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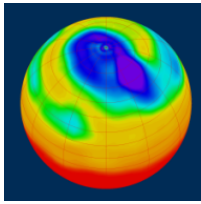

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# Reading NetCDF files with Python

Thanks to all contributors:

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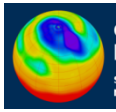

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# So many options!

There are many options for working with NetCDF files in Python. In this example we have chosen to highlight the use of the **netCDF4-python** module.

The **netCDF4-python** module is useful because:

- It implements the basic "classic" model as well as more advanced features.
- It provides a simple interface to the NetCDF structure.
- It has been used as the underlying NetCDF I/O layer for many more advanced packages.

# Opening a netCDF file

To open a netCDF file from python, you simply call the `Dataset()` constructor as follows:

```
>>> from netCDF4 import Dataset
>>> dataset = Dataset('data.nc')

>>> print dataset.file_format
NETCDF4_CLASSIC
```

# Working with “classic” NetCDF

The `netCDF4` module can read in any netCDF format.

This tutorial will focus exclusively on the NetCDF-”classic” data model using: `NETCDF4_CLASSIC`

The "classic" data model is made up of dimensions, variables and attributes (as discussed earlier).

# Interrogating dimensions

You can interrogate dimensions using simple dictionary calls:

```
>>> print dataset.dimensions.keys()
['time', 'latitude', 'bound', 'longitude']

>>> print dataset.dimensions['time']
<type 'netCDF4.Dimension'> (unlimited):
      name = 'time', size = 1
```

# Interrogating variables

You can interrogate variables using simple dictionary calls:

```
>>> print dataset.variables.keys()
['tcc', 'time', 'latitude', 'longitude']

>>> tcc_var = dataset.variables['tcc']
>>> print tcc_var
<type 'netCDF4.Variable'>
float32 tcc(time, latitude, longitude
    missing_value: 9.999e+20
    name: tcc
    title: Total cloud cover
unlimited dimensions: time
current shape = (1, 181, 360)
filling off
```

# Global attributes

`Global` attributes are available as attributes of the python dataset instance:

```
# Get conventions attribute
>>> print dataset.Conventions
CF-1.5

# Or find all NetCDF global attributes
>>> for attr in dataset.ncattrs():
...     print attr, '=', getattr(dataset, attr)
...
Conventions = CF-1.0
history = Written in a hurry on a Tuesday!
```

# Variable attributes

`Variable` attributes are available as attributes of the python variable instance:

```
# Get units attribute
>>> print tcc_var.units
0-1

# Or find all variable attributes
>>> for attr in tcc_var.ncattrs():
...     print attr, '=', getattr(tcc_var, attr)
...
long_name = Total cloud cover
units = 0-1
```

# Accessing the data

`Variables` contain data, which you can access:

```
# Get a whole variable array
>>> arr = dataset.variables['tcc'][:]
>>> arr.shape
(1, 181, 360)
>>> type(arr)
<type 'numpy.ndarray'>

# Get a sub-slice of the array
>>> subset = dataset.variables['tcc'][0,10:15,5]
>>> subset.shape
(5,)
```

**This is awesome!**
It returns a NumPy array

For NetCDF variable has missing data - a Masked Array!

# Further reading

Python-netCDF4:

http://netcdf4-python.googlecode.com/svn/trunk/docs/netCDF4-module.html