

```
In [28]: import numpy as np
import statistics as sts
from matplotlib import pyplot as plt
import time
import math
import multiscale_online_quantile as mq
import multiscale_online_shift_quantile as msq
%matplotlib inline
```

Sudent change detect

create sudden change data

the length of the data is 10000, first change happens at 3001, second change happens at 7001

```
In [11]: data= mq.sudden_drift_data(initial=0.8,final=0.4,
change1 = 3001,change2 = 7001,total_time=10000)
```

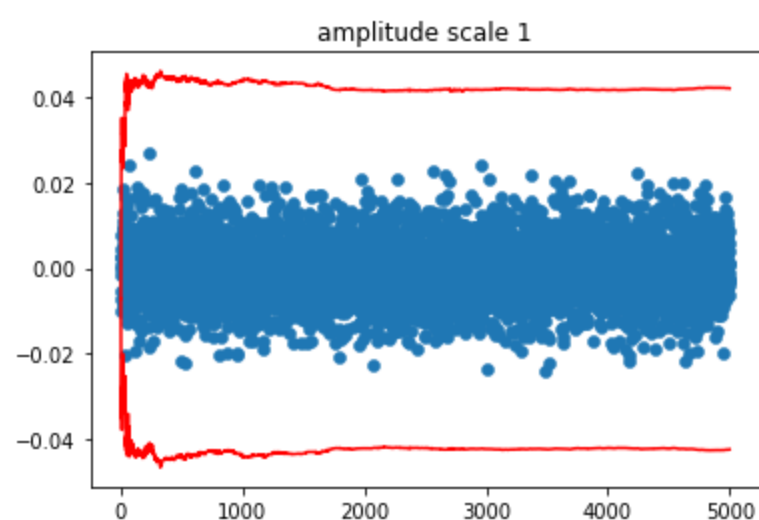
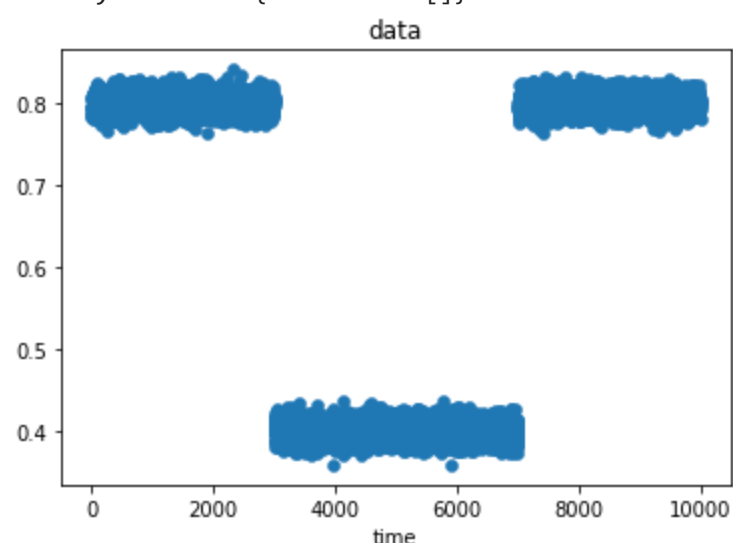
multiscale online detect

compare time for each single scale

```
In [49]: test = mq.conststest
threshold = 4
min_scale = 1
max_scale = 1

start = time.time()
a, lower, upper, anomalyInterval = mq.multiscale_online_minmax(data, test, threshold, min_scale, max_scale)
end = time.time()
fig = mq.plot_amplitudes(data, a, lower, upper, min_scale, max_scale)
print('time : {}'.format(end - start))
print('anomalyInterval : {}'.format(anomalyInterval))
```

```
time : 4.5242979526519775
anomalyInterval : {'level 1': []}
```

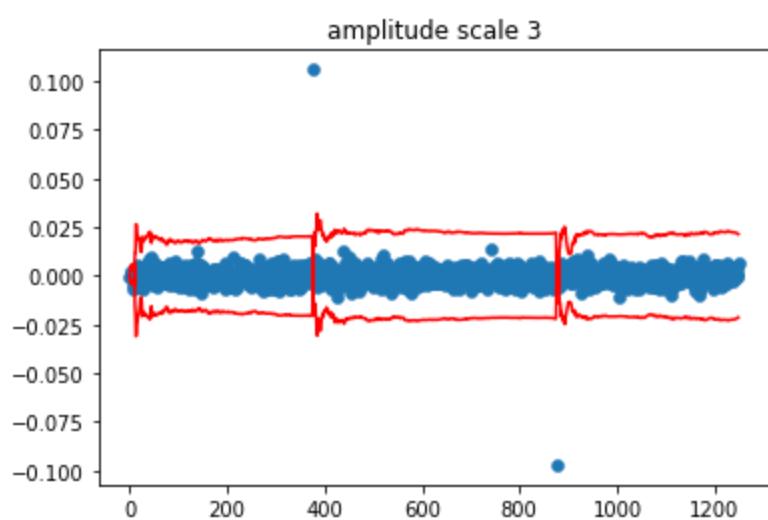
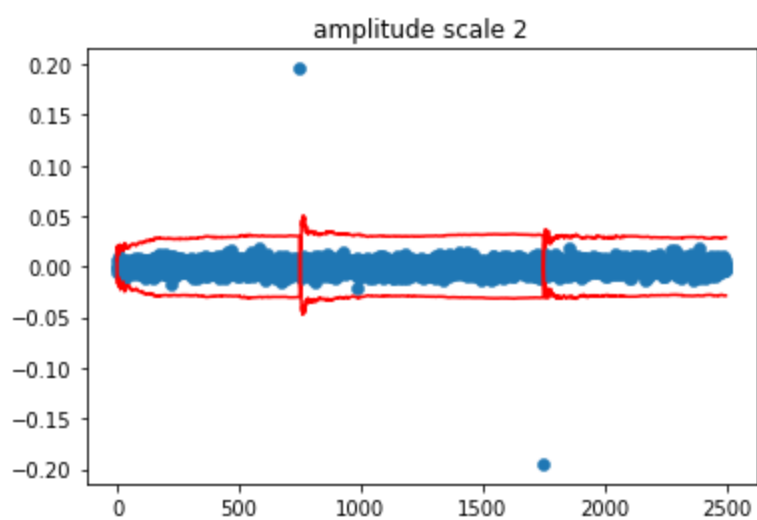
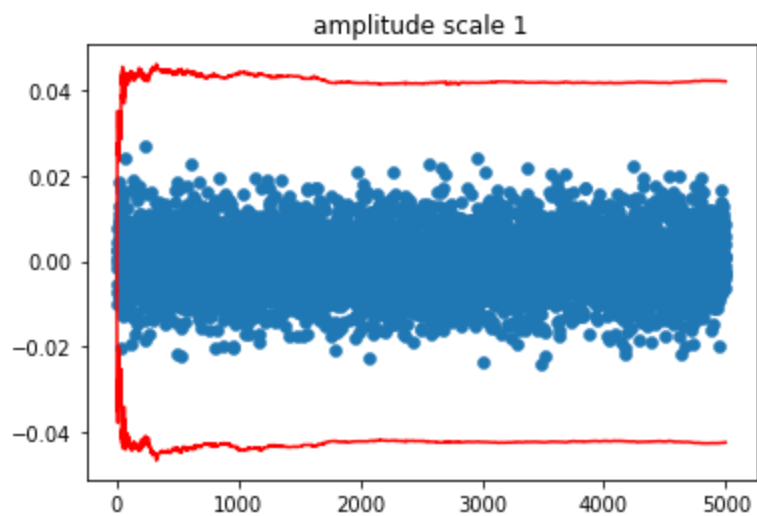
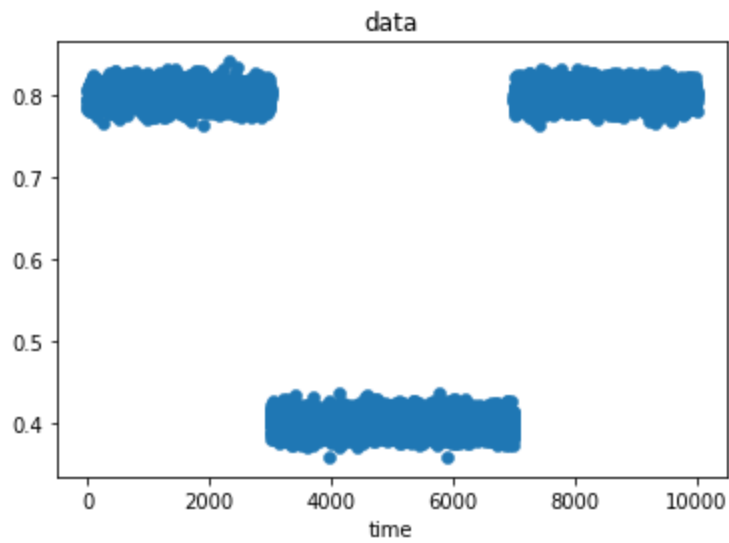


scale	1	2	3	4	5	6	7	8	9	10
time	4.57	1.40	0.66	0.30	0.16	0.11	0.05	0.03	0.024	0.016

```
In [52]: test = mq.conststest
threshold = 4
min_scale = 1
max_scale = 3
start = time.time()
a, lower, upper, anomalyInterval = mq.multiscale_online_minmax(data, test, threshold,
min_scale, max_scale)
end = time.time()
fig = mq.plot_amplitudes(data, a, lower, upper, min_scale, max_scale)
print('time : {}'.format(end - start))
print('anomalyInterval : {}'.format(anomalyInterval))
```

```
ANOMALY: scale: 3, partition: [72,80], amplitude: -0.0064238550099490616, lower: -0.004898652291075459, upper: 0.005642998971183824
ANOMALY: scale: 2, partition: [3000,3004], amplitude: 0.19561092116518972, lower: -0.03005825748618729, upper: 0.030039617188681866
ANOMALY: scale: 3, partition: [3000,3008], amplitude: 0.10600963192223604, lower: -0.02042396058701054, upper: 0.020210436868728584
ANOMALY: scale: 2, partition: [7000,7004], amplitude: -0.19472925343203554, lower: -0.030569306691149656, upper: 0.03103640270966803
ANOMALY: scale: 3, partition: [7000,7008], amplitude: -0.09712997390558854, lower: -0.02207512620240725, upper: 0.02213329731900269
```

ANOMALY: scale: 3, partition: [7040,7048], amplitude: -0.005933743397977628, lower: -0.005326414997513587, upper: 0.0063599191328072
 43
 time : 6.828397512435913
 anomalyInterval : {'level 1': [], 'level 2': [[3000, 3004], [7000, 7004]], 'level 3': [[72, 80], [3000, 3008], [7000, 7008], [7040, 7048]]}



multiscale shift online detect

compare time for each single scale

In [48]:

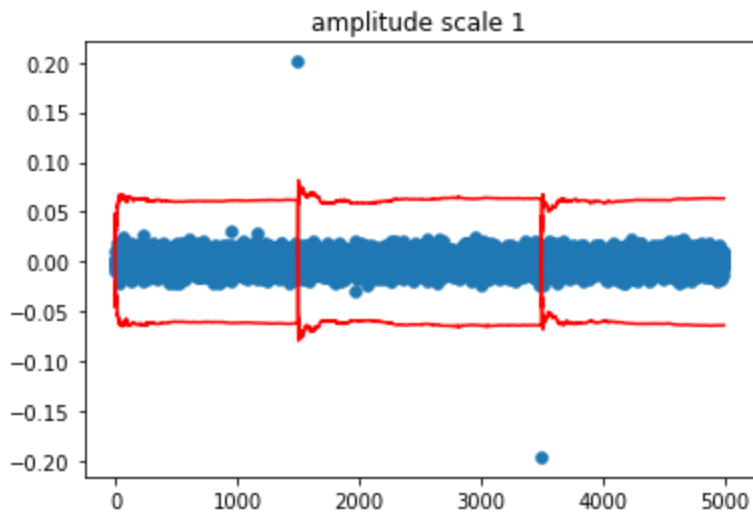
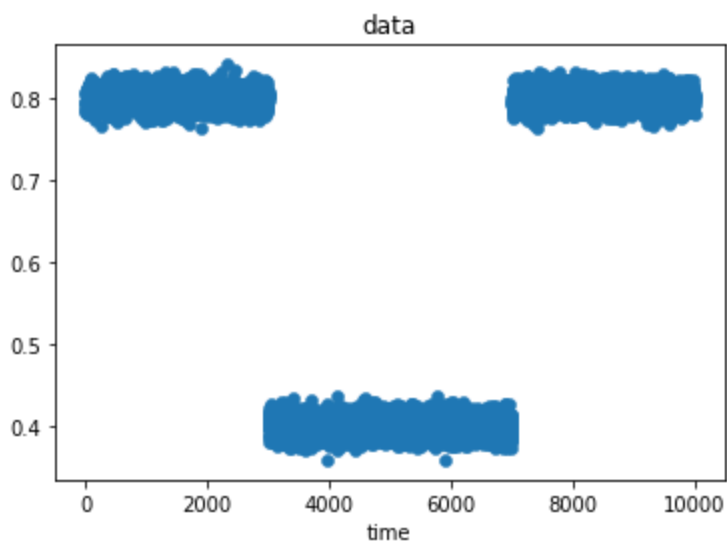
```
test = msq.contstest
threshold = 4
min_scale = 1
max_scale = 1

start = time.time()
a, lower, upper, anomalyInterval = msq.multiscale_online_shift_minmax(data, test, threshold,
                                                                    min_scale, max_scale)

end = time.time()
fig = msq.plot_amplitudes(data, a, lower, upper, min_scale, max_scale)

print('time : {}'.format(end - start))
print('anomalyInterval : {}'.format(anomalyInterval))
```

ANOMALY: scale: 1, partition: [3001,3003], amplitude: 0.20097701065925094, lower: -0.06169185925995613, upper: 0.06170176659515453
 ANOMALY: scale: 1, partition: [7001,7003], amplitude: -0.19564377387281318, lower: -0.06391221132416187, upper: 0.06378021548933448
 time : 3.9160237312316895
 anomalyInterval : {'level 1': [[3001, 3003], [7001, 7003]]}



scale	1	2	3	4	5	6	7	8	9	10
time	3.90	1.96	1.14	0.7	0.56	0.60	0.68	0.82	1.05	1.48

In [44]:

```

test = msq.contstest
threshold = 4
min_scale = 1
max_scale = 3

start = time.time()
a, lower, upper, anomalyInterval = msq.multiscale_online_shift_minmax(data, test, threshold,
                                                                    min_scale, max_scale)

end = time.time()
fig = msq.plot_amplitudes(data, a, lower, upper, min_scale, max_scale)

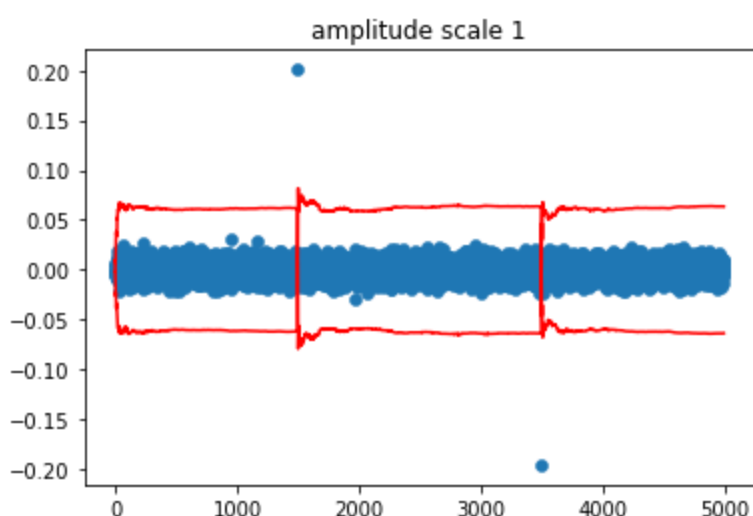
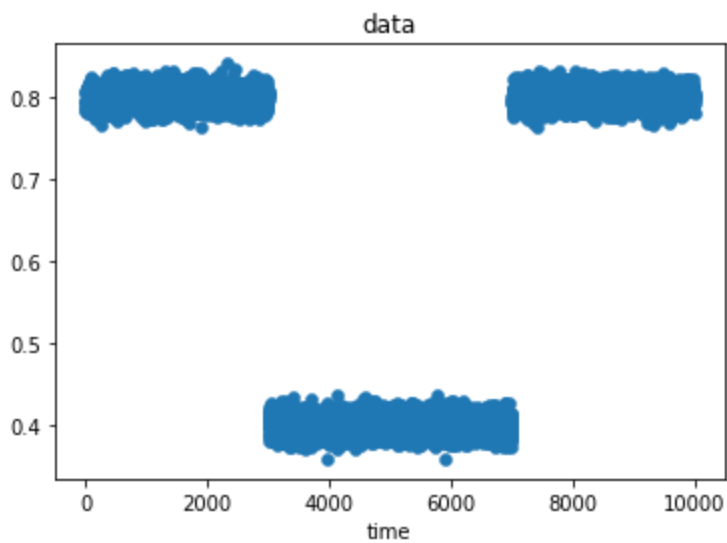
print('time : {}'.format(end - start))
print('anomalyInterval : {}'.format(anomalyInterval))

```

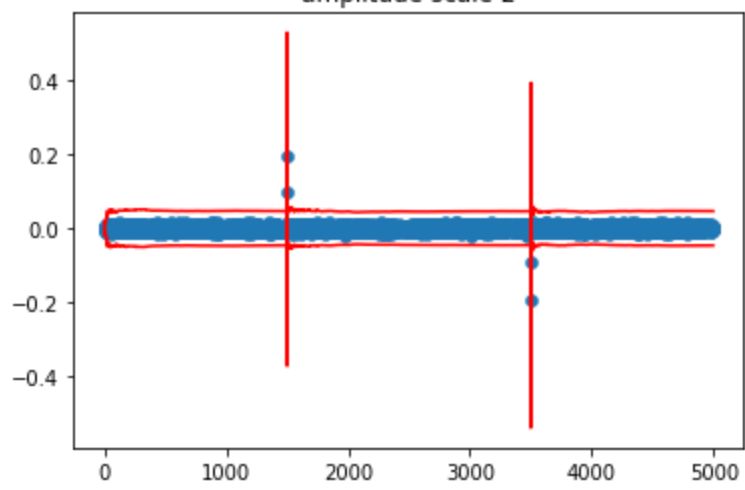
```

ANOMALY: scale: 1, partition: [3001,3003], amplitude: 0.20097701065925094, lower: -0.061682893396597174, upper: 0.06169236114636531
ANOMALY: scale: 2, partition: [2999,3003], amplitude: 0.09826857188839166, lower: -0.045984441796574224, upper: 0.04579179102904696
ANOMALY: scale: 3, partition: [2995,3003], amplitude: 0.049953159498443894, lower: -0.030642917580713625, upper: 0.03069446331546422
6
ANOMALY: scale: 1, partition: [7001,7003], amplitude: -0.19564377387281318, lower: -0.06391221132416187, upper: 0.06378021548933448
ANOMALY: scale: 2, partition: [6999,7003], amplitude: -0.09332460949362989, lower: -0.045689540116676454, upper: 0.04574487472486822
ANOMALY: scale: 3, partition: [6995,7003], amplitude: -0.05000787744102518, lower: -0.031691686251096154, upper: 0.03184045456032498
5
time : 11.161432027816772
anomalyInterval : {'level 1': [[3001, 3003], [7001, 7003]], 'level 2': [[2999, 3003], [6999, 7003]], 'level 3': [[2995, 3003], [6995,
7003]]}

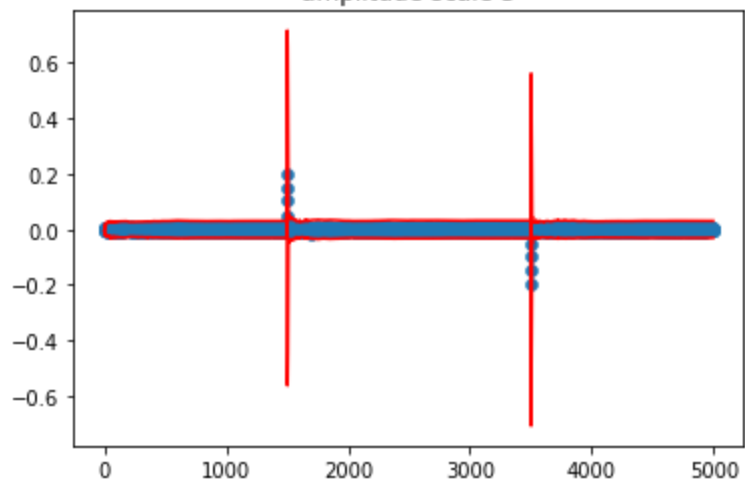
```



amplitude scale 2



amplitude scale 3



Compare the multiscale online method and multiscale shift online method

method	scale	1	2	3	4	5	6	7	8	9	10
multiscale online	time	4.57	1.40	0.66	0.30	0.16	0.11	0.05	0.03	0.024	0.016
multiscale shift online	time	3.90	1.96	1.14	0.7	0.56	0.60	0.68	0.82	1.05	1.48

In []: