

Solution - Computational Modeling Exercise

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This is a reference solution for the **12.806 Computational Modeling Exercise**, including versions of required and suggested figures for reference and all code used to produce the solution. This solution was implemented in Python using wildly-popular scientific and numerical libraries.

For convenience, we'll use two very powerful Python libraries:

- [pandas](#) - an analysis package based on data tables; allows you to quickly organize tabular data and run common statistics and analysis on them.

```
import numpy as np
import pandas as pd
```

Additionally, we'll need to generate some plots, so we'll use the standard Python visualization libraries:

- [matplotlib](#) - Matlab-like visualization library
- [seaborn](#) - extension to matplotlib which generates quick statistical plots when data is packaged into pandas data structures; additionally includes aesthetic tweaks which greatly improve the matplotlib basics

```
%matplotlib inline
import matplotlib.pyplot as plt
import seaborn as sns
# Set some plot aesthetics
plt.style.use(['seaborn-ticks', 'seaborn-talk'])
```

Finally, to read the Excel spreadsheet data source in the final part of this notebook, you'll need the [xlrd](#) package, which you can install by invoking:

```
$ pip install xlrd
```

Part 1 - Contemporary Trends in Atmospheric CO₂

We'll start by downloading the monthly mean CO₂ data, using a shell command in the cell below.

```
!wget ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_mm_mlo.txt .
```

```
--2017-01-30 14:27:52--  ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_mm_mlo.txt
=> 'co2_mm_mlo.txt'
Resolving aftp.cmdl.noaa.gov... 140.172.200.31
Connecting to aftp.cmdl.noaa.gov|140.172.200.31|:21... connected.
Logging in as anonymous ... Logged in!
==> SYST ... done.      ==> PWD ... done.
==> TYPE I ... done.    ==> CWD (1) /products/trends/co2 ... done.
==> SIZE co2_mm_mlo.txt ... 49083
==> PASV ... done.      ==> RETR co2_mm_mlo.txt ... done.
Length: 49083 (48K) (unauthoritative)

100%[=====>] 49,083          223KB/s   in 0.2s
```

2017-01-30 14:27:54 (223 KB/s) - 'co2_mm_mlo.txt' saved [49083]

--2017-01-30 14:27:54-- <http://./>

Resolving failed: nodename nor servname provided, or not known.

wget: unable to resolve host address `.'

FINISHED --2017-01-30 14:27:54--

Total wall clock time: 2.6s

Downloaded: 1 files, 48K in 0.2s (223 KB/s)