Where next?

ISC summary

CONGRATULATIONS!

You did it!

We learnt about python basics

- Basics and control flow, booleans
- Lists, slicing and tuples
- Input/output
- Strings and text processing
- Functions, libraries and scripts
- Sets and dictionaries
- Errors and debugging
- OOP

And more advanced libraries

- Numpy: arrays and masked arrays
- Matplotlib: plotting
- NetCDF (& CF): reading and writing data

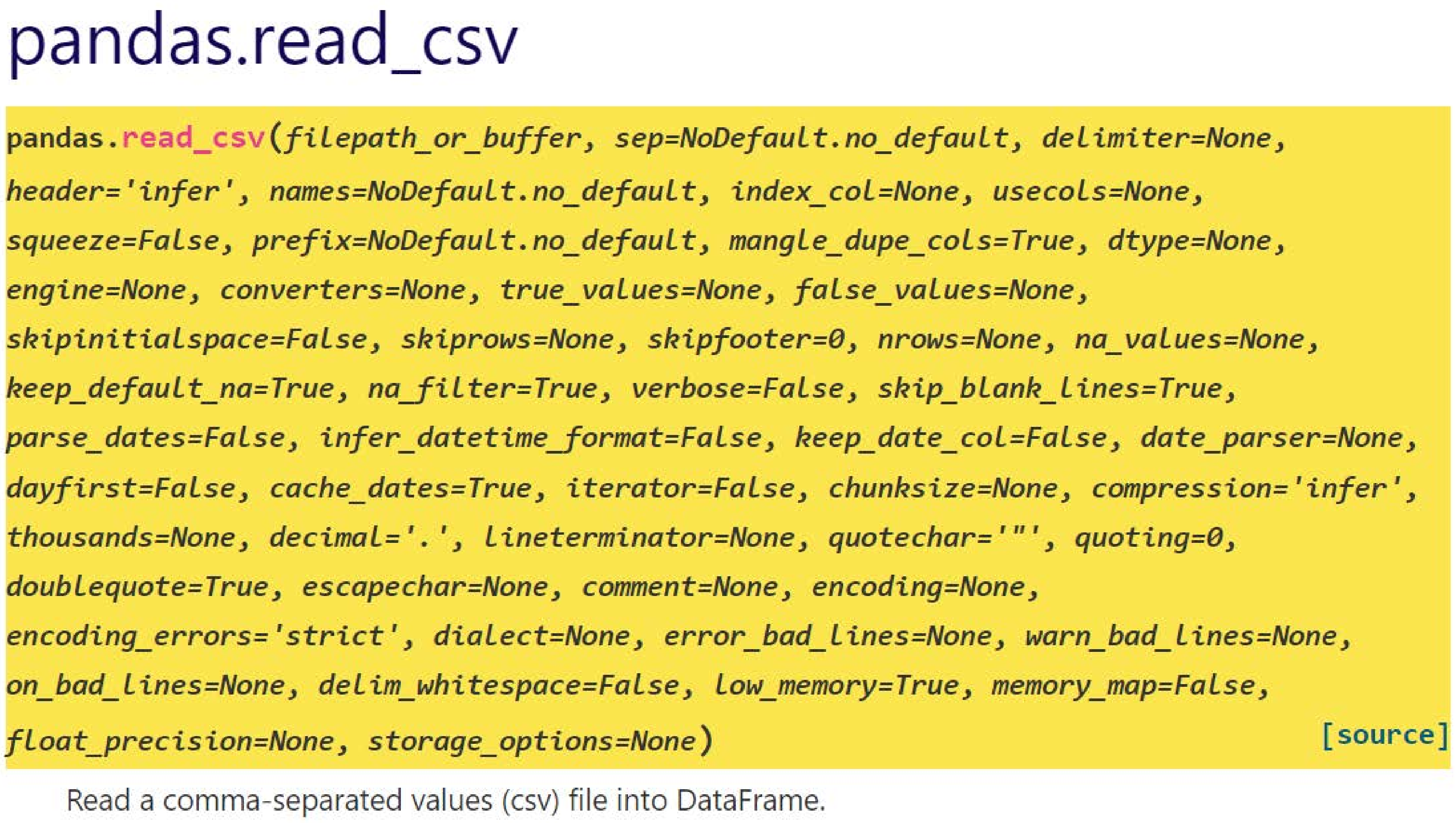
We didn't have time for…

https://pandas.pydata.org/pandas-docs/stable/user_guide/10min.html

- For tabulated data (e.g. Excel on steroids)
- Powered by Numpy
- Fast and efficient
- Can be integrated with Dask (for parallel / delayed / out-of-memory operations)

pandas for tabulated data

Sorting by an axis:

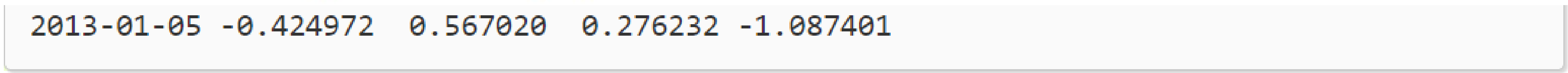


pandas.read_csv

```
pandas.read_csv(filepath_or_buffer, sep=NoDefault.no_default, delimiter=None,
header='infer', names=NoDefault.no_default, index_col=None, usecols=None,
squeeze=False, prefix=NoDefault.no_default, mangle_dupe_cols=True, dtype=None,
engine=None, converters=None, true_values=None, false_values=None,
skipinitialspace=False, skiprows=None, skipfooter=0, nrows=None, na_values=None,
keep_default_na=True, na_filter=True, verbose=False, skip_blank_lines=True,
parse_dates=False, infer_datetime_format=False, keep_date_col=False, date_parser=None,
dayfirst=False, cache_dates=True, iterator=False, chunksize=None, compression='infer',
thousands=None, decimal='.', lineterminator=None, quotechar='"', quoting=0,
doublequote=True, escapechar=None, comment=None, encoding=None,
encoding_errors='strict', dialect=None, error_bad_lines=None, warn_bad_lines=None,
on_bad_lines=None, delim_whitespace=False, low_memory=True, memory_map=False,
float_precision=None, storage_options=None)
```

[source]

Read a comma-separated values (csv) file into DataFrame.



```
2013-01-05 -0.424972  0.567020  0.276232 -1.087401
```

We didn't have time for...

cf python

Iris

xarray

- python library: handles NC, PP
- integrates with matplotlib/cartopy (*cfplot*)
- subsetting, averaging, regridding etc.

- python library: handles NC, PP, GRIB
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- python library: handles NC, Zarr
- integrates with matplotlib/cartopy
- subsetting, averaging, regridding etc.

https://ncas-cms.github.io/cf-python/

http://xarray.pydata.org/en/stable/

https://scitools-iris.readthedocs.io/en/latest/

cf python

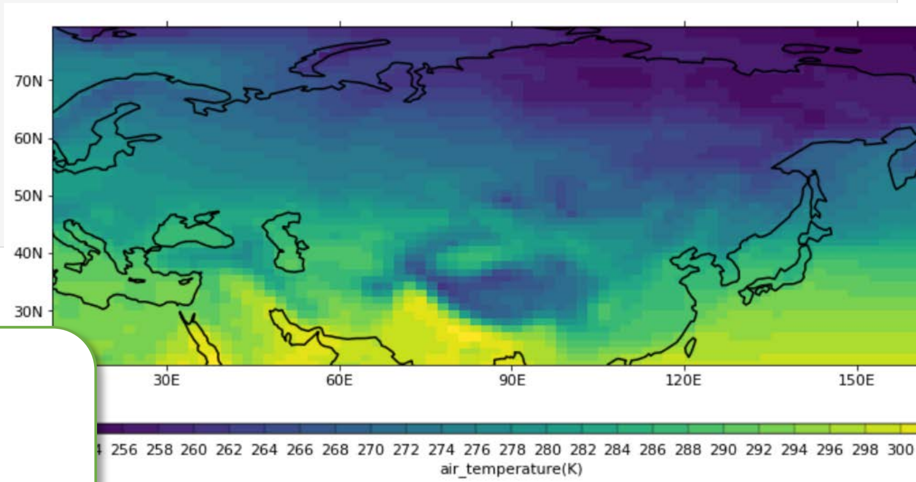
```python
# Import cf and cfplot
import cf
import cfplot as cfp

# Read the data from NetCDF files
f = cf.read(file_pattern)[0]

# Sub-select a spatial region
subset = f.subspace(longitude=cf.wi(10, 170, 'degrees'), latitude=cf.wi(20, 80, 'degrees'))

# Calculate an average over all time steps
average = subset.collapse('T: mean')

# Plot a map of the temporal average
cfp.con(average, blockfill=True, lines=False)
```



Look out for the next NCAS course: https://ncas.ac.uk/study-with-us/data-analysis-tools/

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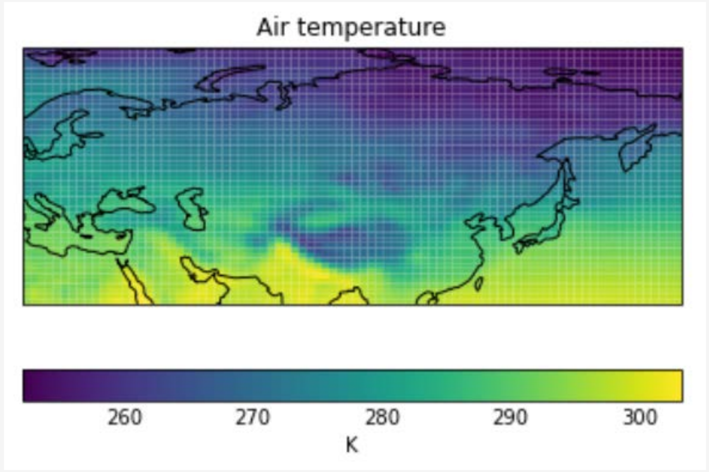
```python
# Import iris and required libraries
import iris
from iris.util import equalise_attributes
import matplotlib.pyplot as plt
import iris.quickplot as qplt

# Read the data from NetCDF files
f = iris.load(file_pattern)
equalise_attributes(f)
merged = f.concatenate_cube()

# Sub-select a spatial region
subset = merged.extract(iris.Constraint(longitude=lambda cell: 10 <= cell <= 170) &
                        iris.Constraint(latitude=lambda cell: 20 <= cell <= 80))

# Calculate an average over all time steps
average = subset.collapsed('time', iris.analysis.MEAN)

# Plot a map of the temporal average
plot = qplt.pcolor(average)
plt.gca().coastlines()
plt.show()
```



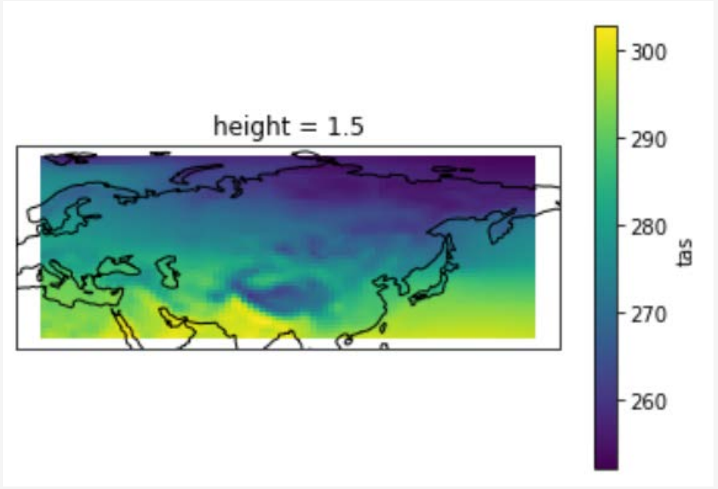
```python
# Import xarray and required libraries for plotting
import xarray as xr
import cartopy.crs as ccrs
import matplotlib.pyplot as plt

# Read the data from NetCDF files
f = xr.open_mfdataset(file_pattern)

# Sub-select a spatial region
subset = f.sel(lon=slice(10, 170), lat=slice(20, 80))

# Calculate an average over all time steps
average = subset.mean(dim="time")

# Plot a map of the temporal average
ax = plt.subplot(projection=ccrs.PlateCarree())
average['tas'].plot()
ax.coastlines()
```



Where to go next?

- The best way to learn is to play...
- Get python installed on your desktop/laptop (on Windows, MAC or Linux).
- Read/write files
- Move/copy files/folders using scripts
- Make some nice plots
- Start a small project:
  - Write down the steps – *think algorithmically!*
  - Convert the steps to pseudo-code – *test ideas/code as you go*
  - Convert to Python functions / classes / scripts / modules

Places to learn more/practice

- Codecademy site has great exercises:

  https://www.codecademy.com/learn/learn-python

- Free Code Camp: https://www.freecodecamp.org/learn/scientific-computing-with-python/

- Python website has documentation for all the standard library modules (sys, maths, etc.):

  https://docs.python.org/

Places to learn more/practice

- Python website also has tutorials:

  https://docs.python.org/3/tutorial/

- Software-Carpentry web site hosts videos and presentations and lots more:

  https://software-carpentry.org/lessons/

ISC course materials

Full version of the modules and exercises/solutions:

https://github.com/ncasuk/ncas-isc

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Good luck!