



Python for Climate Science

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Outlines

- Setup
- Basic Python Syntax and IDLE
- Numpy, Matplotlib, Xarray, AOESpy library
- Working with climate data in Python
- Example, Exercise

Setup

- Anaconda
 - <https://www.anaconda.com/distribution/>
- Python version 3.0+
 - (version 2.7 is not compatible)
- IDLE: Jupyter Notebook, Spyder,
iPython terminal. ...)



Python Basics

- **Numpy**
 - Analyze and manipulate matrix/vector

<https://scipy.org/install.html>

<https://www.numpy.org/devdocs/reference/>

- **Matplotlib**
 - Plotting Library

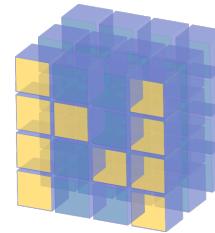
<https://matplotlib.org/3.1.0/users/installing.html>

- **Xarray, AOESpy (v1)**

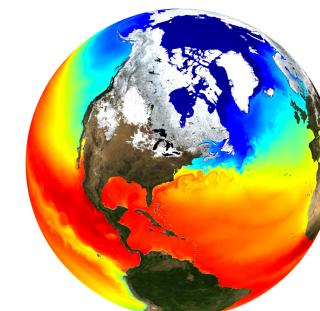
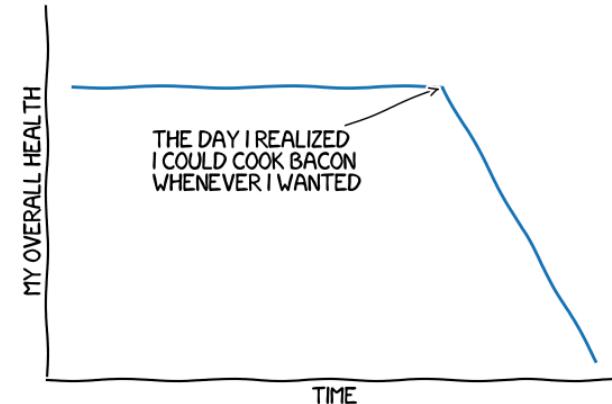
- Climate python tools

<http://xarray.pydata.org/>

<https://github.com/afahadabdullah/AOESpy>



NumPy



GMU (June 18, 2020)

Python is the easier language to learn. No brackets, no main.



You get errors for writing an extra space



Setup (For GMU COLA server)

- **Login to cola server: replace with your own username**

ssh -XY *user*@cola6.gmu.edu

- **In terminal type: (Use vim if you prefer)**

> gedit .bashrc

- **Add the following lines, save and close**

module load anaconda/3

export PROJ_LIB=/opt/anaconda3/share/proj/

- **In terminal type:**

> source .bashrc

- **Copy python tutorial Jupiter notebook files to your directory**

> cp /project/airsea/pythontut2020/*.ipynb ~/

Setup (For GMU COLA server)

You can basically use any ipython terminal such as: **spyder**, **jupyter notebook**, or just **ipython terminal** itself

We will work with **jupyter notebook**. As the tutorial is in **jupyter notebook** file download the following html files to your local computer to follow in other methods. (**only download this if you are not going to use jupyter notebook**)

<https://drive.google.com/drive/folders/1ArxyFN3ZP7-MFGPrh0G3iaNmVfX1sLWI?usp=sharing>

Setup (For GMU COLA server)

Steps to open jupyter notebook in COLA:

Type in your current terminal

jupyter notebook --no-browser --port=8888

if it doesn't work type the following:

jupyter lab --no-browser --ip='0.0.0.0' --port=8888

open a new terminal and type/paste the following line

**(replace with you own username, remember to use same
cola server in both terminal)**

ssh -N -L 8888:localhost:8888 **username@cola6.gmu.edu**

```
[Fri Jun 19 10:35:35 UTC 2020] Jupyter Notebook --no-browser --port=8888
[I 10:35:35.707 NotebookApp] JupyterLab extension loaded from /opt/anaconda3/lib/python3.7/site-p
ackages/jupyterlab
[I 10:35:35.708 NotebookApp] JupyterLab application directory is /opt/anaconda3/share/jupyter/lab
[I 10:35:36.754 NotebookApp] Loading the assignment_list nbgrader serverextension
[I 10:35:36.758 NotebookApp] Loading the course_list nbgrader serverextension
[I 10:35:36.766 NotebookApp] Loading the formgrader nbgrader serverextension
[W 10:35:36.770 NotebookApp] No nbgrader_config.py file found (rerun with --debug to see where nb
grader is looking)
[I 10:35:36.789 NotebookApp] Loading the validate_assignment nbgrader serverextension
[I 10:35:36.790 NotebookApp] Serving notebooks from local directory: /homes/afahad
[I 10:35:36.790 NotebookApp] The Jupyter Notebook is running at:
[I 10:35:36.790 NotebookApp] http://localhost:8888/?token=7f7adc00c10e83e1210b72a6cb2b13ef5607be0
8ec4eaef9
```

Type in your laptop internet browser:

<http://localhost:8888/>

**If it asks for a token, copy the token from the first terminal (like this)
and enter**

8888 is a port that we are using.

If the port is shows busy try something like 8889.
Remember to replace it in all lines

Setup (For GMU COLA server)

If you're in the COLA server with the notebook terminal you sholud see something like this:

The screenshot shows a Jupyter Notebook interface with a file browser. The top navigation bar includes links for 'Files', 'Running', 'Clusters', 'Formgrader', 'Courses', and 'Assignments'. On the right side of the header are 'Quit' and 'Logout' buttons. Below the header is a toolbar with 'Upload', 'New', and a search icon. The main area displays a list of files and folders in a table format. The columns are 'Name', 'Last Modified', and 'File size'. The table includes the following entries:

Name	Last Modified	File size
0	5 months ago	
AOESpy-master	10 months ago	
class	13 days ago	
data	7 months ago	
grads	5 months ago	
MERRA2	7 days ago	
miniconda3	5 months ago	
Pangeo-at-AOES	13 days ago	
project	a year ago	
python	10 months ago	
R	4 days ago	
scratch	a year ago	
scripts	5 months ago	
session	2 days ago	
source	2 hours ago	111 kB
Python Basics.ipynb		

Click [python_basics.ipynb](#) file to get start with!

Where to go Next

- Python 3+ Basic: <https://www.sololearn.com/Course/Python/> (or any good tutorial)
- Colormaps: <https://matplotlib.org/3.1.0/tutorials/colors/colormaps.html>
<http://colorbrewer2.org>
- Panda data frame structure for NETCDF: <http://xarray.pydata.org/en/stable/>
- Matplotlib Basemap for different mapping projection and functions:
<https://matplotlib.org/basemap/users/examples.html>
- More climate in python <https://kpeginon.github.io/Pangeo-at-AOES/index.html>
- More netcdf, python, CDO examples: <https://afahadab dullah.com/blog>
- Last but no least, Google whatever you need from a large python community
<https://www.google.com/>



Thanks!



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