

RESEARCH TOOLS 2011

VIDEO 18

2011-Nov-08

Kurt Schwehr

<http://schwehr.org>

UNH CCOM/JHC

Python: hdf5 bags with h5py, numpy and matplotlib



```
researchtools@ubuntu:~$ mkdir -p video/18
researchtools@ubuntu:~$ cd video/18
researchtools@ubuntu:~/video/18$
```

RT Video 18 - Python - HDF5 with h5py, numpy and matplotlib

2011-Nov-08
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Applications Places System

Index of /mgg/NOS/coast - Mozilla Firefox

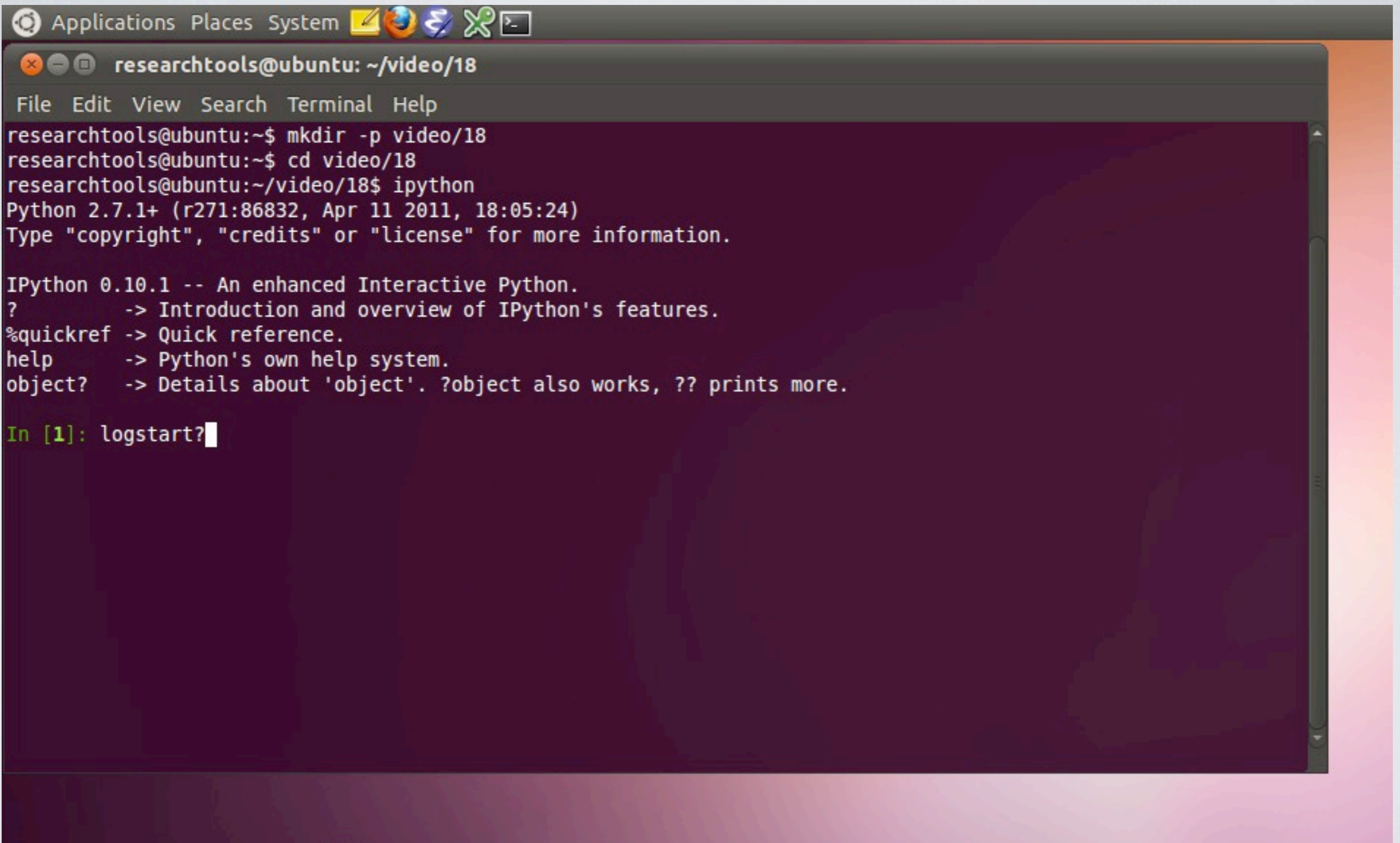
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D00001-D02000/	04-Apr-2011 13:27	-
F00001-F02000/	28-Sep-2011 08:52	-
H00001-H02000/	23-Apr-2009 07:47	-
H02001-H04000/	23-Apr-2009 08:43	-
H04001-H06000/	07-Dec-2010 10:50	-
H06001-H08000/	07-Dec-2010 10:57	-
H08001-H10000/	10-Feb-2011 10:35	-
H10001-H12000/	12-Oct-2011 09:16	-
H12001-H14000/	17-Oct-2011 06:30	-
L00001-L02000/	21-Apr-2009 10:40	-
L02001-L04000/	07-Dec-2010 11:05	-
W00001-W02000/	03-Jan-2011 12:03	-

A terminal window titled "researchtools@ubuntu: ~/video/18" is shown. The window has a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The terminal content shows the user creating a directory, changing to it, and starting IPython. IPython displays its version (0.10.1) and provides help for various commands like "?", "%quickref", "help", and "object?". The user has entered "In [1]: logstart?" and the cursor is at the end of the line.

```
Applications Places System 
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
researchtools@ubuntu:~$ mkdir -p video/18
researchtools@ubuntu:~$ cd video/18
researchtools@ubuntu:~/video/18$ 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]: logstart?
```



```
Applications Places System [icons]
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
Base Class:      <type 'instancemethod'>
String Form:    <bound method InteractiveShell.magic_logstart of <IPython.ipplib.InteractiveShell object at 0xb77d638c>>
Namespace:     IPython internal
File:          /usr/lib/python2.7/dist-packages/IPython/Magic.py
Definition:    logstart(self, parameter_s='')
Docstring:
Start logging anywhere in a session.

%logstart [-o|-r|-t] [log name [log mode]]

If no name is given, it defaults to a file named 'ipython_log.py' in your
current directory, in 'rotate' mode (see below).

'%logstart name' saves to file 'name' in 'backup' mode. It saves your
history up to that point and then continues logging.

%logstart takes a second optional parameter: logging mode. This can be one
of (note that the modes are given unquoted):
append: well, that says it.
backup: rename (if exists) to name~ and start name.
global: single logfile in your home dir, appended to.
over  : overwrite existing log.
rotate: create rotating logs name.1~, name.2~, etc.

:
```


global: single logfile in your home dir, appended to.
over : overwrite existing log.
rotate: create rotating logs name.1~, name.2~, etc.

Options:

-o: log also IPython's output. In this mode, all commands which generate an Out[NN] prompt are recorded to the logfile, right after their corresponding input line. The output lines are always prepended with a '#[Out]#' marker, so that the log remains valid Python code.

Since this marker is always the same, filtering only the output from a log is very easy, using for example a simple awk call:

```
awk -F'#\[Out\]#' ' {if($2) {print $2}}' ipython_log.py
```

-r: log 'raw' input. Normally, IPython's logs contain the processed input, so that user lines are logged in their final form, converted into valid Python. For example, %Exit is logged as `' ip.magic("Exit")`. If the -r flag is given, all input is logged exactly as typed, with no transformations applied.

-t: put timestamps before each input line logged (these are put in comments).

(END)


```
Applications Places System [Icons]
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
researchtools@ubuntu:~$ mkdir -p video/18
researchtools@ubuntu:~$ cd video/18
researchtools@ubuntu:~/video/18$ 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]: logstart?

In [2]: logstart -o -r -t video-18-log.py append
Activating auto-logging. Current session state plus future input saved.
Filename      : video-18-log.py
Mode          : append
Output logging : True
Raw input log  : True
Timestamping  : True
State         : active

In [3]:
```

```
Applications Places System [Icons]
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
help      -> Python's own help system.
object?   -> Details about 'object'. ?object also works, ?? prints more.

In [1]: logstart?

In [2]: logstart -o -r -t video-18-log.py append
Activating auto-logging. Current session state plus future input saved.
Filename      : video-18-log.py
Mode          : append
Output logging : True
Raw input log  : True
Timestamping  : True
State         : active

In [3]: ls -l
total 4
-rw-r--r-- 1 researchtools researchtools 44 2011-11-07 19:37 video-18-log.py

In [4]: !head video-18-log.py
logstart?
# Mon, 07 Nov 2011 19:37:32
ls -l
# Mon, 07 Nov 2011 19:37:44
!head video-18-log.py

In [5]:
```


Applications Places System


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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
 Parent Directory		-	
 B00001-B02000/	16-Nov-2009 09:07	-	
 D00001-D02000/	04-Apr-2011 13:27	-	
 F00001-F02000/	28-Sep-2011 08:52	-	
 H00001-H02000/	23-Apr-2009 07:47	-	
 H02001-H04000/	23-Apr-2009 08:43	-	
 H04001-H06000/	07-Dec-2010 10:50	-	
 H06001-H08000/	07-Dec-2010 10:57	-	
 H08001-H10000/	10-Feb-2011 10:25	-	

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H12259/	28-Sep-2011 09:00	-
H12260/	06-Sep-2011 09:39	-
H12261/	06-Sep-2011 09:46	-
H12262/	08-Sep-2011 10:43	-
H12263/	08-Sep-2011 10:44	-
H12264/	06-Sep-2011 10:23	-
H12266/	28-Sep-2011 09:01	-
H12276/	12-Oct-2011 09:20	-
H12279/	12-Oct-2011 08:40	-

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http://surveys.ngdc.noaa.gov...coast/H12001-H14000/H12279/

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← → surveys.ngdc.noaa.gov/mgg/NOS/coast/H12001-H14000/H12279/ ☆ ↻ Google 🔍 🏠

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<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
 Parent Directory		-	
 BAG/	12-Oct-2011 08:39	-	
 bottom_samples/	12-Oct-2011 08:44	-	

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http://surveys.ngdc.noaa.go...4000/H12279/bottom_samples/

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NOAA NATIONAL GEOPHYSICAL DATA CENTER
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
Parent Directory	-	-	-
H12279_VB_4m_MLLW_1of1.bag.gz	18-Aug-2011 13:23	2.2M	

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http://surveys.ngdc.noaa.go...279_VB_4m_MLLW_1of1.bag.gz


```
Applications Places System [Icons]
researchtools@ubuntu: ~/video/18
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In [5]: !wget http://surveys.ngdc.noaa.gov/mgg/NOS/coast/H12001-H14000/H12279/BAG/H12279_VB_4m_MLLW_lof1.bag.gz
--2011-11-07 19:40:16-- http://surveys.ngdc.noaa.gov/mgg/NOS/coast/H12001-H14000/H12279/BAG/H12279_VB_4m_MLLW_lof1.bag.gz
Resolving surveys.ngdc.noaa.gov... 140.172.184.18
Connecting to surveys.ngdc.noaa.gov|140.172.184.18|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 2313411 (2.2M) [application/x-gzip]
Saving to: `H12279_VB_4m_MLLW_lof1.bag.gz'

100%[=====>] 2,313,411 752K/s in 3.0s

2011-11-07 19:40:19 (752 KB/s) - `H12279_VB_4m_MLLW_lof1.bag.gz' saved [2313411/2313411]

In [6]: !gunzip *.gz

In [7]: ls -l
total 24132
-rw-r--r-- 1 researchtools researchtools 24706392 2011-08-18 15:23 H12279_VB_4m_MLLW_lof1.bag
-rw-r--r-- 1 researchtools researchtools 301 2011-11-07 19:40 video-18-log.py

In [8]: !file H12279_VB_4m_MLLW_lof1.bag
H12279_VB_4m_MLLW_lof1.bag: Hierarchical Data Format (version 5) data

In [9]:
```

```
Applications Places System [icons]
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
researchtools@ubuntu:~/video/18$ jobs
[1]+  Stopped                  ipython
researchtools@ubuntu:~/video/18$ sudo apt-get install python-h5py
[sudo] password for researchtools:
Reading package lists... Done
Building dependency tree
Reading state information... Done
python-h5py is already the newest version.
0 upgraded, 0 newly installed, 0 to remove and 3 not upgraded.
researchtools@ubuntu:~/video/18$ fg
```



```
Applications Places System [Icons]
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
8 : _ip.system("file H12279_VB_4m_MLLW_1of1.bag")
9 : _ip.system("md5sum H12279_VB_4m_MLLW_1of1.bag")
10: import h5py
11:
12: _ip.magic("history ")

In [13]: bag = h5py.
h5py.AttributeManager h5py.__format__ h5py._ipy_completer h5py.h5o
h5py.Dataset h5py.__getattr__ h5py._proxy h5py.h5p
h5py.Datatype h5py.__hash__ h5py._stub h5py.h5r
h5py.ExternalLink h5py.__init__ h5py.check_dtype h5py.h5s
h5py.File h5py.__name__ h5py.filters h5py.h5t
h5py.Group h5py.__new__ h5py.get_config h5py.h5z
h5py.H5Error h5py.__package__ h5py.get_enum h5py.highlevel
h5py.Reference h5py.__path__ h5py.get_vlen h5py.ip_running
h5py.RegionReference h5py.__reduce__ h5py.h5 h5py.ipapi
h5py.SoftLink h5py.__reduce_ex__ h5py.h5a h5py.is_hdf5
h5py.__all__ h5py.__repr__ h5py.h5d h5py.new_enum
h5py.__builtins__ h5py.__setattr__ h5py.h5e h5py.new_vlen
h5py.__class__ h5py.__sizeof__ h5py.h5f h5py.selections
h5py.__delattr__ h5py.__str__ h5py.h5fd h5py.special_dtype
h5py.__dict__ h5py.__subclasshook__ h5py.h5g h5py.utils
h5py.__doc__ h5py._conv h5py.h5i h5py.version
h5py.__file__ h5py._extras h5py.h5l

In [13]: bag = h5py.
```



```
10: import h5py
```

```
11:
```

```
12: _ip.magic("history ")
```

```
In [13]: bag = h5py.
```

h5py.AttributeManager	h5py.__format__	h5py._ipy_completer	h5py.h5o
h5py.Dataset	h5py.__getattr__	h5py._proxy	h5py.h5p
h5py.Datatype	h5py.__hash__	h5py._stub	h5py.h5r
h5py.ExternalLink	h5py.__init__	h5py.check_dtype	h5py.h5s
h5py.File	h5py.__name__	h5py.filters	h5py.h5t
h5py.Group	h5py.__new__	h5py.get_config	h5py.h5z
h5py.H5Error	h5py.__package__	h5py.get_enum	h5py.highlevel
h5py.Reference	h5py.__path__	h5py.get_vlen	h5py.ip_running
h5py.RegionReference	h5py.__reduce__	h5py.h5	h5py.ipapi
h5py.SoftLink	h5py.__reduce_ex__	h5py.h5a	h5py.is_hdf5
h5py.__all__	h5py.__repr__	h5py.h5d	h5py.new_enum
h5py.__builtins__	h5py.__setattr__	h5py.h5e	h5py.new_vlen
h5py.__class__	h5py.__sizeof__	h5py.h5f	h5py.selections
h5py.__delattr__	h5py.__str__	h5py.h5fd	h5py.special_dtype
h5py.__dict__	h5py.__subclasshook__	h5py.h5g	h5py.utils
h5py.__doc__	h5py._conv	h5py.h5i	h5py.version
h5py.__file__	h5py._extras	h5py.h5l	

```
In [13]: bag = h5py.File('H12279_VB_4m_MLLW_1of1.bag')
```

```
In [14]:
```



```
Applications Places System [Icons] [Terminal]
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
In [14]: bag.filename
Out[14]: 'H12279_VB_4m_MLLW_1of1.bag'

In [15]: bag.name
Out[15]: '/'

In [16]: bag.items()
Out[16]: [('BAG_root', <HDF5 group "/BAG_root" (4 members)>)]

In [17]: bag.values()
Out[17]: [<HDF5 group "/BAG_root" (4 members)>]


In [18]: bag.items()[0][1]
Out[18]: <HDF5 group "/BAG_root" (4 members)>

In [19]: bag['/BAG_root']
Out[19]: <HDF5 group "/BAG_root" (4 members)>

In [20]: bag['/BAG_root'].items()
Out[20]:
[('elevation', <HDF5 dataset "elevation": shape (1696, 1820), type "<f4">),
 ('metadata', <HDF5 dataset "metadata": shape (4971,), type "|S1">),
 ('tracking_list', <HDF5 dataset "tracking_list": shape (0,), type "|V19">),
 ('uncertainty', <HDF5 dataset "uncertainty": shape (1696, 1820), type "<f4">)]

In [21]: root = bag['
```



```
Applications Places System 
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
In [21]: root = bag['BAG_root']

In [22]: type(root)
Out[22]: <class 'h5py.highlevel.Group'>

In [23]: root.name
Out[23]: '/BAG_root'

In [24]: root.parent
Out[24]: <HDF5 group "/" (1 members)>

In [25]: root.items()
Out[25]:
[('elevation', <HDF5 dataset "elevation": shape (1696, 1820), type "<f4">),
 ('metadata', <HDF5 dataset "metadata": shape (4971,), type "|S1">),
 ('tracking_list', <HDF5 dataset "tracking_list": shape (0,), type "|V19">),
 ('uncertainty', <HDF5 dataset "uncertainty": shape (1696, 1820), type "<f4">)]

In [26]: root.values()
Out[26]:
[<HDF5 dataset "elevation": shape (1696, 1820), type "<f4">,
 <HDF5 dataset "metadata": shape (4971,), type "|S1">,
 <HDF5 dataset "tracking_list": shape (0,), type "|V19">,
 <HDF5 dataset "uncertainty": shape (1696, 1820), type "<f4">]

In [27]: metadata_node = root['metadata']
```



```
Applications Places System [Icons] [Terminal]
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
In [27]: metadata_node = root['metadata']

In [28]: type(metadata_node)
Out[28]: <class 'h5py.highlevel.Dataset'>

In [29]: whos
Variable      Type      Data/Info
-----
bag           File      <HDF5 file "H12279_VB_4m_<...>f1.bag" (mode r+, 23.6M)>
h5py         module   <module 'h5py' from '/usr<...>on2.7/h5py/__init__.pyc'>
metadata_node Dataset  <HDF5 dataset "metadata":<...>hape (4971,), type "|S1">
root         Group    <HDF5 group "/BAG_root" (4 members)>

In [30]: metadata_node = root['/BAG_root/metadata']

In [31]: whos
Variable      Type      Data/Info
-----
bag           File      <HDF5 file "H12279_VB_4m_<...>f1.bag" (mode r+, 23.6M)>
h5py         module   <module 'h5py' from '/usr<...>on2.7/h5py/__init__.pyc'>
metadata_node Dataset  <HDF5 dataset "metadata":<...>hape (4971,), type "|S1">
root         Group    <HDF5 group "/BAG_root" (4 members)>

In [32]: #metadata = ''.join(metadata_node.value)

In [33]: metadata_node.value
```



```
Applications Places System [Icons] [Terminal]
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help

In [32]: #metadata = ''.join(metadata_node.value)

In [33]: metadata_node.value
Out[33]:
array(['<', '?', 'x', ..., '>', '\n', ''],
      dtype='|S1')

In [34]: metadata = ''.join(metadata_node.value)

In [35]: whos
Variable      Type      Data/Info
-----
bag           File      <HDF5 file "H12279_VB_4m_<...>f1.bag" (mode r+, 23.6M)>
h5py          module    <module 'h5py' from '/usr<...>on2.7/h5py/__init__.pyc'>
metadata      str       <?xml version="1.0"?>\n<s<...>on></smXML:MD_Metadata>\n
metadata_node Dataset    <HDF5 dataset "metadata":<...>hape (4971,), type "|S1">
root          Group     <HDF5 group "/BAG_root" (4 members)>

In [36]: metad
metadata      metadata_node

In [36]: metadata[:50]
Out[36]: '<?xml version="1.0"?>\n<smXML:MD_Metadata xmlns:smX'

In [37]:
```



```
Applications Places System [Icons] [Terminal]
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
bag      File      <HDF5 file "H12279_VB_4m <...>f1.bag" (mode r+, 23.6M)>
h5py     module   <module 'h5py' from '/usr<...>on2.7/h5py/__init__.pyc'>
metadata str      <?xml version="1.0"?>\n<s<...>on></smXML:MD_Metadata>\n
metadata_node Dataset  <HDF5 dataset "metadata":<...>hape (4971,), type "|S1">
root     Group    <HDF5 group "/BAG_root" (4 members)>

In [36]: metad
metadata      metadata_node

In [36]: metadata[:50]
Out[36]: '<?xml version="1.0"?>\n<smXML:MD_Metadata xmlns:smX'

In [37]: import numpy






In [38]: from matplotlib import pyplot

In [39]: pyplot.interactive(True)

In [40]: root.items()
Out[40]:
[('elevation', <HDF5 dataset "elevation": shape (1696, 1820), type "<f4">),
 ('metadata', <HDF5 dataset "metadata": shape (4971,), type "|S1">),
 ('tracking_list', <HDF5 dataset "tracking_list": shape (0,), type "|V19">),
 ('uncertainty', <HDF5 dataset "uncertainty": shape (1696, 1820), type "<f4">)]

In [41]: root['elevations']
```



```
Applications Places System     
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
353      cls = {h5o.TYPE_GROUP: Group, h5o.TYPE_DATASET: Dataset,
/usr/lib/pymodules/python2.7/h5py/h5o.so in h5py.h5o.get_info (h5py/h5o.c:2228)()
KeyError: "Name doesn't exist (Symbol table: Object not found)"
In [42]: elev_node = root['elevation']
In [43]: type(elev_node)
Out[43]: <class 'h5py.highlevel.Dataset'>
In [44]: whos
Variable      Type      Data/Info
-----
bag           File      <HDF5 file "H12279_VB_4m_<...>f1.bag" (mode r+, 23.6M)>
elev_node    Dataset   <HDF5 dataset "elevation"<...>(1696, 1820), type "<f4">
h5py         module    <module 'h5py' from '/usr<...>on2.7/h5py/__init__.pyc'>
metadata     str       <?xml version="1.0"?>\n<s<...>on></smXML:MD_Metadata>\n
metadata_node Dataset   <HDF5 dataset "metadata":<...>hape (4971,), type "|S1">
numpy        module    <module 'numpy' from '/us<...>n2.7/numpy/__init__.pyc'>
pyplot       module    <module 'matplotlib.pyplo<...>7/matplotlib/pyplot.pyc'>
root         Group     <HDF5 group "/BAG_root" (4 members)>
In [45]: elev = elev_node.value
In [46]: w
```



```
Applications Places System [Icons]
researchtools@ubuntu: ~/video/18
File Edit View Search Terminal Help
metadata_node Dataset <HDF5 dataset "metadata":<...>hape (4971,), type "|S1">
numpy module <module 'numpy' from '/us<...>n2.7/numpy/__init__.pyc'>
pyplot module <module 'matplotlib.pyplot<...>7/matplotlib/pyplot.pyc'>
root Group <HDF5 group "/BAG_root" (4 members)>

In [45]: elev = elev_node.value

In [46]: whos
Variable      Type      Data/Info
-----
bag           File      <HDF5 file "H12279_VB_4m<...>f1.bag" (mode r+, 23.6M)>
elev         ndarray   1696x1820: 3086720 elems, type `float32`, 12346880 bytes (11 Mb)
elev_node    Dataset   <HDF5 dataset "elevation"<...>(1696, 1820), type "<f4">
h5py         module    <module 'h5py' from '/usr<...>on2.7/h5py/__init__.pyc'>
metadata     str       <?xml version="1.0"?>\n<s<...>on></smXML:MD_Metadata>\n
metadata_node Dataset   <HDF5 dataset "metadata":<...>hape (4971,), type "|S1">
numpy        module    <module 'numpy' from '/us<...>n2.7/numpy/__init__.pyc'>
pyplot       module    <module 'matplotlib.pyplot<...>7/matplotlib/pyplot.pyc'>
root         Group     <HDF5 group "/BAG_root" (4 members)>

In [47]: whos ndarray
Variable    Type      Data/Info
-----
elev       ndarray   1696x1820: 3086720 elems, type `float32`, 12346880 bytes (11 Mb)

In [48]:
```



```
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pyplot      module      <module 'matplotlib.pyplo<...>7/matplotlib/pyplot.pyc'>
root        Group       <HDF5 group "/BAG_root" (4 members)>

In [47]: whos ndarray
Variable    Type        Data/Info
-----
elev        ndarray    1696x1820: 3086720 elems, type `float32`, 12346880 bytes (11 Mb)

In [48]: elev.shape
Out[48]: (1696, 1820)

In [49]: elev.min()
Out[49]: -16.997538

In [50]: elev.max()
Out[50]: 1000000.0

In [51]: 1.0e6
Out[51]: 1000000.0

In [52]: elev.mean()
Out[52]: 903907.70889487874

In [53]: elev[elev>9.0e5] = numpy.NaN

In [54]:
```



```
Out[48]: (1696, 1820)

In [49]: elev.min()
Out[49]: -16.997538

In [50]: elev.max()
Out[50]: 1000000.0

In [51]: 1.0e6
Out[51]: 1000000.0

In [52]: elev.mean()
Out[52]: 903907.70889487874

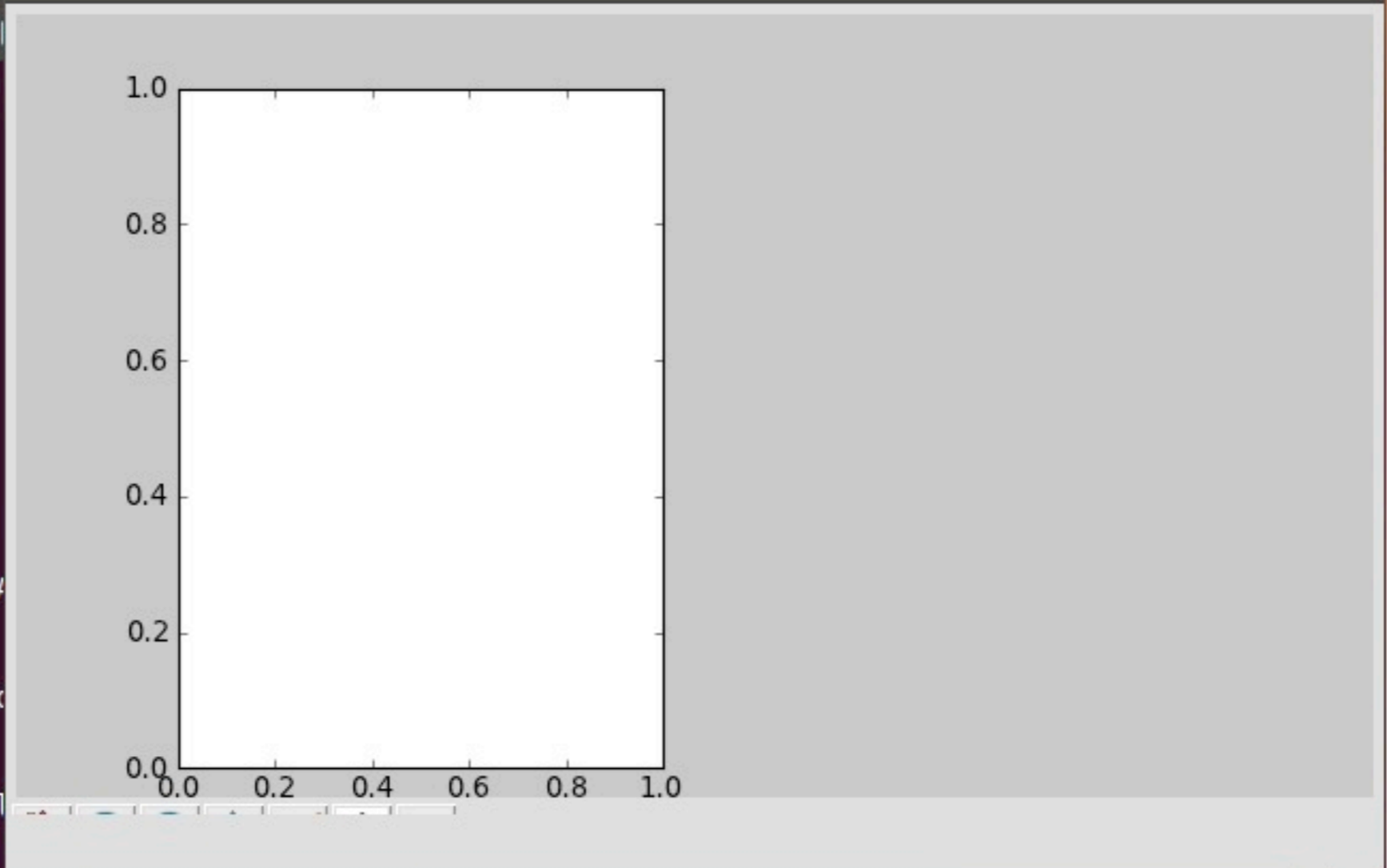
In [53]: elev[elev>9.0e5] = numpy.NA

In [54]: pyplot.figure(1)
Out[54]: <matplotlib.figure.Figure object at 0xa29342c>

In [55]: pyplot.subplot(121)
pyplot.subplot(121) pyplot.subplot(121)

In [55]: pyplot.subplot(121)
Out[55]: <matplotlib.axes.AxesSubplot object at 0xa29342c>

In [56]:
```



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Figure 1

```
Out[49]: -16.997538

In [50]: elev.max()
Out[50]: 1000000.0

In [51]: 1.0e6
Out[51]: 1000000.0

In [52]: elev.mean()
Out[52]: 903907.70889487874

In [53]: elev[elev>9.0e5] = numpy.NAN

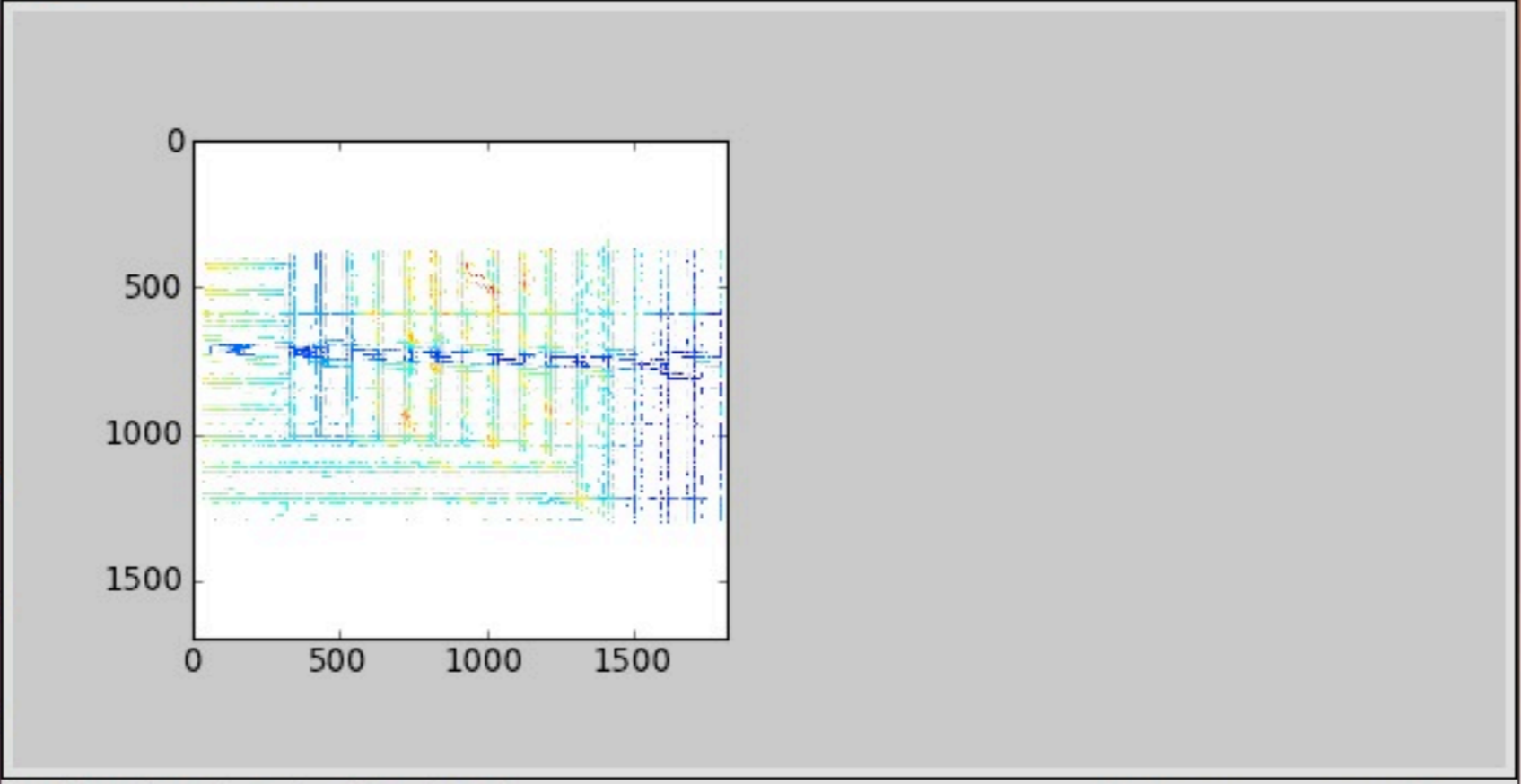
In [54]: pyplot.figure(1)
Out[54]: <matplotlib.figure.Figure object at 0xa5a592c>

In [55]: pyplot.subplot
pyplot.subplot pyplot.subplot


In [55]: pyplot.subplot(121)
Out[55]: <matplotlib.axes.AxesSubplot object at 0xa5a592c>

In [56]: pyplot.imshow(elev)
Out[56]: <matplotlib.image.AxesImage object at 0xa5a592c>

In [57]:
```



x=1312.54 y=667.939


```
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In [56]: pyplot.imshow(elev)
Out[56]: <matplotlib.image.AxesImage object at 0xa5a592c>

In [57]: elev.min()
Out[57]: nan

In [58]: elev.max()
Out[58]: nan

In [59]: elev1d = elev.reshape(elev.size)

In [60]: whos ndarray
Variable  Type      Data/Info
-----
elev      ndarray  1696x1820: 3086720 elems, type `float32`, 12346880 bytes (11 Mb)
elev1d    ndarray  3086720: 3086720 elems, type `float32`, 12346880 bytes (11 Mb)

In [61]: elev1d_finite = [ ]

In [62]: for item in ele
elev      elev1d      elev1d_finite  elev_node

In [62]: for item in elev1d:
.....:     if numpy.isfinite(item):
.....:         elev1d_finite.append(
```



```
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In [62]: for item in elev1d:
.....:     if numpy.isfinite(item):
.....:         elev1d_finite.append(item)
.....:
.....:

In [63]: whos
Variable      Type      Data/Info
-----
bag           File      <HDF5 file "H12279_VB_4m_<...>f1.bag" (mode r+, 23.6M)>
elev         ndarray   1696x1820: 3086720 elems, type `float32`, 12346880 bytes (11 Mb)
elev1d       ndarray   3086720: 3086720 elems, type `float32`, 12346880 bytes (11 Mb)
elev1d_finite list      [-12.401611, -12.359504, <...>, -14.934336, -14.915773]
elev_node    Dataset   <HDF5 dataset "elevation"<...>(1696, 1820), type "<f4">
h5py         module    <module 'h5py' from '/usr<...>on2.7/h5py/__init__.pyc'>
item         float32   nan
metadata     str       <?xml version="1.0"?>\n<s<...>on></smXML:MD_Metadata>\n
metadata_node Dataset   <HDF5 dataset "metadata":<...>hape (4971,), type "|S1">
numpy        module    <module 'numpy' from '/us<...>n2.7/numpy/__init__.pyc'>
pyplot       module    <module 'matplotlib.pyplo<...>7/matplotlib/pyplot.pyc'>
root         Group     <HDF5 group "/BAG_root" (4 members)>

In [64]: elev1d_finite = numpy.array( elev1d_finite )

In [65]: whos ndarra
```


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```
elev1d_finite list [-12.40161
elev_node Dataset <HDF5 data
h5py module <module 'h
item float32 nan
metadata str <?xml vers
metadata_node Dataset <HDF5 data
numpy module <module 'n
pyplot module <module 'p
root Group <HDF5 grou
```

In [64]: elev1d_finite = numpy.array()

In [65]: whos ndarray

Variable	Type	Data/Info
elev	ndarray	1696x1820:
elev1d	ndarray	3086720: 3
elev1d_finite	ndarray	296606: 29

In [66]: 100 * float(len(elev1d) - 1) / len(elev1d)

Out[66]: 90.3909003732117

In [67]: pyplot.subplot(122)

Out[67]: <matplotlib.axes.AxesSubplot object at 0xa5ace8c>

In [68]:

Figure 1

Figure 1 displays two subplots. The left subplot is a heatmap with a y-axis from 0 to 1500 and an x-axis from 0 to 1500. It shows a dense pattern of colored lines (blue, green, yellow, red) with a prominent horizontal blue line at approximately y=700. The right subplot is a blank white square with axes ranging from 0.0 to 1.0 on both the x and y axes.

Out[67]: <matplotlib.axes.AxesSubplot object at 0xa5ace8c>

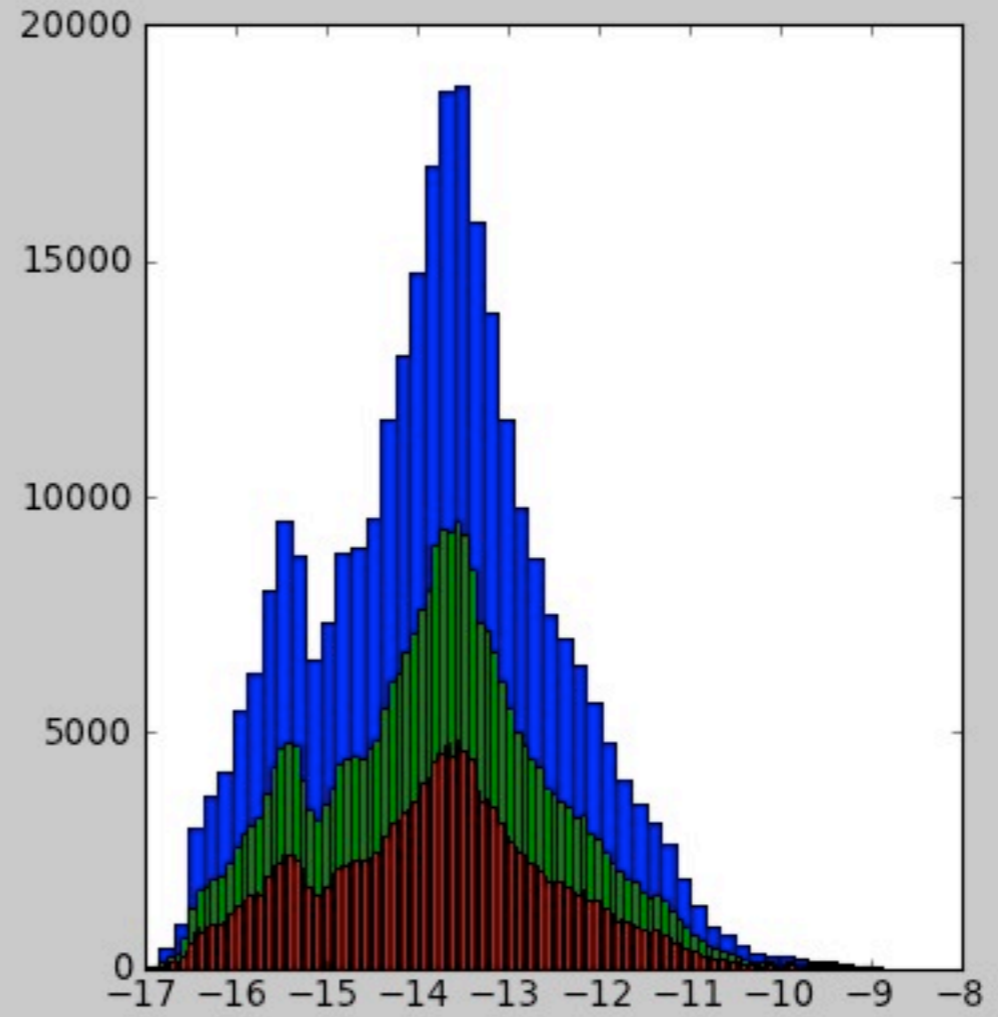
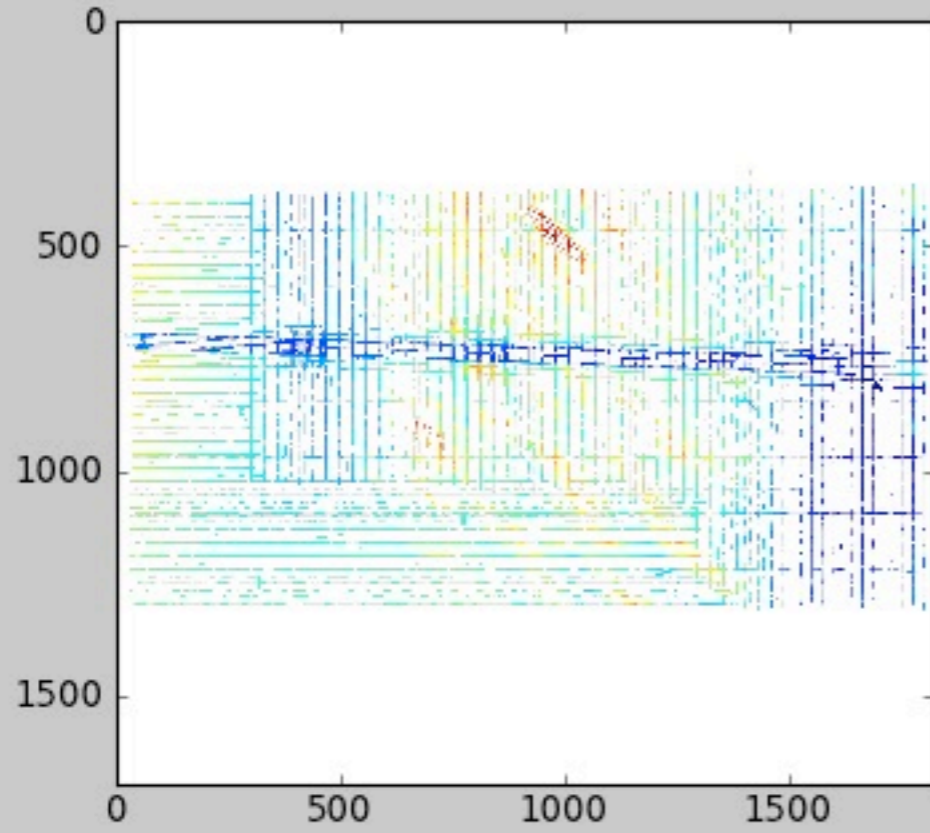
In [68]: pyplot.hist(elev1d_finite, bins=50)

Out[68]:

```
(array([ 64, 430, 964, 2971, 3682, 4194, 5451, 6258, 8005,
        9517, 8730, 6540, 7343, 8806, 8945, 9563, 11631, 12973,
        14778, 16986, 18588, 18695, 15810, 13882, 11646, 9764, 8725,
        7520, 7028, 6451, 5646, 4783, 4031, 3502, 3116, 2657,
        1936, 1318, 918, 707, 470, 313, 265, 273, 187,
        157, 168, 118, 70, 31]),
array([-16.99753761, -16.83523399, -16.67293037, -16.51062675,
        -16.34832314, -16.18601952, -16.0237159 , -15.86141228,
        -15.69910866, -15.53680504, -15.37450142, -15.2121978 ,
        -15.04989418, -14.88759056, -14.72528694, -14.56298332,
        -14.4006797 , -14.23837608, -14.07607246, -13.91376884,
        -13.75146523, -13.58916161, -13.42685799, -13.26455437,
        -13.10225075, -12.93994713, -12.77764351, -12.61533989,
        -12.45303627, -12.29073265, -12.12842903, -11.96612541,
        -11.80382179, -11.64151817, -11.47921455, -11.31691093,
        -11.15460732, -10.9923037 , -10.83000008, -10.66769646,
        -10.50539284, -10.34308922, -10.1807856 , -10.01848198,
        -9.85617836, -9.69387474, -9.53157112, -9.3692675 ,
        -9.20696388, -9.04466026, -8.88235664]),
<a list of 50 Patch objects>)
```

In [69]: pyplot.hist(elev1d_finite, bins=50)

Figure 1



x=-12.0819 y=8190.05



```
-10.66769646, -10.62712055, -10.58654465, -10.54596874,  
-10.50539284, -10.46481693, -10.42424103, -10.38366512,  
-10.34308922, -10.30251331, -10.26193741, -10.2213615 ,  
-10.1807856 , -10.14020969, -10.09963379, -10.05905788,  
-10.01848198, -9.97790607, -9.93733017, -9.89675426,  
-9.85617836, -9.81560246, -9.77502655, -9.73445065,  
-9.69387474, -9.65329884, -9.61272293, -9.57214703,  
-9.53157112, -9.49099522, -9.45041931, -9.40984341,  
-9.3692675 , -9.3286916 , -9.28811569, -9.24753979,  
-9.20696388, -9.16638798, -9.12581207, -9.08523617,  
-9.04466026, -9.00408436, -8.96350845, -8.92293255, -8.88235664]),
```

<a list of 200 Patch objects>

In [71]: elevld_finite.min()

Out[71]: -16.997538

In [72]: elevld_finite.max()

Out[72]: -8.8823566

In [73]: elevld_finite.mean()

Out[73]: -13.79857116848614

In [74]: elevld_finite.std()

Out[74]: 1.300281743814951

In [75]:

-17 -16 -15 -14

