

## Environmental Modelling (C003809)

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

**Credits 3.0**

**Study time 90 h**

### Course offerings and teaching methods in academic year 2025-2026

A (semester 2)

English

Gent

lecture

seminar

### Lecturers in academic year 2025-2026

Soetaert, Karline

WE11

lecturer-in-charge

Bonte, Dries

WE11

co-lecturer

### Offered in the following programmes in 2025-2026

[Master of Science in Marine and Lacustrine Science and Management](#)

**crdts**

3

**offering**

A

### Teaching languages

English

### Keywords

### Position of the course

### Contents

Present day environmental problems (e.g. eutrophication, contaminant dispersal, climate change, ocean acidification) require a quantitative approach. To better understand how natural systems respond to such changing inputs and boundary conditions, biogeochemical models of varying complexity are being called upon. The central aim of this course is to learn how to develop and apply such models. In this course we will focus particularly on elemental cycling (Carbon, Nitrogen etc) and transport of contaminants within aquatic ecosystems (e.g. rivers, estuaries, lakes, oceans). Models are implemented in the open-source programming language R.

Models in the environmental sciences.

- What is a model?
- Types of models
- Model examples (e.g. North Sea, Scheldt estuary, ocean acidification)

Construction of models

- Balance equations, boundary conditions, transport formulation, kinetic rate laws
- Reactive transport models (box models, 1D, 2D and 3D)
- pH models, acid-base chemistry and CO<sub>2</sub> uptake

Model solution

- steady-state solutions versus transient solutions
- analytical versus numerical solution
- numerical integration procedures

Model applications

- Causes of uncertainty in model predictions
- Sensitivity analysis
- Fitting models to data: parameter estimation, cost functions, estimators (least squares, maximum likelihood)
- Parameter uncertainty
- Model selection

### Initial competences

**Final competences**

- 1
- 2
- 3
- 4
- 5

**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, Lecture

**Study material**

None

**References****Course content-related study coaching****Assessment moments**

end-of-term assessment

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

Oral assessment

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

Oral assessment

**Examination methods in case of permanent assessment****Possibilities of retake in case of permanent assessment**

not applicable

**Calculation of the examination mark**

oral exam: 100%