Prior knowledge for Master Applied Earth Sciences

Students are required to have a bachelor's degree in physical science or engineering. All students must have sufficient prior knowledge in mathematics (at least 16 EC, including probability and statistics), physics, and programming at a level equivalent to an undergraduate engineering or science degree.

In addition, it is recommended to have prior knowledge of Earth sciences. We offer an online course for students without this knowledge.

This document gives a detailed overview of expected prior knowledge for the MSc programmes Civil Engineering, Environmental Engineering, and Applied Earth Sciences. If you lack some of these competencies, but fulfil the general admission requirements, you are strongly advised to review these before the start of the programme.

Students who are concerned about their ability to satisfy all criteria are encouraged to contact the admissions office and/or programme coordinator.

Programming in **Python**:

- Variables, Constants, Operators and Expressions
- Common data types (e.g., int, float, strings, chars, boolean)
- Basic data structures: lists, tuples, dictionaries and sets
- Basic read/write operations from text files
- if/then/else statements
- Loops
- Functions
- Importing packages
- Numpy arrays: 1-D, 2-D and N-D arrays, array creation
- Numpy basic operations: addition, subtraction, multiplication, division, dot product, matrix multiplication
- Numpy array manipulation: sorting, indexing and slicing, reshaping and transpose, joining arrays
- Basic plotting with matplotlib

Calculus, linear algebra, differential equations, numerical mathematics at BSc-level, covering at least the following topics:

- Integration (multiple integrals) and differentiation (incl. partial derivatives, numerical)
- Matrix algebra (sum, product, inverse, transpose)
- Eigenvalues and eigenvectors, determinants
- Taylor series
- Complex numbers
- Inner products
- Numerical differentiation and integration, truncation errors
- Ordinary Differential Equations and basic Partial Differential Equations solutions
- Gaussian elimination and LU decomposition

- Solution of linear systems
- Least squares method
- Nonlinear solution, bisection and Newton's methods

Statistics and probability concepts consistent with a BSc-level course:

- Set theory and fundamental probability rules
- Basic continuous probability distributions (Gaussian, binomial, exponential, uniform)
- Basic discrete probability distributions (uniform, binomial, geometric)
- Probability density function, cumulative distribution function
- Conditional probability, independence
- Expectation, variance and standard deviation, covariance and correlation