

RESEARCH TOOLS 2011

LECTURE 16

2011-Oct-25

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UNH CCOM/JHC

Matplotlib part 2 - graphing GPS wander



Wednesday, November 2, 11

<http://vislab-ccom.unh.edu/~schwehr/Courses/2011/esci895-researchtools/>

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researchtools@ubuntu: ~/class/16

File Edit View Search Terminal Help

researchtools@ubuntu:~/class/16\$

researchtools@ubuntu:~/class/16\$ wget http://vislab-ccom.unh.edu/~schwehr/rt/examples/2011-10-11.gga.dat.bz2
--2011-10-25 11:11:40-- http://vislab-ccom.unh.edu/~schwehr/rt/examples/2011-10-11.gga.dat.bz2
Resolving vislab-ccom.unh.edu... 192.168.3.3
Connecting to vislab-ccom.unh.edu[192.168.3.3]:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 226512 (221K) [application/x-bzip2]
Saving to: `2011-10-11.gga.dat.bz2'

100%[=====>] 226,512 --.-K/s in 0.02s

2011-10-25 11:11:40 (10.6 MB/s) - `2011-10-11.gga.dat.bz2' saved [226512/226512]

researchtools@ubuntu:~/class/16\$

terrain.grd 16-Oct-2010 12:16 20K

```

researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help
researchtools@ubuntu:~/class/16$
researchtools@ubuntu:~/class/16$ wget http://vislab-
--2011-10-25 11:11:40-- http://vislab-
Resolving vislab-ccom.unh.edu... 192.168.
Connecting to vislab-ccom.unh.edu|192.168.
HTTP request sent, awaiting response...
Length: 226512 (221K) [application/x-bz2]
Saving to: `2011-10-11.gga.dat.bz2'

100%[=====]
2011-10-25 11:11:40 (10.6 MB/s) - `2011-
researchtools@ubuntu:~/class/16$

```

```

emacs23@ubuntu
File Edit Options Buffers Tools Operate Mark Regexp Immediate Subdir Help
#!/usr/bin/env python
import pyproj
import numpy as np
import sys, os

def wander_list(filename):
    print 'working on file:',filename

```

```

-U:--- wander2.py All L9 (Python yas)-----
/home/researchtools/class/16:
total used in directory 240 available 10805228
drwxr-xr-x  2 researchtools researchtools  4096 2011-10-25 11:19 .
drwxr-xr-x 13 researchtools researchtools  4096 2011-10-25 07:32 ..
-rw-r--r--  1 researchtools researchtools 226512 2011-10-20 08:21 2011-10-11.g
gga.dat.bz2
-rw-r--r--  1 researchtools researchtools   142 2011-10-25 11:19 wander2.py
-rw-r--r--  1 researchtools researchtools    23 2011-10-25 11:17 wander2.py~
-U:%%- 16 All L5 (Dired by name)-----

```

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File Edit View Search Terminal Help

```

researchtools@ubuntu:~/class/16$ wget http://vislab-ccom.unh.edu/~schwehr/rt/examples/2011-10-11.gga.dat.bz2
--2011-10-25 11:11:40-- http://vislab-ccom.unh.edu/~schwehr/rt/examples/2011-10-11.gga.dat.bz2
Resolving vislab-ccom.unh.edu... 192.168.3.3
Connecting to vislab-ccom.unh.edu|192.168.3.3|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 226512 (221K) [application/x-bzip2]
Saving to: `2011-10-11.gga.dat.bz2'

100%[=====] 226,512 --.-K/s in 0.02s

2011-10-25 11:11:40 (10.6 MB/s) - `2011-10-11.gga.dat.bz2' saved [226512/226512]

```

```

researchtools@ubuntu:~/class/16$ ipython
Python 2.7.1+ (r271:86832, Apr 11 2011, 18:05:24)
Type "copyright", "credits" or "license" for more information.

```

```

IPython 0.10.1 -- An enhanced Interactive Python.
?          -> Introduction and overview of IPython's features.
%quickref  -> Quick reference.
help       -> Python's own help system.
object?    -> Details about 'object'. ?object also works, ?? prints more.

```

```

In [1]: ls
2011-10-11.gga.dat.bz2  wander2.py  wander2.py~

```

```

In [2]: import wander2

```

```

In [3]: reload wander2
-----> reload(wander2)
Out[3]: <module 'wander2' from 'wander2.pyc'>

```

```

In [4]: █

```

snippets

-U:%%- 16 All L5 (Dired by name)-----

```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help

#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):
    print 'working on file:' , filename

```

```

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File Edit View Search Terminal Help

In [4]: dir(wander2)
Out[4]:
['_builtins_',
'__doc__',
'__file__',
'__name__',
'__package__',
'np',
'os',
'pyproj',
'sys',
'wander_list']

In [5]: wander2
wander2      wander2.py  wander2.pyc  wander2.py~

In [5]: wander2.wander_list

```

```

1:19 .
7:32 ..
8:21 2011-10-11.g
1:19 wander2.py
1:17 wander2.py~

```

```

-U:%%- 16 All L5 (Dired by name)

```

```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help
#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):
    print 'working on file:' , filename

```

```

researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help
['__doc__',
 '__file__',
 '__name__',
 '__package__',
 'np',
 'os',
 'pyproj',
 'sys',
 'wander_list']

In [5]: wander2
wander2      wander2.py  wander2.pyc  wander2.py~

In [5]: wander2.wander_list('2011-10-11.gga.dat.bz2')
working on file: 2011-10-11.gga.dat.bz2

In [6]:

```

```

1:19 .
7:32 ..
8:21 2011-10-11.gga
1:19 wander2.py
1:17 wander2.py~

```

video backup snippets

-U:%%- 16 All L5 (Dired by name)

```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help
#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:' , filename

    geod = pyproj.Geod(ellps='WGS84')

```

```

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File Edit View Search Terminal Help

In [5]: wander2.wander_list('2011-10-11.gga.dat.bz2')
working on file: 2011-10-11.gga.dat.bz2

In [6]: loadtxt?
Object `loadtxt` not found.

In [7]: import numpy as np

In [8]: np.load
np.load      np.loads      np.loadtxt

In [8]: np.loadtxt?

```

```

1:19 .
7:32 ..
8:21 2011-10-11.gga.dat.bz2
1:19 wander2.py
1:17 wander2.py~

```



backup



snippets

```

-U:%%- 16 All L5 (Dired by name)-----

```

```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help
#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:' , filename

    geod = pyproj.Geod(ellps='WGS84')

```

```

researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help
Object `loadtxt` not found.

In [7]: import numpy as np

In [8]: np.load
np.load      np.loads      np.loadtxt

In [8]: np.loadtxt?

In [9]: ls
2011-10-11.gga.dat.bz2  #wander2.py#  wander2.py  wander2.py~  wander2.pyc

In [10]: ! bzcat 2011-10-11.gga.dat.bz2 | head

```

```

1:19 .
7:32 ..
8:21 2011-10-11.gga.dat.bz2
1:19 wander2.py
1:17 wander2.py~

```



backup



```

-U:%%- 16 All L5 (Dired by name)-----

```


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File Edit Options Buffers Tools IM-Python Python YASnippet Help

```
researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help
np.load      np.loads    np.loadtxt

In [8]: np.loadtxt?

In [9]: ls
2011-10-11.gga.dat.bz2  #wander2.py#  wander2.py  wander2.py~  wander2.pyc

In [10]: ! bzcat 2011-10-11.gga.dat.bz2 | head
# x y z quality satellites hdop
-70.9395833333 43.1354166667 35.7 2 9 1.1
-70.9395766667 43.135415 36.1 2 9 1.1
-70.93957 43.1354133333 36.5 2 9 1.1
-70.9395666667 43.1354133333 37.0 2 9 1.1
-70.9395633333 43.1354133333 37.4 2 9 1.1
-70.9395633333 43.1354133333 37.8 2 9 1.1
-70.9395616667 43.1354133333 38.3 2 9 1.1
-70.9395616667 43.135415 38.7 2 9 1.1
-70.93956 43.1354133333 39.1 2 9 1.1

bzcat: I/O or other error, bailing out. Possible reason follows.
bzcat: Broken pipe
      Input file = 2011-10-11.gga.dat.bz2, output file = (stdout)

In [11]:
```

```
1:19 .
7:32 ..
8:21 2011-10-11.gga.dat.bz2
1:19 wander2.py
1:17 wander2.py~
```

video backup snippets

-U:%%- 16 All L5 (Dired by name)

Auto-saving...done

```

researchtools@ubuntu: ~/class/
File Edit View Search Terminal Help
np.load      np.loads    np.loadtxt

In [8]: np.loadtxt?

In [9]: ls
2011-10-11.gga.dat.bz2 #wander2.py#

In [10]: ! bzcat 2011-10-11.gga.dat.b
# x y z quality satellites hdop
-70.9395833333 43.1354166667 35.7 2 9
-70.9395766667 43.135415 36.1 2 9 1.1
-70.93957 43.1354133333 36.5 2 9 1.1
-70.9395666667 43.1354133333 37.0 2 9
-70.9395633333 43.1354133333 37.4 2 9
-70.9395633333 43.1354133333 37.8 2 9
-70.9395616667 43.1354133333 38.3 2 9
-70.9395616667 43.135415 38.7 2 9 1.1
-70.93956 43.1354133333 39.1 2 9 1.1

bzcat: I/O or other error, bailing out
bzcat: Broken pipe
Input file = 2011-10-11.gga.d

In [11]:

```

```

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File Edit Options Buffers Tools IM-Python Python YASnippet Help

#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:' , filename

    geod = pyproj.Geod(ellps='WGS84')
    x,y,z,quality,satellites,hdop = loadtxt(filename, unpack=True)

-U:|-- wander2.py      All L13      (Python yas)-----
/home/researchtools/class/16:
total used in directory 240 available 10805228
drwxr-xr-x  2 researchtools researchtools  4096 2011-10-25 11:19 .
drwxr-xr-x 13 researchtools researchtools  4096 2011-10-25 07:32 ..
-rw-r--r--  1 researchtools researchtools 226512 2011-10-20 08:21 2011-10-11.g
gga.dat.bz2
-rw-r--r--  1 researchtools researchtools   142 2011-10-25 11:19 wander2.py
-rw-r--r--  1 researchtools researchtools    23 2011-10-25 11:17 wander2.py~

-U:%%- 16              All L5      (Dired by name)-----
Wrote /home/researchtools/class/16/wander2.py

```



```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help

#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:' , filename

    geod = pyproj.Geod(ellps='WGS84')
    x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

```

```

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File Edit View Search Terminal Help

/home/researchtools/class/16/wander2.py
9     print 'working on file:'
10
11    geod = pyproj.Geod(ellps='WGS84')
--> 12    x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)
13

NameError: global name 'loadtxt' is not defined

In [13]:

```

```

-U:**- wander2.py All L12 (Python yas)-----
/home/researchtools/class/16:
total used in directory 240 available 10805228
drwxr-xr-x  2 researchtools researchtools  4096 2011-10-25 11:19 .
drwxr-xr-x 13 researchtools researchtools  4096 2011-10-25 07:32 ..
-rw-r--r--  1 researchtools researchtools 226512 2011-10-20 08:21 2011-10-11.g
ga.dat.bz2
-rw-r--r--  1 researchtools researchtools   142 2011-10-25 11:19 wander2.py
-rw-r--r--  1 researchtools researchtools    23 2011-10-25 11:17 wander2.py~

-U:%%- 16 All L5 (Dired by name)-----

```



```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help
#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:' , filename

    geod = pyproj.Geod(ellps='WGS84')
    x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

```

```

researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help

NameError: global name 'loadtxt' is not defined

In [13]: reload wander2
-----> reload(wander2)
Out[13]: <module 'wander2' from 'wander2.py'>

In [14]: wander2.wander_list('2011-10-11.gga.dat.bz2')
working on file: 2011-10-11.gga.dat.bz2

In [15]:

```

```

1:19 .
7:32 ..
8:21 2011-10-11.gga.dat.bz2
1:19 wander2.py
1:17 wander2.py~

```



backup



```

-U:%%- 16 All L5 (Dired by name)-----
Wrote /home/researchtools/class/16/wander2.py

```

```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help
+ [new] [open] [home] [close] [download] [upload] [undo] [cut] [copy] [paste] [find] [print] [wrench] [help]
^
#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:' , filename

    geod = pyproj.Geod(ellps='WGS84')
    x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

```

```

researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help
working on file: 2011-10-11.gga.dat.bz2

In [15]: x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)
-----
NameError                                Traceback (most recent call last)
/home/researchtools/class/16/<ipython console> in <module>()

NameError: name 'filename' is not defined

In [16]:

```



backup



```

-U:**- wander2.py All L12 (Python yas) -----
menu-bar edit copy

```

```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help
+ [new] [open] [home] [close] [download] [upload] [undo] [redo] [cut] [paste] [find] [print] [wrench] [help]
^
#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:' , filename

    geod = pyproj.Geod(ellps='WGS84')
    x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

```

-U:**- wander2.py All L12 (Python yas) -----
 menu-bar edit copy

```

researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help

/home/researchtools/class/16/<ipython console> in <module>()
NameError: name 'filename' is not defined

In [16]: x,y,z,quality,satellites,hdop = np.loadtxt('2011-10-11.gga.dat.bz2' , unpack=True)

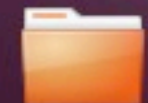
In [17]: np.average(x)
Out[17]: -70.939601490675187

In [18]:

```



backup



snippets

```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help
#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:', filename

    geod = pyproj.Geod(ellps='WGS84')
    x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

    print 'done loading file:', filename

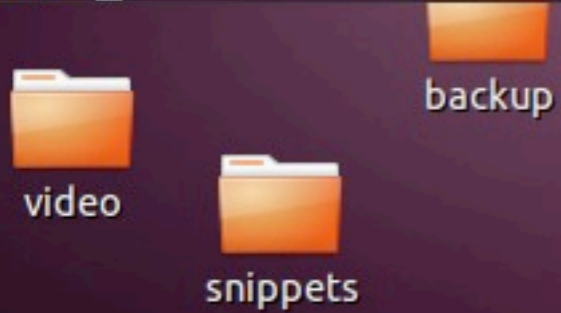
```

-U: *- wander2.py All L11 (Python yas)

```

researchtools@ubuntu: ~/class/
File Edit View Search Terminal Help
/home/researchtools/class/16/<ipython
NameError: name 'filename' is not def.
In [16]: x,y,z,quality,satellites,hdop
In [17]: np.average(x)
Out[17]: -70.939601490675187
In [18]:

```



```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help
#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:', filename

    # TODO: file bug report with author
    geod = pyproj.Geod(ellps='WGS84')
    x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

    x_ave = np.average(x)
    y_ave = np.average(y)

    for i in range(len(x))

    print 'done loading file:', filename
  
```

-U: *- wander2.py All L18 (Python yas)

```

researchtools@ubuntu: ~/class/
File Edit View Search Terminal Help

/home/researchtools/class/16/<ipython

NameError: name 'filename' is not def.

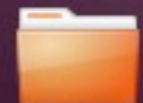
In [16]: x,y,z,quality,satellites,hdop

In [17]: np.average(x)
Out[17]: -70.939601490675187

In [18]:
  
```



backup



snippets


```
emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help
#!/usr/bin/env python
```

```
researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help

In [17]: np.average(x)
Out[17]: -70.939601490675187

In [18]: range(5)
Out[18]: [0, 1, 2, 3, 4]

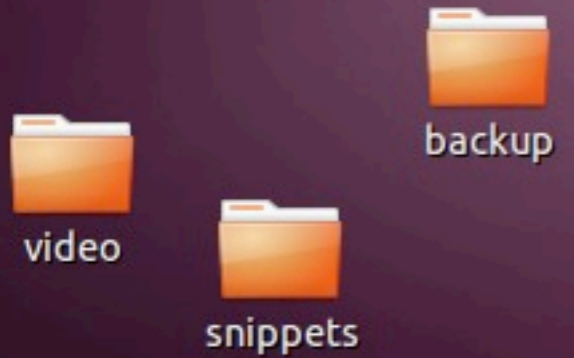
In [19]: len(x)
Out[19]: 86330

In [20]: range(len(x))
```

```
for i in range(len(x))

print 'done loading file:', filename

-U: *- wander2.py All L18 (Python yas)
Auto-saving...done
```



```
researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help
86328,
86329]

In [21]: import pyproj

In [22]: geod = pyproj.Geod(ellps='WGS84')

In [23]: geod.inv(x[0], y[0], x[-1],y[-1])
Out[23]: (29.09995959658065, -150.90001875216535, 5.298079823618996)

In [24]:
```

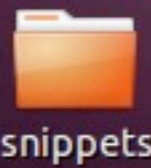
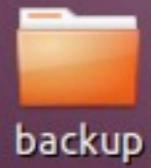
```
# TODO: file bug report with author
geod = pyproj.Geod(ellps='WGS84')
x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

x_ave = np.average(x)
y_ave = np.average(y)

for i in range(len(x)):
    d = geod.inv(x_ave, y_ave, x[i], y[i])

print 'done loading file:', filename
```

-U: --- wander2.py All L12 (Python yas) -----



```
researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help
In [24]: delta_dir = [ ]
In [25]: delta_dir.append(1.23456)
In [26]: del
del          delattr    delta_dir
In [26]: delta_dir
Out[26]: [1.23456]
In [27]: delta_dir.append(1.23456)
```

```
# TODO: file bug report with author
geod = pyproj.Geod(ellps='WGS84')
x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

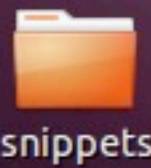
x_ave = np.average(x)
y_ave = np.average(y)

delta_dir = [ ]
delta_m = [ ]

for i in range(len(x)):
    d = geod.inv(x_ave, y_ave, x[i], y[i])
    delta_dir.[]

print 'done loading file:', filename

return delta_dir, delta_m
```



```

researchtools@ubuntu: ~/clas
File Edit View Search Terminal Help
In [21]: import pyproj
In [22]: geod = pyproj.Geod(ellps='W
In [23]: geod.inv(x[0], y[0], x[-1],
Out[23]: (29.09995959658065, -150.90
In [24]: delta_dir = [ ]
In [25]: delta_dir.append(1.23456)

```

```

emacs23@ubuntu
File Edit Options Buffers Tools IM-Python Python YASnippet Help
#!/usr/bin/env python
import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:', filename

    # TODO: file bug report with author
    geod = pyproj.Geod(ellps='WGS84')
    x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

    x_ave = np.average(x)
    y_ave = np.average(y)

    delta_dir = [ ]
    delta_m = [ ]

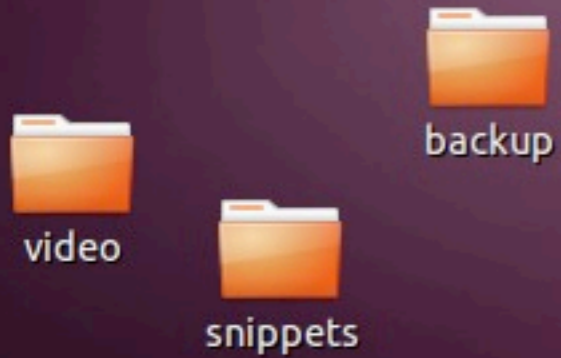
    for i in range(len(x)):
        d = geod.inv(x_ave, y_ave, x[i], y[i])
        delta_dir.append( d[0] )
        delta_m.append( d[

    print 'done loading file:', filename

    return delta_dir, delta_m

-U: *- wander2.py All L24 (Python yas)

```



```

researchtools@ubuntu: ~/class/16
File Edit View Search Terminal Help

--> 553     _Geod._inv(self, inx, iny, inz, ind, radians=radians)
554         # if inputs were lists, tuples or floats, convert back.

555         outx = _convertback(xisfloat,xislist,xistuple,inx)

/usr/lib/pymodules/python2.7/pyproj/_geod.so in _geod.Geod._inv (_geod.c:1956)()
ValueError: undefined inverse geodesic (may be an antipodal point)

In [31]:

```

```

# TODO: file bug report with author
geod = pyproj.Geod(ellps='WGS84')
x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

x_ave = np.average(x)
y_ave = np.average(y)

delta_dir = [ ]
delta_m = [ ]

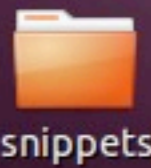
for i in range(len(x)):
    d = geod.inv(x_ave, y_ave, x[i], y[i])
    delta_dir.append( d[0] )
    delta_m.append( d[2] )

print 'done loading file:', filename

return delta_dir, delta_m

```

-U:--- wander2.py All L24 (Python yas)-----
Wrote /home/researchtools/class/16/wander2.py



Out[29]: <module 'wander2' from 'wander2.py'>

In [30]: wander2.wander_list('2011-10-11.gga.dat.bz2')
working on file: 2011-10-11.gga.dat.bz2

ValueError Traceback (most recent call last)

/home/researchtools/class/16/<ipython console> in <module>()

/home/researchtools/class/16/wander2.py in wander_list(filename)

```
20
21     for i in range(len(x)):
--> 22         d = geod.inv(x_ave, y_ave, x[i], y[i])
23         delta_dir.append( d[0] )
24         delta_m.append( d[2] )
```

/usr/lib/python2.7/pyproj/_init_.pyc in inv(self, lons1, lats1, lons2, lats2, radians)

```
551     ind, disfloat, dislist, distuple = _copytobuffer(lats2)
552     # call geod_inv function. inputs modified in place.
--> 553     _Geod._inv(self, inx, iny, inz, ind, radians=radians)
554     # if inputs were lists, tuples or floats, convert back.
```

555 outx = _convertback(xisfloat,xislist,xistuple,inx)

/usr/lib/python2.7/pyproj/_geod.so in _geod.Geod._inv (_geod.c:1956)()

ValueError: undefined inverse geodesic (may be an antipodal point)

In [31]:

--U:--- wander2.py All L24 (Python yas)-----
Wrote /home/researchtools/class/16/wander2.py

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```

21     for i in range(len(x)):
--> 22         d = geod.inv(x_ave, y_ave, x[i], y[i])
23         delta_dir.append( d[0] )
24         delta_m.append( d[2] )

```

```

/usr/lib/python2.7/pyproj/_init_.pyc in inv(self, lons1, lats1, lons2, lats2, radians)
551     ind, disfloat, dislist, distuple = _copytobuffer(lats2)
552     # call geod_inv function. inputs modified in place.

```

```

--> 553     _Geod._inv(self, inx, iny, inz, ind, radians=radians)
554     # if inputs were lists, tuples or floats, convert back.

```

```

555     outx = _convertback(xisfloat,xislist,xistuple,inx)

```

```

/usr/lib/python2.7/pyproj/_geod.so in _geod.Geod._inv (_geod.c:1956)()

```

ValueError: undefined inverse geodesic (may be an antipodal point)

```

In [31]: try:
.....:     print 'hello'
.....:     raise
.....:     print 'we will never get here'
.....: except:
.....:     print 'oops... we do not care'
.....:

```

hello
oops... we do not care

In [32]:

```

File Edit View Search Terminal Help
21 for i in range(len(x)):
--> 22     d = geod.inv(x_ave,
23         delta_dir.append( d[
24         delta_m.append( d[2]

/usr/lib/pymodules/python2.7/pyproj/
551     ind, disfloat, disli
552     # call geod_inv func

--> 553     _Geod._inv(self, inx
554     # if inputs were lis

555     outx = _convertback(

/usr/lib/pymodules/python2.7/pyproj/
ValueError: undefined inverse geodes

In [31]: try:
.....:     print 'hello'
.....:     raise
.....:     print 'we will never ge
.....: except:
.....:     print 'oops... we do no
.....:
hello
oops... we do not care

In [32]:

```

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```

#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:', filename

    # TODO: file bug report with author
    geod = pyproj.Geod(ellps='WGS84')
    x,y,z,quality,satellites,hdop = np.l

    x_ave = np.average(x)
    y_ave = np.average(y)

    delta_dir = [ ]
    delta_m = [ ]

    for i in range(len(x)):
        try:
            d = geod.inv(x_ave, y_ave, x[i],
                delta_dir.append( d[0] )
                delta_m.append( d[2] )

        print 'done loading file:', filename

    return delta_dir, delta_m

```

-U:**- wander2.py All L27 (Python yas)

Comment Out Region	C-c #
Uncomment Region	
Mark current block	C-c C-k
Mark current def	C-M-h
Mark current class	
Shift region left	C-c <
Shift region right	C-c >
Import/reload file	C-c RET
Execute buffer	C-c C-c
Execute region	C-c
Execute def or class	C-M-x
Execute string	C-c C-s
Start interpreter...	C-c !
Go to start of block	C-c C-u
Go to start of class	
Move to end of class	
Move to start of def	C-M-a
Move to end of def	C-M-e
Describe mode	C-c ?


```

File Edit View Search Terminal Help
21     for i in range(len(x)):
---> 22         d = geod.inv(x_ave,
23             delta_dir.append( d[
24             delta_m.append( d[2]

/usr/lib/python2.7/pyproj/
551         ind, disfloat, disli
552         # call geod_inv func

--> 553         _Geod._inv(self, inx
554         # if inputs were lis

555         outx = _convertback(

/usr/lib/python2.7/pyproj/
ValueError: undefined inverse geodes

In [31]: try:
.....:     print 'hello'
.....:     raise
.....:     print 'we will never ge
.....: except:
.....:     print 'oops... we do no
.....:
hello
oops... we do not care

In [32]:

```

```

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File Edit Options Buffers Tools IM-Python Python YASnippet Help
+ - X Save Undo Redo Cut Copy Paste Find Print Settings Help
#!/usr/bin/env python

import pyproj
import numpy as np
import sys, os

def wander_list(filename):

    print 'working on file:', filename

    # TODO: file bug report with author
    geod = pyproj.Geod(ellps='WGS84')
    x,y,z,quality,satellites,hdop = np.loadtxt(filename, unpack=True)

    x_ave = np.average(x)
    y_ave = np.average(y)

    delta_dir = [ ]
    delta_m = [ ]

    for i in range(len(x)):
        try:
            d = geod.inv(x_ave, y_ave, x[i], y[i])
            delta_dir.append( d[0] )
            delta_m.append( d[2] )
        except:
            delta_dir.append( 0 )
            delta_m.append( 0 ) # zero meters away

    print 'done loading file:', filename

    return delta_dir, delta_m

-U:--- wander2.py All L29 (Python yas)-----
Wrote /home/researchtools/class/16/wander2.py

```

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```

3.4912088107213037,
3.50062238829351,
3.8281235420952644,
3.94433964777003,
4.060567551353248,
4.1789663091148554,
4.388448213074405,
4.388448213074405,
4.388448213074405,
4.505248916403868,
4.623982585077899,
4.623982585077899,
4.623982585077899,
4.623982585077899,
4.715534445531724,
4.715534445531724,
4.812829697001647])

```

In [34]: dir, m = wander2.wander_list('2011-10-11.gga.dat.bz2')

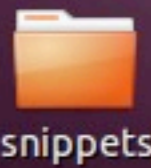
```

for i in range(len(x)):
    try:
        d = geod.inv(x_ave, y_ave, x[i], y[i])
        delta_dir.append( d[0] )
        delta_m.append( d[2] )
    except:
        delta_dir.append( 0 )
        delta_m.append( 0 ) # zero meters away
[]
print 'done loading file:', filename

return delta_dir, delta_m

```

-U:--- wander2.py All L29 (Python yas) (No changes need to be saved)



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```
In [34]: dir, m = wander2.wander_list('2011-10-11.gga.dat.bz2')
working on file: 2011-10-11.gga.dat.bz2
done loading file: 2011-10-11.gga.dat.bz2
```

```
In [35]: average(m)
```

```
NameError Traceback (most recent call last)
```

```
/home/researchtools/class/16/<ipython console> in <module>()
```

```
NameError: name 'average' is not defined
```

```
In [36]: np.average(m)
```

```
Out[36]: 2.7593596863410674
```

```
In [37]: np.min(m)
```

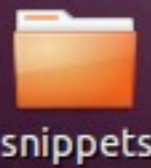
```
Out[37]: 0.0
```

```
In [38]:
```

```
for i in range(len(x)):
    try:
        d = geod.inv(x_ave, y_ave, x[i], y[i])
        delta_dir.append( d[0] )
        delta_m.append( d[2] )
    except:
        delta_dir.append( 0 )
        delta_m.append( 0 ) # zero meters away
print 'done loading file:', filename
return delta_dir, delta_m
```

-U:--- wander2.py All L29 (Python yas)-----

(No changes need to be saved)



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```

In [36]: np.average(m)
Out[36]: 2.7593596863410674

In [37]: np.min(m)
Out[37]: 0.0

In [38]: np.max(m)
Out[38]: 22.79234075047605

In [39]: from matplotlib import pyplot

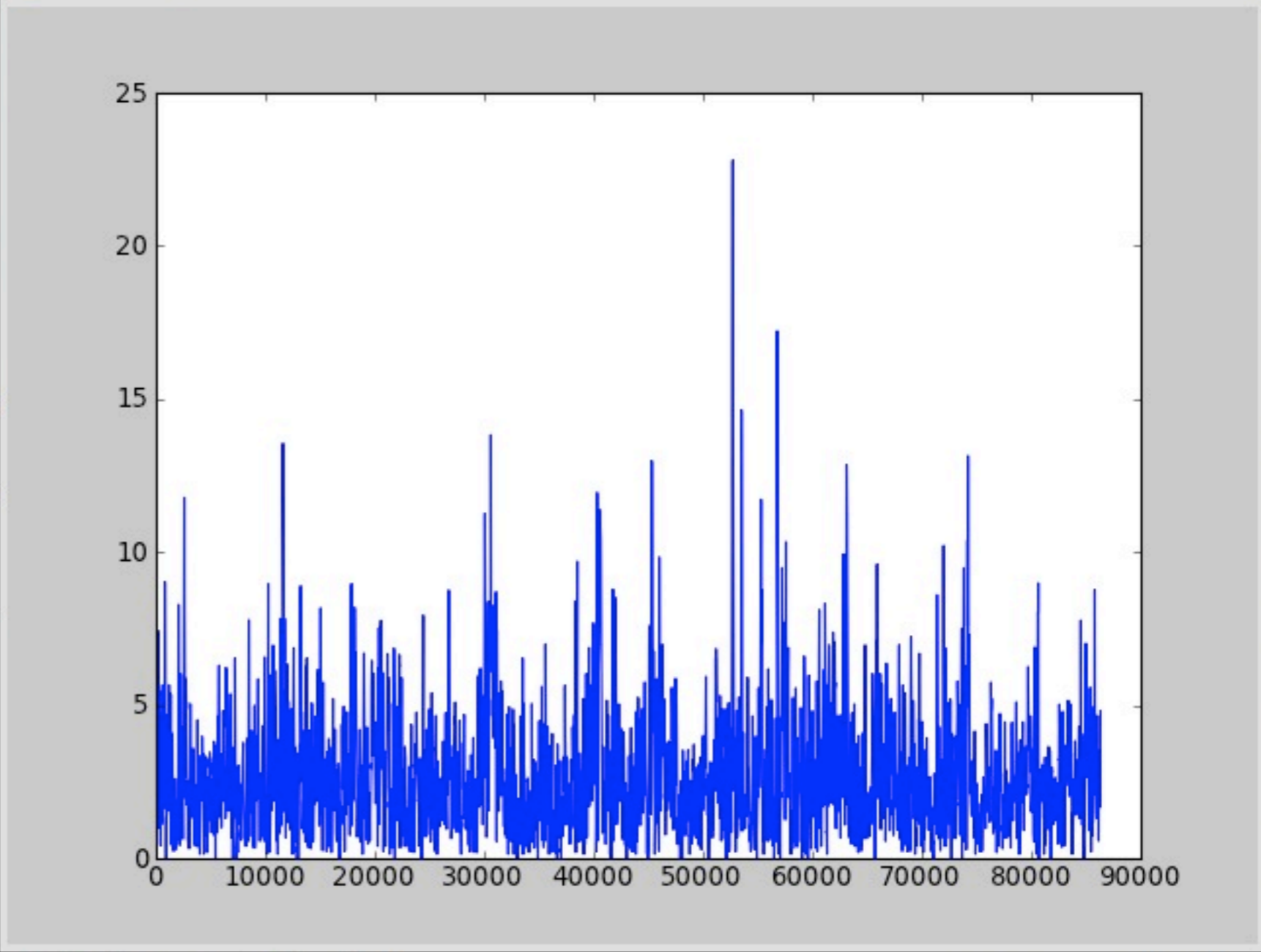
In [40]: pyplot.pl
pyplot.plot      pyplot.plot_date  pyplot

In [40]: pyplot.plot(m)
Out[40]: [<matplotlib.lines.Line2D object

In [41]: pyplot.show()

```

Figure 1



x=16034.7 y=6.88776

```

return delta_dir, delta_m

```

-U:--- wander2.py All L29 (Python yas) (No changes need to be saved)

video backup snippets

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File Edit View Search Terminal Help

In [39]: from matplotlib import pyplot

In [40]: pyplot.pl

pyplot.plot pyplot.plot_date pyplot.plotfile pyplot.plotting

In [40]: pyplot.plot(m)

Out[40]: [<matplotlib.lines.Line2D object at 0xaa1ad4c>]

In [41]: pyplot.show()

In [42]: pyplot.hist()

TypeError Traceback (most recent call last)

/home/researchtools/class/16/<ipython console> in <module>()

TypeError: hist() takes at least 1 argument (0 given)

In [43]: pyplot.hist?

```

for i in range(len(x)):
    try:
        d = geod.inv(x_ave, y_ave, x[i], y[i])
        delta_dir.append( d[0] )
        delta_m.append( d[2] )
    except:
        delta_dir.append( 0 )
        delta_m.append( 0 ) # zero meters away
print 'done loading file:', filename
return delta_dir, delta_m

```

-U:--- wander2.py All L29 (Python yas)-----

(No changes need to be saved)



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```
String Form: <function hist at 0xa8e248c>
Namespace: Interactive
File: /usr/lib/pymodules/python2.7/matplotlib/pyplot.py
Definition: pyplot.hist(x, bins=10, range=None, normed=False, weights=None, cumulative=False, bottom=None, histtype='bar', align='mid', orientation='vertical', rwidth=None, log=False, hold=None, **kwargs)
Docstring:
call signature:

hist(x, bins=10, range=None, normed=False, cumulative=False,
      bottom=None, histtype='bar', align='mid',
      orientation='vertical', rwidth=None, log=False, **kwargs)

Compute and draw the histogram of *x*. The return value is a
tuple (*n*, *bins*, *patches*) or ([*n0*, *n1*, ...], *bins*,
[*patches0*, *patches1*,...]) if the input contains multiple
data.
```

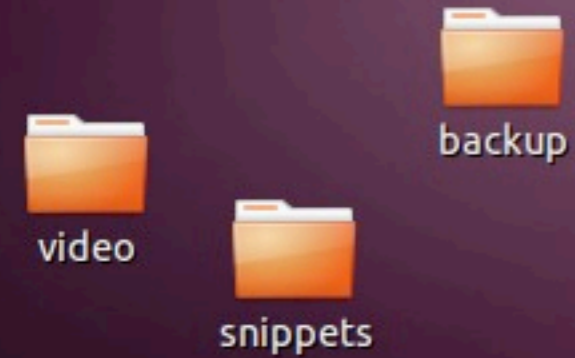
```

for i in range(len(x)):
    try:
        d = geod.inv(x_ave, y_ave, x[i], y[i])
        delta_dir.append( d[0] )
        delta_m.append( d[2] )
    except:
        delta_dir.append( 0 )
        delta_m.append( 0 ) # zero meters away
print 'done loading file:', filename

return delta_dir, delta_m

```

-U:--- wander2.py All L29 (Python yas)-----
(No changes need to be saved)

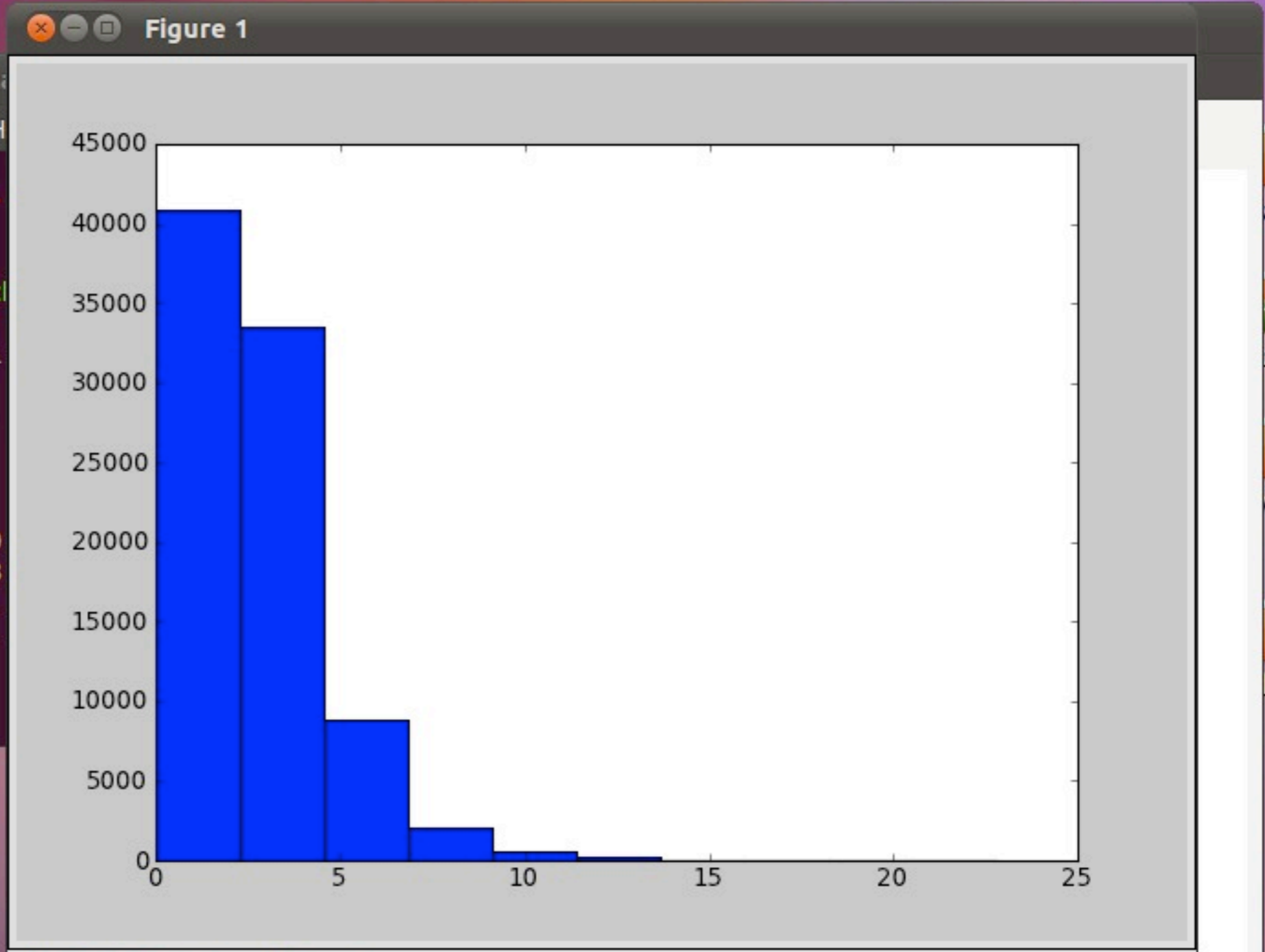


```

researchtools@ubuntu: ~/cl
File Edit View Search Terminal H
In [42]: pyplot.hist()
-----
TypeError

/home/researchtools/class/16/<ipytl
TypeError: hist() takes at least 1
In [43]: pyplot.hist?
In [44]: pyplot.hist(m)
Out[44]:
(array([40897, 33576, 8894, 2100
array([ 0.          , 2.27923408
        9.1169363 , 11.39617038,
        18.2338726 , 20.51310668,
<a list of 10 Patch objects>)
In [45]: 

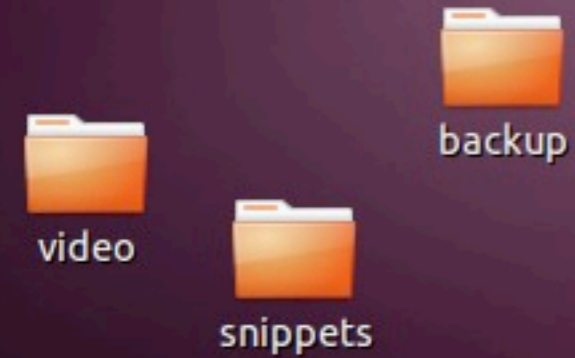
```



```

x=6.33995 y=24910.7
delta_m.append( 0 ) # zero meters away
[]
print 'done loading file:', filename
return delta_dir, delta_m
-U:--- wander2.py All L29 (Python yas)-----
(No changes need to be saved)

```



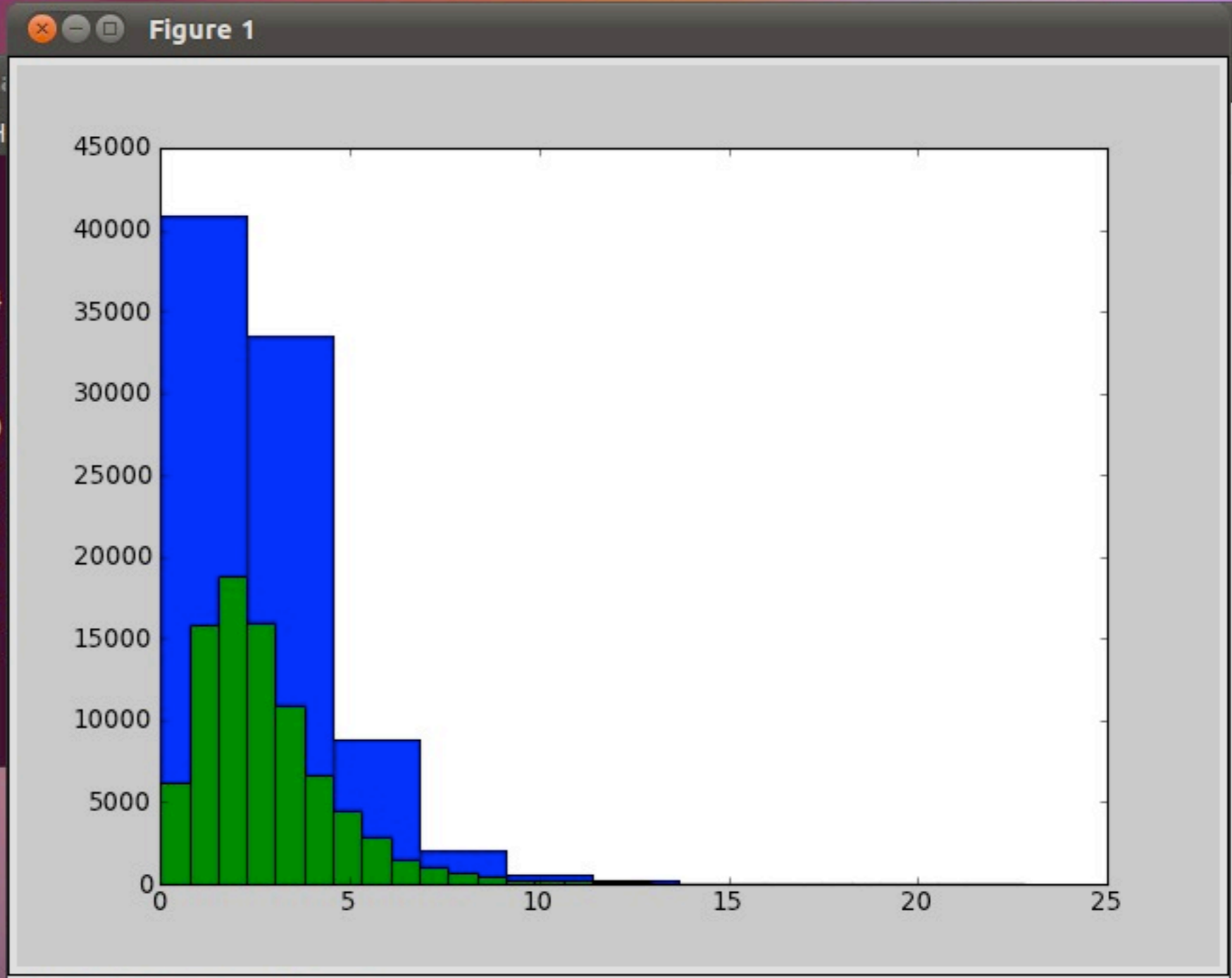
```

researchtools@ubuntu: ~/cli
File Edit View Search Terminal H
<a list of 10 Patch objects>

In [45]: pyplot.hist(m, bins=30)
Out[45]:
(array([ 6241, 15809, 18847, 15954,
        1013,  649,  438,  187,
         10,  12,   8,  13,
         3,   4,   8]),
 array([ 0.          ,  0.75974469,
        3.03897877,  3.79872346,
        6.07795753,  6.83770223,
        9.1169363 ,  9.87668099,
       12.15591507, 12.91565976,
       15.19489383, 15.95463853,
       18.2338726 , 18.99361729,
       21.27285137, 22.03259606,
        <a list of 30 Patch objects>)

In [46]:

```

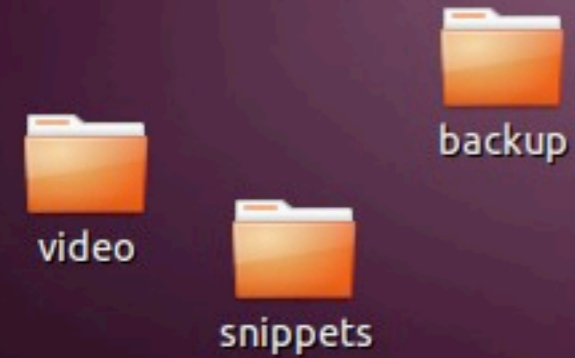


```

delta_m.append( 0 ) # zero meters away
[]
print 'done loading file:', filename

return delta_dir, delta_m
-U:--- wander2.py All L29 (Python yas)-----
(No changes need to be saved)

```



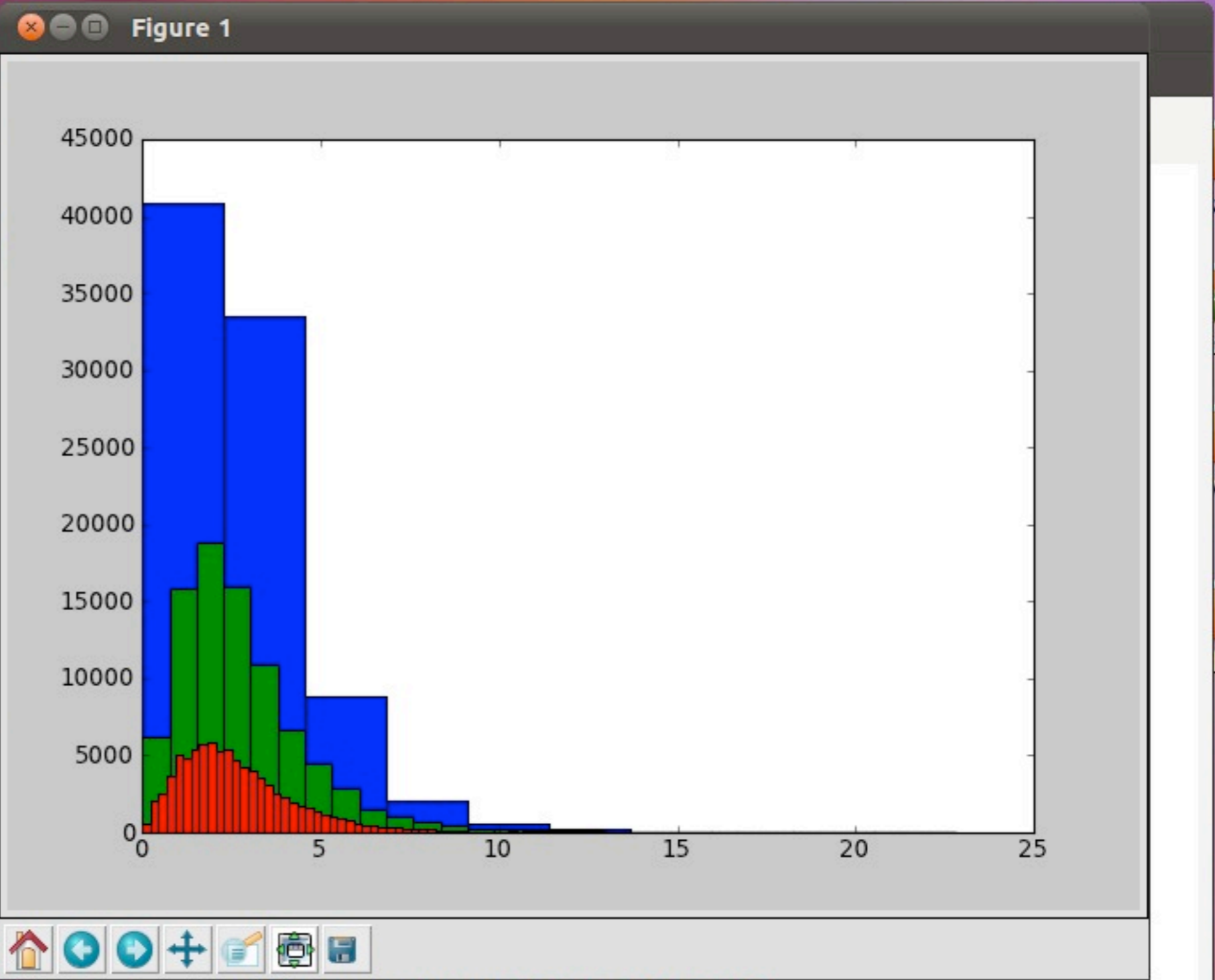

```

researchtools@ubuntu: ~/cli
File Edit View Search Terminal H

32: reload(wander2)
33: wander2.wander_list('2011-10-1
34: dir, m = wander2.wander_list('
35: average(m)
36: np.average(m)
37: np.min(m)
38: np.max(m)
39: from matplotlib import pyplot
40: pyplot.plot(m)
41: pyplot.show()
42: pyplot.hist()
43: #?pyplot.hist
44: pyplot.hist(m)
45: pyplot.hist(m, bins=30)
46: pyplot.hist(m, bins=100)
47: _ip.magic("history ")

In [48]:

```



```

delta_m.append( 0 ) # zero meters away
[]
print 'done loading file:', filename

return delta_dir, delta_m
-U:--- wander2.py All L29 (Python yas)-----
(No changes need to be saved)

```

