsaturated zone. The course fits in a sequence of courses of increasing level: Principles of Groundwater Flow (Period 1), Hydrogeological Transport Phenomena and Environmental Hydrogeology (Period 4).
Skills: In this course students learn how to come up and work out flow and transport equations for different situations and different initial and boundary conditions. The mathematical level is high. Students learn to think themselves, for example if you think a value is missing in the exercise, you have to search on the internet for an appropriate value yourself. Also transport modeling in Modflow is a topic. During the lectures there is referred to real problems and applications.

Assessment, structure and work load
Two times a week four hours lecture. Some exercises are included in the lectures. Every week students have to hand in assignments, which are graded. The work load was balanced, on average students spend . These assignments are of equal or higher level than the exercises in the lecture. There also is an excursion to a contamination site, with a guest lecture, about which you have to hand in a report. Another guest lecture at the end of the course covers virus transport.

Experiences
Students think the didactical quality of Majid Hassanizadeh is very high. Students think the course is very instructive and of high level. The lecture notes of Majid, which he sends to every student, are good. You are allowed to use them during the final exam. Overall, students get relatively low grades for their final exam, but the grades of the assignments compensate for this.

1.5 Ecosystem modelling

Overview

Period	2	Course code	GEO4-2302
Timeslot	A + B	Mean rating last year	
Teacher	M.G. Rietkerk	Mean workload last year	
Contact	m.g.rietkerk@uu.nl	Success rate last year	

1.6 Quantitative water management

Overview

Period	3	Course code	GEO4-6001
Timeslot	A	Mean rating last year	**4.8**
Teacher	Dh. J. Buma	Mean workload last year	11 h
Contact	j.buma@uu.nl	Success rate last year	97 %

Disclaimer

Before reading further, one should realize that this course is still very new (at the time of writing it has been given twice) and thus still in development.

Acquired knowledge and skills

According to Osiris, the course will allow the student to:

- present a complete overview of quantitative water management issues around the world and in the Netherlands in particular;
- perform basic calculations to support flood protection and drainage system and irrigation system design;
- understand the complex relationships between water quantity and chemical and ecological quality;
- reflect on current and future developments in quantitative water management in the context of global change.

The water management issues covered in the course are: drainage, land subsidence, flooding, flood protection, salt intrusion, reservoir management, irrigation and water quality. These topics are coupled with assignments that involve calculations at a very basic level. This allows the course to cover such a broad range of subjects. However, if the student already has some basic knowledge on a subject, this also implies that there is not a lot of new knowledge to be acquired by following this course. About half of the calculations can be done on a calculator, the other half is best done in Excel. There are a few tricks in Excel that might be new for relatively inexperienced Excel users, but anybody that has worked with Excel for a few other courses will most likely not gain any new skills.

The most important aspect of the course (that is not mentioned in Osiris) is perhaps the practical, "real-life", approach that is used in some of the assignments. Assignments in most other courses will either give you all the required data or allow you to find it online, but this course also addresses the fact that acquiring good data can be very hard in practice; data might be missing, wrong values might be used (human error) or the data might not represent the current workings of the system anymore. However, in the current set-up of the course this is only the case in two assignments.

Assessment, structure and work load

The course is generally structured as follows: (1) lecture and answers about previous assignment, (2) general lecture about a new topic, (3) lecture about new assignment, (4) time to work on new assignment, (5) deadline before next lecture. This usually implies two lectures per week, which generally last 2x45 minutes, creating a lecture total of 3 hours per week. If the student has good basic mathematical skills, the assignments are quite easy and should not take up too much time. All in all, this gives the course a very balanced, but also very light work load. After the first year of this course, students complained that the work load was too light. This is currently still the case, although improvements have been made.

Experiences

The course includes a field trip to a local water board, which can be interesting for students that are not familiar with what a water board does.

Conclusion
This course has a lot of potential to fill a gap left open by most other courses; to assess quantitative water management issues from a practical, realistic mindset instead of the more academic, research oriented approach that is often taken in most other courses. However, at the moment the level of the course is below that of most other courses in the Earth, Surface and Water (ESW) Master. Student really have problems with level of the course. It is much too low and lectures do not discuss in-depth content at all. Therefore, students do not feel stimulated to do their utter best for this course. Students that follow a water-related track of ESW can probably find other, more suitable courses than this one. But the course might be quite suitable for students of other tracks, who want to get an idea about (quantitative) water management.

1.7 Coastal zone and river management

Overview

Period	3	Course code	GEO4-4403
Timeslot	B	Mean rating last year	**4.1**
Teacher	A.P. Oost	Mean workload last year	17.5 h
Contact	a.oost@uu.nl	Success rate last year	

1.8 Water policy, governance and law

Overview

Period	4	Course code	GEO4-6002
Timeslot	A	Mean rating last year	
Teacher	H.K. Gilissen	Mean workload last year	
Contact	h.k.gilissen@uu.nl	Success rate last year	

1.9 Drinking water and sanitation

Overview

Period	4	Course code	GEO4-6003
Timeslot	B	Mean rating last year	
Teacher	C. Vink	Mean workload last year	
Contact	c.vink@uu.nl	Success rate last year	

1.10 Land surface hydrology

Overview

Period	1	Course code	GEO4-4404
Timeslot	B	Mean rating last year	7.6
Teacher	dr. R. van Beek	Mean workload last year	16 h
Contact	r.vanbeek@uu.nl Zon 1.10	Success rate last year	22 out of 28

Book: S. Dingman Physical Hydrology, 2nd Edition (ISBN: 978-1-57766-561-8). (obligated)
Principles of Groundwater flow (GEO4-1434) and Land Surface Hydrology are “obligated” for master students with the track Hydrology. One of them 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.

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 analyze 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 modeling 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). One lecture students have to read two papers and discuss them. Students have to write a paper based on literature and a model 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 modeling 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.