

Paleoclimatology (C002664)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size	<i>(nominal values; actual values may depend on programme)</i>		
Credits 6.0	Study time 150 h	Contact hrs	52.5 h

Course offerings and teaching methods in academic year 2022-2023

A (semester 1)	English	Gent	seminar: coached exercises	5.0 h
			lecture	25.0 h
			group work	22.5 h

Lecturers in academic year 2022-2023

Verschuren, Dirk	WE11	lecturer-in-charge
De Batist, Marc	WE13	co-lecturer

Offered in the following programmes in 2022-2023

	crdts	offering
Master of Science in Teaching in Science and Technology (main subject Geology)	6	A
Master of Science in Bioscience Engineering: Land, Water and Climate	6	A
Master of Science in Geology	6	A
Master of Science in Geology	6	A
Exchange programme in Geology (master's level)	6	A

Teaching languages

English

Keywords

Paleoclimate, paleoceanography, climate change, global change, Quaternary, Holocene, El Niño, tectonics, thermohaline circulation, climate mechanism

Position of the course

The aim of this course is to provide the students with a basic understanding of the global climate system, as starting point for the teaching of advanced knowledge in late-Cenozoic climate history and the full range of natural climate variations on both short (years to centuries) and long (thousands to millions of years) time scales; and of how the long-term perspective gained from paleoclimate data can be exploited for better prediction of future climate change resulting from the interaction of natural and anthropogenic climate drivers.

Contents

- 1 Overview of the structure and functioning of the world climate system with emphasis on components subject to variation at time scales of years and longer.
- 2 History and mechanisms of natural climate variation at all time scales (tectonics, Milankovitch factors, thermohaline circulation, bipolar see-saw, monsoons, solar activity, volcanoes, ENSO, NAO) with emphasis on the processes, their temporal and spatial scale of operation, periodicities in external forcing, feedback mechanisms and interactions between atmosphere, geosphere, biosphere, hydrosphere and cryosphere.
- 3 Overview of the principal archives and proxy indicators of climate change, their (potential) applications and characteristic limitations.
- 4 Historical perspective and scientific basis for anthropogenic climate change, with in-depth discussion of recent findings and the associated uncertainties.

Initial competences

Bachelor geology, biology or geography

Final competences

- 1 The student demonstrates basic knowledge of the functioning of the large-scale physical elements of the global climate system, and of potential and limitations of all important natural archives and techniques in paleoclimate reconstruction.
- 2 The student demonstrates advanced knowledge of the complete range of patterns, frequencies and natural mechanisms of climate change during the late-Cenozoicum, with emphasis on Quaternary ice ages and the Holocene.
- 3 The student demonstrates insight in the scales (both in space and in time) of operation of the various climate mechanisms, and their modulation through variable influences from and interactions between the atmosphere, geosphere, biosphere, hydrosphere and cryosphere.
- 4 The student displays an objective critical attitude towards new data, interpretations, theories and models of anthropogenic climate change in the context of the long-term perspective obtained from paleoclimate research.
- 5 The student demonstrates the ability to process, combine, evaluate, and synthesize in a structured manner complex information from the primary scientific literature of multiple relevant sub-disciplines.
- 6 The student has acquired the following competences: competences in geology and related sciences, general scientific competences and intellectual competences, competences in collaboration and communication, and social competences.

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

Extra information on the teaching methods

Lectures: 20 Powerpoint presentations with text and figures, made available beforehand on Ufora

Teamwork: group assignments involving a literature review with synthesis and written report, on 1) topics of debate in the fields of paleoclimatology and global change, and 2) methods of paleoclimate research

Seminar: class presentation and discussion of group assignment, using a PPT presentation
Due to COVID19, alternative teaching methods may be implemented

Learning materials and price

Estimated total cost: 80.0 EUR

English handbook: Ruddiman, W.F., 2007. Earth's Climate: Past and Future. (2nd Edition). W. H. Freeman & Co., 480 pp. ISBN 0716784904, 9780716784906. Print-outs of the derived and annotated Powerpoint presentations, made available via Ufora, are brought to class to complete with personal notes.

~100 pp. primary scientific literature available via Ufora.

References

- Burroughs, W.J., 2001. Climate Change: a Multidisciplinary Approach. Cambridge University Press, ISBN: 0-521-56125-6
- Alverson, K.D. et al. (eds.), 2003. Paleoclimate, Global Change, and the Future. Springer Verlag, New York, ISBN: 3-540-42402-4
- Oldfield, F., 2005. Environmental Change: Key Issues and Alternative Perspectives. Cambridge University Press, ISBN: 0-521-53633-2
- Bradley, R.S., 1999. Paleoclimatology: reconstructing climates of the Quaternary. Academic Press, London, ISBN: 0-12-124010-X
- Cronin, T.M., 2010. Paleoclimates - Understanding Climate Change Past and Present. Columbia University Press, New York, ISBN: 978-0-231-14494-0

Course content-related study coaching

Moderation/supervision of group assignments; pre-evaluation feedback on written reports.
Contact with teaching staff via Ufora, or in person on 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, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

PE: On-campus exam with questions testing both knowledge and insight in material presented in lectures and personal work or group assignments of fellow students. Examination in the 2nd examination period is possible.

On-line exam is exceptionally possible with valid reason, e.g. COVID19-related.

NPE: Evaluation of the written report, presentation and discussion abilities of the student regarding the group assignments.

Students who miss the non-periodical evaluation cannot pass for the course. A 2nd chance for evaluation is offered in modified form between the 1st and 2nd examination period.

Calculation of the examination mark

25% NPE

75% PE

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