GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Land–Atmosphere Interactions (I002451)

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

Credits 4.0 **Study time 120 h**

Course offerings in academic year 2025-2026

Lecturers in academic year 2025-2026

Offered in the following programmes in 2025-2026	**crdts**	**offering**

Teaching languages

English

Keywords

Land cover, climate, climate feedback, evaporation, hydrological cycle

Position of the course

This course deals with the dynamic interaction between land and atmosphere, and will complement other courses on hydrology, environmental sciences and ecology within the programme. The students will explore the observed and expected impact of the land surface on the dynamics of the lower atmosphere, as well as the importance of land use as a means to mitigate climate change and weather extremes. Throughout this journey, we will assess the potential of in situ and satellite observations, as well as numerical models, to give an insight into the mechanisms underlying the interchange of water, heat and carbon between land and atmosphere. As a whole, the course aims to present an overview of the role of the terrestrial hydrosphere and biosphere in our changing climate, and introduce state-of-the-art numerical techniques in this field of science.

Contents

Theory

1. Introduction: The Land–Atmosphere Interface
2. Atmospheric Vertical Profiles
3. Boundary Layer Dynamics
4. Land Radiation Budget
5. Surface Energy Fluxes
6. Latent Heat Flux Estimation
7. Vegetation & Surface Conductance
8. Soil moisture & Vegetation Feedbacks
9. Land Use & Land Cover Feedbacks
10. From Local to Global Scales

Practicals

For the practicals, students will be working with the CLASS model (https://classmodel.github.io) to familiarize with the different topics discussed in the theory, involving the boundary layer state and land–atmosphere feedbacks.

Initial competences

This course builds on learning outcomes from the course units: 'Earth Sciences', 'Environmental Sciences', 'Ecology', 'Fluid Mechanics', 'Differential equations',

'Modelling and Simulation of Biosystems' and 'Mass and Heat Transport'; these learning outcomes may have been achieved differently.

Final competences

1 Students understand the processes behind the carbon, water and heat exchange from land to atmosphere
2 Students have a clear understanding of land–atmosphere feedbacks and their role in climate
3 Students have a basic knowledge on geo-engineering for mitigating climate change impacts
4 Students can operate a conceptual land–atmosphere model and critically interpret the results

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

Group work, Seminar, Lecture, Independent work

Study material

None

References

– Terrestrial Hydrometeorology. W. J. Shuttleworth. Willey–Blackwell (2012)
– Transport in the Atmosphere–Vegetation–Soil Continuum. A. F. Moene, J. C. van Dam. Cambridge (2014)
– Ecological Climatology: Concepts and Applications. G. Bonan. Cambridge (2015)
– Atmospheric Boundary Layer. J. V. G. de Arellano, C. C. van Heerwaarden et al. Cambridge (2015)

Course content-related study coaching

Assessment moments

end-of-term and continuous assessment

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

Written assessment with open-ended questions

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

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Peer and/or self assessment, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Calculation of the examination mark

60% theory, 20% group peer-reviewed presentation, 20% computer practical report
The examiner may fail students who eschew period aligned and/or non-period aligned evaluations for this course unit.