**FACULTY OF SCIENCE**

**LUND UNIVERSITY**

# Master Programme in Computational Science, Geoscience, 120 credits

*September 2024 – June 2026*

**Computations are becoming more and more important in research and industry. To make predictions, analysis or to replace experiments, we make use of numerical simulations and machine learning on large computers. We generate and store large amounts of data and use data science to search for patterns, connections, and trends.**

The Master Programme in Computational Science with specialisation in Geoscience will give you detailed knowledge about the underlying methods with respect to geoscience. You will learn how to study complex processes in natural sciences, and how Computational Science can contribute to knowledge evolution in society. A few of many examples are studies in, and research on, environment and climate change, global environmental issues and global cycles. The programme will prepare you for a professional career in academia as well as in business and industry.

## Programme overview

This interdisciplinary education will give you leading edge knowledge in the field of computational science. The specialisation has students with a background in mathematics/physics and an interest in geoscience and programming as a target group. In addition to knowledge in theory for computational science, there will be an emphasis on obtaining knowledge about the practical tools that are used by professionals in the field and you will amongst several things train your skills in programming. You will get generic knowledge and skills of importance for computationally intensive working tasks, such as problem

formulation, information search, data processing, scientific writing, and presentation techniques.

The programme has three separate specialisations: Geoscience, Physics and Scientific Computing. You will study several courses together with students from another specialisation than your own and there will opportunities to do common projects and thesis work. During your studies, an interdisciplinary perspective is emphasized and you will also study together with students from biology, geology, environmental sciences, physical geography and chemistry.

The education has a strong connection to research. You will meet and be taught by active and internationally well recognised researchers and you will be in contact with several research groups. You will at the same time be prepared for a career in business and industry.

## Programme structure

Within computational science with geoscience specialisation analytical, numerical and statistical methods are used to analyse and draw conclusions from numerical models, as well as huge datasets from geoscientific experiments. The programme contains a mix of courses in geoscience, mathematics and computational science that will give you broad knowledge in numerical methods within data science, Monte-Carlo simulations and solutions to differential equations. You will also get insight into the interplay between computational methods and the underlying physical phenomena and models that are studied.

### Compulsory courses 30 credits

BERN01     Modelling in Computational Science 7.5 credits
BERN03     Introduction to Climate system modelling, 7.5 credits
NUMN21     Advanced Course in Numerical Algorithms with Python, 7.5 credits
NUMN32     Numerical Methods for Differential Equations, 7.5 credits

### Alternative-compulsory (elective) courses 45 credits, of which 30 credits in geoscience

NGEA20     Introduction to Hydrology, 15 credits
NGEA21     The Climate System, 15 credits

| NGEA04 | Ecosystems Analysis, 15 credits |
| NGEN01 | Climate Change and its Impacts on the Environment, 15 credits |
| NGEN02 | Ecosystem Modelling, 15 credits |
| NGEN17 | Global Ecosystem Dynamics, 15 credits |
| GEOB21 | Livets utveckling och jordens klimat (in Swedish), 15 credits |
| GEON06 | Palaeoecological methods and environmental analysis, 15 credits |
| GEON09 | Global Environmental Change from a Geological Perspective, 15 credits |
| BERN02 | Reproducible Data Science and Statistical Learning, 7.5 credits |
| BERN04 | Introduction to Artificial Neural Networks and Deep Learning, 7.5 credits |
| MASC13 | Markov Processes, 7.5 credits |
| MASC14 | Stationary Stochastic Processes, 7.5 credits |
| MASM11 | Monte Carlo Methods for Statistical Inference, 7.5 credits |
| MASM17 | Time Series Analysis, 7.5 credits |
| MASM22 | Linear and Logistic Regression, 7.5 credits |
| MASM25 | Spatial statistics with Image Analysis, 7.5 credits |
| NUMN26 | Simulation Tools, 7.5 credits |
| NUMN28 | Numerical Simulations of Flow Problems, 7.5 credits |

## Optional courses 15 credits

The optional courses are to be chosen from geoscience, computational science, mathematics, mathematical statistics or numerical analysis.

## Degree project 30 credits

BERMXX    Degree project Master of Science

*Table 1 Course of study, example*

| Year 1 | Autumn 1 | Autumn 2 | Spring 1 | Spring 2 |
|---|---|---|---|---|
| | **BERN01** Modelling in Computational Science, 7.5 credits | **NUMN32** Numerical Methods for Differential Equations, 7.5 credits | NGEN02 Ecosystem Modelling, 15 credits | GEON09 Global Environmental Change from a Geological Perspective, 15 credits |
| | **NUMN21** Advanced Course in Numerical Algorithms with Python, 7.5 credits | **BERN03** Introduction to Modelling of Climate Systems, 7.5 credits | | |
| Year 2 | Autumn 1 | Autumn 2 | Spring 1 | Spring 2 |
| | MASC13 Markov Processes, 7.5 credits | MASM25 Spatial statistics with image analysis, 7.5 credits | **Degree project Master of Science, 30 credits** | |
| | BERN02 Reproducible Data Science and Statistical Learning, 7.5 credits | BERN04 Introduction to Artificial Neural Networks and Deep Learning, 7.5 credits | | |

## Career opportunities

After graduation, there are several different career paths depending on which subject profile you have chosen. The Master's programme gives you a solid ground for postgraduate education in natural sciences. You can also choose a career path outside academia and then find attractive jobs in areas where there is a need to solve computational problems both in industry and in public administration and other organisations.

## Requirements and selection

### Entry requirements

Bachelor´s degree in Physics of at least 180 credits. The degree must contain at least 15 credits in geoscience.

Proficiency in English equivalent to English 6/B from Swedish upper-secondary school.

*or*

Bachelor's degree of at least 180 credits in Science or Engineering. The degree must contain at least 30 credits mathematics, of which 6 credits in programming and 7,5 credits in statistics, and an additional 60 credits in mathematics and/or physics. The degree must contain at least 15 credits in geoscience.

Proficiency in English equivalent to English 6/B from Swedish upper-secondary school.

### Selection criteria

Based on grades awarded for previous academic courses, with majors in science, technology and mathematics, as well as a statement of purpose for the application in which applicants state their goals with the programme (from the applicant's "Summary sheet").

## Degree

**Master of Science**
Major: Computational Science with specialisation in Geoscience
**Naturvetenskaplig masterexamen**
Huvudområde: Beräkningsvetenskap med fördjupning i geovetenskap

## Application

Apply online using [Universityadmissions.se](Universityadmissions.se)
Application period: 16 October 2023 - 15 January 2024
Language of instruction: English

## Contact

Master coordinator Robert Klöfkorn  [compsci@math.lu.se](compsci@math.lu.se)