Course Specifications

Valid as from the academic year 2013-2014

Climate Change: Evidence, Impacts & Mitigation (C003023)

Course size *(nominal values; actual values may depend on programme)*

Credits 5.0 **Study time 125.0 h** **Contact hrs** 40.0 h

Course offerings and teaching methods in academic year 2013-2014

A (semester 2)	lecture	20.0 h
	seminar: practical PC room classes	2.5 h
	seminar: coached exercises	2.5 h
	group work	15.0 h

Lecturers in academic year 2013-2014

Verschuren, Dirk	WE11	lecturer-in-charge
Boeckx, Pascal	LA08	co-lecturer
Bonte, Dries	WE11	co-lecturer
Steppe, Kathy	LA09	co-lecturer
Verbeeck, Hans	LA09	co-lecturer
Verhoest, Niko	LA04	co-lecturer

Offered in the following programmes in 2013-2014	crdts	offering
Master of Science in Biology	5	A
Master of Science in Bioscience Engineering: Land and Water Management	5	A
Master of Science in Geography	5	A

Teaching languages

English

Keywords

Climate change, greenhouse effect, CO2 emissions, biosphere impacts, carbon cycle, climate prognosis, IPCC, adaptation, mitigation, sustainable development

Level

advanced

Position of the course

This course provides a broad multi-disciplinary overview of the topic of anthropogenic climate change with emphasis on the processes of climate change itself and of its impacts on carbon cycling, the abiotic environment, the biosphere and the human environment. Biosphere impacts are treated at all levels of plant/animal biology: physiology, populations and species, structure and functioning of ecosystems. Attention is given to the various methods of climate-change research and the associated uncertainty in climate-change prognoses, and to strategies of adaptation and mitigation. By being presented with the complete picture in a single course, students learn to judge the relative importance of different processes at different spatial and temporal scales, develop appreciation for the different perspectives of different stakeholder groups, and become more comfortable with the uncertainties linked to particular positions.

Contents

1 Aspects of general climatology relevant to climate change; temperature structure of the atmosphere, atmospheric circulation, diverse feedbacks.
2 The greenhouse effect: physics and chemistry of natural and anthropogenic greenhouse gases, and their historical trends.
3 The carbon cycle: main carbon reservoirs and fluxes, fossil fuels and energy, human perturbation of the carbon cycle.
4 Air pollution and global dimming.
5 Predicting 21st-century climate: long-term historical perspective, forcing attribution,

IPCC prognoses and emission scenarios, sources of uncertainty in long-term climate prediction.
6 Impacts of global warming on the cryosphere.
7 Hydrological processes relevant to climate change, and impacts of global warming on the hydrological cycle.
8 Plant ecophysiology and climate-change effects on C3/C4 competition.
9 Role of ecosystems/vegetation in the global carbon cycle.
10 Earth system models (IPCC-GCMs) and land-surface models (DGVMs), with application to climate change impacts on tropical rainforests.
11 Impacts of global warming on the biosphere: species distributions, phenology, habitat loss, exotic/invasive species and diseases, evolutionary aspects.
12 Climate change and biological conservation.
13 Sources, sinks, anthropogenic emissions and mitigation of non-CO2 greenhouse gases: N2O, CH4, O3.
14 Impacts on the human environment with emphasis on global food security, differentiating between western and developing countries. Practical exercises involving computer exercises exploring the effects of various climate-change related scenarios; and student presentations and discussion on topics of current or past controversy in climate change.

Initial competences

Having successfully completed an introductory course in ecology, e.g. Ba1 Ecologie in Biology or equivalent; or having acquired the relevant knowledge by personal study or other means.

Final competences

Demonstrate advanced knowledge of the causes of recent (natural and anthropogenic) climate change in relation to long-term climate history, of all relevant aspects of the carbon cycle, and of the opogenic climate change on the abiotic earth environment, the biosphere (fysiology, species distributions, ecosystems) and the human environment.
Demonstrate basic knowledge of the potential and limitations of diverse observational and paleoclimatological methods of climate study, and of the climate models used in prognoses over the 21st century.
Display a science-based critical attitude towards new data, interpretations, theories and models of anthropogenic climate change and the historical interaction between humans, climate and nature.
Demonstrate ability to process, combine, evaluate, and synthesize in a structured manner complex information from the primary scientific literature of multiple relevant sub-disciplines.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Group work, lecture, seminar: coached exercises, seminar: practical PC room classes

Extra information on the teaching methods

Lectures: Powerpoint presentations with text and figures, made available beforehand on Minerva
Seminar: 1) interactive, introductory computer class on climate-change modeling; 2) class presentation and discussion of group assignment, using PPT presentations
Teamwork: group assignments involving a literature review with synthesis and written report, on topics of debate in the field of global change

Learning materials and price

English handbook ‘Global warming: understanding the forecast’ by David Archer (Blackwell, 2007, ISBN 978-1-4051-4039-3, kost ~€30); ~150 pp. ppt presentations and ~50 pp. primary literature made available via Minerva. Total Estimated Cost: 40€.

References

IPCC (2007). 4th Assessment Report on Climate Change: summary for policymakers.
Neil Roberts (1998). The Holocene: an environmental history, 2nd Ed. Blackwell (ISBN 0-631-18638-7).

Course content-related study coaching

Supervision of computer-aided interactive exercises. Supervision and guidance of group

assignment. Personal contact with instructors by appointment.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions

Examination methods in case of permanent evaluation

Oral examination, assignment

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Extra information on the examination methods

Questions testing both knowledge of and insight in material presented in lectures; testing of insight in the influence of used methods on the interpretation of climate data

Calculation of the examination mark

Period-bound theory exam 75%; reports and presentation of groupwork 25%

Facilities for Working Students

1. Possible exemption from educational activities requiring student attendance
2. Possible rescheduling of the exam to a different time in the same academic year