EPOS-N
EUROPEANPLATEOBSERVINGSYSTEM - NORWAY

Enlighten-Web
- data visualization tool and virtual research environment

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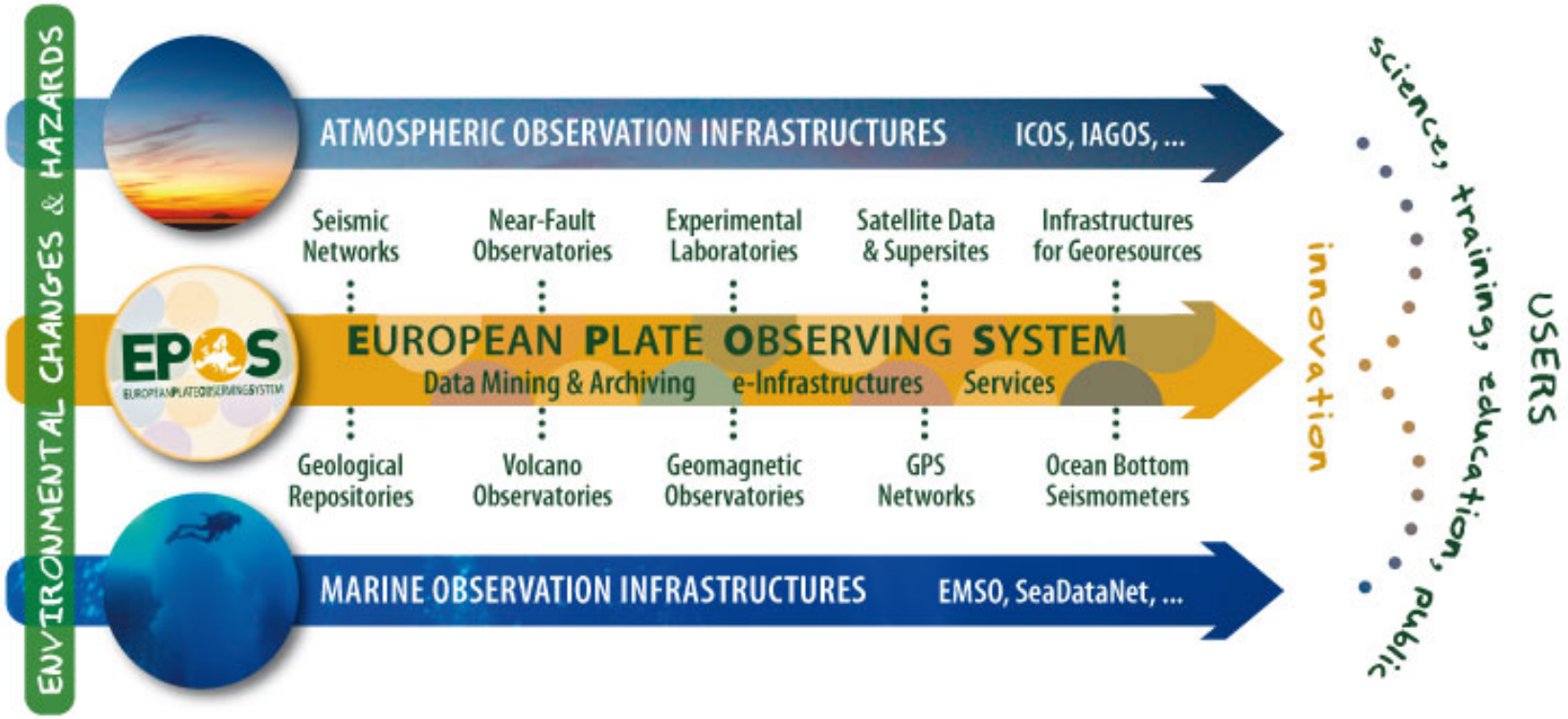
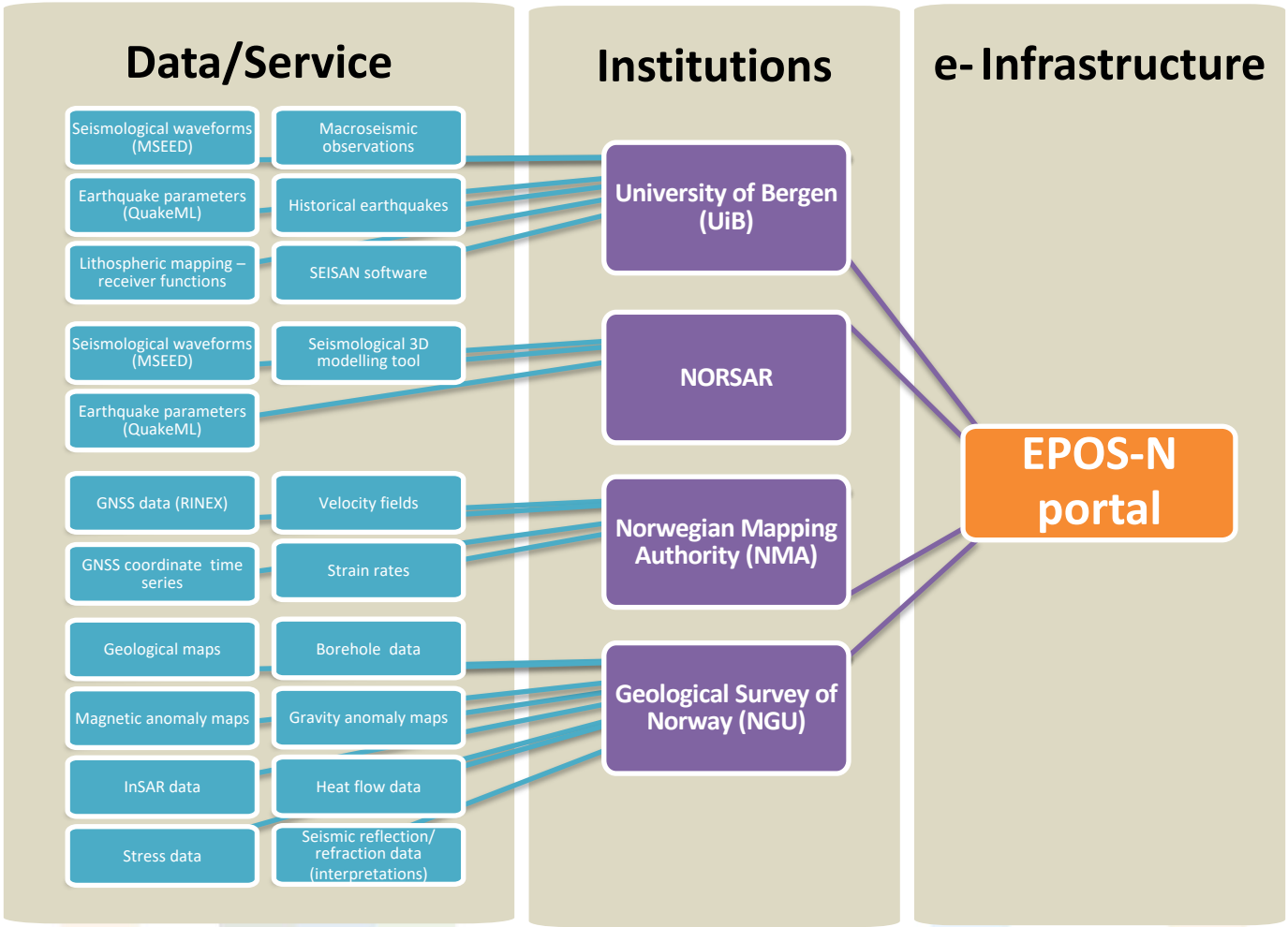
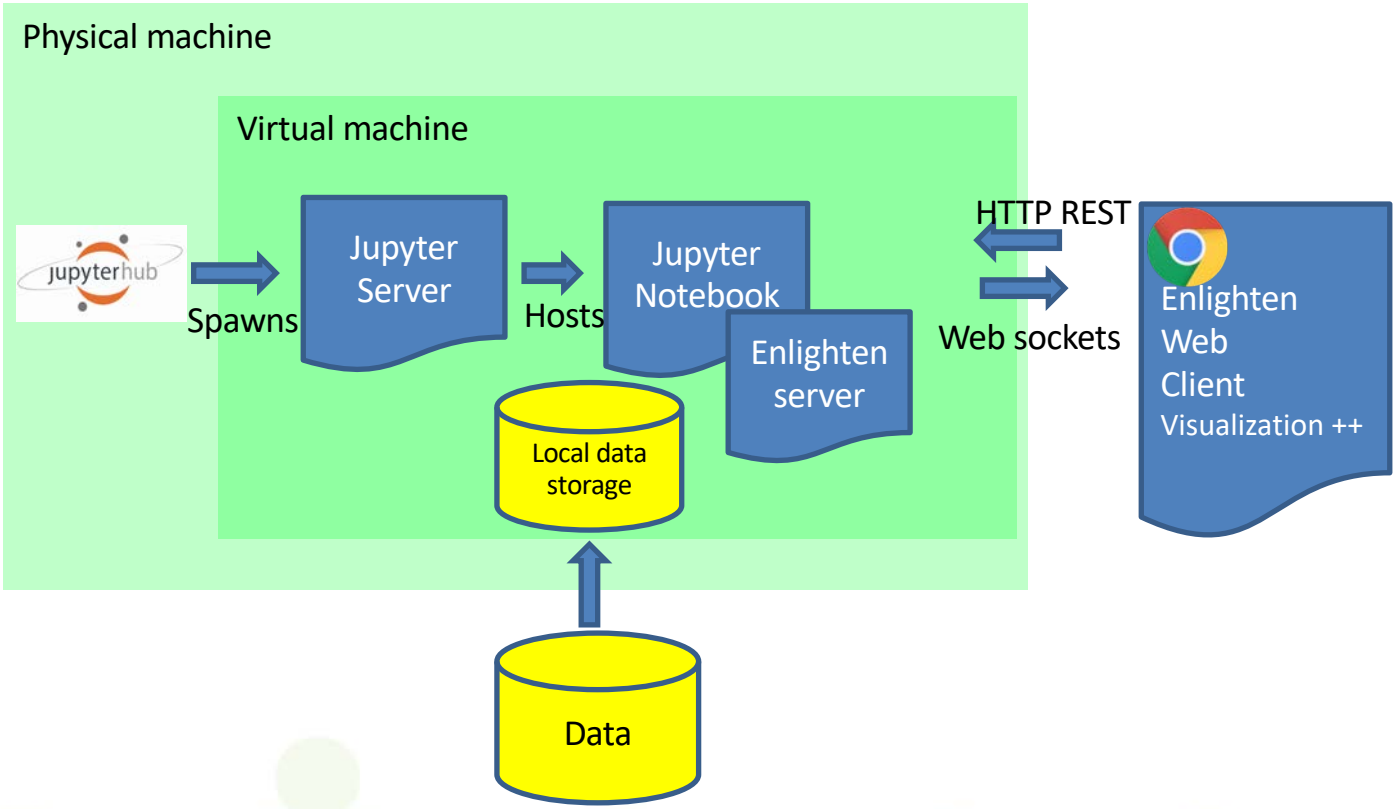
EPOS and other e-infrastructures



EPOS-N project

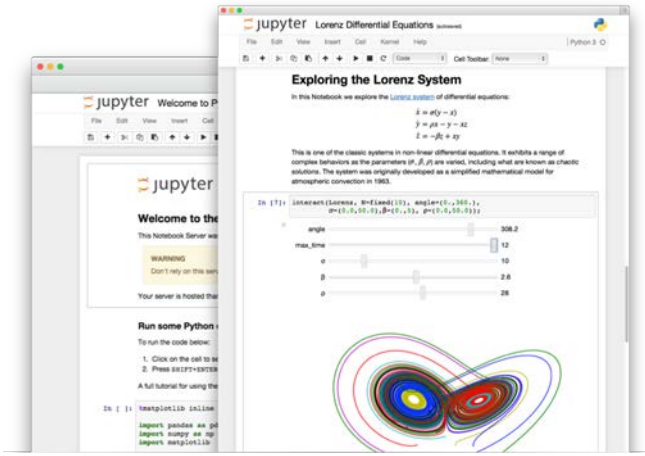


Enlighten-Web VRE

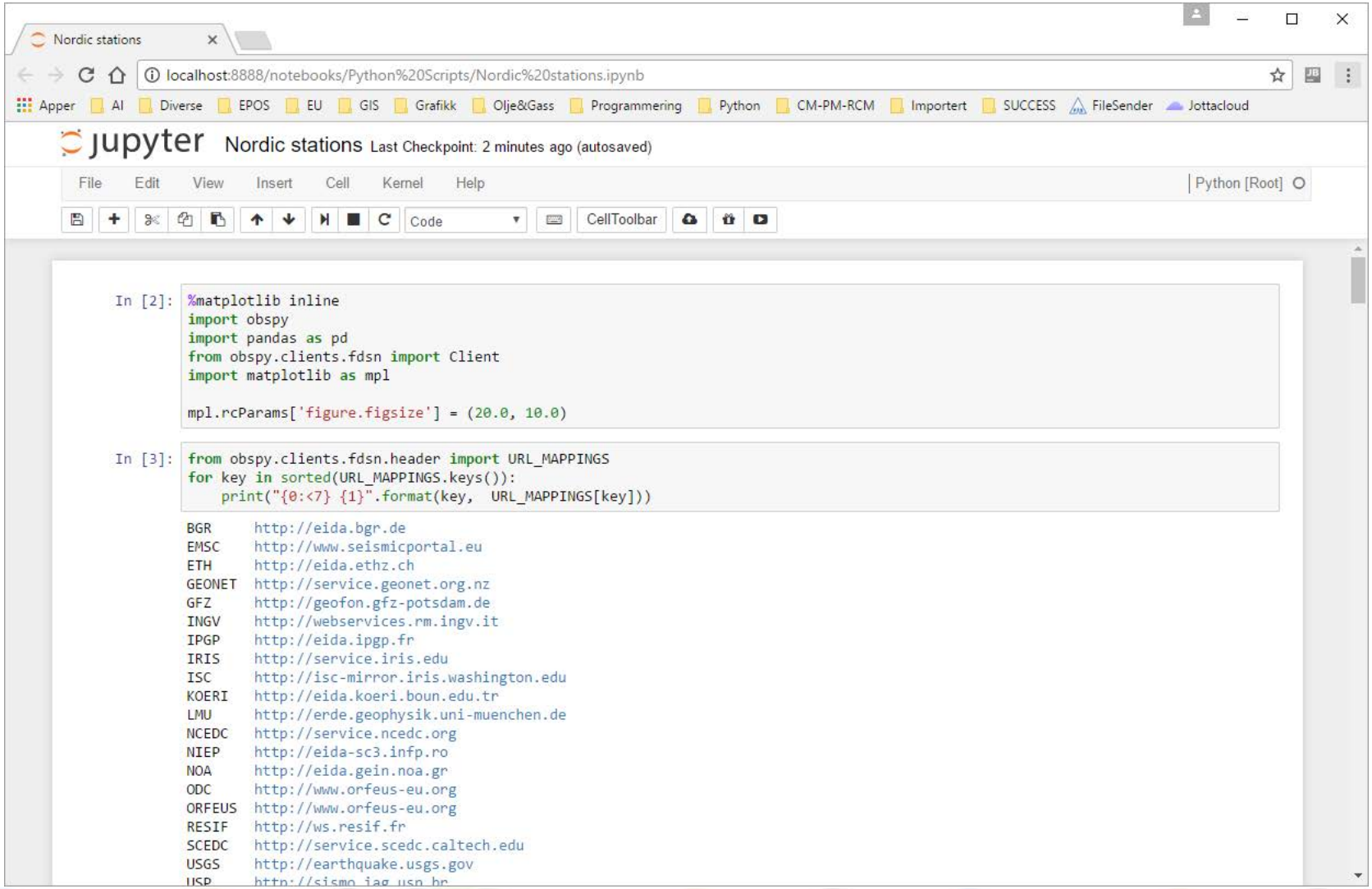


Jupyter notebook

- A web application that allows you to create and share documents that contain live code, equations, visualizations and explanatory text or presentations
- Enables programming from a web-browser in programming language by choice
  - Python, R, C++, Fortran
- Code runs on server



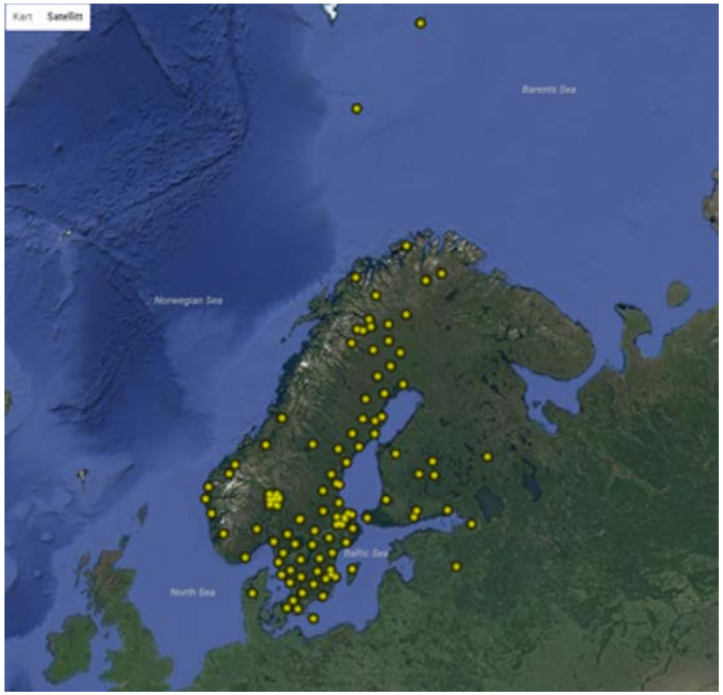
Notebook example



Notebook example cont.

```
In [20]: orfeus = Client("ORFEUS")
         stations = orfeus.get_stations(minlongitude=3, minlatitude=54, maxlongitude=32, maxlatitude=81)

         gfz = Client("GFZ")
         stations += gfz.get_stations(network="UP,HE,DK")

         print (stations)
```

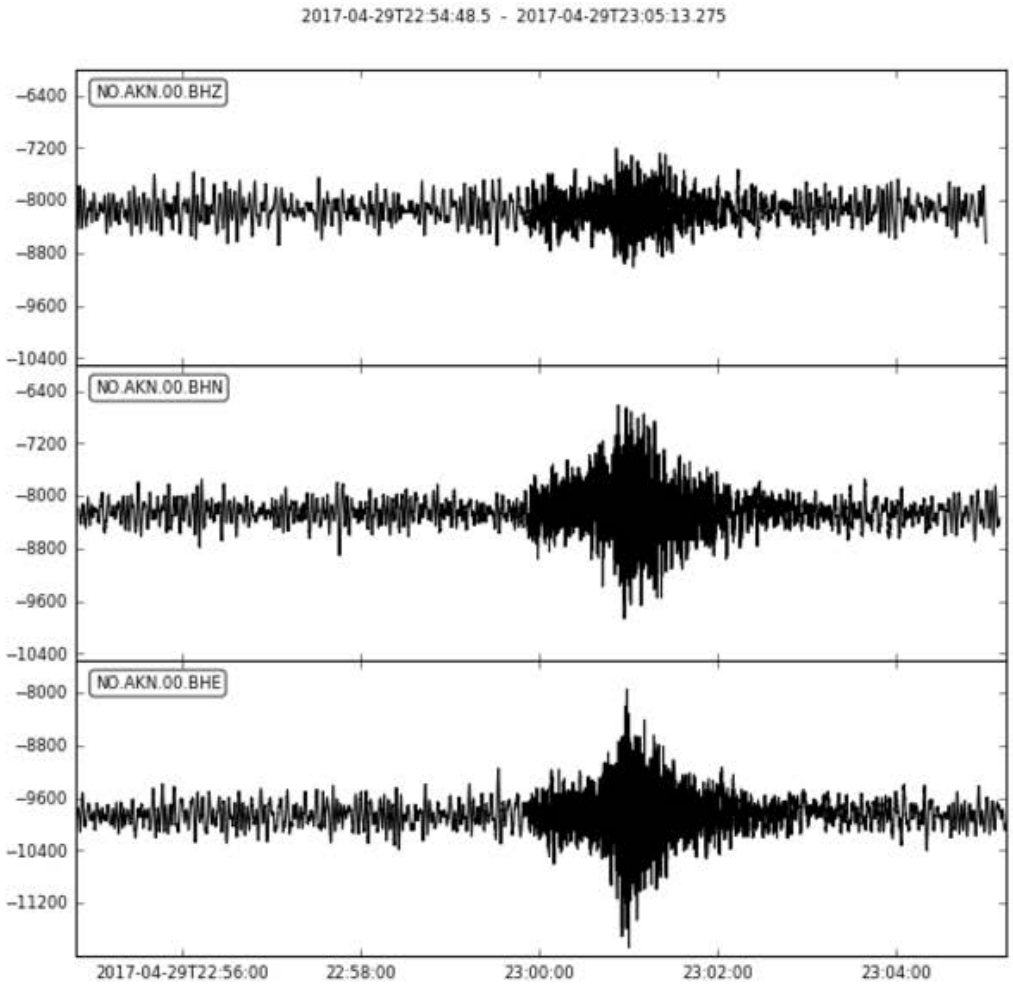
```
Inventory created at 2017-05-18T09:14:26.000000Z
        Sending institution: SeisComP3 (ODC)
        Contains:
                Networks (6):
                        HF
                        IU
                        NO
                        NR
                        NS
                        UP
                Stations (55):
                        HF.HFC2 (HFC2)
                        HF.HFSC2 (old Hagfors Array Site)
                        IU.KBS (Ny-Alesund, Spitzbergen, Norway)
                        IU.KEV (Kevo, Finland)
                        IU.KONO (Kongsberg, Norway)
                        NO.AKN (Aaknes, Norway)
                        NO.ARE0 (ARE0)
                        NO.NAO01 (NORSAR ARRAY SITE 01A01)
                        NO.NAO03 (NORSAR ARRAY SITE 01A03)
                        NO.NB201 (NORSAR ARRAY SITE 02B01)
                        NO.NB204 (NORSAR ARRAY SITE 02B04)
                        NO.NBO00 (NORSAR ARRAY SITE 01B00)
                        NO.NBO03 (NORSAR ARRAY SITE 01B03)
                        NO.NC203 (NORSAR ARRAY SITE 02C03)
                        NO.NC204 (NORSAR ARRAY SITE 02C04)
                        NO.NC301 (NORSAR ARRAY SITE 03C01)
                        NO.NC303 (NORSAR ARRAY SITE 03C03)
```



Notebook example cont.

In [43]:
```
from obspy import UTCDateTime
t1 = UTCDateTime("2017-04-29T22:55:00")
st = orfeus.get_waveforms("NO", "AKN", "*", "*", t1, t1+10*60)
```

In [44]:
```
st.plot()
```



Notebook example cont.

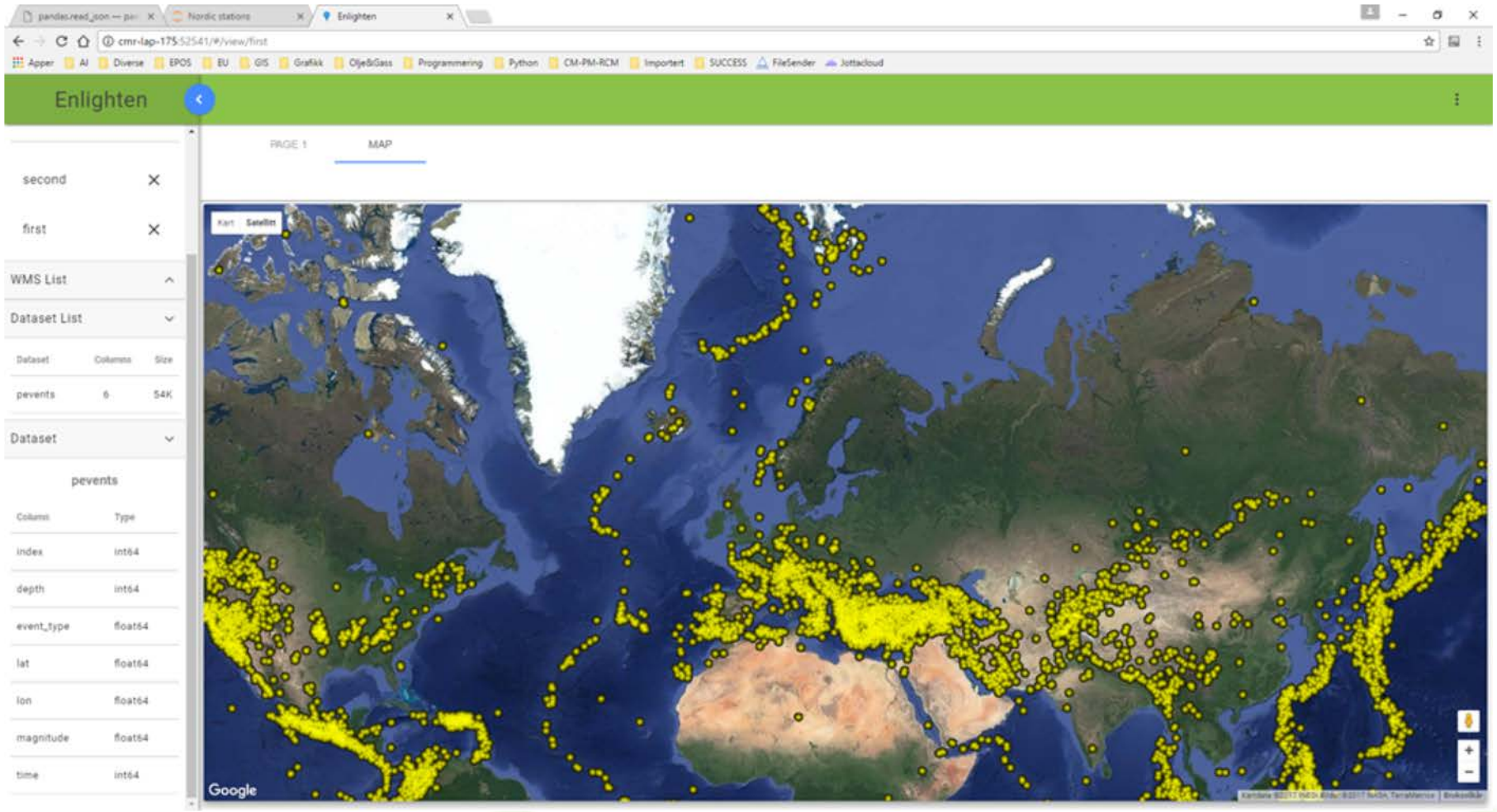
In [12]:
```
import pandas as pd
import matplotlib as mpl

import obspy
from obspy.clients.fdsn import Client
emsc = Client('EMSC')

from obspy import Catalog
events = Catalog()

from obspy import UTCDateTime
t0 = UTCDateTime("2016-05-01T00:00:00.000")
t1 = UTCDateTime("2017-05-18T00:00:00.000")
dt = 3*24*60*60
```

Query events from EMSC. Need to split in shorter time spans for each query because of limitations on responce size

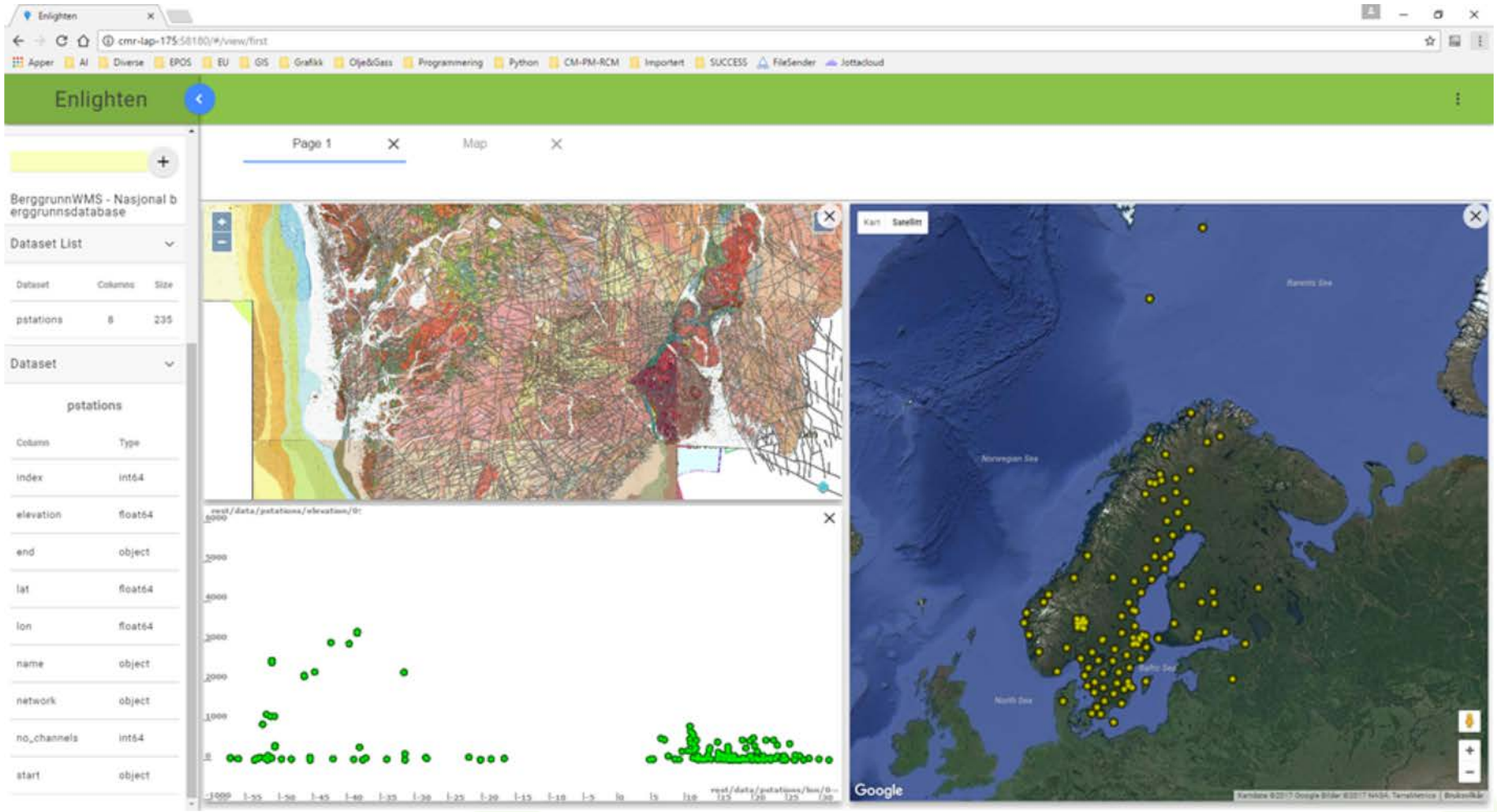
In [13]:
```
while True:
    ev_period = emsc.get_events( t0,t0+dt )
    events += ev_period
    print(t0, ", len = ", len(ev_period))

    t0+=dt
    if t0 >= t1:
        break
```

```
2016-05-18T00:00:00.000000Z , len =  388
2016-05-21T00:00:00.000000Z , len =  406
2016-05-24T00:00:00.000000Z , len =  380
2016-05-27T00:00:00.000000Z , len =  416
2016-05-30T00:00:00.000000Z , len =  378
2016-06-02T00:00:00.000000Z , len =  426
```

Enlighten-Web visualization of seismic events



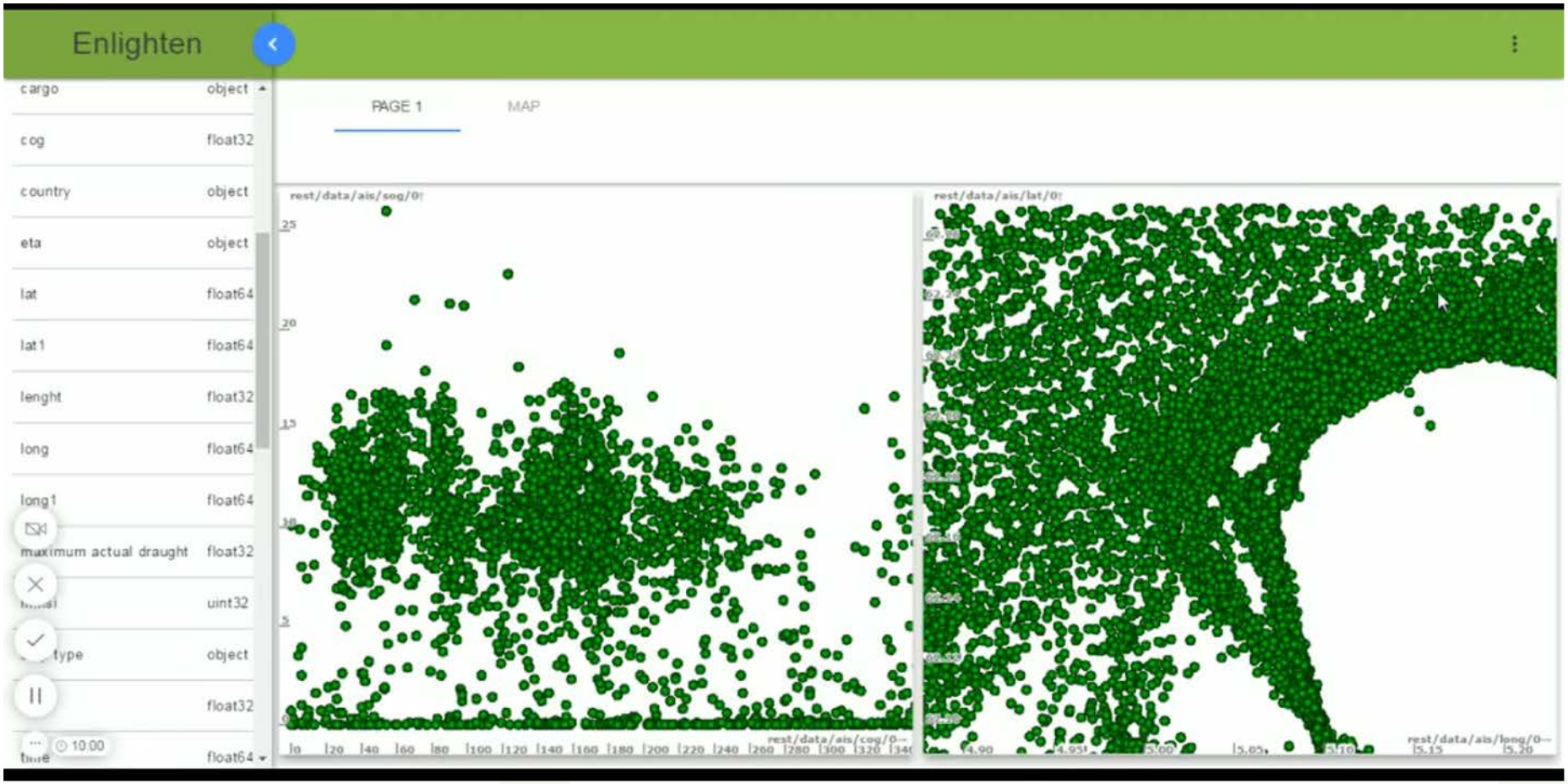
The Enlighten-web client for visualization



Enlighten-web features

- Interactive real-time visualization linked to a dynamic programming interface
- Effective visualization of large multidimensional data sets
- Interactive mapping of millions of points
- Explorative visualization, e.g. for extracting trends and outliers in the data
- Confirmative visualization for analysis of hypotheses
- Brushing and linking

Brushing and linking



Jupyter Notebooks

- Seismology
  - http://krischer.github.io/seismo_live/

- A gallery of interesting Jupyter Notebooks
  - https://github.com/jupyter/jupyter/wiki/A-gallery-of-interesting-Jupyter-Notebooks

Feedback

- https://goo.gl/forms/W0nDOGfm2T2nD6pW2
- Reward – lottery
  - Wed morning

And now let's do some work!