GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2024-2025

Introduction to the Dynamics of Atmospheres (C001427)

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

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 1)	Dutch	Gent	lecture
			independent work
			seminar

Lecturers in academic year 2024-2025

Termonia, Piet	WE05	lecturer-in-charge

Offered in the following programmes in 2024-2025	crdts	offering
Master of Science in Teaching in Science and Technology(main subject Mathematics)	6	A
Master of Science in Teaching in Science and Technology(main subject Physics and Astronomy)	6	A
Master of Science in Mathematics	6	A
Master of Science in Physics and Astronomy	6	A
Master of Science in Physics and Astronomy	6	A

Teaching languages

Dutch

Keywords

Meteorology, atmosphere, dynamics, equations of motion, quasi geostrophic analysis, linear perturbation theory, wave solutions, baroclinic instabilities, general circulation, numerical techniques

Position of the course

The behaviour of the atmosphere is treated as a problem of applied fluid mechanics, starting from scratch. The equations are derived. These equations are too complex to be solved analytically. Two techniques to gain insight are introduced: (a) linear perturbation theory to study the wave solutions and (b) quasi geostrophic analysis to explain and understand the origin of baroclinic disturbances. Besides applying such simplifying techniques one can also rely on modelling to gain insight in atmospheric dynamics. The current popular numerical techniques are briefly discussed. The advantages and disadvantages of both approaches (analytic vs. numerical) are compared.

Contents

1. Forces on air parcels
2. The dynamical equations
3. Elementary properties of atmospheric motion (geostrophic wind, potential temperature, adiabatic temperature gradient,static stability, gradient wind, thermal wind, barotropic vs. baroclinic atmosphere)
4. Circulation and vorticity
5. Quasi geostrophic analysis
6. Linear perturbation theory
7. Baroclinic instabilities
8. The influence of the planetary boundary layer
9. General circulation
10. Numerical modelling

Initial competences

Basic knowledge from Bachelor on classical mechanics, vector calculus, partial differential equations

Final competences

1 Apply continuum mechanics to atmospheres in general.
2 Notion of the problems in atmosheric dynamics.
3 Connect concepts in thermodynamics to meteorology.
4 Give a mathematical formulation for phenomena of dynamcis of fluids.
5 Investigate flows in the atmosphere by apllication of physical laws and principles.
6 Distinguish and explain various types of flows in the atmosphere.
7 Explain and interprete graphs and diagrams related to the dynamics of atmospheres.
8 Understand the importance of mathematical analytical and numerical modeling in the context of meteorology.
9 Identifying and applying the right approach to gain the insight in synoptic-scale disturbances and energy transfers in the general circulation.

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, Independent work

Extra information on the teaching methods

Classroom problem solving sessions: the students solve a list of exercises and the solutions are then discussed

Study material

Type: Slides

Name: Slides'
Indicative price: € 10
Optional: no
Additional information: Slides (hand outs for the students) based on "An introduction to Dynamics Meteorology", J. R. Holton, 1992, ISBN 0-12-354355-X

References

An Introduction to Dynamic Meteorology, J.R. Holton, 1992, ISBN 0-12-354355-X, Academic Press

Course content-related study coaching

The lecturer is available for extra coaching if necessary

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

Exam determines 100% of the final mark.