

Building Skills in Environmental Data Analysis with Python

A short course targeted at working professionals and graduate students wanting to level up their data analysis skills.

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For anyone working with environmental data, scripting languages are a superpower. They not only expand what you can do, but they also vastly improve how quickly and effectively you can do it. There is a natural progression from doing calculations by hand, to using a calculator, to working in spreadsheets, and finally to using a scripting language. At each stage, however, the barrier to entry can seem higher, and many people find programming intimidating. The key to success is to first get over the initial hurdle of starting, and secondly to integrate this into your workflow so that you use the tools routinely. Once you do, tasks that once took hours can be completed in minutes.

In this course, we will remove that barrier. You will learn the fundamentals of Python for environmental data analysis through hands-on exercises using freely available software. Python is one of the world's most widely used programming languages, with an enormous ecosystem of open-source libraries for data analysis and visualization. Its open-source nature means that it is continually improved by a global community, and thousands of specialized tools are freely available.

By the end of the course you have the foundation needed to continue developing your skills independently, with the support of online resources and modern AI tools, and the confidence to use Python routinely in your day-to-day work.

Learning competencies

During the course, participants will develop the following practical skills:

- Install and run Python on your own laptop.
- Use the JupyterLab interface and create Jupyter Notebooks.
- Perform calculations on a dataset using the NumPy library.
- Read and process time series data using the Pandas library.
- Produce high-quality figures using Matplotlib.
- Perform basic statistical analyses and summarize datasets.

By the end of the course, you will be able to read environmental datasets into Python, explore and analyse the data, perform basic statistical analysis, produce high-quality figures, and how to save scripts to reproduce your analysis.

Course structure

This course involves a combination of synchronous (in-class, on zoom) and asynchronous (in your own time) delivery. Synchronous sessions are two hours per week, and they are recorded so you can watch

them back if you miss anything. The asynchronous recorded materials will be around one hour per week, and you will need to spend at least two hours per week working independently to keep up with the materials. Hence, the course requires approximately five hours work per week. During each session, we will focus on acquiring and analysing publicly available datasets from sources such as Open Canada, Environment Canada, international NGOs, academic data repositories and others. The course also teaches you how to use artificial intelligence (AI) constructively. You will learn how to use AI to improve your efficiency while avoiding shortcuts that undermine your own understanding and learning. In the final week students will prepare an *analysis portfolio* that they will share in class with other students and receive feedback on. Students will also prepare a personal action plan describing how they intend to incorporate Python into their own research or professional workflow, and they may optionally submit this to the instructor for feedback.

The course is structured as shown:

	Synchronous session	Asynchronous materials
1.	Software setup and your first calculations	Review lesson videos and complete associated exercises (3 hours)
2.	Python basics – getting comfortable with lists and NumPy arrays	Review lesson videos and complete associated exercises (3 hours)
3.	Powerful plots – beautiful figures using Matplotlib	Review lesson videos and complete associated exercises (3 hours)
4.	Time series data – learning the power of Pandas	Review lesson videos and complete associated exercises (3 hours)
5.	Clean workflows – bringing it all together and refining your scripts	Prepare your analysis portfolio
6.	A problem shared is a problem halved – sharing our analyses	Refine your analysis and submit, along with your personal work plan.

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