Introduction to Geospatial Raster and Vector Data with Python

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The Netherlands eScience Center

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Who are we?

- The Netherlands eScience Center is a national center for **innovative software solutions in academic research**.
- Established to bridge the gap between digital technologies and scientific and scholarly inquiry.
- Our Research Software Engineers
  - help researchers interpret results,
  - make tools and methods reusable for the wider research community,
  - co-author research and methodological publications.

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Digital Skills Programme

- Hands-on courses, 2-3 days
- In person & online
- Based on The Carpentries & CodeRefinery, and
- In-house developed materials.

Topics cover:

- Open & Reproducible Research Software
- Intermediate and Advanced Research Software Skills
- Advanced Technologies (e.g. GPUs, Deep Learning)

Schedule 2023

January	Data Analysis and Visualisation in Python for Researchers Machine learning in Python with scikit-learn	**July**	Parallel Programming with Python
March	Reproducible research with R packages Intermediate Research Software Development with Python Astronomical Data Science with Python	**August**	Introduction to Deep Learning
April	Parallel Programming with Python GPU programming	**September**	Reproducible research with R packages Good Practices in Research Software Development (CodeRefinery)
May	Introduction to Geospatial Raster and Vector Data with Python Introduction to Deep Learning	**October**	Introduction to Geospatial Raster and Vector Data with Python GPU programming
June	Image Processing with Python Good Practices in Research Software Development (CodeRefinery)	**November**	Foundations of astronomical data science

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Digital Skills Programme

Our Digital Skills Workshops are **free and open to researchers in the Netherlands**.

We also offer paid options of custom workshops dedicated to your organisation. To learn more, contact:
training@esciencecenter.nl

See upcoming workshops:
esciencecenter.nl/events/?f=workshopsnl/events

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NL-RSE brings together the community of people writing and contributing to research software from Dutch universities, knowledge institutes, companies and other organizations to share knowledge, to organize meetings, and raise awareness for the scientific recognition of research software.

Website: https://nl-rse.org/
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tinyurl.com/2023-05-08-geospatial-python-1

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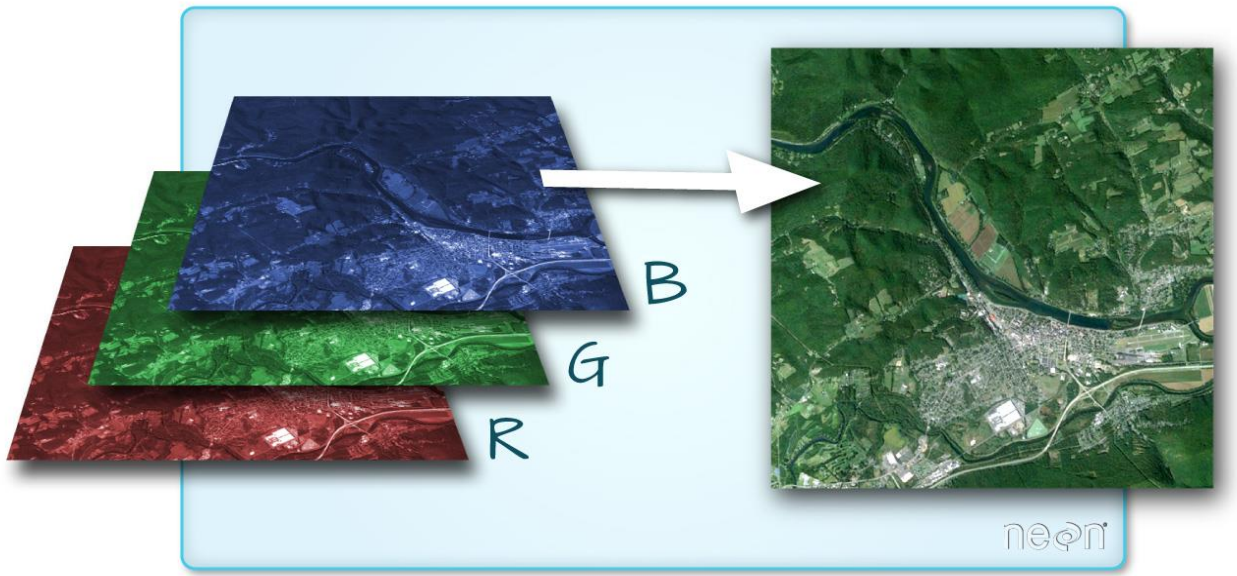
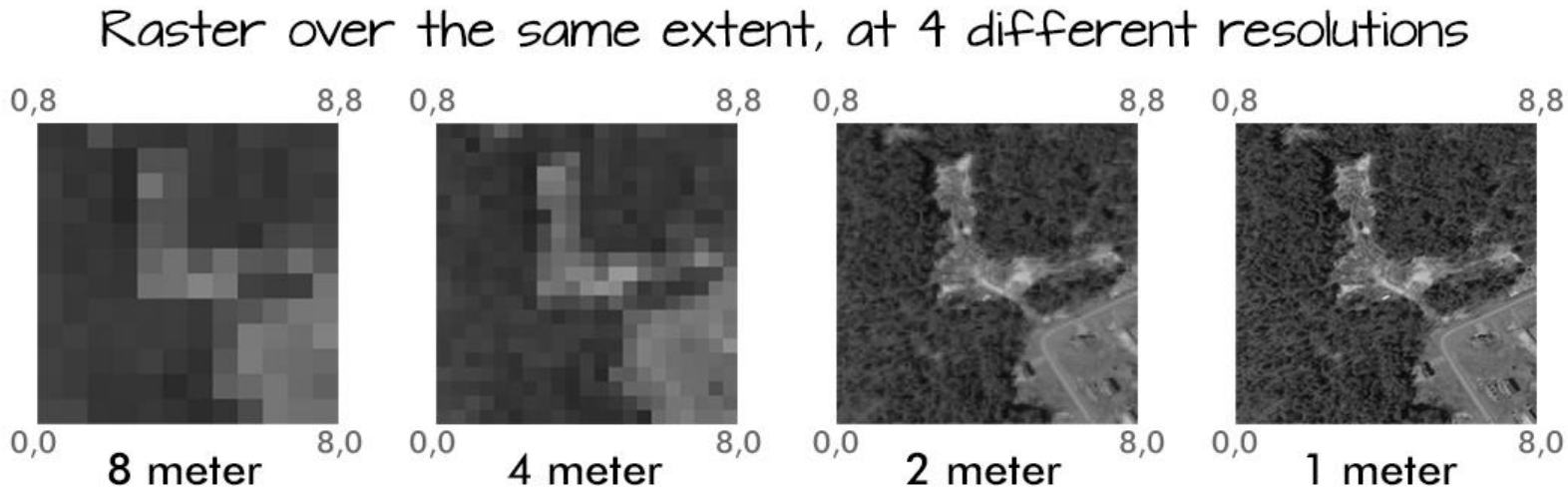
Just a bit of background intro...

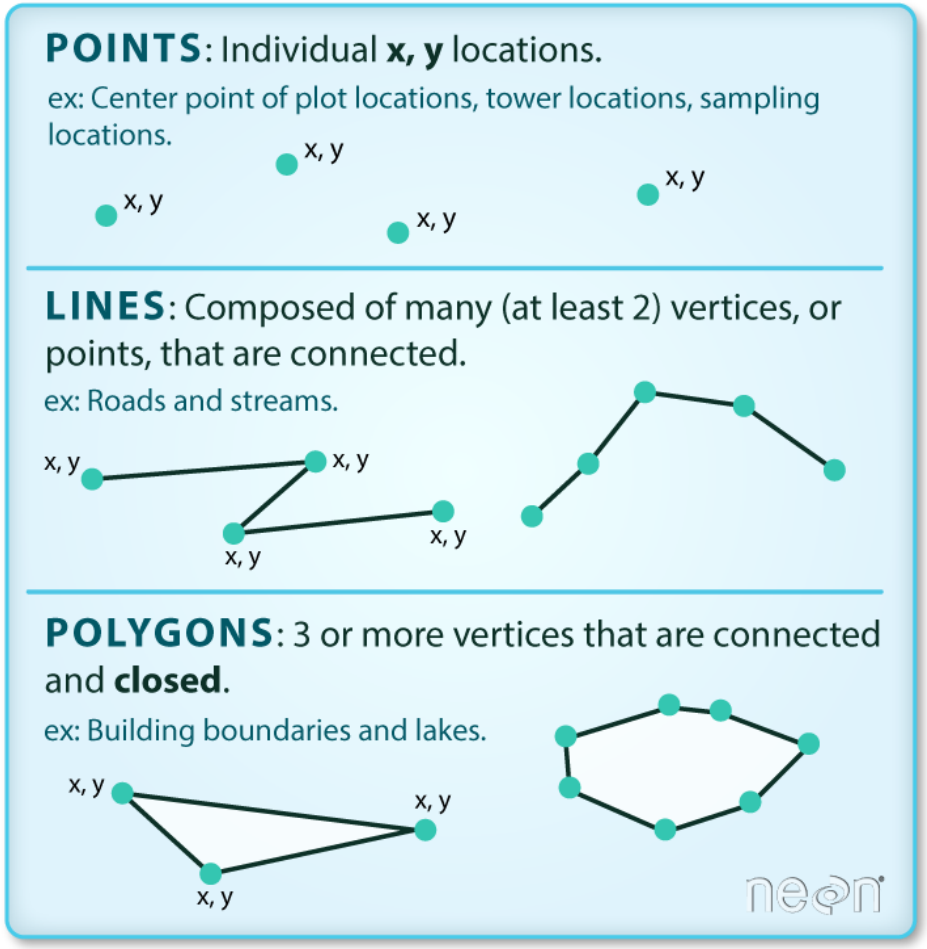
Raster data



- Raster: pixelated data
- Geospatial attributes:
  - Extent
  - Resolution



Vector data



- Vector objects are either:
  - Points
  - Lines
  - Polygons
- Represent specific feature on Earth's surface
- Contain attributes of the features

But wait ...
the Earth is not flat ...

Coordinate Reference System (CRS)

A CRS mainly contains :

- **Ellipsoid:** A model of the shape of the earth
- **Projection:** A mathematical transformation from a global earth to a flat surface.

Coordinate Reference System (CRS)

Ellipsoid: is Earth an orange? Or a lemon?

Projection:
How can I peel this orange/lemon?

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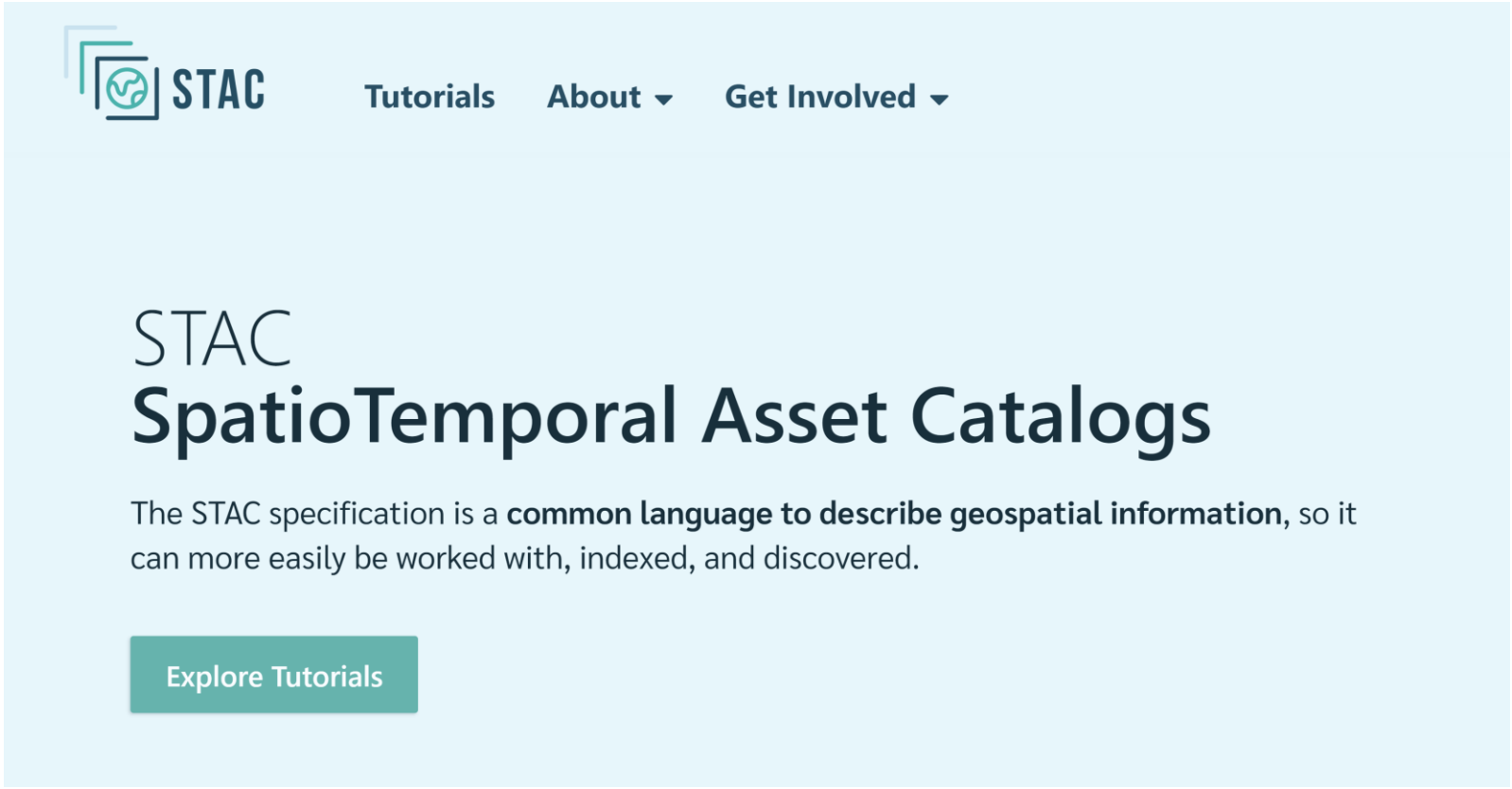
Manipulate CRS info

- Store CRS info
  - **EPSG**
  - Well-Known Text (WKT)
  - PROJ
- Conversion between CRS:
  - Geospatial Data Abstraction Library (GDAL)

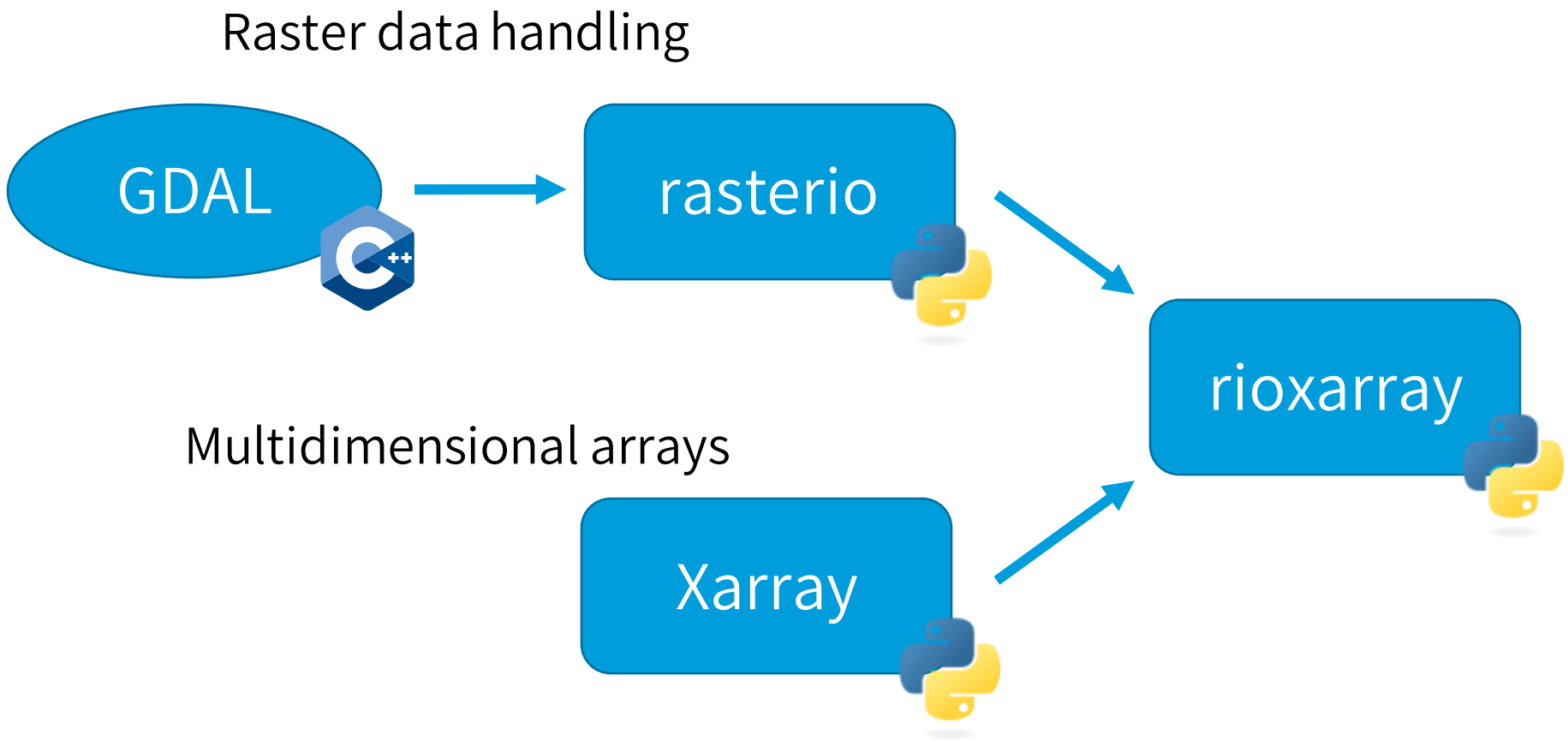
Satellite imagery access: STAC

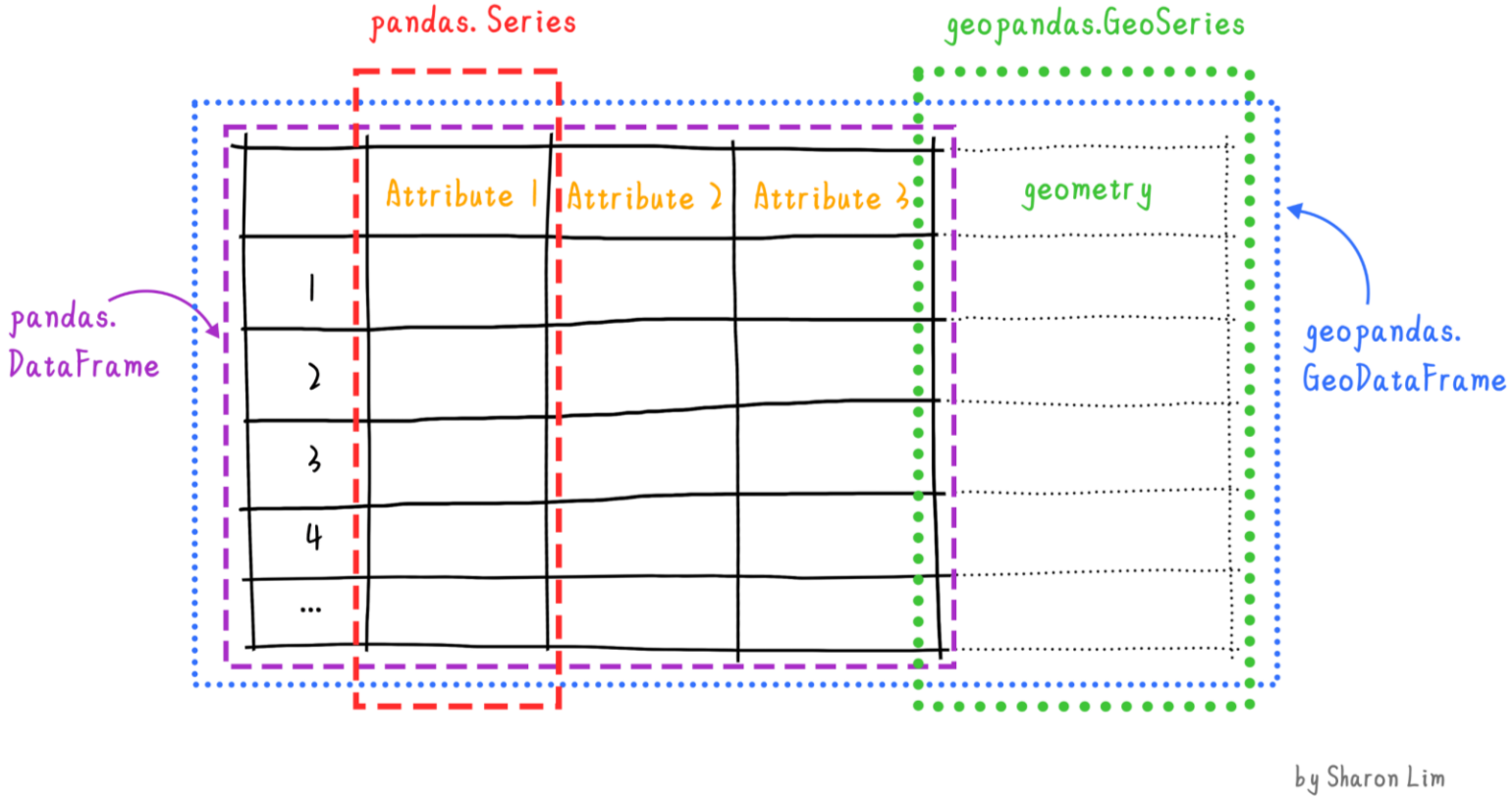
- Searching: ***pystac-client***
- Manage catalog: ***pystac***



Raster data processing: ***rioxarray***

- Data loading
- Raster calculation
- Visualization



vector data processing: ***geopandas***

- Data loading
- Spatial query
- Visualization