

Climate Through Earth's History (I002466)

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

Credits 5.0 **Study time** 140 h **Contact hrs** 70.0h

Course offerings in academic year 2022-2023

A (semester 1) English Gent

Lecturers in academic year 2022-2023

Seidenkrantz, Marit-Solveig AARHUS01 lecturer-in-charge
Knudsen, Mads Faurschou AARHUS01 co-lecturer

Offered in the following programmes in 2022-2023

	crdts	offering
International Master of Science in Soils and Global Change (main subject Physical Land Resources and Global Change)	5	A

Teaching languages

English

Keywords

Position of the course

To give the student an understanding of the mechanisms which govern Earth's climate, and the processes causing climate change, incl. plate tectonics, ocean and atmospheric circulation, orbital forcing, solar irradiation and greenhouse gasses. This aim is reached by giving the students a comprehensive understanding of the Earth's climate history and how climate has changed over timescales ranging from from years to millions of years.

Contents

The course discusses how and why climate has changed through Earth's history. Primary focus will be on understanding the various mechanisms that control climate and longer and shorter time scales. The course will include examples of studies from of different environments and investigation methods.

Initial competences

Final competences

After the course the student is expected to be able to:

- 1) Discuss, compare and combine the main oceanographic and atmospheric processes that influence climate on long and short timescales. The significance and impact of each process and mechanism must be evaluated separately as well as placed in the perspective of the entire climate system.
- 2) Discuss various types of climatic events and scenarios and relate these to specific causes and mechanisms, incl. differentiating between internal and external forcing.
- 3) Explain how plate tectonic processes influence climate and the greenhouse gas balance of the Earth system as well as discuss and evaluate the significance of each plate tectonic element on climate separately and combined.
- 4) Explain the Milankovitch-cycles and how they influence global climate. This includes their influence on atmospheric circulation, precipitation, and how these orbital forces relate to glacial/interglacials.
- 5) Explain climate variations such as Dansgaard-Oeschger cycles, Heinrich events, Bond events, Younger Dryas/Allerød etc. and evaluate the causes of these climate fluctuations.
- 6) Discuss and evaluate possible causes for Holocene and modern climate variability, and place these into the perspective of future climate development.

7) Evaluate the influence of solar variability on climate.

Conditions for credit contract

This course unit cannot be taken via a credit contract

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture

Learning materials and price

All additional hand-outs/power-points.

References

Ruddiman, W.F. 2013. Earth's Climate. Past and Future (3rd edition), chap. 2, chap. 3 p. 56-74, chap. 4, chap. 5, p. 102-118 (p. 98-102 is expected known as background knowledge), chap. 6 p. 126-132, chap. 7, chap. 8 except box 8-2, chap. 9 – 20, Appendix 1, Appendix 2
Lowe, J.J. & Walker, M.J.C. 1997. Reconstructing Quaternary Environments. Chapter 7.
Marshak, S. 2001/2005. Earth, Portrait of a Planet. Chap 18.3-18.4, p. 551-557 & Chap. 20.4, p. 616-624
Gray, L.J. et al. 2010. Solar influences on climate. Reviews of Geophysics 48, RG4001, page 1-24.
Haug, G.H., Hughen, K.A., Sigman, D.M., Peterson, L.C. Röhl, U., 2001. Southward migration of the intertropical convergence zone through the Holocene. Science 293, 1304-1308.
Hilgen, F.J., Krijgsman, W., Langereis, C.G., Lourens, L.J., Santarelli, A. & Zachariasse, W.J. 1995: Extending the astronomical (polarity) time scale into the Miocene. Earth and Planetary Science Letters, 136: 495-510.
Knudsen, M.F., et al. 2011. Tracking the Atlantic Multidecadal Oscillation through the last 8,000 years. Nature Communications 2,178 | DOI: 10.1038/ncomms1186
Sarachik, E.S. & Alverson K. 2000. Pages Newsletter vol 8 (1).
Seidenkrantz, M.-S., Knudsen, K.L. & Kristensen, P. 2000. Marine late Saalian to Eemian environments and climatic variability in the Danish shelf area. Geologie en Mijnbouw/Netherlands Journal of Geosciences 7 (2/3), 335-343.
Seidenkrantz, M.-S., Kuijpers, A. & Schmith, T. 2009. Our climate out of order? Aktuell Naturvidenskab, vol 5. – Available in both English and Danish.

Course content-related study coaching

Assessment moments

end-of-term assessment

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

Oral examination

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

Oral examination

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Calculation of the examination mark