Earth Sciences

Faculty of Agricultural and Environmental Sciences
Wageningen University

Quality Assurance Netherlands Universities (QANU)
Catharijnesingel 56
PO Box 8035
3503 RA Utrecht
The Netherlands

Phone: +31 (0) 30 230 3100
Telefax: +31 (0) 30 230 3129
E-mail: info@qanu.nl
Internet: www.qanu.nl

Project number: Q355

CONTENTS

This report was finalized on 5 December 2012.

Report on the bachelor's programme Soil, Water, Atmosphere and the master's programme Earth and Environment of Wageningen University

This report takes the NVAO's Assessment framework for limited programme assessments as a starting point.

Administrative data regarding the programmes

Bachelor's programme Soil, Water, Atmosphere

Name of the programme:	Soil, Water, Atmosphere
CROHO number:	56968
Level of the programme:	bachelor's
Orientation of the programme:	academic
Number of credits:	180 EC
Specializations or tracks:	n.a.
Location:	Wageningen
Mode of study:	full time
Expiration of accreditation:	31 December 2013

Master's programme Earth and Environment

Name of the programme:	Earth and Environment
CROHO number:	60100
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	n.a.
Location:	Wageningen
Mode of study:	full time
Expiration of accreditation:	31 December 2013

The visit of the assessment committee Earth Sciences to the Faculty of Agricultural and Environmental Sciences of Wageningen University took place on 25 and 26 June 2012.

Administrative data regarding the institution

Name of the institution:	Wageningen University
Status of the institution:	publicly funded institution
Result institutional quality assurance assessment:	positive

Quantitative data regarding the programmes

The required quantitative data regarding the programmes are included in Appendix 5.

Composition of the assessment committee

The committee that assessed the bachelor's programme Soil, Water, Atmosphere and the master's programme Earth and Environment consisted of:

- Prof. M.A. Herber (chair), professor of Geo-Energy, University of Groningen, the Netherlands;
- Prof. M. Landrø, professor of Applied Geophysics, NTNU Tronheim (Norwegian University of Science and Technology), Norway;
- Prof. J.W. Hopmans, professor of Vadose Zone Hydrology, University of California (Davis), USA;
- Prof. Emeritus D.E. Walling, hydrologist/geomorphologist, University of Exeter, UK;
- Dr. M.A. Ossevoort, assistant professor of Science Education and Communication, University of Groningen, The Netherlands;
- E. Rost (student member), master's student of Earth Sciences, VU Amsterdam.

The committee was supported by Dr. Willemijn van Gastel, who acted as secretary.

Appendix 1 contains the curricula vitae of the members of the committee.

General information regarding Wageningen University

Wageningen University
Wageningen University is comprised of one faculty, the Faculty of Agricultural and Environmental Sciences. The Faculty consists of 80 chair groups, arranged in five departments. All educational programmes, bachelor and master, are organized by the Education Institute (OWI). The Board of the OWI is responsible for the content, quality and finances of the educational programmes. Every programme has a programme director and a programme committee, consisting of equal numbers of students and academic staff. The programme committee is responsible for the content and quality of the programme, though in a formal sense this is subject to approval by the Board of the OWI. The programme director is responsible for the realization of the programme.

The courses are provided by staff of the chair groups, the 'supply side'. The programme committees are considered the 'demand side', with the programme director being the 'matchmaker'.

Wageningen has four examining boards, usually consisting of five to eight people from different disciplines. Before the site visit period, these boards were in the process of strengthening the quality management of assessment processes and procedures.

Each programme has one or more study advisers, who are tasked with supporting students throughout their study career. Study advisers provide information and invite students for progress evaluations and meetings to plan the student's individual curriculum. Each student needs the study adviser's approval for the elective parts of the programme she/ he has chosen. The study advisor offers approval within the context provided by the examing boards.

Working method of the assessment committee

Preparation
After receiving the critical reflection, the project manager checked the quality and completeness of the information provided. After approval, the critical reflection was forwarded to the committee, in both printed form and digitally. In addition, the committee members read a total of 15 bachelor- and 17 mastertheses, selected by the chair, for each programme that was assessed (see Appendix 7).

Before the site visit the project manager created a draft programme for the interviews (see Appendix 6). The draft programme was discussed with the chair of the committee and the coordinator of the Education Institute. As requested by QANU, the coordinators of the programmes carefully composed a select and representative panel for all interviews.

Site visit
During the initial meeting at the start of each site visit, the committee members discussed among themselves their findings regarding the critical reflection and the theses. They also discussed their task and working methods and the proposed domain-specific requirements (see Appendix 2).

During the site visit, interviews were held with representatives of the programme, students, staff members, recently graduated alumni, the Programme Committee, the Examining Board and a student adviser. A consultation hour was scheduled to give students and staff of the programmes the opportunity to talk to the committee. No requests were received for the consultation hour.

The committee used part of the final day of the site visit to discuss the assessment of the programmes and to prepare a preliminary presentation of the findings. The site visit concluded with an oral presentation by the chairman of the general assessment and several specific findings and impressions of the programme.

Report
After the site visit the project manager wrote a draft report based on the committee's findings. The draft was first commented upon by the committee members and then sent to the faculty to check for factual irregularities. All comments made by the faculty were discussed with the chair of the committee and, if necessary, with the other committee members. After revision, the report became official.

Decision rules
In accordance with NVAO's Assessment Framework for Limited Programme Assessments (as of 6 December 2010), the committee used the following definitions for the assessment of each individual programme, both of the standards and the programme as a whole.

Generic quality
The quality that can reasonably be expected in an international perspective from a higher education bachelor or master programme.

Unsatisfactory
The programme does not meet the current generic quality standards and shows serious shortcomings in several areas.

Satisfactory
The programme meets the current generic quality standards and shows an acceptable level across its entire spectrum.

Good
The programme systematically surpasses the current generic quality standards across its entire spectrum.

Excellent
The programme systematically clearly surpasses the current generic quality standards across its entire spectrum and is regarded as an international model.

Summary judgement

This report provides the findings and considerations of the Earth Sciences committee on the bachelor's and master's programme in Earth Sciences at Wageningen University (WU). The committee assessment is based on information in the critical reflection, interviews during the site visit and a selection of theses.

In general, the committee concludes that the focus of the bachelor's and master's programme on the interactions between the Earth and the environment close to the surface is unique in the Netherlands. It applauds the excellent facilities and motivated lecturers who are capable of and willing to pay close attention to the students. The main points for attention are a) the slow study progress of students and high percentage of drop out in the bachelor's programme, b) the feasibility of the many tracks in the master's programme and c) the chair groups' freedom to select their own assessment methods and criteria.

Standard 1: Intended learning outcomes
The *bachelor's* and *master's programme* of Earth Science at the WU have, as other academic programmes of Earth Sciences, the planet Earth as the object of study, its genesis and its quality of life. These sciences are strongly interdisciplinary, with interaction between various factors, such as humans, animals, relief, soil, water, lithology, atmosphere, hydrosphere and vegetation. Knowledge is gathered about its origin, current and former composition, and structure and the processes acting in and between the components of geosphere, hydrosphere, atmosphere and biosphere. Equally important is knowledge of how to manage and sustainably use Earth's resources and understand the influence of human activity on the terrestrial system. It takes into account society's rapidly growing demand for well-trained Earth Scientists prepared to tackle scientific and societal issues. The bachelor's and master's programme of the WU focus on the interactions between Earth and the environment close to the surface. The committee concludes that this focus is unique in the Netherlands.

The *bachelor's programme* aims to pass on knowledge, skills and an academic attitude to enable students to recognize, analyse and answer questions in the interrelated fields of soil, water and atmosphere. The committee appreciates the focus of the programme on interactions between Earth and the environment close to the surface. It intends to offer primarily a solid base, with which graduates can successfully continue towards a master's degree. The committee characterizes this orientation as not broad oriented, this orientation is clear from the beginning and justified.

The objectives of the *master's programme* are to pass on knowledge, skills and an academic attitude to enable students to practise their profession independently or to continue their training in scientific research. The focus lies on the composition, structures and processes of the upper Earth's zone with special attention being paid to the influence of human activities on the Earth's surface patterns and processes. The orientation of the master's programme seems to meander between an academic research master and a broad, more professionally oriented master. The committee advises that the programme needs to be more clearly defined.

The committee concludes that the *bachelor's* and *master's* programme fit well in the domain specific framework of reference. It states that the framework is an understandable representation of Earth Sciences and offers enough anchor points for programmes to establish their own objectives. Derived from this framework of reference, the programmes have formulated intended learning outcomes. The intended learning outcomes are phrased along the line of the Dublin descriptors. The committee established that the intended learning outcomes are in line with this framework and reflect the level, profile and orientation of both the bachelor's and master's programme.

Standard 2: Teaching-learning environment

Bachelor's programme
The bachelor consists of 180 EC divided over three years. The first two years consist of compulsory courses that aim to give all students the same background. Most of the auxiliary courses are scheduled during the first year, including mathematics, physics, statistics and chemistry. Second-year courses are more advanced. Most deal with one or more themes (soil, water, atmosphere) in relation to one or more aspects (physical, chemical, biological, spatial). The year concludes with two courses with a strong field component. In the third year, students may choose three courses (18 EC) from a list of 14 optional courses that focus on specific themes or aspects. Moreover, they can choose electives or a minor in the first or second semester. The programme concludes with a thesis of 12 EC.

The committee has studied the various aspects of the teaching and learning environment. The content, level and orientation of the curriculum are in line with the intended learning outcomes. The curriculum represents the intention to generate a deep understanding of the interactions between Earth and the environment close to the surface very well and is designed in such a way that graduates are able to enter a master programme of Earth Sciences without remarkable problems. There is an appropriate balance between mandatory courses on the one hand and optional courses on the other, to develop more specific knowledge and skills of personal interest.

The committee concludes that a high percentage of students do not graduate within three years. Although the committee is aware of the efforts of the management and lecturers to improve the success rate and efficiency, it suggests introducing a binding study recommendation (BSA) and a so-called "harde knip" between bachelor's and master's programme. WU is in the process of implementing the legally obligatory 'harde knip'. Furthermore the committee encourages a more proactive and structural guidance to enforce adequate progress.

Master's programme
The master's programme includes ten different thesis tracks. Students select one track as a specialization. Each track contains specific courses, a thesis and an internship. The tracks are *Aquatic Ecology and Water Quality Management, - Atmospheric Chemistry and Air Quality, - Earth System Science, - Hydrology and Quantitative Water Management, - Land Dynamics, - Meteorology, - Nature Conservation and Plan Ecology, - Soil Biology and Biological Soil Quality, - Soil Chemistry and Chemical Soil Quality, - Soil Physics, Ecohydrology and Groundwater Management.* The master's programme was restructed in 2011. In line with the recommendations from the prior quality assessment committee, the number of master's programmes was reduced from three to one.

The committee is conscious that the research conducted by the chair groups of Wageningen University heavily influences the content of the master's programme. As a consequence, there are still too many tracks. The composition of individual curricula as a track combined with electives makes it difficult to guarantee that every student composes a coherent programme in which all the intended learning outcomes are achieved. The Examining Board should play an active role in controlling and approving the student's programme. The committee also advises

evaluating the individually chosen programmes against the intended learning outcomes. The evaluation will show whether the number of tracks is appropriate or not.
The committee concludes that the content and level of the master's programme are sufficient to guarantee that students achieve the intended learning outcomes. The programme has a distinct academic, research orientation. However, the committee states that the professional orientation of the master's programme should be strengthened, as most graduates choose a non-research-oriented career. The content of the programme could contain more professionally oriented learning skills, possibly with the aid of internships and excursions. The committee is convinced that these improvements will be implemented due to the proactive attitude of management and staff.

The committee concludes that the intake, efficiency and success rates of the master's programme are adequate. According to the critical reflection, the programme is perceived by students as demanding, but during the site visit, the student's did not show indications that their progress is hindered by a high workload.

Bachelor's and master's programme
The committee recommends that improve the programme-related quality assurance should be improved. Although the staff have good insight into the quality of the courses related to their own chair groups, there is a limited overview of both the *bachelor's* and the *master's* curricula. In particular, the new master's programme - with many tracks - has to be closely monitored to assess whether the intended learning outcomes are achieved in every track.

The committee states that the programmes are provided by motivated lecturers who are capable and willing to pay close attention to the students. Students profit directly from their research expertise as it is reflected in the education programme. The committee invites the lecturers to exploit their strong international research contacts in a more effective way to enlarge the international profile of the programme. There are many ways to increase the international standing of both programmes, including attracting more students from abroad and providing exchange opportunities for their own students.

The committee noticed that students and staff profit from excellent facilities at the new campus. The laboratories in particular are equipped with modern and high-quality apparatus.

The programmes include fieldwork and practical training. The committee learned that many Earth Science programmes have no legally based safety assurance system for fieldwork. The committee strongly recommends to re-evaluate the content of such a system in order to enhance fieldwork safety as well as legally protect faculty, staff and students. The committee suggests developing a national system in cooperation with the other academic Earth Sciences programmes in the Netherlands. Furthermore, the committee advises that first aid courses should be obligatory for both students and lecturers as well.

Standard 3: Assessment and achieved learning outcomes
The committee verified the assessment system and methods as well as the achievement of intended learning outcomes by students.

It concludes that the assessment system is sufficient but leaves room for improvement. It is convinced that these improvements will be made, considering the proactive attitude of the programme director and staff towards continuous improvement. The main concern of the committee is the chair groups' freedom to develop assessment methods and criteria as it might induce assessment procedures that differ per track or course. The committee learned that there are plans to fix the weighting for each chair group. From the programme's point of view, this was considered fair since it was stated that research characteristics among chair groups differ. For example, data collection is more time consuming in one chair group than in the other groups. As a result, this chair group will put more weight on 'general research competences' than the other groups. The committee strongly disagrees with this policy and states that it is the quality of the individual aspects that count, not so much the time spent on it. Therefore, the committee advises setting the weighting among all chair groups equally. The committee is positive about the rubrics, formulated in the new forms for evaluating theses and internships. They are comprehensive and allow a reliable grading. The grading of theses and internship should be further improved by introducing a fixed weighting of aspects on which grades are based.

The programmes offer many re-sit opportunities. The committee strongly advises management to revise this policy because it induces delay during the study programme. Moreover, it does not prepare students to deal with compelling deadlines, which is an important skill and attitude required by both academic research or a professional career.

To assess the achievement of the learning outcomes, the committee has studied several theses. Based on the theses and the information gathered about progress and success rates, the committee established that bachelor's and master's students achieve the learning outcomes well. The committee is impressed by the quality of the bachelor's theses and the novelty of research topics in the master's theses.

The committee assesses the standards from the Assessment framework for limited programme assessments in the following way:

Bachelor's programme Soil, Water, Atmosphere:

Standard 1: Intended learning outcomes	satisfactory
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment and achieved learning outcomes	satisfactory
General conclusion	satisfactory

Master's programme Earth and Environment:

Standard 1: Intended learning outcomes	satisfactory
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment and achieved learning outcomes	satisfactory
General conclusion	satisfactory

The chair and the secretary of the committee hereby declare that all members of the committee have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 5 December 2012

Prof. M.A. Herber
(chair)

Dr. Willemijn van Gastel
(secretary)

Description of the standards from the Assessment framework for limited programme assessments

Standard 1: Intended learning outcomes

The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements.

Explanation:
As for level and orientation (bachelor's or master's; professional or academic), the intended learning outcomes fit into the Dutch qualifications framework. In addition, they tie in with the international perspective of the requirements currently set by the professional field and the discipline with regard to the contents of the programme.

Findings

The committee has evaluated the intended learning outcomes of the Earth Sciences bachelor's and master's programmes of Wageningen University (WU) with regard to content, level and orientation. It studied the domain-specific framework (1.1), the profile and orientation (1.2), and the objectives and intended learning outcomes (1.3).

1.1 Domain-specific framework of reference
The domain-specific framework was created by the Chamber of Earth Sciences and educational administrators and/or heads of departments of the Dutch university institutions with degree programmes in the Earth Sciences (included in Appendix 2). This framework is a modified version of the one established in 2006. In updating the framework, use was made of 'Agenda 2020: perspectives of the Earth Sciences', the outcome of a series of consultation workshops organized in 2009 by the Council for Earth and Life Sciences (RAL) of the Royal Netherlands Academy of Arts and Sciences (KNAW).

According to the domain-specific framework, Earth Sciences have the planet Earth as their object of study, its genesis and its quality of life. These sciences are strongly interdisciplinary, with interaction between various factors, such as humans, animals, relief, soil, water, lithology, atmosphere, hydrosphere and vegetation. Knowledge is gathered about its origin, current and former composition, and structure and the processes acting in and between the components of geosphere, hydrosphere, atmosphere and biosphere. Equally important is knowledge of how to manage and sustainably use Earth's resources and understand the influence of human activity on the terrestrial system. It takes into account society's rapidly growing demand for well-trained Earth Scientists prepared to tackle scientific and societal issues.

The committee studied the domain-specific reference framework and concludes that it is a well structured outline of the domain of Earth Sciences. Because the Dutch university institutions with degree programmes in Earth Sciences were involved in its creation, it is not surprising that they fit into that framework, including the Earth Sciences bachelor's and master's programme at WU. Although the framework is of Dutch design, the strong international research positions of the institutes guarantee its international value.

1.2 Profile and orientation
One of the recommendations of Agenda 2020 was to produce complementary Earth Sciences programmes in the Netherlands that together cover the entire domain. As a result, universities and their programmes will differ in their focus. The bachelor's and master's programmes at Wageningen are strongly related to two of the four subdomains described in the domain-specific framework: 1) surface and 2) biosphere-hydrosphere-atmosphere. They

focus on the soil and interactions with water and the atmospheric boundary layer, as well as on the physical, chemical and biological processes in these domains.

In the critical reflection, the focus of the *bachelor's programme* is visualized in a matrix with three columns: soil, water and atmosphere, including the physical, chemical, biological and spatial aspects. In addition, the bachelor's programme deals with the impact of human activities on the Earth and with sustainability issues of the Earth's surface and atmosphere. Practical applications include predicting floods and droughts in river basins, weather forecasting, soil and water quality in human-dominated landscapes, and the effect of climate change. The focus of the *master's programme* follows on from this, with a strong emphasis on the Earth's 'Critical Zone', including the atmospheric boundary layer where flows of energy and matter determine the conditions for sustaining life. Comparing the position of the master's programme with the different fields of application described in the domain-specific reference framework, special attention is paid to natural resources, terrestrial space, functioning of terrestrial ecosystems and natural human-induced hazards.

The committee agrees with the management of the programmes that the focus on the interactions between Earth and the environment close to the surface is unique in the Netherlands. It therefore encourages the programmes to compare themselves with relevant international programmes. The committee is aware that international contacts for research purposes already exist. However, it feels that these contacts could be used more extensively both to draw inspiration for their own profile, and to benchmark themselves. This will assist to fulfil the faculty's intention to create a strong international position.

The primary aim of the *bachelor's* programme is to prepare students for entry in a master's programme with a focus on soil, water and atmosphere. Programme management stated that a professional orientation is not feasible because there is hardly any employment for bachelor's graduates with the exception of second degree teachers. The committee wonders whether there is no employment because the academic-oriented programme does not meet professional requirements. Although the committee understands the programme's decision to focus on preparation for a master's programme, it encourages management to explore options for a professional orientation as well.

The committee initially questioned the orientation of the *master's programme*. The programme clearly promotes a strong academic orientation. However, the programme's orientation appears to extend beyond a purely academic focus. This is underpinned by the fact that only 20% of graduates actually enrol in a PhD programme. During the site visit, the programme managers explained that an academically oriented level implies that students are capable of thinking and acting on an academic cognitive level. The intention is to produce graduates who are qualified for both PhD programmes and for positions in industry and government. The committee advises that the orientation of the programme should be more clearly and explicitly defined. At present, there is some confusion as to what the programme actually offers.

1.3 Objectives and intended learning outcomes

Bachelor's programme
According to the critical reflection, the bachelor's programme aims to pass on knowledge, skills and an academic attitude to enable students to recognize, analyse and answer questions in the interrelated fields of soil, water and atmosphere. Following this objective, the intended

learning outcomes are formulated and phrased along the lines of the Dublin descriptors (Appendix 3). The learning outcomes are subdivided into: 1) domain-specific knowledge and understanding and applying that understanding; 2) scientific learning outcomes (the ability to apply concepts, approaches and techniques in the domain, including data capture, analysis, modelling and simulation); 3) domain-specific skills (the ability to learn to analyse and execute a problem in the field of soil, water and atmosphere); and 4) general academic learning outcomes. The committee studied these learning outcomes and established that they reflect the profile and orientation of the programme. The comparison with the Dublin descriptors shows that the learning outcomes are formulated at the bachelor's level.

Master's programme
The objectives of the master's programme are to pass on knowledge, skills and an academic attitude to enable students to practise their profession independently or to continue their training in scientific research. The focus lies on the composition, structures and processes of the upper Earth's zone with special attention being paid to the influence of human activities on the Earth's surface patterns and processes.

As in the bachelor's programme, the intended learning outcomes are subdivided into four groups: 1) domain-specific knowledge and understanding and applying that understanding; 2) scientific learning outcomes; 3) domain-specific skills; and 4) general academic learning outcomes. The outcomes are included in appendix 3. According to the critical reflection, the intended learning outcomes stress that graduates are able to carry out independently a research project in the domain of Earth and the Environment, and critically reflect on theory and practice. Therefore, they qualify for relevant PhD programmes. The critical reflection also stated that the employment orientations are: 1) fundamental research, 2) applied research and 3) consultancy. The committee studied these learning outcomes and established that they reflect the profile of the programme. The learning outcomes fit strongly with an academic research orientation but are also sufficiently directed to a professional orientation.

Considerations
The committee has studied the domain-specific framework of reference and profile and orientation of the programmes. The objectives derived from this profile and orientation are set in the formulation of intended learning outcomes. The committee has evaluated the extent to which these outcomes meet the international requirements with respect to content, level and orientation. The committee concludes that the intended leaning outcomes of both the *bachelor's* and *master's* programme sufficiently meet these requirements.

The domain-specific reference framework was developed by Dutch universities. The committee concludes that the framework offers a clear outline of the domain of Earth Sciences. The bachelor's and master's programmes of Wageningen University fit well within this domain, and they position themselves clearly in the interaction between earth and the environment. The committee wishes to stress that this niche position could and should be exploited more internationally.

The *bachelor's* programme aims to prepare graduates for enrolment in a master's programme in Earth Sciences, especially in the field of soil, water and atmosphere. The committee characterizes this orientation as unilateral because the professional orientation is not well developed. However, this aim is clear from the beginning and can be justified. The level of the intended learning outcomes is demonstrated by means of the Dublin descriptors. It has been shown that bachelor graduates successfully enrol in Earth Sciences master's programmes. Therefore, the committee concludes that the content, level and orientation of the bachelor's programme are sufficient.

The orientation of the *master's* programme seems to meander between an academic research master and a broad, more professionally oriented master. Nevertheless, its objectives and intended learning outcomes are in line with the profile of the programme. The academic level of the learning outcomes is sufficient. The content of the learning outcomes is strongly related to academic research, but also reflects an adequate professional orientation. Therefore, the committee concludes that the content, level and orientation of the master's programme are sufficient.

Conclusion
Bachelor's programme Soil, Water, Atmosphere: the committee assesses Standard 1 as **satisfactory**.
Master's programme Earth and Environment: the committee assesses Standard 1 as **satisfactory**.

Standard 2: Teaching-learning environment

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

Explanation:
The contents and structure of the curriculum enable the students admitted to achieve the intended learning outcomes. The quality of the staff and of the programme-specific services and facilities is essential to that end. Curriculum, staff, services and facilities constitute a coherent teaching-learning environment for the students.

Findings
In this standard, the findings of the committee regarding the extent to which the bachelor and master curricula enable students to achieve the intended learning outcomes are described. The findings are directed to the curriculum (2.1), didactic concept (2.2), quality assurance system (2.3), staff (2.4), intake and study load (2.5), facilities (2.6), support (2.7), internationalisation (2.8), plagiarism (2.9) and safety (2.10).

2.1 Curriculum

Bachelor's programme
The bachelor consists of 180 EC divided over three years. The academic year starts in September and consists of two semesters of three periods each. The first two years consist of compulsory courses to give all students the same background. In the third year, students select 18 EC in the domain of soil, water or atmosphere and write a thesis worth 12 EC. In addition, students choose a minor or electives lasting six months (30 EC). An overview of the curriculum is included in Appendix 4. Of the 138 EC of compulsory courses, 40 EC focuses on auxiliary knowledge, 50 EC deal separately with the three themes of soil, water and atmosphere, and at least 40 EC are dedicated to the study of physical, chemical, biological or spatial aspects of the three compartments of soil, water and atmosphere or other integrations.

Most of the auxiliary courses are scheduled during the first year, including mathematics, physics, statistics and chemistry. Furthermore, at least one soil, one water and one atmosphere course are scheduled. To acquaint students with the whole Earth Sciences domain, integration courses are included, like *Introduction to Environmental Sciences* and *Soil, Water and Atmosphere Integration Course*. During the site visit, the committee raised the issue whether the programme contains enough physics and mathematics. The committee learned from lecturers and students that physics and mathematics are mostly and sufficiently integrated in various courses. The master's students agreed with their lecturers and stated that their basic knowledge of physics and mathematics was sufficient to enrol in the master's programme. Also, extra courses can be followed if students feel insecure about their knowledge and skills.

Second-year courses are more advanced. Most deal with one or more of themes (soil, water, atmosphere) in relation to one or more aspects (physical, chemical, biological, spatial). In addition, students follow a course (*Systems Earth)* that deals with the integration of the spheres (pedosphere, hydrosphere, biosphere, atmosphere), and two auxiliary courses, *Applied Multivariate Mathematics* and *Introduction to Geo-information Science*. The year concludes with two courses with a strong field component.

In the third year, students may choose three courses (18 EC) from a list of 14 optional courses that focus on specific themes or aspects. Moreover, they can choose electives or a minor in the first or second semester. The programme concludes with a thesis of 12 EC.

The committee noted the large number of compulsory courses in the first two years. The interviewed students stated that it is sometimes hard to remain motivated. However, they confirmed that at the end of the first year, the courses become more interesting and specialised. The committee is positive about the structure of the first two years because it precludes the existence of incoherent individual programmes.

Bachelor thesis
The thesis process involves designing a research proposal, conducting the research and reporting the results on a bachelor's level. In general, the students analyse data from existing databases. If they collect their own data, incidentally an additional free choice course of 6 credits is counted. Students mentioned that there is a tendency to spend more time on the thesis than scheduled to improve its quality. The committee is not in favour of this since it will induce delay and creates the possibility that students who progress on schedule may get lower rates than students who do not, which is not considered fair. The committee would prefer 18 EC for all students because, it is of the opinion that 12 EC for a thesis is rather limited.

Bachelor fieldwork
Fieldwork is an essential part of all Earth Sciences programmes. Fieldwork in the bachelor's programme takes place in laboratory 'simulated fields' and on locations in the Netherlands, France, Germany and Belgium. Laboratory work is performed in various courses. In the *Integration Soil, Water and Atmosphere* course, students work in the soil physics laboratories. The *Fluid Mechanics* and *Subsurface Solute Transport* courses also make use of laboratories. During the *Introduction to Atmosphere* course, students perform observations at a weather station. A field practical in the Netherlands is incorporated in the *Hydrology, Water Quality and Meteorology* course. For the *Hydrology* course, students are required to carry out a hydro-geological system description and computer exercises in groundwater modeling in the Ardennes, Belgium.

Bachelor curriculum related to the learning outcomes
The critical reflection contains a table that summarizes the contribution of courses and thesis to the achievement of the intended learning outcomes. The committee studied this table and established that the intended learning outcomes are sufficiently achieved. It noted that the general learning outcomes are presented in the thesis but seldom in courses. For example, the academic skill 'to assess problems and research by taking and defending a position and

showing readiness to shift ground if necessary' is only covered in three courses. The committee suggests that academic skills are trained more extensively and explicitly before students start their theses.

Master's programme

The master's programme consists of 120 EC divided over two years. The programme combines courses in the first year (60 EC) with a mandatory internship and thesis in the second year (60 EC). The first year consists of two compulsory common courses (12 EC) for all students and three restricted optional courses (18 EC) per thesis track, two of which prepare students for their thesis. The compulsory common courses are *Interdisciplinary Topics in Earth and Environment* and *Environmental Data Collection and Analysis*. Furthermore, students carry out multidisciplinary consultancy work in project teams (12 EC) within the university-wide *Academic master cluster* or in the specific academic master cluster *Climate Change: impact, adaptation and mitigation.* An overview of the courses is included in Appendix 4.

The master's programme was restructured in 2011. In line with the recommendations from the prior quality assessment committee, the number of master programmes was reduced from three to one. The current programme is derived from the masters in *Soil Science*, *Hydrology and Water Quality* and *Meteorology and Air Quality*.

According to the critical reflection, the master's programme includes ten different thesis tracks. Students select one track as a specialization. Each track contains specific courses, a thesis and an internship. These tracks are:

- Aquatic Ecology and Water Quality Management
- Atmospheric Chemistry and Air Quality
- Earth System Science
- Hydrology and Quantitative Water Management
- Land Dynamics
- Meteorology
- Nature Conservation and Plan Ecology
- Soil Biology and Biological Soil Quality
- Soil Chemistry and Chemical Soil Quality
- Soil Physics, Ecohydrology and Groundwater Management

The committee was surprised that the current programme contains still so many thesis tracks such that it seems to contradict the intention to consolidate the original master's programmes. Some of the interviewed students stated that the current programme offers too many options, but others appreciated the opportunity to select a specialized topic of personal interest. The management of the programme stressed that differentiation into ten tracks is logical because each track refers to the research area of one or more of the Wageningen chair groups. The committee understands this, although it also wonders to what extent the existence of many tracks will induce fragmentation in the individual programmes. Each track is coherent in itself, but the electives (18 EC) may cause non ideal compositions of the individual curricula. The interviewed students stated that the study adviser helps to compose an individual programme that has to be approved by the Examining Board. Nevertheless, the committee learned that the coherence of individual curricula varies and advises the programme to inform students more clearly about the boundaries between coherent and fragmented programme compositions.

The committee further questioned the content of the individual study programmes as it noted that it is possible to compose an individual curriculum without fieldwork in some tracks. The committee learned from the management however that fieldwork is in the common part and also implicitly provided in other courses, resulting in enough fieldwork in every track. The committee recommends to make this more explicit in the course descriptions.

Master thesis
The thesis forms the central part of the curriculum. Students independently design, conduct and report about a research project. According to the critical reflection, each chair group has a thesis coordinator who oversees the intake of thesis students, informs them about general procedures, and helps with the selection of a research topic. The procedures are recorded in the thesis guidelines. Usually, research topics are embedded within ongoing research at the chair groups, though students can also undertake a thesis project on a subject of their own interest. In case of the latter, the chosen topic must be within the expertise of the available staff and meet the criteria of academic quality and supervision to be accepted.

Master internship
The internship gives students the opportunity to gain work experience in professional surroundings and to prepare them for (professional) careers. Each chair group has an internship coordinator who manages student intake, discusses procedures that are recorded in the internship guidelines, and helps students to find an internship. The internship can also be used to gain international experience and many students choose to do their internship abroad. The students interviewed stated that finding an internship was quite difficult. They did not feel adequately informed about opportunities offered by the government or engineering institutes. According to the alumni, graduates are not well enough prepared for a non-research career. The committee concludes that the internship and general preparation for a professional career have to be improved. Despite personal involvement of some lecturers in industry or government as well as the involvement of the Advisory board consisting of staff from industry and government in the composition of the curriculum, the committee advises to consult more explicitly on the best way to prepare students for a professional career. This will help to improve the programme in such a way that the graduates will meet professional requirements.

Master curriculum related to the intended learning outcomes
The critical reflection contains a table that summarizes the contribution of courses, the internship and thesis to the achievement of the intended learning outcomes. The committee studied the table and established that, in general, the programme enables students to achieve the intended learning outcomes. It noted that the scientific learning outcomes and general academic learning outcomes are sufficiently covered by the thesis and internship but minimal covered by courses. For example, the intended learning outcome 'function effectively in multidisciplinary teams' is only explicitly trained in the courses of the common part. The committee advises that scientific and general academic learning outcomes in courses should be expressed in a more visible way.

2.2 Didactic concept and methods

Lecturers in the *bachelor's and master's programmes* are members of the chair groups that are part of the science groups of Wageningen University. This construction ensures a strong connection between research and education. The committee discussed to what extent educational priorities are anchored in this structure compared to research priorities. The programme management explained that the balance between research and education is good at the organisational level. Wageningen University has a demand-supply system for education, where the programme committees of the education institute are responsible for the demand side and the chair groups represent the supply side. Strategically demand and supply must be aligned. If Wageningen University moves in a particular scientific direction, this leads to changes in the staff of the science groups and also to changes in the study programmes.

The lecturers interviewed were very positive about this research-based learning concept. They emphasized the requests of the master students to offer the whole spectrum of research areas in which the chair groups are involved. The committee is positive about the fact that education is supported with up-to-date research knowledge. However, it is also aware of the risk that research aims may overrule the educational aims. For example, the committee understands that the ten tracks are optimal for research but questioned if they are optimal for education.

The teaching methods in the *bachelor's programme* can be clustered into:

- Lectures for both small and large groups of students. If the content requires exercises, lectures and tutorials are combined. Lectures are mostly directed to knowledge transfer and provide opportunities for discussions;
- Tutorials. Group size for tutorials ranges from 20-40 students, and the active participation of the students is required, i.e. they have to study the theory and prepare assignments at home in advance;
- Practical training: students practice a technical (computer) or other (lab work) skill;
- Field work and excursions;
- Group work as a part of practical training and fieldwork. In group work, students work together to solve a specific task or problem;
- Thesis.

The large amount of fieldwork and practical training is characteristic of the bachelor's programme. Together, they make up half of the contact hours.

The teaching methods in the *master* are the same as in the bachelor, plus an internship. As a consequence of the substantial part of the thesis project and internship, teaching methods are mostly defined by self study and individual support by lecturers. The committee established that the learning methods are commonly used ones. It appreciates the extensive fieldwork and practical training, in which students learn to apply their knowledge directly.

2.3 Programme related Quality assurance

The committee has studied the quality system by which the *bachelor's* and *master's* programme are evaluated and improved regularly.

Every course is evaluated by means of a standard university online survey which includes the content of the courses and the general quality of the education. Its results are analysed and interpreted by the programme committee and programme director. In addition for these programmes, Pyrus, the study association, performs classroom face-to-face course evaluations. According to the critical reflection, the programme takes into account first-year evaluations, Bachelor and Master graduate evaluations, career surveys among alumni and the Education Monitor. Furthermore, results are used from national surveys like the National Monitor of Higher Education and the annual National Student Survey. The committee is positive about the use of many sources. The programme director and programme committee discuss the outcomes and take action if necessary. However, it has gained no insight into how often and how structurally these sources are used and by whom.

The committee has noted that the response to the online survey is very low. In its opinion this can easily be avoided by providing a written survey at the end of every course. The programme committee explained that the university does not want to do this because of the workload involved with written surveys. The committee also learned that the individual and classroom evaluations do not always match. This calls into question the reliability of the measurements. Students informed the committee that they do not know exactly how the results of the survey are used for programme improvements. The committee concludes that the course evaluations could and should be improved: more transparency, better understanding of differences between the two surveys, and replacing the digital with a written survey.

The committee learned that the individual lecturers are fully aware of the quality of the courses they are involved in, but not necessarily of the whole programme. The quality assurance of the entire bachelor's and master's curriculum is the prime responsibility of the programme committee. The assessment committee noted that the programme committee does not have a complete overview of the whole curricula either, since they primarily concentrate on the course evaluations and individual requests or complaints. The assessment committee therefore advises the programmes to develop a formal procedure for reviewing both curricula in their entirety. This kind of evaluation provides important information about the coherency of the curricula and the extent to which they are in line with the intended learning outcomes.

2.4 Staff

The committee evaluated the quality and quantity of the staff of the *bachelor's* and *master's programmes*. According to the critical reflection, nearly all lecturers combine education with research tasks. The scientific quality of the staff is apparent from their active participation in scientific research, and almost every lecturer has a PhD. Most are members of either SENSE-WIMEK (Wageningen Institute for Environment and Climate Research) or PE&RC (The C.T. de Wit Graduate School for Production Ecology & Resource Conservation). More staff members of the master's programme than the bachelor's programme are members of a research school. There are no other remarkable differences in staff composition between the two programmes. The committee established that the scientific quality of the lecturers is evident.

In conformance with the faculty policy, recently appointed lecturers follow a didactic and educational trajectory (BKO). The committee could however not obtain any percentages/numbers on BKO qualified staff. Lecturers who were employed before the BKO was established are required to obtain a BKO in the near future. Furthermore, university policy gives equal weight to teaching and research. Examples of this policy are that both education and research are discussed in the annual staff performance review and that the tenure track requires an equal focus on research and education.

The staff-student ratio in the *bachelor's* programme is 1:5.64 and 1:5.48 in the *master's* programme. These values are high, partly due to the considerable amount of intensive practical and laboratory work and fieldwork. The committee concludes that the current high staff-student ratio gives lecturers the opportunity to pay a lot of individual attention to the students. The committee learned that the communication between students and lecturers is very good. Students indicated that they feel motivated by the lecturers. The lecturers are easily accessible.

2.5 Intake and study load

Appendix 5 shows the figures for enrolment, efficiency and drop-out.

Bachelor's programme

According to the critical reflection, students are admitted on the basis of their pre-university qualifications. For the bachelor's programme, applicants with the secondary school profile Nature & Engineering are admissible. Applicants with the profile Nature & Health are eligible if they included physics in their programme. All students take revision mathematics and statistics in two courses of three credits, which build on the subjects at secondary school and aim to bring all students to the same level. These courses are offered to accommodate both groups, students with mathematics A and with mathematics B background and to bring the cohort up to the same level. Furthermore, additional mathematics and statistics, physics and chemistry are part of the first-year programme. According to the critical reflection document the link with the pre-university trajectory is appropriate and the committee has no reasons to think otherwise.

The table in Appendix 5 shows that first-year enrolment has increased to 74 in 2010. The committee noted that on average one-third of the students drop out during the programme. This proportion is relatively high. The committee discussed this with the programme management, lecturers and study advisers. They all agree that a binding study recommendation will help students who are not sufficiently capable or motivated to consider another major. Introduction of a binding study advise is however a university decision and although the committee advises to do so, it is not clear when this can be executed.

In line with the VSNU and OCW, the target percentage of graduates with a bachelor's degree after four years is 70%. The success rate at Wageningen University is 51%, the average for the bachelor's programme is 63%. The committee is aware that the Education Institute has already decided to start a project to improve study success. The first step will be an investigation into the causes of the delay. Furthermore, some of the courses are being improved because they are hard to pass. A lecturer illustrated this by mentioning a 40% failure rate on a particular course. The critical reflection reports that students and graduates rated the study load as good. Students and staff evaluate the programme as demanding. During the visit, students did not indicate that the programme is too demanding to finish their bachelor in time.

Master's programme

The basic intake procedure of the master is in line with the policy of Wageningen University. These requirements include a relevant bachelor's degree, a grade point average of at least 70%, and fluency in English (both written and spoken). Furthermore, good working knowledge of calculus and statistics and proficiency in the use of information technology is required. A bachelor's degree in Earth Sciences/Geosciences, Physical Geography, Environmental Sciences, Biology (Ecology), Chemistry, Physics or Engineering is considered relevant. All applications are judged individually with regard to the probability of the student being able to successfully complete the two common courses and one thesis/internship track in the allotted time. Only graduates from the bachelor's programme in Soil, Water, Atmosphere have unconditional admission. The requirements for students from a university of applied sciences have been tightened. These students are now only allowed to follow a master's programme if they have successfully complete a specific minor in their bachelor's programme, or have followed a pre-master programme lasting half a year. In addition, two minors were developed to better prepare students from different university programmes in and outside Wageningen. The Admission Committee takes the final decisions.

The number of master students is around 40 and in 2011 and 2012 50. Half of them came from the bachelor's programme Soil, Water, Atmosphere. The other half has another WUR bachelor background, a Dutch bachelor's degree or an international academic background.

According to the critical reflection, students indicate that the study load for the thesis and internship is higher than they expected. During the site visit however, students did not indicate that the programme is too demanding. Considering the large group of students who finish in two years, the study load appears to be appropriate (Appendix 5).

The committee is aware that the different backgrounds lead to different success rates. Success rates are close to 90% within three years. In 2003 and 2006 the success rates were lower due to a high intake of students with a bachelor's degree from universities of applied sciences.

2.6 Facilities

Based on written documentation and a guided tour, the committee is convinced that the facilities are very good. The campus is new and equipped with state of the art instruments and laboratories. The committee was particularly impressed by the field and laboratory facilities, like the Kraijenhoff van de Leur Laboratory for Water and Sediment Dynamics.

2.7 Support

Bachelor's programme

Two study advisers currently guide the students through the three years of their studies. At the start of the first year, the study advisers introduce the programme and the main procedures. In January they discuss the students' progress and motivation in individual meetings or small groups. A second meeting is scheduled for June. If necessary, additional discussions take place or students are referred to the dean. In the second year, a general meeting is organized as preparation for the choices to be made in year 3: minors, exchange options (Erasmus) and electives. This meeting is jointly organized with the meeting for third-year students, where information is given by staff and the programme team as a preparation for the master. Support is also provided by the lecturers. During the site visit, the committee noted that lecturers are very accessible, and students do not hesitate to contact them if needed. But given the high percentage of drop-outs, it seems that some students slip through the net of support. The committee therefore suggests to improve the support system for students who do not openly ask for advice.

Master's programme

According to the critical reflection, study advice is first presented during the Annual Introduction Days in August. After a general introduction, the study adviser makes appointments with the new students before the start of the programme. Together they develop an individual programme proposal for the first year based on the student's background, competence and interests. During the common courses, but also during the study year, students adjust their ideas. The individual programme may be changed in consultation with the study adviser and with an approval of the Examining Board. At the end of period 4, students are invited to discuss their study progress, but generally there has already been contact at an earlier stage. Students were satisfied with the coaching given by the study adviser and appreciate the information they received for planning and selecting their curriculum. Support is also provided by the lecturers. The committee is aware that staff is very accessible and willing to help. However, the committee heard from students and alumni that they need more information and guidance toward a professional orientation. Therefore, the committee advises strengthening proactive support in that respect.

2.8 Internationalisation
The bachelor's and master's programmes take place in an international context. The WU is internationally oriented, and the chair groups are embedded in international networks. The bachelor students participate in excursions to Germany and France and international fieldwork is part of some courses. Master students have access to a wide range of research areas and field stations all over the world. Despite all this, the committee feels that the educational programmes should profit more from the international position of the chair groups. Currently, the bachelor's programme is partly taught in English, and the student population in both programmes is mainly Dutch. The committee has already advised strengthening the existing international connections to raise the profile of the programmes. These connections can also be used for exchanging students. Finally, the committee advises teaching all courses and providing all study information in English.

2.9 Plagiarism
During the visit, plagiarism was discussed because the minutes of the Examining Board meetings indicated that some incidents extend across the faculty. The committee learned from the Examining Board that it is informed of every incident. The Board talks to the student and decides what the consequences are. It confirmed that this situation seldom occurs. The students and lecturers interviewed added that they are aware of this procedure. The committee learned that specific attention is paid to this topic in the first course of the bachelor's programme, and that there is also a website to help students navigate in the grey area between plagiarism and a proper use of literature.

2.10 Safety
An important issue related to fieldwork is safety. To guarantee that students know about the risks, dangerous situations and safety rules, they have to sign a waiver before each fieldtrip. The committee has not discussed this topic during the site visit and is aware that fieldwork arranged by the WU may be less prone to accidents than other programmes of Earth Sciences in the Netherlands because it includes fewer visits to hazardous areas. Nevertheless, after discussing this topic with other universities, it advises ensuring that fieldwork is carried out in accordance with a legally based safety assurance system. The committee strongly recommends 1) assessing the legal position of the faculty, staff and students and 2) developing a legally based safety assurance system. The committee suggests developing this system in cooperation with other Earth Sciences programmes in the Netherlands. Furthermore, it advises obligatory first aid courses for both students and lecturers.

Considerations

Bachelor's programme
The committee concludes that the content and level of the bachelor's programme are sufficient to guarantee that students achieve the intended learning outcomes. The curriculum is properly structured and provides a solid basis to enrol in a subsequent Earth Sciences master's programme. There is an appropriate balance between mandatory courses on the one

hand and optional courses on the other, to develop more specific knowledge and skills of personal interest. The committee approves the programme's aim to train students primarily for following a master programme. Nevertheless, there is a need to explore the possibilities of training students for a professional career as well.

The committee stated that the efficiency and drop-out rates for the bachelor's programme are cause for concern. A high percentage of students do not graduate on time. The committee agrees with the argument that the delay is partly due to the lack of the strict separation between completing the bachelor's programme and starting the master's programmes. Although the committee is aware of the efforts of the management and lecturers to improve the success rate and efficiency, it suggests introducing a binding study recommendation (BSA) and a so-called "harde knip" between bachelor and master program. Furthermore the committee encourages an improvement in the proactive and structural guidance to enforce adequate progress.

Master's programme
The committee concludes that the content and level of the master's programme are sufficient to guarantee that students achieve the intended learning outcomes. However, the committee states that the professional orientation of the master's programme needs to be strengthened as most graduates choose a non-research-oriented career. There are clear indications that their preparation can be optimised. The content of the programme could refer to more professionally oriented learning skills, and more attention should be paid to the internship and excursions. The committee is convinced that these improvements will be implemented, given the proactive attitude of management and staff.

The committee has established that research conducted by the chair groups of Wageningen University heavily influences the content of the master's programme. As a consequence, there are still (too) many tracks. The composition of individual curricula as a track combined with electives makes it difficult to guarantee that every student composes a coherent programme in which all the intended learning outcomes are achieved. The Examining Board should play an active role in controlling and approving the student's programme. The committee also advises evaluating the individually chosen programmes against the intended learning outcomes. The evaluation will show whether the number of tracks is appropriate or not.

The committee concludes that the intake, efficiency and success rates of the master's programme are adequate. According to the self reflection, the programme is perceived by students as demanding, but during the visit the students did not show e any signals that the progress is hindered by a high workload. A relatively low percentage of students enrol from other universities than Wageningen, including a relatively low number of international students.

Bachelor's and master's programme
The committee is concerned about the programme-related quality assurance. Although the staff have good insight into the quality of courses related to their chair groups, an overview of both the *bachelor's* and the *master's* curricula is lacking. In particular, the new master's programme - with many tracks - has to be closely monitored to assess whether the intended learning outcomes are achieved in every track.

The committee states that the programmes are provided by motivated lecturers who are capable of and willing to pay close attention to the students. Their educational quality is strengthened by the BKO policy, and students profit directly from their research expertise as it is implemented in the education programme.

The committee noticed that students and staff profit from the excellent facilities at the new campus. The laboratories in particular are equipped with modern and high-quality apparatus.

The committee noted that the international orientation of both the bachelor's and master's programme is moderate and can be improved. There are many ways to increase their standing in the world, including attracting more students from abroad and providing exchange opportunities for their own students.

Conclusion
Bachelor's programme Soil, Water, Atmosphere: the committee assesses Standard 2 as **satisfactory**.
Master's programme Earth and Environment: the committee assesses Standard 2 as **satisfactory**.

Standard 3: Assessment and achieved learning outcomes

The programme has an adequate assessment system in place and demonstrates that the intended learning outcomes are achieved.

Explanation:
The level achieved is demonstrated by interim and final tests, final projects and the performance of graduates in actual practice or in post-graduate programmes. The tests and assessments are valid, reliable and transparent to the students.

Findings
In this standard, the findings of the assessment system and methods used are described (3.1), followed by the success rate and performance of both the bachelor and master graduates (3.2).

3.1. Assessment system and methods
The committee studied the examination policy, the role of the Examining Board and the quality of several assignments. Special attention was paid to the procedure to assess the students' performance during the thesis project.

The Examining Board is in the process of strengthening its procedures for guaranteeing the quality of assessments. These procedures involve two primary elements. The first is that each examiner is explicitly responsible for ensuring that assessment of a course is valid, reliable and transparent. Documents have been produced to help examiners and lecturers achieve this, and meetings were organized in the spring of 2011. The second element is that the Examining Board visits the chair groups on a regular basis to verify the quality of assessment of courses they provided. Additional visits will take place when required, for example when indicated by the results of course evaluations.

Making valid, reliable and transparent assessments is a regular part of the University Teaching Qualification (BKO). To enhance the reliability of assessments, examiners need to explain which elements in the students' answers lead to a certain mark. For multiple choice questions this is embodied in the answer key, and for open answer questions this is shown by model answers, assessment criteria or rubrics. Sometimes, a second assessor is required to enhance reliability. The committee noted that peer review of written exams seldom takes place.

There are a number of methods of assessment used, including assignments, essays, multiple choice questions and open book exams. Before the visit, the committee was sceptical about the open book exams. After hearing the explanation from lecturers and students, however, it agreed that this kind of examination is appropriate in courses where insight and interpretation are assessed.

The current policy gives each chair group freedom to choose an assessment form and associated criteria. Every chair group therefore has its own strategy. Recently, the chair groups have been developing an assessment plan' in which the content and assessment aspects are described for every course. The implementation of this plan will improve the transparency of the assessment form and criteria. The Examining Board will assist its implementation.

The committee noted that there are three re-sit opportunities per year and course. The only restriction students encounter is that all of the courses must be passed before starting the thesis. The committee states that this policy induces delay and extra workload for lecturers. One lecturer illustrated the unwanted effects of this policy by indicating that a course of 40 students may result in 100 students taking the exam.

It is conceivable that the small number of students and the close contact between students and lecturers hinder objective assessments. The committee discussed this topic with the lecturers. The lecturers state that this is not a problem for the written exams. It is more difficult to remain objective when personal progress is assessed, for example during the thesis project. However, a second examiner always ensures that the assessment is fair and objective.

For the *bachelor's* thesis, students are required to write a research proposal, including a description of the problem, the objectives, the research questions and the methodology for data collection. The topic is chosen from a list and discussed with the supervisor The assessment includes evaluating a) the proposal (5%), b) scientific writing skills (pass/fail), c) ethics part of report (pass/fail), d) presentation at symposium (15%), e) discussion at symposium and f) bachelor thesis content There is a (revised) form to structure the evaluation of these aspects. Theses are evaluated by a supervisor and reviewed by a second examiner. According to the students, support during the thesis project is more than sufficient. They also mentioned that the criteria used are clear. The committee concludes that the support for producing the theses is adequate. Extra support and incentives could, however, be employed to reduce delays during the writing process.

The *master's* thesis project covers a proposal, theoretical frame, design, data analysis and discussion. It ends with a written report, an oral presentation and a final discussion between student, supervisor(s) and examiner. The thesis is evaluated using a standard, university-wide assessment form. It assesses general research competences (30-60%), quality of the thesis report (30-60%), the colloquium (5%) and the final oral examination (5%). Recently, a rubric was developed for each component of the assessment, describing the relation between the level of performance and the grade. Theses are evaluated by a supervisor and reviewed by a second examiner. According to the students, support during the thesis project is more than sufficient. Students and supervisors agree on the weighting of each aspect before the start of the thesis.

The committee studied the assessment form and discussed it with the lecturers, management and the Examining Board. It applauds the efforts to make the grading of the theses objective and explicit. It also appreciates the rubrics, which have improved consistency and transparency. However, the committee is unimpressed by the variable weighting of the aspects as this leads to unequal judgements among students. The committee learned that there are plans to advise to fix the weighting for each chair group in the programme. From the programme's point of view, the differences were considered fair since it was stated that research characteristics among chair groups differ. For example, data collection is more time consuming in one chair group than in the other groups. As a result, this chair group will put more weight on 'general research competences' than the other groups. The committee strongly disagrees with this policy and states that it is the quality of the individual aspects that count, not so much the time spent on it. Therefore, the committee advises setting the weighting among all chair groups equally.

For the *master*'s internship, a university-wide assessment form is used. An external supervisor and an internal supervisor are appointed for the internship. The external supervisor advises on the quality of the student's performance, and the internal supervisor grades the internship. Rubrics are used as benchmark for grading policy. The committee noted that the internship was rated very similarly to the thesis, with aspects that fit with the requirements of a company: professional skills (20-50%), internship report (20-50%), self-reflection on internship (10-30%), presentation (5%) and examination (5%). As with the assessment of the thesis, the committee advises setting only one set of weighting factors.

3.2 Success rate and performance

Based on the theses and the careers of both bachelor and master graduates, the committee established that the intended learning outcomes are achieved.

Bachelor's programme

Prior to the site visit, the committee received 15 bachelor theses selected from a list in the critical reflection of all the theses completed in the last two years. The theses were selected to cover the range of the research topics. Emphasis was placed on the theses graded with a six. The committee agreed that the quality of the theses is acceptable, and they show convincingly that students acquire the programme's intended learning outcomes. The committee was impressed by the quality of a number of theses. One thesis had almost the quality of a master thesis.

The committee noted that half of the theses were graded with at least an 8. Management informed the committee that the introduction of the evaluation form is expected to lead to more conservative grading. It is also aware of the delay caused by too much time spent on the thesis. The committee is of the opinion that this should be avoided since it can lead to a grade which is not fair towards those students who do complete the work in time The aim should be to retain the quality of the theses while meeting the deadlines.

According to the critical reflection, the majority of the bachelor graduates continues on to a master's programme: for the 2003-2007 cohort, this was more than 95%. The graduates who follow the Earth and Environment master have no noticeable problems. This indicates that bachelor students achieve the intended learning outcomes and are well prepared for a master.

Master's programme

The committee selected 15 master theses in the same procedure as described for the bachelor. It agreed that the quality of the theses is acceptable, and they show convincingly that students acquire the programme's intended learning outcomes. The committee was impressed with the novelty of some of the topics.

The committee learned from the critical reflection that students find qualified jobs at the appropriate level and in their field of knowledge. Successful careers have been established in scientific contexts and in research or engineering companies. During the visit, the committee spoke with alumni about the programme. All reported that the programme had been important for and beneficial to their careers.

The committee noted that the majority of the theses are graded with 8 or higher. It learned from the programme management that the final grade is based on several subgradings. Those subgradings are mostly a six or higher, with the consequence that it is nearly impossible to score an average of 6. The programme management and the assessment committee confirmed that the theses are of high quality. The committee suggests to be aware of the tendency to raise grades. This suggestion is supported by the observation that some assessed theses were graded higher than the grades the committee members should have given.

Considerations

The committee verified the assessment system and methods as well as the achievement of intended learning outcomes by students. It concludes that the assessment system is adequate but leaves room for improvement. It is convinced that these improvements will be made, considering the proactive attitude of the programme director and staff towards continuous improvement.

The main concern of the committee is the chair groups' freedom to select their own assessment methods and criteria. The committee advises restricting this freedom. It appreciates the efforts already made to introduce an assessment plan and it advises management to continue this process and to start implementing it as soon as possible.

The committee is positive about the rubrics, formulated in the new forms for evaluating theses and internships. They are comprehensive and promote consistent and reliable grading. Unfortunately, the variable weighting of aspects on which the grading of a Master thesis is based negates the move towards increased consistency and reliability. This should be addressed by the Examining Board.

The committee strongly advises management to address the generous re-sit policy and the resulting delay students incur during the bachelor thesis process. Graduates have to be trained to deal with compelling deadlines and it will also create a more levelled playing field for the students.

To assess the achievement of the learning outcomes, the committee has studied several theses. Based on the theses and the information gathered about progress and success rates, the committee established that bachelor and master students achieve the learning outcomes well. The committee is impressed with the quality of the bachelor theses and the novelty of research topics in the master's theses.

Conclusion

Bachelor's programme Soil, Water, Atmosphere: the committee assesses Standard 3 as **satisfactory**.
Master's programme Earth and Environment: the committee assesses Standard 3 as **satisfactory**.

General conclusion
The committee holds the opinion that the focus of the programmes on the interactions between the Earth and the environment close to the surface is unique in the Netherlands. It applauds the excellent facilities and motivated lecturers who are capable of and willing to pay close attention to the students.

During the visit, the committee has identified three main issues needing special attention. Firstly, the committee observed a relative high percentage of drop out and study delay in the bachelor's programme. It holds the opinion that an investigation of the causes is necessary to make improvements, together with a BSA and clear cut between the bachelor's and master's programme. It appreciates that efforts are already taken to get a better understanding of this high percentages. Secondly, it concludes that there are still (too) many tracks in the master's programme. The committee understands that differentiation into ten tracks is logical because each track refers to the research area of one or more of the Wageningen chair groups. It wonders, however, to what extent the existence of many tracks is suitable for education considering the risk that it may induce fragmentation in the individual programmes. Thirdly, the committee is not positive toward the chair groups' freedom to select their own assessment methods and criteria. The committee advises restricting this freedom. It appreciates the efforts already made to implement an assessment plan and it advises management to monitor this process.

Although not discussed during the site visit, the committee strongly recommends that, in case there is no legally based safety assurance system, it should be developed as a matter of urgency. Such system is needed to legally protect faculty, staff and students. Inherent to this topic, teaching staff should ensure that safety rules are enforced in the field. In addition, obligatory first aid courses for students and lecturers are recommended.

The committee is convinced that the quality of the bachelor's and master's programme is maintained by the highly motivated and capable lecturers and other persons who are responsible for the programmes.

Conclusion
The committee assesses the *bachelor's programme Soil, Water, Atmosphere* as **satisfactory**.
The committee assesses the *master's programme Earth and Environment* as **satisfactory**.

Appendices

Appendix 1: Curricula vitae of the members of the assessment committee

Prof. Rien Herber holds the position of professor in Geo-Energy at the Energy and Sustainability Research Institute of the University of Groningen. After graduating as a geophysicist in Utrecht University in 1979 he started his career in Shell in the research lab in Rijswijk. Following assignments in Brunei, Thailand and the Netherlands he moved northward to Norway as exploration manager for Norske Shell, during which period the deep water Atlantic Margin was opened. In 1998 he moved back to NAM as exploration manager. Still based in Assen, he was appointed in 2003 as Vice President Exploration for Shell in Europe. In this capacity he was responsible for the Shell operated exploration activities in the UK, Netherlands, Norway, Ukraine, Sweden and Ireland, non-operated Shell interests in Germany, Denmark and Italy as well as new exploration opportunities outside these countries. In addition to these responsibilities he has been Deputy General Manager of NAM since 2004 until mid 2009 when he left Shell to take up the professorship in Groningen. Herber is a member of the Dutch Mining Council since 2010.

Prof. Jan Hopmans is Professor of Vadose Zone Hydrology at the University of California, Davis. He graduated with a Master degree in Hydrology at Wageningen Agricultural University (Netherlands) in 1981 and received his PhD in 1985 at Auburn University (USA) in soil physics. He accepted a faculty position at the University of California, Davis, USA, in 1988. His research and teaching activities focus on the development of experimental and mathematical methods to better understand the fundamental processes controlling soil water flow and transport in the vadose zone across spatial scales, and include interests in pore-scale processes, soil water-plant relationships, irrigation water management at field and basin scale, and climate change impacts on CA hydrology. He has about 150 peer-reviewed publications in soil science and water resources journals. He is fellow of the Soil Science Society of America and the American Geophysical Union, and he received the 2003 Soil Physics Don and Betty Kirkham Award. He was past-chair of Department of Land, Air and Water Resources at UC Davis, and is currently Associate Dean of the College of Agricultural and Environmental Sciences, and Co-Editor of Vadose Zone Journal.

Prof. Des Walling recently retired as Reardon Smith Professor of Geography at the University of Exeter, UK and he is currently Emeritus Professor of Physical Geography within the College of Life and Environmental Sciences at Exeter. His research and teaching interests lay at the interface of Hydrology and Geomorphology, with particular reference to erosion, sediment transport and sediment budgets at both the catchment and global scale. He has a special interest in the use of fallout radionuclides for sediment tracing. He has published 34 books and edited volumes and more than 500 papers in journals and conference proceedings. He has maintained a strong involvement in international scientific activities throughout his career and he has served as President of the International Commission on Continental Erosion (ICCE), the International Association of Sediment Water Science (IASWS) and the World Association of Sedimentation and Erosion Research (WASER). He is currently a member of the Steering Committee of the UNESCO International Sediment Initiative. He was the recipient of the IAHS/UNESCO/WMO International Hydrology Prize in 2007 and the AGU Hydrological Sciences Award in 2008.

Prof. Martin Landrø is Professor of applied geophysics at the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway. His main fields of interests are reservoir geophysics (including time lapse seismic), seismic inversion methods, rock physics, four-component seismic, marine seismic acquisition, analysis of CSEM data, and gravimetric methods for monitoring purposes. He is leader of the ROSE consortium at NTNU. This consortium is focused on rock physics, geomechanics and various seismic methods. Present research activities include time lapse seismic in general, time lapse refraction methods, time lapse tomographic inversion, monitoring of CO2-storage, rock physics, modelling of air gun sources, using CSEM-data for monitoring purposes, and research related to improve understanding of salt. In 2009 Landrø launched a research project focusing on long term monitoring (LOSEM) of an old underground blow out (from 1989), where the objective is to investigate long term migration of gas through shallow sediments. Landrø currently serves as a member of the programme committee for the Norwegian Academy of Technical Sciences.

Dr. Miriam Ossevoort holds the position of assistant professor of Science Education and Communication at the Faculty of Mathematics and Natural Science of the University of Groningen. After graduating as biologist at the University of Groningen in 1990 she got her PhD in Immunology at Leiden University in 1995. In 2001 she started as an upper level secondary school teacher in biology in Amsterdam after being a post-doctoral researcher for 5 years at the scientific research institute BPRC in Rijswijk. In 2002 she moved back to Groningen and started as a teacher trainer in biology and assistant professor in biology didactics. Since 2009 she is an assistant professor in science education and communication. Her main focus of research is science reading and scientific argumentation in higher education. In addition, she has been involved in curriculum development of academic skills of the life science bachelor program, is chair of the exam committee of the master Science Education and Communication, and is member of the assessment committee of the Basic Teaching Qualification (BKO).

Evelien Rost is a graduate student of Earth Sciences specialisation Solid Earth at the Vrije Universiteit Amsterdam (VU). After finishing a pre-university education (VWO) at the Christelijk Lyceum in Delft, she started with the bachelor Earth Sciences at the VU in 2007. During the first two years of her bachelor she was active in several committees at the Earth Sciences study association. In 2010 she took part in organizing excursions to Denmark and Scotland for groups up to 70 persons. To be more involved with the quality of the Earth Sciences bachelor and master offered at the VU, she was a member of the education committee of the Earth Sciences bachelor (2009-2010) and master (2011). Furthermore, as a member of the education committee, she was involved in the assessment of the new curriculum for the Earth Sciences bachelor presented by the Curriculum committee in 2010.

Appendix 2: Domain-specific framework of reference

Realization of the domain-specific reference framework for Earth Sciences

The domain-specific reference framework was created by the Chamber for Earth Sciences and educational administrators and/or heads of departments of university institutions with degree programs in the Earth Sciences. It evolved out of a number of joint meetings. The Chamber decided to formulate a general domain-specific reference framework applicable to all Earth Science programs in the Netherlands. Each institute is responsible for its own self-evaluation against the Dublin descriptors for the international positioning of its programmes. The current domain-specific framework is a modified version of the framework established in 2006. It takes into account society's rapidly growing demand for well-trained Earth scientists prepared to tackle scientific and societal issues. In updating the framework, use has been made of "Agenda 2020: Perspectives of the Earth Sciences", the outcome of a series of consultation workshops organized in 2009 by the Council for Earth and Life Sciences (RAL) of the Royal Netherlands Academy of Arts and Sciences (KNAW). Successful implementation of innovative fundamental and applied research often relies on input from various scientific disciplines, enabling cross fertilization of ideas. However, deepening of knowledge of a discipline is often one of the means to seek its boundaries. It is precisely at the interface between separate disciplines that crucial breakthroughs may be made. Both mono- and interdisciplinary training and education, as is the case for Earth Sciences, should therefore be stimulated. Demand for highly educated persons is currently strong and is expected to increase, with correspondingly good job opportunities for Earth scientists. The Dutch government has recently identified a number of key economic sectors in which industry, academia and (semi)governmental institutions should collaborate in fields relevant to society. Earth Sciences has a strong position in two of these nine key economic sectors: energy and water.

System Earth

Earth Sciences have the planet Earth as their object of study, its genesis and its quality of life. Knowledge is gathered about its origin, its current and former composition, structure, and the processes acting in and between the components geosphere, hydrosphere, atmosphere and biosphere. Equally important is knowledge of how to manage and sustainably use Earth's resources and understand the influence of human activity on the terrestrial system. It is of vital importance to gain insight into the wide range of time and spatial scales on which earth processes operate and are manifest. The study of Earth Sciences combines aspects of observation in different forms, via remote-sensing (air and land surface), field studies (surface/outcrop observations and measurements), measurements from within the Earth (e.g. seismology, earth material), analysis of data using laboratory methodology and techniques, and through developing and testing of concepts via computational modelling and simulations. Over the last couple of decades, increasing attention has been paid to the relationship between the Earth Sciences and society. The impact is clear in the fields of natural resource (energy – raw materials – water) evaluation, global climate evolution, the environment and natural and man-induced hazards. In The Netherlands, Earth Science knowledge is widely employed in the design of infrastructure in our heavily populated delta and in the use and management of the shallow and deep subsurface. This development has led to a replacement of the question "what does the Earth mean for humans?" by the question "what do humans mean for the Earth?" In other words: What roles do anthropogenic factors play in terrestrial and atmospheric processes and how can this knowledge be translated into governmental policies and societal action? Also, which measures can we take to incorporate, absorb or mitigate the consequences of man-induced changes in the Earth system? The rapid technological and computational innovations of recent years have created important new challenges and opportunities for the development of Earth Sciences in general and for the training of a new generation of students and young scientists in particular. These technological innovations, partly initiated and stimulated by advances in the field of IT, in modern forms of observation, analysis and experimentation, visualization, simulation and modelling, along with improvements in data mining, technical data processing and data assimilation, have led to a broader and deeper insight into how the Earth system works and how we can be more effective in the use and management of the planet. Science is no longer conducted exclusively within the limits of one discipline and this applies equally to Earth Sciences, where physics, chemistry, biology/microbiology/ecology and applied mathematics/informatics are integrated. In an even wider perspective, Earth Sciences research is increasingly incorporating knowledge from the social sciences. The practice of the various Earth Science disciplines themselves is also characterized by an increasing integration and by multidisciplinary collaboration. Going beyond the boundaries of the Earth Sciences disciplines does not mean, however, that the role of specializations will decrease. Integration and specialization both demand attention if further development is to take place. Specialist depth remains essential to multidisciplinary research at high levels. Likewise, a good connection is essential between fundamental aspects and applied aspects.

The Earth system contains the following four subdomains:

Geosphere
The geosphere encompasses the solid part of planet Earth, from depths of a few 100s of meters, through the Earth's crust and mantle to its core. Most of it is inaccessible for direct, *in-situ* observation; hence predicting its architecture and physico-chemical properties is a challenging task. Large- and small-scale cycles and processes, heat exchange and movement of material take place between the different subcomponents and towards the surface and atmosphere, on a wide range of time and spatial scales. Plate tectonics, mountain range formation and erosion, geochemical differentiation and cyclicity, terrestrial material formation and deformation, strength and tension of and within materials, along with resources like energy, water and ores are all aspects of the Earth system that are directly linked to solid or deep Earth. Knowledge of the solid Earth comes from geological, geophysical and geochemical research in the following subdisciplines: tectonics, structural geology, seismology, experimental materials science and deformation, sedimentology, paleomagnetism, petrology, volcanology, thermodynamics and isotope geochemistry.

Surface
The subdomain 'Surface' covers the shallow subsurface, to a maximum depth of several hundred meters, the Earth's surface and the lower part of the atmosphere (Troposphere). Processes and developments in the deep Earth (endogenous processes) serve as boundary conditions for the working and effectiveness of physical, chemical and biological processes at the Earth's surface. Exogenous near-surface processes between the atmosphere and the Earth's surface layer involve complex, non-linear interactions acting on a wide range of temporal and spatial scales. Flow of matter plays a crucial role in this subdomain, whether in the form of particles or in the form of solutes or gasses. Such flows, via surface and groundwater in the biosphere and soil, are responsible for the further development of the terrestrial relief through erosion and sedimentation, the development and maintenance of natural ecosystems and changes in physico-chemical properties of soils. The Earth's surface is the habitat of man, where there is
a strong link between human activities and natural processes, e.g. concerning the use of the underground to realize infrastructural projects, the production of agricultural crops and, on a larger scale, concerning the consequences of "climate change" for landscape and society, in

the form of sea level rise and changes in land use. Relevant subdisciplines include soil science, physical geography, geology, biogeochemistry, sedimentology and hydrology. Further distinctions can be made: soil chemistry and physics, geomorphology, hydrodynamics, Quaternary geology, hydrology/geohydrology/ecohydrology, soil and microbiology, landscape ecology, geo-informatics and geostatistics.

Biosphere-hydrosphere-atmosphere
Physical and chemical processes determine the status of the atmosphere and the water and element cycles that interact directly with the Earth's surface (vegetation, soil, surface water). This interaction is partly determined by climate variability and change, and partly by land use. Water infiltrating into the surface not only provides a means of subsistence (store of drinking water, irrigation water), it is an important conditioning factor for a large series of linked physical, chemical and biological/microbiological processes in the soil and shallow subsurface. The flow of the water at the land surface ensures the transport of particulate and dissolved substances (nutrients, contaminants, trace elements) from the land surface via the rivers to the oceans. Water and climate processes, acting over a range of temporal and spatial scales, are vital to the Earth's biosphere. This is also true for the interaction between the lithosphere and the biosphere. An important element is the crucial role played by the biosphere in maintaining or changing the biogeochemical functioning of the Earth. The primary subdisciplines of this domain are: meteorology, air quality/atmospheric chemistry, climatology, physics and soil physics, hydrogeology, hydraulics, environmental hydrology, landscape ecology, ecology (including aquatic ecology), geobiochemistry, biology/microbiology, paleontology, geoinformatics, and paleoceanography/marine sciences.

Applied Earth Sciences
Applied Earth Sciences are concerned with the part of the Earth that interacts strongly with society, namely the upper few kilometres of the Earth's crust. This layer hosts the largest part of our resources (from water to ore minerals) and supports an increasing number of infrastructural interventions. In this domain, sedimentological, tectonic, and other natural processes have a profound impact on engineered and other manmade structures, ranging from tunnel building to excavations and constructions. Sustainable management of this delicate outer shell of the Earth requires a combination of highly sophisticated tools to image the Earth's subsurface at depths of tens to thousands of meters, and a profound understanding of the phenomena involved. Exploration and exploitation, as well as processing and recycling, of terrestrial materials (including oil and gas) require the ability to develop and employ prudent and environmentally friendly engineering approaches to the use of the Earth and its subsurface resources. This means that not only geological processes and systems, but also the fundamentals of processes imposed by man, like fluid flow through porous media, geophysical and petrophysical exploration techniques, geomechanics for deformation, strength and tension in rocks and soil, chemistry for mining, metal production, and recycling of materials should be taught. To study these processes, considerable attention is paid to the observation, analysis, and processing techniques themselves. The study of Applied Earth Sciences has a strong geological component and involves the primary subdisciplines: applied geophysics, petroleum engineering, reservoir geology, geo-engineering and resource engineering.

Place of Earth Sciences in society
It is very important that degree programs reflect the current working environment and the application of the Earth Sciences in modern society. Potential employers include universities, government and semi-government agencies, consultancy firms and industry. The different fields of application are:

Natural resources
This covers the application of existing, as well as development of new technologies for the geological and geophysical exploration of natural resources present in the continental subsurface and below the sea, and the sustainable, environmentally responsible management and use of these resources. Examples of natural resources include: industrial minerals, water for human consumption and food production, energy, raw materials and soil (food supply). In the future, particular attention will be paid to the scarcity of resources and to the energy transition.

Terrestrial space
Sustainable management of the subsurface, natural ecosystems and aboveground space are essential to man's future existence. The shallow underground is being increasingly used for laying infrastructural facilities (cables, tunnels, transport lines, etc.), the building of utilities (storage of goods, shopping centers, waste products, etc.) and the storage of energy (thermal, potential, etc.), of energy carriers (e.g. gas) or of residues (CO2, etc.). In many regions the use of land is intensifying and changing. On a global scale there is excessive population growth in deltas, coastal areas and along rivers. This creates intense pressure on the use of these areas and the atmosphere. Earth Science expertise is essential to the management of these areas. Given the many possible uses for the subsurface (e.g. support for constructions, substrate for agriculture and nature, source of minerals, ecological cleansing of groundwater and contaminated soil, etc.), there is also a connection with environmental planning.

Functioning of terrestrial (eco)systems
This field covers, on the one hand, the influence of human activities on soil, water and atmosphere and, on the other hand, natural variations in the quality of the terrestrial environment, including undisturbed (eco)systems. Earth Science expertise and knowledge are essential for both aspects, as well as to our ability to sustain the quality of life and our environment. For the management and removal of contaminants in the terrestrial environment, like the cleaning up of polluted terrains or waste disposal, knowledge and expertise in the fields of civil, chemical and microbiological technology are required.

Natural and man-induced hazards
This field covers the study and analysis of natural hazards like earthquakes, tidal waves, hurricanes and tornadoes, floods and droughts, tsunamis and volcanic eruptions, as well as risks resulting from human activities, like subsidence due to the extraction of groundwater or oil and natural gas, interventions in the courses of rivers, creating recreational and residential areas in vulnerable regions, etc. Most importantly, the risks resulting from climate change belong to this field of application. It is particularly in this area that sound Earth Science knowledge is required input for policy measures at local authority, provincial and national government levels. Safety is an increasingly important dimension in our society.

Earth Sciences as auxiliary science
Another field of application of the Earth Sciences is as an auxiliary science. Modern Earth Sciences (with its tendency towards exact, quantitative aspects) form a foundation for other disciplines, like ecology, archaeology and geobioarchaeology, agricultural and environmental sciences, oceanography and meteorology, in the same way as e.g. physics, chemistry and biology have affected the Earth Sciences.

General objective of a degree programme in Earth Sciences
The general objective of the university programmes is to produce graduates capable of conducting activities appropriate to the broad field of Earth Sciences at the academic level.

These activities include research (fundamental, strategic or applied science), development, advisory, didactic or implementation activities. The modern Earth scientist should be equipped with knowledge of terrestrial processes in order to i) determine or predict the present architecture and physico-chemical properties at the surface, lower atmosphere and shallow to deep subsurface and how this controls human activities, and ii) understand and predict how natural and/or man-induced processes will impact our environment. The need for further insight into terrestrial processes requires understanding of a broad spectrum of spatial and time scales and an approach which pays attention to the interaction of and between the various terrestrial subdomains.

Objective of a bachelor degree programme in Earth Sciences
Earth Sciences is a broad science, which examines the processes and patterns found on the Earth's surface in the deep and shallow subsurface and in the atmosphere. This science is strongly interdisciplinary, with interaction between various factors, such as humans, animals, relief, soil, water, lithology, atmosphere, hydrosphere and vegetation. The three-year bachelor's programme in Earth Sciences teaches the student knowledge and skills in the field of the 'Earth system' in a broad sense, and in one of the four subdomains in particular. The programme focuses on learning to understand patterns and processes, including applications, using modern techniques like geo-informatics, simulation and modelling. It is very important that a bachelor graduate in Earth Sciences has experience with both field and laboratory studies. After completing a bachelor's programme in Earth Sciences the student has:

• Knowledge and insight into terrestrial and/or atmospheric processes, the fundamental mechanisms underlying these processes, and the resulting patternsand systems.
• Insight into the place that the Earth Sciences occupy in relation to other fields of science.
• Insight into the activities and responsibilities of an Earth scientist.
• Knowledge of techniques used in the description and interpretation of Earth Science phenomena in and on the Earth's crust: sampling, analysing, simulating and modelling data.
• Skills in application of the research techniques most commonly used in the Earth Sciences and an ability to learn new techniques. This refers especially to measurement techniques used in the laboratory or in the field, and analysis techniques and software used for the acquisition, storage, analysis and modelling of the data.
• Basic skills in preparing a research plan, defining and formulating a problem, collecting relevant background information (literature search) and collecting and processing data.
• Ability to report clearly on scientific research both orally and in writing.
• Ability to work independently as well as in a team.
• Ability to collaborate with scientists from allied disciplines.
• Ability to defend own viewpoint and willingness to revise that standpoint after scientific discussion.
• A socially responsible attitude towards the sustainable use of natural resources and the terrestrial environment.

Objectives of a master's degree programme in Earth Sciences
The objectives of a master programme in Earth Sciences are to impart to the students the knowledge, attitudes, skills, and insights which render the graduate master (1) capable of practicing his/her profession independently, or (2) qualified for continuing training in scientific research. The graduate master should be competitive in his/her field on the international labour market, both for employment in trade and industry or government and within PhD-research programs at international scientific institutions. After completing a master's programme in Earth Sciences the student:

• Has specific theoretical and practical knowledge of the Earth Sciences, notably within the field of his/her specialization, such that he or she can start and successfully complete a PhD thesis or to take up a position at an academic level with government or government-related institutions, with private companies, or elsewhere.
• Is experienced in carrying out research. This experience has been gradually developed through the confrontation with research and with active researchers, and through active participation in research, in a manner that enables the student to consciously decide whether he/she prefers to continue his/her studies in order to obtain a PhD degree or to take up a position outside the academic world with or without a doctoral degree.
• Is able to function in his/her discipline at an academic level, both in way of thinking and in daily practice; has been stimulated to work on his/her personal development, notably regarding consciousness, independence, communicative behaviour and attitude towards co-operation.
• Has recognized the need to continue his/her education; the graduate is aware of the need to keep in touch with relevant developments within his/her discipline, and is prepared to realize this (lifelong learning).
• Has gained insight into the broad historical, philosophical and social context of the discipline and aspects concerning the intellectual integrity and moral and ethical dimensions of scientific research and its applications.
• Is able to successfully compete on the international labour market.

In the Master programme the students should obtain three levels of expertise:

• *Knowledge*: This comprises a basic understanding of the theory and scientific principles behind the theme or techniques taught, and an appreciation of when and how it can be appropriately used or applied. It does not imply that the student will work intensively with it in the programme itself. The group of courses that reach only the *knowledge*-level are generally restricted to the first year of the master.
• *Practical capability*: This means that at some point during the programme, usually at the beginning of the second master year, the student will have achieved a deep enough knowledge of a (group of) theme(s) or technique(s) that the student can demonstrate that he/she is in a position to apply this knowledge. In essence this means that this particular theme or group of themes will lie in the student's specialist direction.
• *Mastery*: Students will be expected to demonstrate that in at least one theme, they have carried out a research project (e.g. a field-based project) and produced a thesis document. This project may be done in Critical reflection BSc Soil, Water, Atmosphere 2011 | Wageningen University | 33 cooperation with other students but needs to comprise results adding to fundamental scientific knowledge. It should demonstrate the use of intellectual and creative skills as well as a working familiarity with current expertise in the subject, thereby contributing to it, for instance through the modification and further development of existing modelling tools. The mastery level is applicable to the Master-thesis.

Appendix 3: Intended learning outcomes

Learning outcomes of the Bachelor's programme:

	After successful completion of the programme graduates are expected to be able to:	**Dublin descriptors**
Domain-specific knowledge and understanding and applying that understanding	1 Explain the mechanisms underlying processes operating on the Earth, and the resulting structures and patterns on the Earth's surface	Knowledge and understanding Applying knowledge and understanding Making judgments
	2 Explain the position of the Earth Sciences in relation to other fields of science and the role of Earth scientists in society	Knowledge and understanding Applying knowledge and understanding Making judgments
Scientific learning outcomes (research)	3 Analyse a problem in the field of soil, water, and atmosphere by writing a research plan under supervision, including the main phases of scientific research such as collecting and reflecting on relevant scientific literature	Applying knowledge and understanding Making judgments
	4 Apply procedural knowledge by executing research, such as processing and interpreting data and placing results in a wider context	Applying knowledge and understanding Making judgments
Domain-specific skills	5 Apply physical, chemical, biological and spatial concepts and approaches that are used to describe and interpret phenomena, occurring at or near the Earth's surface	Applying knowledge and understanding Making judgments
	6 Apply laboratory and field techniques, and mathematical, computational and statistical methods that Earth scientists commonly use	Applying knowledge and understanding Making judgments
	7 Use common software as ArcGIS, Maple and SPSS for data acquisition, storage, analysis and modelling	Applying knowledge and understanding
General academic learning outcomes	8 Execute projects effectively, both individually and as a member of a multidisciplinary team	Communication Making judgments Learning skills
	9 Interpret and explain current scientific research, both orally and in writing	Communication Making judgments
	10 Assess problems and research by taking and defending a position and showing readiness to shift ground if necessary	Communication Making judgments Learning skills
	11 Demonstrate a responsible attitude by reflecting on social and ethical issues that arise in the field of Earth Sciences	Making judgments Learning skills
	12 Design and plan their own learning path (under supervision)	Learning skills

Learning outcomes of the Master programme:

	After successful completion of the programme graduates are expected to be able to:	**Dublin descriptors (description on master level)**
Domain-specific knowledge and understanding and applying that understanding	1 Demonstrate state-of-the-art knowledge and understanding of the features, functions and processes characterizing the Earth system, its constituent spheres, and the interactions among the spheres	Knowledge and understanding Applying knowledge and understanding
	2 Demonstrate understanding of the cycling of matter and the flows of energy into, within and between the pedosphere, hydrosphere, atmosphere and biosphere	Knowledge and understanding Applying knowledge and understanding
	3 Convert knowledge and understanding of complex physical, chemical and biological processes into useful modelling concepts and apply these to real-world situations	Applying knowledge and understanding Making judgments
	4 Forecast the further progress of Earth processes, inclusive of the interferences therein by humankind, and its implications for sound and sustainable use and management of the Earth	Applying knowledge and understanding Making judgments
Scientific learning outcomes (research)	5 Interpret academic literature, recognize different ways of reasoning and demonstrate a critical and constructive attitude with regard to the analysis of complex problems in their field of specialization; and formulate creative and innovative approaches to the solution of these problems	Applying knowledge and understanding Making judgments
	6 Independently formulate and execute research in accordance with academic standards within their field of specialization, thus contributing to the development of the body of knowledge in this field	Applying knowledge and understanding Making judgments
Domain-specific skills	7 Link theory, observations, experiments, and modelling across different time and space scales	Applying knowledge and understanding Making judgments
General academic learning outcomes	8 Communicate clearly – both orally and in writing – the outcomes of their research and discuss these results with specialists and non-specialists	Communication Making judgments
	9 Function effectively in multidisciplinary teams and, using their expertise, towards multidisciplinary or interdisciplinary issues	Communication Making judgments Learning skills
	10 Show awareness of the need to keep in touch with relevant developments within their discipline and recognize, understand and apply new concepts as they emerge	Communication Making judgments Learning skills
	11 Demonstrate understanding of the moral and ethical dimensions of scientific research and its applications, and the importance of intellectual integrity	Learning skills
	12 Critically reflect on their performance and results, as well as on those of colleagues	Communication Making judgments Learning skills

Appendix 4: Overview of the curricula

Bachelor's programme

		Period 1 September-October	Period 2 November-December	Period 3 January	Period 4 February	Period 5 March-April	Period 6 May-June/July	
BBW year 1	**MO**	YEI 10306 Intro. Environmental sciences	BIP-10306 Introductory Physics	PCC-12403 General Chemistry 2	AEW-21306 Soil & Water 2	MAT-14903 MAT-15003 Mathematics 2&3	NCP-10503 Ecology 1	
	AF	MAT-14803 (RO1*) Mathematics 1 MAT-15303 (RO2*) Statistics 1 / PCC-12303 General Chemistry 1	LAD 10806 Soil & Water 1	MAT-15403 Statistics 2		MAQ-10306 Introduction Atmosphere	LAD-10309 Integration course Soil, Water and Atmosphere	
BBW year 2	**MO**	SEG-20306 Water Quantity & Quality	SOQ-22306 Chemical Processes in Soil, Water, Atmosphere	MAQ-21806 Meteorology and Climate	GRS 10306 Introduction Geo-information science	SOQ-21806 Soil Quality	HWM-23306 Field Practical Hydrology, Water Quality and Meteorology	LAD-22306 Geology, Soils and Landscapes of the Rhine-Meuse Delta
	AF	MAT-23306 Multivariate Mathematics applied	ESS-20306 System Earth: Scale Dependence, Feedbacks and Global Change			MAQ-22806 Atmosphere-Vegetation-Soil Interactions		
BBW year 3 RO3**	**MO**	HWM-20806 Hydrogeology	MAQ-32306 Boundary-layer Processes	ESS-33806 Integrated Water Management				
	AF	INF-22306 Programming in Phyton LAD-32806 Soil & Landscape Variability	SOQ-32806 Biological Interactions in Soils GRS-20806 Geo-information Tools MAQ-34806 Atmospheric Chemistry and Air Quality HWM-23806 Fluid Mechanics					
BBW year 3 RO4**	**MO**				AEW-31306 Water Quality MAQ-30306 Atmospheric Practical	SEG-21306 Sub-surface solute Transport	LAD-33306 Geology and Landscapes of the World	AEW-20706 Practical Aquatic Ecology and Water Quality
	AF					GRS-20806 Geo-information Tools		
			HWM-80812 BSc Thesis Soil, Water, Atmosphere			HWM-80812 BSc Thesis Soil, Water, Atmosphere		

* Restricted Optional (RO): With VWO mathematics B choose RO1, with VWO mathematics A choose RO2.
** Choose 18 credits from RO3 or RO4.

Course code	Course name	Credits	CS or RO	Year	Period	Lectures	Tutorials	Practical	Field excursions	Group work	Individual paper	Internship	Thesis
Common Part													
YEI-30306	Interdisciplinary Topics in Earth and Environment	6	CS	M1	1	16	26				1		
YEI-30806	Environmental Data Collection and Analysis	6	CS	M1	1	20		46	16	3			
YMC-60303	Modular Skills Training (MOS)	3	CS	M1				0					
YMC-60809	Academic Consultancy Training	9	RO1	M1									
ESS-60309	Climate Change: Impact, Adaptation and Mitigation	9	RO1	M1	5-6		24	24		44			
Aquatic Ecology and Water Quality Management (AEW)													
AEW-30306	Ecology: Classics and Trends	6	RO2	M1	2	8				7	2		
INF-31806	Models for Ecological Systems	6	RO2A	M1	3	15	12	64		10			
SOQ-33806	Environmental Analytical Techniques	6	RO2A	M1	3	16	12	70		4			
AEW-31306	Water Quality	6	RO2A	M1	4	24	51						
SOQ-34806	Applications in Soil and Water Chemistry	6	RO2A	M1	4	14	40	20					
AEW-20706	Practical Aquatic Ecology and Water Quality	6	RO2A	M1	6	12		88	32				
Earth System Science (ESS)													
ESS-31806	Biogeochemical Cycles	6	RO3	M1	2	36	13	18					
ESS-32306	Earth System Modelling	6	RO3	M1	4	24	16	45					
ESS-34306	Field Training Land-Atmosphere Interactions	6	RO3	M1	6			30	116				
Hydrology and Quantitative Water Management (HWM)													
INF-32806	Models for Environmental Systems	6	RO4	M1	3	24	6	82					
SEG-31306	Advanced Hydrological Systems Analysis	6	RO4	M1	4	18		80					
HWM-30306	Advanced Environmental Hydraulics	6	RO4A	M1	5	42		22					
HWM-32806	Hydrological Processes in Catchments	6	RO4A	M1	5	28		22	42				
Atmospheric Chemistry and Air Quality (MAQ-chemistry)													
MAQ-34806	Atmospheric Chemistry and Air Quality	6	RO5	M1	2	36		24					
INF-32806	Models for Environmental Systems	6	RO5	M1	3	24	6	82					
MAQ-31806	Atmospheric Modelling	6	RO5A	M1	5	10		80					
ESS-34306	Field Training Land-Atmosphere Interactions	6	RO5A	M1	6			30	116				
Meteorology (MAQ-Meteorology)													
MAQ-32806	Atmospheric Dynamics	6	RO6	M1	2	24		48					
INF-32806	Models for Environmental Systems	6	RO6	M1	3	24	6	82					
MAQ-31806	Atmospheric Modelling	6	RO6A	M1	5	10		80					
ESS-34306	Field Training Land-Atmosphere Interactions	6	RO6A	M1	6			30	116				
Nature Conservation and Plant Ecology (NCP)													
INF-31806	Models for Ecological Systems	6	RO7	M1	3	15	12	64		10			
NCP-30306	Plant, Vegetation and Systems Ecology	6	RO7	M1	6	12	20		80				
AEW-30306	Ecology: Classics and Trends	6	RO7A	M1	2	8				7	2		
GRS-33306	Advanced GIS for Earth and Environment	6	RO7A	M1	4	16		43					
Soil Physics, Ecohydrology and Groundwater Management (SEG)													
SEG-30306	Ecohydrology	6	RO8	M1	2	36		12					
INF-32806	Models for Environmental Systems	6	RO8	M1	3	24	6	82					
SEG-31306	Advanced Hydrological Systems Analysis	6	RO8	M1	4	18		80					

Course code	Course name	Credits	CS or RO	Year	Period	Lectures	Tutorials	Practical	Field excursions	Group work	Individual paper	Internship	Thesis
Land dynamics (LAD)													
LAD-30306	Inventory Techniques for Geosciences	6	RO9	M1	2	12		48	10	10			
GRS-33306	Advanced GIS for Earth and Environment	6	RO9	M1	4	16		43					
LAD-31806	Field Training Geosciences	6	RO9	M1	6				160				
Soil Biology and Biological Soil Quality (SOQ-biology)													
SOQ-32806	Biological Interactions in Soils	6	RO10	M1	2	24	9	60					
INF-31806	Models for Ecological Systems	6	RO10	M1	3	15	12	64		10			
SOQ-31806	Nutrient Management	6	RO10A	M1	5	23	50		4				
SOQ-35306	The Carbon Dilemma	6	RO10A	M1	5	24	36				1		
Soil Chemistry and Chemical Soil Quality (SOQ-Chemistry)													
SOQ-33806	Environmental Analytical Techniques	6	RO11	M1	3	16	12	70		4			
SOQ-34806	Applications in Soil and Water Chemistry	6	RO11	M1	4	14	40	20					
SOQ-35306	The Carbon Dilemma	6	RO11	M1	5	24	36				1		
Internships and Theses													
AEW-70424	MSc Internship Aquatic Ecology and Water Quality Management	24	RO2	M2								5	
AEW-80436	MSc Thesis Aquatic Ecology and Water Quality Management	36	RO2	M2									25
ESS-70424	MSc Internship Earth System Science	24	RO3	M2								5	
ESS-80436	MSc Thesis Earth System Science	36	RO3	M2									25
HWM-70424	MSc Internship Hydrology and Quantitative Water Management	24	RO4	M2								5	
HWM-80436	MSc Thesis Hydrology and Quantitative Water Management	36	RO4	M2									25
MAQ-71324	MSc Internship Air Quality and Atmospheric Chemistry	24	RO5	M2								5	
MAQ-81336	MSc Thesis Air Quality and Atmospheric Chemistry	36	RO5	M2									25
MAQ-70824	MSc Internship Meteorology	24	RO6	M2								5	
MAQ-80836	MSc Thesis Meteorology	36	RO6	M2									25
NCP-70424	MSc Internship Nature Conservation and Plant Ecology	24	RO7	M2								5	
NCP-80436	MSc Thesis Nature Conservation and Plant Ecology	36	RO7	M2									25
SEG-70424	MSc Internship Soil Physics, Ecohydrology and Groundwater Management	24	RO8	M2								5	
SEG-80436	MSc Thesis Soil Physics, Ecohydrology and Groundwater Management	36	RO8	M2									25
LAD-70424	MSc Internship Land Dynamics	24	RO9	M2								5	
LAD-80436	MSc Thesis Land Dynamics	36	RO9	M2									25
SOQ-70424	MSc Internship Soil Quality	24	RO10	M2								5	
SOQ-81836	MSc Thesis Soil Biology and Biological Soil Quality	36	RO10	M2									25
SOQ-70424	MSc Internship Soil Quality	24	RO11	M2								5	
SOQ-81336	MSc Thesis Soil Chemistry and Chemical Soil Quality	36	RO11	M2									25

Select 1 course from RO1
Students with (supervised) work experience on an academic level may exchange the internship for a second thesis
Select one cluster from RO2 - RO11 in consultation and agreement with your study adviser
If RO2 is selected, choose 2 courses from RO2A in consultation with your study adviser
If RO4 is selected, choose 1 course from RO4A in consultation with your study adviser
If RO5 is selected, choose 1 course from RO5A in consultation with your study adviser
If RO6 is selected, choose 1 course from RO6A in consultation with your study adviser
If RO7 is selected, choose 1 course from RO7A in consultation with your study adviser
If RO10 is selected, choose 1 course from RO10A in consultation with your study adviser

Appendix 5: Quantitative data regarding the programmes

Data on intake, transfers and graduates

Bachelor programme:

	2003	2004	2005	2006	2007	2008	2009	2010
Size cohort at the outset (N)	32	34	38	33	36	47	63	74
Size of Re-enrolment T+1(N)	24	28	31	28	27	37	57	
Diploma after 3 years (%)	38	25	10	29	30			
Diploma after 4 years (%)	75	68	61	50				
Diploma after 5 years (%)	83	75	71					
Diploma after 6 years (%)	96	89						
Diploma after 7 years (%)	100							
Drop-outs by 1 October 2010 (%)	0	11	10	14	4	8		

Master programme:

	2003	2004	2005	2006	2007	2008	2009	2010
Size cohort at the outset (N)	1	12	7	11	8	9	13	9
Success after 2 years (%)	100	75	43	55	88	78		
Success after 3 years (%)	100	92	86	55	88			
Success after 4 years (%)	100	92	86	73				
Drop-outs by 1 October 2010 (%)	0	8	14	18	13	11	15	

Teacher-student ratio achieved

Bachelor programme:
The students-staff ratio is 5.64

Master programme:
The students-staff ratio is 5.48

Average amount of face-to-face instruction per stage of the study programme

Bachelor programme:

Year	Contact hours	Contact hours (% of total)
1	759	45
2	801	47
3	777	46
total	2342	46

Master programme:

Year	Contact hours	Contact hours (% of total)
1	731	43,5
2	30	1,8
total	761	45,3

Appendix 6: Programme of the site visit

8.30-9.15	**Meeting with management**
	D.r G.F. Epema, Programme Director
	Prof. dr. ir. E.W Brascamp, Director Education Institute
	T. Geertsema, Student member DB progr. Committee
	Prof. dr. T.W.M Kuyper, Education Board, former chair progr. committee BWA
	Prof. dr. A.A.M Holtslag, Chairholder Meteorology
9.15- 10.15	**Meeting with students**
	J.G. Habes, BSc student
	M.C. Verbeek, BSc student
	G. Karssenberg, BSc student
	M.J. Vos, MSc student
	A.J. Stegerman, MSc student
	R. Porre, MSc student
	A. Huisman, MSc student
	B.J. Brookhuis, MSc student
10.15-10.30	**Break**
10.30-11.30	**Meeting with lecturers**
	Dr. ir. J.J. Stoorvogel, Associate professor
	Dr. ir. H.A.J. Van Lanen, Associate professor
	Dr. ir. J.C van Dam, Associate professor
	Dr. ir. J.W. van Groenigen, Associate professor
	Prof. dr. M.C. Krol, chair holder
	Dr. ir. J.J.M de Klein, Assistant professor
	Dr. ir. G.J. Steeneveld, Assistant professor
	Dr. L. Weng, Assistant professor
11.30-12.00	**Education committee**
	Dr. ir. E.T.H.M Peeters, Assistant professor
	Prof. dr. ir. S.E.A.T.M van der Zee, Chair holder
	S. Hinborch, BSc student
	C.M.F.J.J. de Kleijn, MSc student, Msc student
	T.W. van Laar, MSc student
12.00-13.00	Lunch incl. tour of the facilities
13.00-13.45	**Meeting with Examining Board and student advisor**
	Dr. ir. R.J.A. van Lammeren, Chair examination committee
	Dr. D. van der Hoek, Secretary of the examination committee
	Ir. A.M. Leemans, Study advisor
	Dr. ir. K. Metselaar, Study advisor
13.45-14.15	**Meeting with alumni**
	Ir. S.A. van der Salm (Waterwatch)
	Ir. B.R.A. Vonk (Meteoconsult)
	Ir. K.H.J Pepers (BAAC BV)

	Ir. I.C. Regelink (PhD-WU soil quality) Ir. N. Wanders (PhD Utrecht university Hydrology) Ir. M.C. Holtslag (PhD-TU delft, wind energy) Ir. J.G.S. Keijsers (PhD-WU, land degradation)
14.45-15.30	**Concluding meeting with management** Dr. G.F. Epema, Programme director Prof. dr. ir. E.W. Brascamp, Director education institute T. Geerstema, Student member DB programme committee Prof. dr. T.W.M. Kuyper, Education board, former chair programme committee Prof. dr. A.A.M. Holtslag, Chair holder meteoroly
17.30-17.45	**Presentation of preliminary results**

Appendix 7: Theses and documents studied by the committee

Prior to the site visit, the committee studied the theses of the students with the following student numbers:

Bachelor programme:

870503738130	880104913090
881209846010	890710253030
890722557010	870705344080
890106051120	880127514110
880505979080	830808122040
891024494100	900630386110
900316466010	880601429110
881107557070	

Master programme:

830119200040	860918396130
860912100100	840529825070
770728383100	840515001040
850831966010	630513027040
860520647090	840914578010
820107167100	850815514120
860120804010	821104831040
860818828090	870215151130
861129927060	

During the site visit, the committee studied, among other things, the following documents (partly as hard copies, partly via the institute's electronic learning environment):

Ordners

A) Minutes relevant commissions
B) Assessments
C) Course guides
D) Evaluations (overview)

Also available:

E) Medewerker monitor 2010 WUR
F) Materials various courses
G) Materials study association
H) Course evaluations (more extensively)

A. Minutes relevant commissions

- Minutes Examination Committee
- Minutes Programme Committee BBW-MEE
- Minutes External Advisory Board (werkveldcommissie)
- Report master Earth and Environment (werkgroep "Earth Sciences" of WU)

B. Assessments (Toetsopgaven) of a number of BBW and MEE courses

For every selected course, the following is given:

1) course guide, to give a background of the course including assessment criteria.
2) examples of examinations

The sequence is alphabetical, based on the chair groups:

AEW Aquatic Ecology and Water Quality Management
GRS Geo-Information Science and Remote Sensing
HWM Hydrology and Quantitative Water Management
INF Information Technology
MAQ Meteorology and Atmospheric Chemistry and Air Quality
MAT Mathematical and Statistical Methods
SEG Soil Physics, Ecohydrology and Groundwater Management
SOQ Soil Quality, Biology and Chemistry

Information on thesis and internship is given too (see information in critical reflection reports):
BSc thesis (HWM-80812)
MSc thesis (XXX-80836); XXX = represents 10 chair groups; 36 = nr of credits
MSc internship (XXX-70424)

C. Course guides

The sequence of the course guides is alphabetical.

Codes refer to the following chair groups
AEW Aquatic Ecology and Water Quality Management
ESS Earth System Science
HWM Hydrology and Quantitative Water Management
INF Information Technology
LAD Land Dynamics
MAQ Meteorology and Atmospheric Chemistry and Air Quality
MAT Mathematical and Statistical Methods
SEG Soil Physics, Ecohydrology and Groundwater Management
SOQ Soil Quality, Biology and Chemistry
YEI Educational institute (for common courses in MEE)
YMC Master Cluster

D. Evaluations

- Overview of course evaluations BBW of 3 years
- Overview of course evaluations MEE
- Overview of course evaluations MSS, MHW, MMA up to 2010-2011
- WO-monitor 2009 (information on MHW)
- Bachelor graduate evaluation
- 1st year bachelor evaluation

- NSE 2011
- Keuzegids (selected pages)
- Success rates (including 2007)
- Peer review of the programmes

BBW =BSc Soil, Water, Atmosphere (Bodem, Water, Atmosfeer)
MEE = MSc Earth and Environment
MSS = MSc Soil Science
MHW = MSc Hydrology and Water Quality
MMA = MSc Meteorology and Air Quality

Appendix 8: Declarations of independence

nvao
nederlands-vlaamse accreditatieorganisatie

DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: PROF. M.A. HERBER

HOME ADDRESS: VIADUCTWEG 10, 9751 HR HAREN

~~HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT /~~
SECRETARY:

SEE ATTACHMENT

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

SEE ATTACHMENT

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS; CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO; HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: HAREN DATE: 25/6/12

SIGNATURE:

DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: MARTIN LANDRØ

HOME ADDRESS: K.O. THORNÆS V.1, 7033 TRONDHEIM, NORWAY

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT / SECRETARY:

SEE ATTACHMENT

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

SEE ATTACHMENT

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS; CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO; HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: WAGENINGEN DATE: 25 June 2012

SIGNATURE: Martin Landrø

nvao
nederlands - vlaamse accreditatieorganisatie

DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: Jan W Hopmans

HOME ADDRESS: 1508 Eligio Lane DAVIS CA 95618 USA

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT / SECRETARY:

SEE ATTACHMENT

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

SEE ATTACHMENT

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS; CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO; HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: Wageningen DATE: June 25 2012

SIGNATURE:

nvao
nederlands - vlaamse accreditatieorganisatie

DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: Professor Desmond E. Walling

HOME ADDRESS: Orchard Close, Lynch Road, Thorverton, EXETER, EX5 5PS, Devon, UK

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT / SECRETARY:

Earth Sciences

SEE ATTACHMENT

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

SEE ATTACHMENT

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS; CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO; HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: Wageningen. DATE: 25.6.12

SIGNATURE: D. E. Walling

nvao
nederlands - vlaamse accreditatieorganisatie

DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: dr. M. A. Ossevoort

HOME ADDRESS: Breedeborg 22, 9722 WK Groningen, the Netherlands

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT / SECRETARY:

SEE ATTACHMENT

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

SEE ATTACHMENT

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS; CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO; HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: Wageningen

DATE: June 25, 2012

SIGNATURE: [signature]

nvao
nederlands - vlaamse accreditatieorganisatie

DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: Evelien Rost

HOME ADDRESS: Commelinstraat 350 1093 UP Amsterdam

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT / ~~SECRETARY~~:

SEE ATTACHMENT

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION: Wageningen University

SEE ATTACHMENT

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS; CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO; HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: Wageningen

DATE: 25-06-2012

SIGNATURE: erost

nvao
nederlands - vlaamse accreditatieorganisatie

DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: W.v. Gastel

HOME ADDRESS: Riverford 35 2318 MG Leiden

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN ~~EXPERT~~ / SECRETARY:

SEE ATTACHMENT

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

SEE ATTACHMENT

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS; CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO; HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: Wageningen

DATE: 25.06.2012

SIGNATURE:

Attachment composition committee Earth Sciences

	Wagening University	Utrecht University	University of Amsterdam	VU Amsterdam	TU Delft
Visit	**25-26 June 2012**	**27-28 June 2012**	**29 June 2012**	**18-19 September 2012**	**16-17 September2012**
Chair	Prof. M.A. Herber	Prof. M.A. Herber	Prof. M.A. Herber	Prof. M.A. Herber	Prof. M.A. Herber
Member	Prof. M. Landrø	Prof. M. Landrø	Prof. M. Landrø	Prof. M. Landrø	Prof. M. Landrø
Member	Prof. J.W. Hopmans	Prof. J.W. Hopmans	Prof. J.W. Hopmans	Prof. J.W. Hopmans	Prof. J.W. Hopmans
Member	Em. Prof D.E. Walling	Em. Prof D.E. Walling	Em. Prof D.E. Walling	Em. Prof D.E. Walling	Em. Prof D.E. Walling
Member	Dr. M.A. Ossevoort	Dr. M.A. Ossevoort	Dr. M.A. Ossevoort	Drs. R.L. Prenen	Drs. R.L. Prenen
Student	E. Rost	E. Rost	M. Weekenstroo	M. Cazemier	M. Cazemier
Secretary	dr. W. van Gastel	dr. W. van Gastel	dr. W. van Gastel	dr. W. van Gastel	dr. W. van Gastel

Institution:	**Programme (CROHO)**	**Mode of study**	**Final date accreditation**
Technische Universiteit Delft	B Technische Aardwetenschappen (56959)	Full time	31-12-2013
	M Applied Earth Sciences (60360)	Full time	31-12-2013
Universiteit Utrecht	B Aardwetenschappen (56986)	Full time	31-12-2013
	M Earth Sciences (66986)	Full time	31-12-2013
Universiteit van Amsterdam	M Earth Sciences (66986)	Full time, part time	31-12-2013
Vrije Universiteit Amsterdam	B Aardwetenschappen (56986)	Full time	31-12-2013
	M Earth Sciences (66986)	Full time	31-12-2013
	M Hydrology (60807)	Full time	31-12-2013
Wageningen Universiteit	B Bodem, water, atmosfeer (56968)	Full time	31-12-2013
	M Earth and Environment	Full time	31-12-2013