EuroSDR
European Spatial Data Research

TECHNISCHE UNIVERSITÄT WIEN

# Fundamentals of Python programming for geospatial applications

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**Dates:** April 5-16, 2027

**Pre-course seminar:** March 2, 2027 (TU Delft)

**Target audience:** Staff of national mapping agencies, other public authorities; professionals and researchers from the public and private sectors; PhD researchers; students

**Prerequisites:** Familiarity with the basic understanding of geospatial data and programming, particularly in Python.

**Course objectives:** Basic skills in computer programming are getting ever more important in our highly digitised world. This specifically applies to geospatial data, which is handled, processed, and managed on a country-wide level by National Mapping and Cadastral Agencies (NMCAs). While not every NMCA officer has to be a software development expert, profound knowledge of programming basics still helps much in the daily routine, e.g., for evaluating the quality of geodata acquired from third-party data providers before release in official country-wide products and databases. The programming language Python is ideal in this respect, as Python is (i) easy to learn and widespread, (ii) a simple scripting and a full-featured programming language, (iii) open source and available for all modern operating systems, (iv) increasingly used for AI, and (v) Python provides a rich set of pre-defined modules and packages for working with geodata.

**Topics tackled**: The course is based on the fully digitised MOOC (Massive Open Online Course) “Python for Natural Sciences,” which was developed at TU Wien. The course is an initiative to bridge knowledge gaps for prospective students and is run in a purely web-based environment.

A Moodle e-learning environment provides access to pre-recorded videos and self-assessment quizzes. Practical programming in Python is carried out in a JupyterHub environment. For each lesson, an IPython notebook demonstrates theory and provides examples, and the attendees will practice Python programming themselves by solving short assignment tasks.




The course is divided into two parts:

- **Part I (week 1) is dedicated to the fundamentals:** data types, operators, containers, loops, conditional expressions, functions, simple data analysis using NumPy, and basic map visualisations using Matplotlib. Based on that, specific programming tools for accessing and processing geodata will be explained and demonstrated in Part II (week 2).

- **Part II (week 2) includes basic operations** like intersecting vector data, working with different Web Map Services (WMT, WMTS, etc.), and accessing global satellite images as well as regional 3D point cloud datasets.

Along with the short self-assessment quizzes and programming tasks, a final practical assignment with an NMCA-related topic serves as the basis for grading.