

Paleoclimatology and Climate Change (C002473)

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

Credits 6.0 Study time 180 h Contact hrs 50.0 h

Course offerings and teaching methods in academic year 2019-2020

A (semester 1)	English	lecture	25.0 h
		group work	22.5 h
		seminar: coached	2.5 h
		exercises	

Lecturers in academic year 2019-2020

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

Offered in the following programmes in 2019-2020

Master of Science in Marine and Lacustrine Science and Management	crdts	offering
	6	A

Teaching languages

English

Keywords

paleoclimate, paleoceanography, climate change, global change, Quaternary, Holocene, El Niño, tectonics, thermohaline circulation, climate mechanisms

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 antropogenic 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

Ba1 System Earth or equivalent.

Final competences

- 1 The student has acquired general scientific and intellectual competences, competences in collaboration and communication, and social competences.
- 2 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.

- 3 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.
- 4 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.
- 5 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.
- 6 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.

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

- Lecture: 20 Powerpoint presentations with text and figures, made available beforehand on Ufora
- Teamwork: group assignments involving literature review, synthesis and report, on topics of debate in the fields of paleoclimatology and global change
- Seminar: class presentation and discussion of group assignments, using PPT presentations

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, with the derived and annotated PPT presentation available via Ufora
 ~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 instructors via Ufora. Personal contact with instructors 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, 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: Questions testing both knowledge and insight in material presented in lectures and

personal work or group assignments of fellow students.

Examination in the second examination period is possible.

NPE: Evaluation of the written report, the ppt presentation and the discussion abilities of the student regarding the group assignment. Students who eschew the non-periodical evaluation cannot pass for the course.

A second examination chance is offered in modified form between the first and second 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