GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2024-2025

Atmospheric Modeling (C002867)

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

Credits 4.0 **Study time 120 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	English	Gent	lecture
			seminar

Lecturers in academic year 2024-2025

Termonia, Piet	WE05	lecturer-in-charge

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Postgraduate Studies in Weather and Climate Modeling	4	A

Teaching languages

English

Keywords

Meteorological modeling, numerical techniques, dynamical and physical meteorology, data assimilation

Position of the course

This course puts the courses “General Meteorology”, “Dynamic Meteorology”, “Physical Meteorology” and “Numerical Techniques” together and is split in two parts. The first part gives an introduction of the constraints on these four courses via needs of atmospheric modeling. The second part will put the technicalities discussed in almost all other courses of the program in an applied research perspective, with the operational constraints of numerical weather prediction as one of the main guidelines.

Contents

1. Basis of atmospheric modeling and requirements on basic knowledge to follow the topic.
2. Dynamical aspects with emphasis on historical trends (stability and efficiency) and links with conceptual meteorology advances.
   a. Links between governing concepts;
   b. simplifying assumptions and their progressive disappearance;
   c. horizontal discretisation related problems;
   d. vertical discretisation related problems;
   e. time discretisation related problems;
   f. synthesis, with links to recent advances in dynamical meteorology.
3. Parameterisation aspects with emphasis on feed-backs (including with the dynamics of models) and their consequences for the NWP concrete work.
   a. Definitions and insight in the exact role of parameterisations;
   b. radiative transfer;
   c. water phase changes and microphysics of clouds and precipitation;
   d. sub-grid scale topography's effects;
   e. surface exchanges (and short insight in surface modeling);
   f. turbulent transport;
   g. non-precipitating convection;
   h. precipitating convection;
   i. feed-backloops- and cycles oriented conclusion.

Initial competences

Besides elementary calculus, one should have acquired the intended competences

of the subjects “General Meteorology”, “Dynamic Meteorology”, “Physical Meteorology” and “Numerical Techniques”.

Final competences

1 The student should be ready for starting research in this field of science or for having a better critical eye on the interpretation of numerical atmospheric simulation results.
2 He/she should have acquired sufficient understanding of the scientific background of the atmospheric modelling trade.
3 He/she also should have some practical experience with modeling in a more general sense.

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

Seminar, Lecture

Extra information on the teaching methods

Practical exercises (in a framework depending on the number of participating students), when possible making use of distant learning facilities (Ufora and e-learning).

Study material

None

References

ECMWF Seminar proceedings.

Course content-related study coaching

Support via Ufora (forum), e-mail and private discussions upon appointment.

Assessment moments

end-of-term assessment

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

Written assessment with open-ended questions, Assignment

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

Written assessment with open-ended questions, Assignment

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

Periodical evaluation (1 exam and 1 project (either individual test [article => code's updating] or group work on a transversal mini-project))
Theory: written exam on links between the numerical model code and bibliography (the inverse of the individual tests) Exercises: project either in the domain of numerical weather prediction or climate modeling.

Calculation of the examination mark