CEEDS

CENTRE OF EXCELLENCE IN ENVIRONMENTAL DATA SCIENCE

Data access and data APIs

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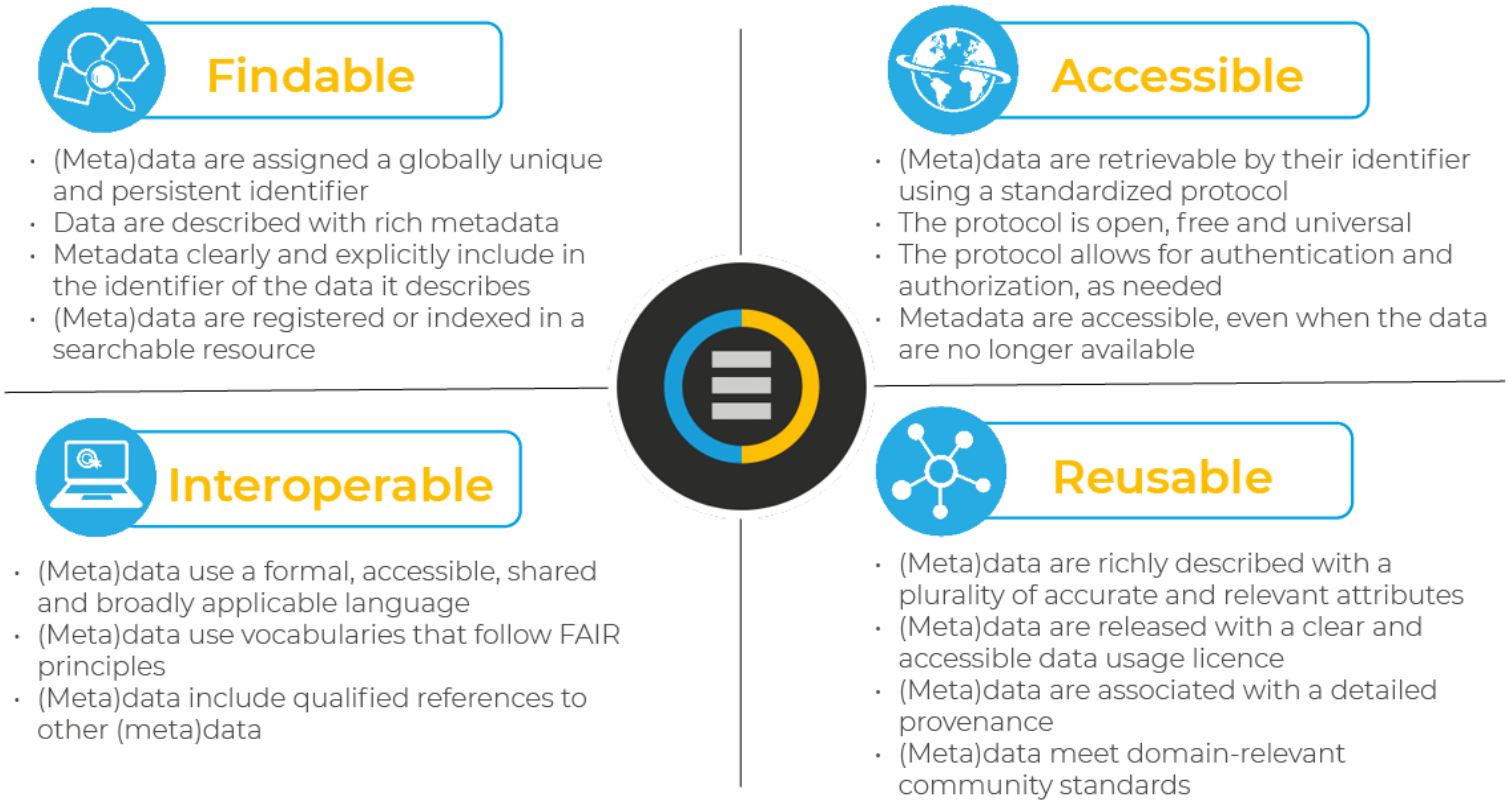
What are the ways you can access environmental data?

- Download from a data website or repository
    - Data.gov.uk
    - Data Centres (e.g. EIDC, NASA, EU)
    - Repositories (e.g. Figshare, Zenodo)
- Download from a data app
- Direct access from a cloud compute platform (e.g. Google Earth Engine, DataLabs)
- Download using a data API

- FAIR environmental data



https://www.ccdc.cam.ac.uk/solutions/about-the-csd/fair-data-principles

NetCDF(.nc) files advantages:

https://nsidc.org/data/user-resources/help-center/what-netcdf

- **Self-Describing**. A netCDF file includes information about the data it contains.
- **Portable**. A netCDF file can be accessed by computers with different ways of storing integers, characters, and floating-point numbers.
- **Scalable**. A small subset of a large dataset may be accessed efficiently.
- **Appendable**. Data may be appended to a properly structured netCDF file without copying the dataset or redefining its structure.
- **Shareable**. One writer and multiple readers may simultaneously access the same netCDF file.
- **Archivable**. Access to all earlier forms of netCDF data will be supported by current and future versions of the software.

- Even better if they are CF-compliant

https://mapscaping.com/what-is-netcdf/

NetCDF files

```
In [46]: ds.to_netcdf("example.nc")

In [47]: reopened = xr.open_dataset("example.nc")
In [48]: reopened
Out[48]: <xarray.Dataset>
Dimensions: (x: 2, y: 3)
Coordinates:
                * x (x) int64 10 20
Dimensions without coordinates: y
Data variables:
foo (x, y) float64 ...
bar (x) int64 ...
baz float64 ...
```

- R packages: ncdf4, tidync
- Python packages: xarray, rioxarray, also netCDF4, nctoolkit
- ArcGIS and QGIS

WMS tiles

Steps:
- Open the web service URL
- Look for the layer map to use

- Easy way to overlay map layers without downloading

- - R package: leaflet (more help), terra
- - python package: ipyleaflet
- - GIS software

Data Application programming interfaces (API)

- API is a software intermediary that allows two applications to talk to each other.
- A data API allows you to programmatically query and access data on a web server.
- Usually, it powers data apps
- You can specify in great detail what to download >> save time and disk space

Examples:

- ERA5 weather reanalysis
- National River Flow Archive (NRFA)
- COSMOS-UK soil moisture
- OpenAIR air quality
- Environmental Agency (WQ and more)

When to use a data API?

You know your query quite well (e.g. time, location, variables)

Vs.

You need to do complex operations on a majority of the data

- Benefits of using API: when you re-run the API request, you get the most updated data!

Understanding data API calls

- A web request done in a specific way
- Example: https://cosmos-api.ceh.ac.uk/collections/1D/locations/CHIMN
  - Try running it on your browser
  - (typically) returns JSON format, easier to use Python or R to convert to data frame
  - Base_url: https://cosmos-api.ceh.ac.uk
  - "daily collection": collections/1D
  - "at CHIMN site": locations/CHIMN

Tip: read documentation carefully!

Documentation sites

- COSMOS-UK
- National River Flow Archive
- Environmental Agency (e.g. water quality) – and others in api.gov.uk
- ERA5
- openair

Apps that uses data API

- UKSCAPE hydrological sensor data integration tool
- COSMOS-UK data request form

- EA Ecology and Fish Explorer – a Shiny app!

Notebooks (in DataLabs)

- COSMOS-UK API
- EA Water Quality API
- ERA5 API
- Using WMS tiles