GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2026-2027

Evolution of Climate & Life: Oceans (C004593)

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

Credits 4.0 **Study time 105 h**

Course offerings and teaching methods in academic year 2026-2027

A (semester 2)	English	Gent	excursion	0.0h
			seminar	0.0h
			peer teaching	0.0h
			lecture	0.0h
			independent work	0.0h
B (semester 2)	English	Gent	independent work	0.0h
			excursion	0.0h
			lecture	0.0h

Lecturers in academic year 2026-2027

Van Rooij, David	WE13	lecturer-in-charge

Offered in the following programmes in 2026-2027	**crdts**	**offering**
Bachelor of Science in Geology	4	A
Master of Science in Marine and Lacustrine Science and Management	6	B
Exchange programme Faculty of Sciences (bachelor's level)	4	A
Preparatory Course Master of Science in Geology	4	A
Preparatory Course Master of Science in Geology	4	A

Teaching languages

English

Keywords

Oceanography, seafloor spreading, hydrothermalism, passive margins, active margins, oceanic circulation, thermohaline circulation, sedimentary processes, paleoceanography, natural resources, natural hazards

Position of the course

This course offers an introduction in the interdisciplinary world of oceanographic and deepwater marine geological research within the larger context of the evolution of climate and life. The dynamics of oceanic circulation, playin a pivotal role for climate and sedimentary processes, will be analyzed in close association with the dynamics of the oceanic lithosphere. These aspects will be discussed within a multidisciplinary geological context, with attention for both natural resources as natural hazards, but also for the interaction between Geosphere and Biosphere. Although the "modus operandi" of the present-day Ocean will receive a lot of attention, case studies of the Tethys and Atlantic domain will highlight their respective plate tectonic as paleoceanographic evolution.

Contents

-1- Introduction: scientific and societal relevance of marine geology, oceanic nomenclature, interactions, scientific breakthroughs, marine scientific methodologies.
-2- Oceanic lithosphere: plate boundaries, seafloor spreading, composition of the oceanic lithosphere and intraplate processes
-3- Ocean margins: genesis and evolutie on of passive margins, including continental rifting. Structure and dynamics of active margins, including

spontaneous versus forced subduction, and constructive and destructive active margins. Transform margins. This part is concluded by a case study on the geodynamic evolution of the Tethys domain.
-4- Oceanic circulation: atmospheric circulation, Ekman transport, water masses, surface currents, geostrophy, thermohaline circulation, (m)eddies, internal waves and tides.
-5- Marine sedimentary processes: sources of (deep-water) oceanic sedimentation, preservation and dissolution (hemi)pelagic processes, downslope transport (mass transport deposits), alongslope transport (contourites) and hybrid systems.
-6- Palaeoceanography: distribution of (hemi)pelagic sediments in time and space. Palaeoceanographic evolution of the Atlantic Ocean and the influence on the Cenozoic climate.
-7- Marine natural resources: hydrothermalism, volcanogenic massive sulphides, Mn nodules, hydrocarbons and gas hydrates. Marine natural hazards: principles of overpressure, mud volcanism and tsunami's

Initial competences

General: the student has a basic knowledge of the structure and functioning of the Earth
Course offering A (Ba Geology): the student has acquired insights with respect to stratigraphy (2 Ba) and sedimentology (2 Ba). During the practical exercises the acquired skills obtained during Programming (2 Ba) will be further used.

Final competences

1 The student has acquired a sound insight in importance of oceans in the present and past operation of the Earth, specifically with respect to lithospheric dynamics, geosphere-biosphere interactions and the steering influence of geodynamics on oceanographic and climatological processes.
2 The student has acquired insights in the occurrence, operation and complexity of marine natural resources and hazards, as well as the linked present and future scientific and societal challenges.
3 The student is familiarized with the scientific nomenclature, objectives and basic interpretation of the most common research methods and technologies in deep-sea exploration.
4 The student has acquired insight in the national and international relevance and applicability of marine (geological) research in the academic domain, for governement and policy, as in the commercial domain.
5 The student has gained experience in the drafting of a concise, comprehensive and linguistically correct overview of a theme related to a recent paradigm in marine geology (only for course offering A).

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

Seminar, Excursion, Lecture, Independent work, Peer teaching

Extra information on the teaching methods

Course offerings A & B
- Excursion: visit to the Flanders Marine Institute (VLIZ, Ostend) and its facilities. During this excursion (1 day, public transport) the scientific and societal relevance of marine research in Flanders will be discussed. A visit of the Marine Robotics Centre and the Marine Station Ostend will bring the students in contact with the different marine scientific research methods and technologies.

Course offering A (Ba Geology)
- Independent work (project): drafting a "state-of-the-art" review of an important marine geological topic, based on historical and recent scientific literature. This is a scientific paper of 3 pages.
- Peer teaching (presentation): short and dynamic "pitch" presentation of the topic of the independent work.
- Seminar:
  - Geodynamics of the Antarctic Peninsula (seismics, geomagnetism)
  - Case study sedimentary processes: Le Danois Bank (seismics, multibeam)

- Case study physical oceanography: Belgica Mound Drift (sidescan sonar, CTD, ADCP)

Course offering B (Ma Marine & Lacustrine Sciences & Management)

- Excursion "evolution of climate & life in the Rheno-Hercynian basin during the Devonian & Carboniferous". This is a 2-day field trip in the south of Belgium (Couvin, Givet, Dinant, Namur). The evolution of the geodynamics, sedimentation and biosphere will be discussed through field observations (outcrops). The costs will only cover transport, accomodation and breakfast.
- Independent work (project): drafting a short paper (4 p, figures inclusive) about a specific topic, covered during the field trip. This is a group assignment (2 persons).

Study material

Type: Handbook

Name: Invitation to Oceanography
Indicative price: € 70
Optional: yes
Language : English
Author : Paul R. Pinet
ISBN : 978-1-28416-469-5
Number of Pages : 598
Online Available : No
Available in the Library : No
Available through Student Association : Yes
Usability and Lifetime within the Course Unit : regularly
Usability and Lifetime within the Study Programme : regularly
Usability and Lifetime after the Study Programme : occasionally

Type: Syllabus

Name: Evolution of Climate & Life: Oceans
Indicative price: Free or paid by faculty
Optional: no
Language : English
Oldest Usable Edition : 2024
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No
Additional information: These course notes will only be available in January 2027.

Type: Excursion

Name: Visit of VLIZ (1st course day)
Indicative price: € 20
Optional: no
Additional information: This field trip will make use of public transport by train (Gent-St-Pieters - Oostende). The students are responsible for their own transportation.

Type: Excursion

Name: Evolution of climate & life in the Rheno-Hercynian basin during the Devonian & Carboniferous
Indicative price: € 50
Optional: no
Additional information: Only for course offering B (Ma Oceans & Lakes). The expenses will only cover transport, accommodation and breakfast. Students are responsible to organize their own lunch and dinner (various choices in Givet (FR) and Dinant).

References

- P. Pinet (2009). Invitation to Oceanography. Jones & Bartlett, 626 pp.
- A. Nicolas (1995). The Mid-Oceanic Ridges. Springer-Verlag, 200 pp.
- C.M.R. Fowler (2005). The Solid Earth. Cambridge University Press, 685 pp.
- W. Lowrie (2007). Fundamentals of Geophysics. Cambridge University Press, 685 pp.
- H. Hueneke & T. Mulder (2010). Deep-Sea Sediments. Developments in Sedimentology 63, Elsevier, 750 pp.
- M. Rebesco & A. Camerlenghi (2008). Contourites. Developments in Sedimentology 60, Elsevier, 688 pp.

- M. Denny (2008). How the Ocean Works. Princeton University Press, 320 pp.
- J.P. Kennett (1982). Marine Geology. Prentice-Hall, 813 pp.

Course content-related study coaching

Interactive assistance during lectures and with Ufora (https://ufora.ugent.be).
Development of marine skills. Coaching by professors and assistants.

Assessment moments

end-of-term and continuous assessment

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

Oral assessment, Written assessment with open-ended questions

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

Oral assessment, Written assessment with open-ended questions

Examination methods in case of permanent assessment

Participation, Presentation, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

PE (examination): written and one oral question
Evaluation of insight in basic concepts, and of the capacity to apply such concepts in real world problems.
NPE: during exercises, excursion, the project and its presentation. The points are transferrable to the second examination session, but not to a subsequent year.

Calculation of the examination mark

PE: 50% written, 25% oral
NPE: 25%
The deadline for the paper needs to be respected. If not, this will not be evaluated.
In case of non-participation to the evaluation of one or more parts, it is not possible to pass for the total of the course. The final grade, if higher than 7/20, will be reduced to 7/20.