Reproducible Research with Jupyter

April 15, 2015

1 Working with the notebook

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$$\dot{x} = \sigma(y - x)$$
$$\dot{y} = \rho x - y - xz$$
$$\dot{z} = -\beta z + xy$$

In [1]:
```
4 + 5
```

Out[1]: 9

In [2]:
```
x = 4
y = 3
```

In [3]:
```
print('The sum of {} and {} is {}.'.format(x, y, x + y))
```

```
The sum of 4 and 3 is 7.
```

In [4]:
```
def sum(x, y):
    return x + y
```

In [5]:
```
sum(3, 2)
```

Out[5]: 5

2 Example: Explorative analysis of grid frequency time series

In [6]:
```
PURPLE = (107.0/255, 36.0/255, 124.0/255)
FREQUENCY_COLOR = (16.0/255, 192.0/255, 225.0/255)

FREQUENCY_FILE = 'path-to-file/file'
```

In [7]:
```
import pandas as pd
%matplotlib inline
import seaborn as sns
```

In [8]:
```
freq = pd.read_hdf(FREQUENCY_FILE, '/frequency')
print('Index of time series: {} to {}.'.format(freq.index[0], freq.index[-1]))
print('Time resolution of time series: {}.'.format(freq.index.freq))
print('Size of time series: {:.2f} MB.'.format(freq.nbytes / 1024 / 1024))
```

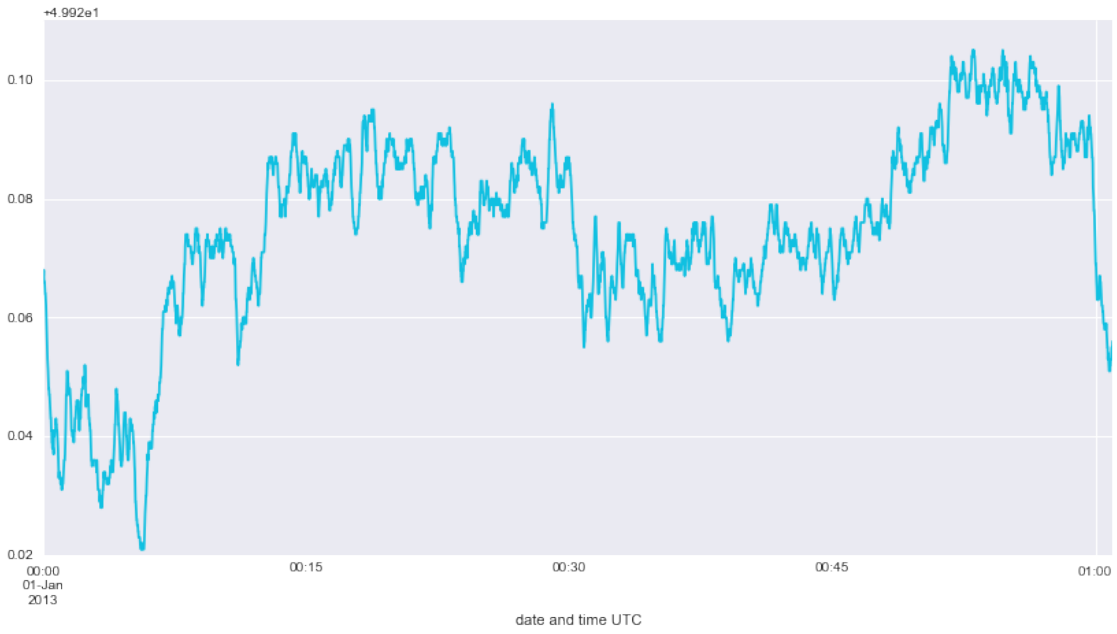
```
Index of time series: 2012-01-01 00:00:00+00:00 to 2013-12-31 23:59:59+00:00.
Time resolution of time series: <Second>.
Size of time series: 481.86 MB.
```

```
In [9]: freq.describe()
```

```
Out[9]: count    63158400.000000
        mean           49.999966
        std             0.021858
        min            49.849000
        25%            49.986000
        50%            50.000000
        75%            50.014000
        max            50.145000
        Name: grid frequency in Hz, dtype: float64
```

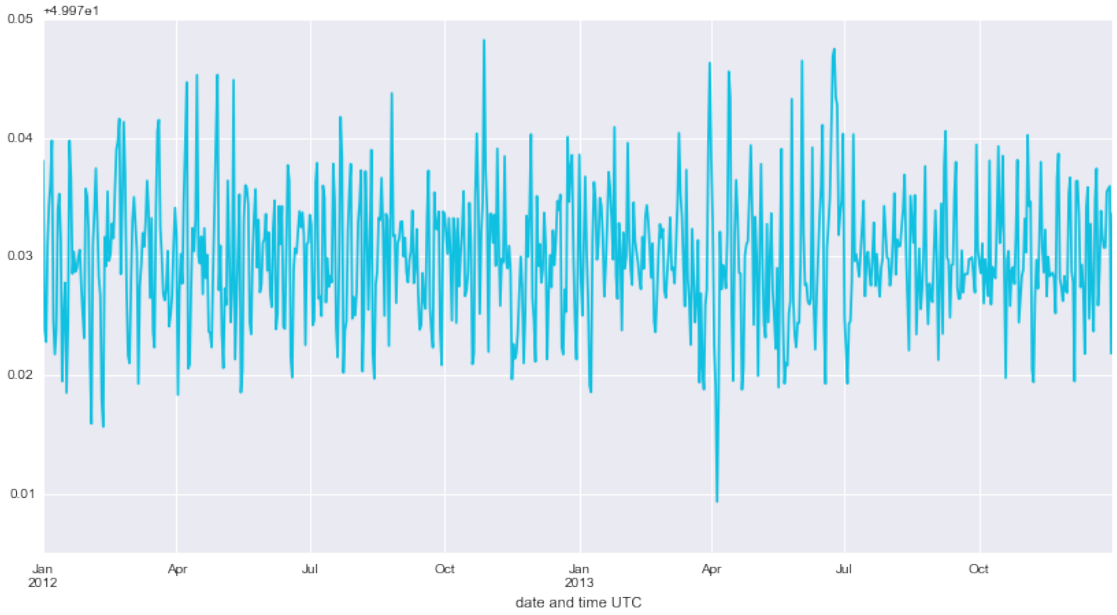
```
In [10]: freq['2013-01-01':'2013-01-01 01:00'].plot(figsize=(14,7), color=FREQUENCY_COLOR)
```

```
Out[10]: <matplotlib.axes._subplots.AxesSubplot at 0x8e62c88>
```



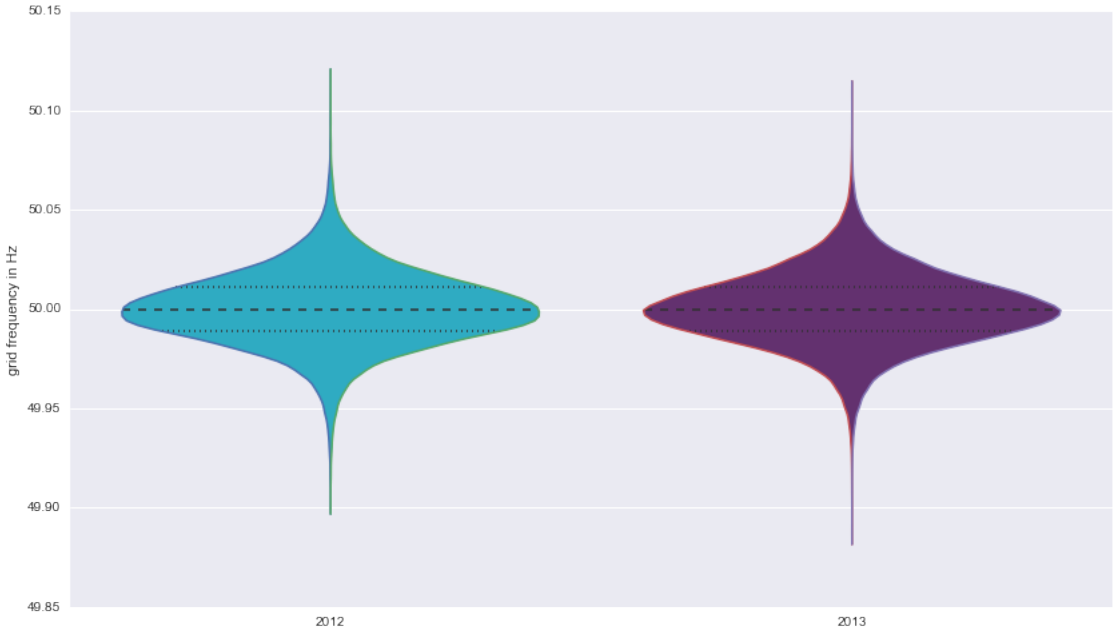

```
In [11]: freq.resample('D').plot(figsize=(14,7), color=FREQUENCY_COLOR)
```

```
Out[11]: <matplotlib.axes._subplots.AxesSubplot at 0x8eaf3c8>
```




```
In [12]: sns.set(rc={"figure.figsize": (14, 8)})
         sns.violinplot(freq.resample('10Min'), groupby=lambda x : x.year, color=[FREQUENCY_COLOR, PURPL
```

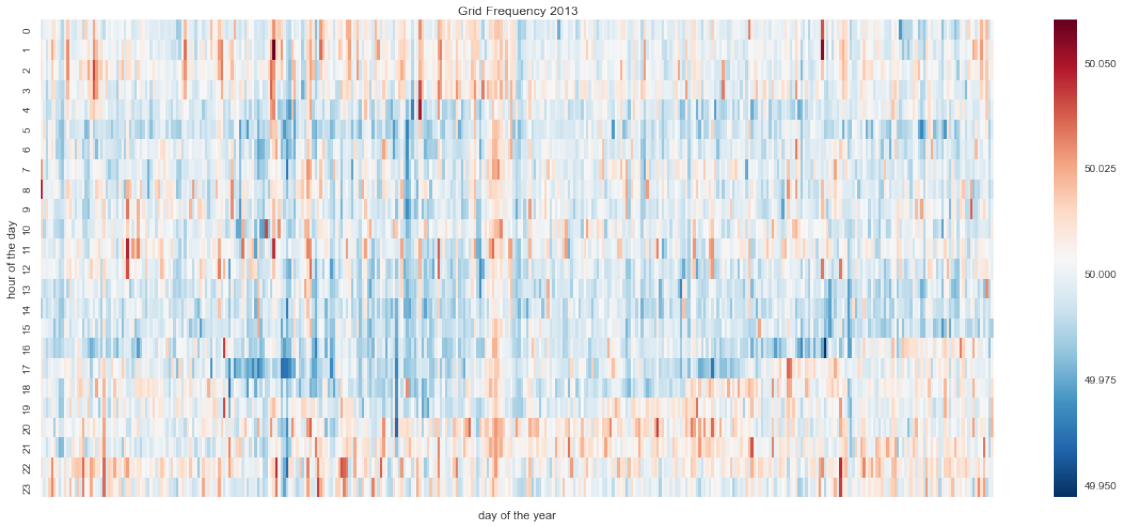
```
Out[12]: <matplotlib.axes._subplots.AxesSubplot at 0x9458710>
```




```
In [13]: freq_per_hour = pd.DataFrame(freq['2013'].resample('H'))
         freq_per_hour['hour'] = [x.hour for x in freq_per_hour.index]
```

```
freq_per_hour['day'] = [x.dayofyear for x in freq_per_hour.index]
freq_per_hour = freq_per_hour.pivot("hour", "day", "grid frequency in Hz")
sns.set(rc={"figure.figsize": (20, 8)})
ax = sns.heatmap(freq_per_hour, xticklabels=False, linewidths=0, cmap="RdBu_r")
ax.xaxis.set_label_text('day of the year')
ax.yaxis.set_label_text('hour of the day')
ax.set_title('Grid Frequency 2013')
```

Out[13]: <matplotlib.text.Text at 0x984ab70>



3 Meta data

```
In [14]: %load_ext watermark
         %watermark
```

```
15/04/2015 13:53:10

CPython 3.4.2
IPython 3.1.0

compiler   : MSC v.1600 64 bit (AMD64)
system     : Windows
release    : 7
machine    : AMD64
processor  : Intel64 Family 6 Model 58 Stepping 9, GenuineIntel
CPU cores  : 4
interpreter: 64bit
```

4 The Notebook

- Use cases
  - scientist's notebook

  - interactive course material including assignments
  - writing papers
- Export to
  - latex
  - markdown
  - pdf
  - html
  - slideshow
- Supported languages:
  - Python
  - Julia
  - R
  - Octave
  - Matlab
  - Haskell
  - Perl
  - Ruby
  - Erlang
  - ...

5 The Project

Evolved from the IPython project

- 2001: `IPython 0.0.1` first release
- 2011: `IPython 0.12` first release including notebook
- 2013: `IPython 1.0` first official release
- 2015: `IPython 3.0` last monolithic release

Project Jupyter succeeds `IPython 3`'s language agnostic parts in different modules.

- `http://jupyter.org/`
- Try it online: try.jupyter.org
- Installation of the current version can be done easiest with Python Scientific Distribution Anaconda