Preparing for volcano geophysics tutorial

1. Install *either* anaconda or miniconda
2. Install obspy via conda
3. Install additional packages
4. Try the jupyter notebooks:
    1. 01_python_basics.ipynb
    2. 02_python_basic_numpy.ipynb
    3. 03_python_basic_plotting.ipynb
    4. 04_programming_control.ipynb
    5. 05_intro_2_obspy.ipynb

Intro to python – Key Advantages: Open and Free

- Python is *interpretive*
  - No compiling of programs (unlike C, C++, or Fortran)
  - Means the python interpreter executes one line at a time (like Matlab)
- Python has many available open-source packages/modules
  - Packages include scripts/functions that perform operations
  - For example, obspy (http://obspy.org) has extensive functions written for seismology
- Python works on any platform (Windows, Linux, Mac)
- Can be used on command line, in Matlab-like Spyder application, or Jupyter Notebooks, which are great for teaching

Python *disadvantages*?

- Somewhat steep learning curve
  - Not as easy to use initially as some other interpretive languages (Matlab)
  - Must get used to command-line functions
- Not as fast for complex processing as well-written compiled codes in C++ or Fortran
  - External codes can be linked from within python to take advantage of speed
- Somewhat complicated to install, keep track of all the packages
  - Package managers and environments make this easier

Python packages and environments

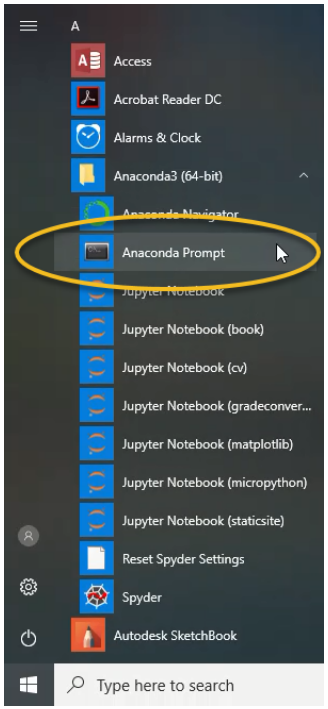
- Packages often depend on other packages
  - E.g., function `dothis`, which is in package `A1` is referenced from another function, `dothat`, which is in the package `B2`.
  - Getting all the right packages installed can be a real hassle, but is made easier using package managers, like conda: (https://www.anaconda.com/)
- Environments allow for groups of packages to be installed where they won't interfere with system python setup
  - Can create environments with different python versions for certain applications, or different versions of packages

Anaconda (3Gb) or miniconda (1Gb)

- Installation with Anaconda takes a lot of space, but includes lots of useful features (along with some you may never use)
- It's a little simpler to get set up with Anaconda, especially on Windows
- Miniconda is bare bones; anything you do with anaconda can be done, but may just take a little more set up
- If you are using Windows and have the disk space, use anaconda
- Although you probably already have python installed on your system, this conda installation will be independent and won't corrupt anything that already exists

Windows Installation with conda and Anaconda

- Install Anaconda: https://www.anaconda.com/download/
  - You want 3.7 and 64 bit
  - Install to your C: drive (should be the default)
  - Then open the Anaconda Prompt from the start menu
- This will open a black window with command line.



Mac or Linux Installation of Anaconda

- Install Anaconda: https://www.anaconda.com/download/
  - You want 3.7 and 64 bit
  - Follow the instructions to make sure it installs properly so the path to the commands is set
- Or install miniconda from https://docs.conda.io/en/latest/miniconda.html
  - You can watch my little screen capture of the installation on a mac: https://youtu.be/W4UOHzTno1g
- With either Anaconda or Miniconda installed…
  - Then open a terminal window
  - If the prompt begins with (base), type conda deactivate

```
(base) WaiteMac:~ gpwaite$ conda deactivate
WaiteMac:~ gpwaite$
```

- The next sequence of commands will
  1. create a new environment for obspy and
  2. install obspy and all the dependencies

Installation of obspy with conda

On the command line (anaconda prompt in windows, or terminal window in linux or macos), type the following

```
conda config --add channels conda-forge
```

- The above command sets conda to install packages from a certain place (conda-forge.org). The next command creates an environment called *obspy* (but you can call it just about anything) with python version 3.7.

```
conda create -n obspy python=3.7
```

- Next you will activate that newly created environment

```
conda activate obspy
```

- You will notice that the command line prompt now has the name of the environment in parentheses (obspy). Now install obspy, and all the packages it depends on:

```
conda install obspy
```

- conda will look for the obspy package at conda-forge, download it, and install it. You will be prompted a couple times for confirmation of download/install.
- You have installed the obspy package, but there are a few more things that are useful to add. This one adds functionality to jupyter notebook to allow for environment switching

```
conda install nb_conda
```

- This should already be installed, but check.

```
conda install basemap
```

- This adds more plotting functions.

```
conda install ipympl
```

- And, if you installed with miniconda instead of anaconda (probably unnecessary if you installed nb_conda first).

```
conda install jupyter
```

Using jupyter notebook

- Jupyter notebook is a web-browser tool that allows you to create python scripts and run then in an interactive mode. It a bit easier to use than the command line in python so lets move to that
- To start this up
  1. open Anacoda Prompt (windows) or terminal/xterm (osx or linux)
  2. activate the obspy environment on the command line
  3. then start jupyter notebook from the command line

```
WaiteMac:Volcano_Seismology gpwaite$ conda activate obspy
(obspy) WaiteMac:Volcano_Seismology gpwaite$ jupyter notebook
```

  4. This will open a new browser window with the jupyter notebook
  5. Now you can open a new notebook or an existing one (they have file extensions (.ipynb for ipython notebook)
  6. From the jupyter notebook browser, navigate to, and open the file: 01_python_basics.ipynb

Important things to remember

- You can update packages with conda, e.g.:

```
conda update obspy
```

- You should use a new environment for different software packages.
  - If you use python for something else, you should create a new environment and install what you need for that purpose there.
  - Some packages require different versions of dependencies so things can get corrupted if you install too many things in one place
- You can have different environments with different versions of python for different uses
  - For example, if a package is not supported in python 3.7, you can create an environment that uses python 3.6 (or 3.5 or whatever) and run the package in that environment
- Always start your obspy sessions the same way:
  1. open Anacoda Prompt if on windows
  2. activate the obspy environment
  3. then start jupyter notebook or ipython or…(we will get into this)

more useful things to know

- In python scripts (or ipython or jupyter notebooks), line indents have meaning
- Some things that work in ipython will not work in python
- Some useful shortcuts in jupyter:
  - shift + return executes a cell and moves to next
  - CNTL + return executes a cell
  - indent selected lines with CNTRL +]
  - reduce indent using CNTRL + [
  - CNTRL + / toggles between commented and uncommented