vis_multispec

June 15, 2020

1 Visualização dos dados multiespectrais

[3]:
```
from datetime import datetime
from os import listdir
from os.path import isfile, join

import os
import random

import glob

import numpy as np
import pandas as pd

import matplotlib.pyplot as plt
import matplotlib
import seaborn as sns

import concurrent.futures

from osgeo import gdal
import rasterio # the GEOS-based raster package
from rasterio import plot as rioplot
import numpy # the array computation library
import geopandas # the GEOS-based vector package
from libtiff import TIFF
from cv2 import *
```

[4]:
```
%matplotlib inline
```

[9]:
```
SAMPLE_INSTANCE = "c160418tscrfl_nfung_64"
FOLDER_SAMPLE =  "RAW/crop_tsc_2016_b2s"
```

[10]:
```
def print_histogram(im):
    plt.hist(im, bins='auto')
    plt.title("Histogram")
    plt.show()
```

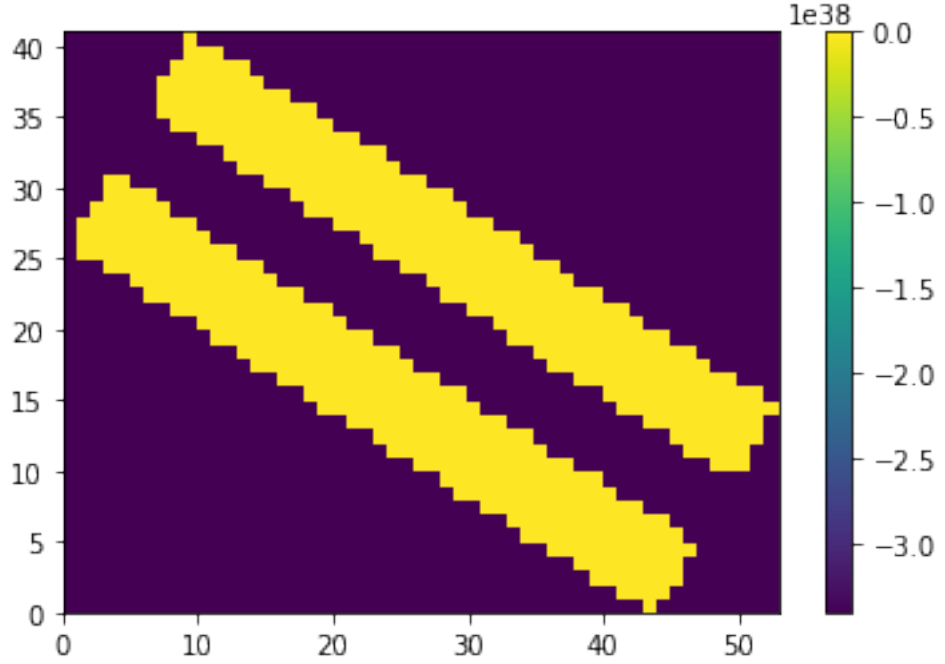
```
    plt.close()
```

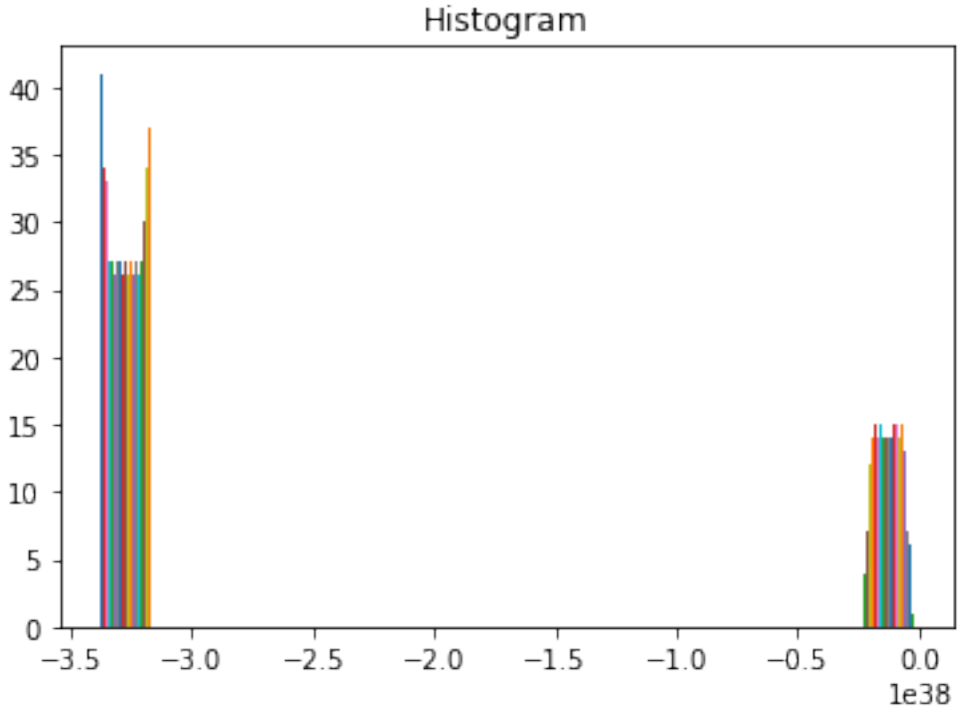
[20]:
```
def remove_less_than_zero(mat):
    mat[mat < 0] = np.NaN
    mat[mat == np.NaN] = 0
    return mat
```

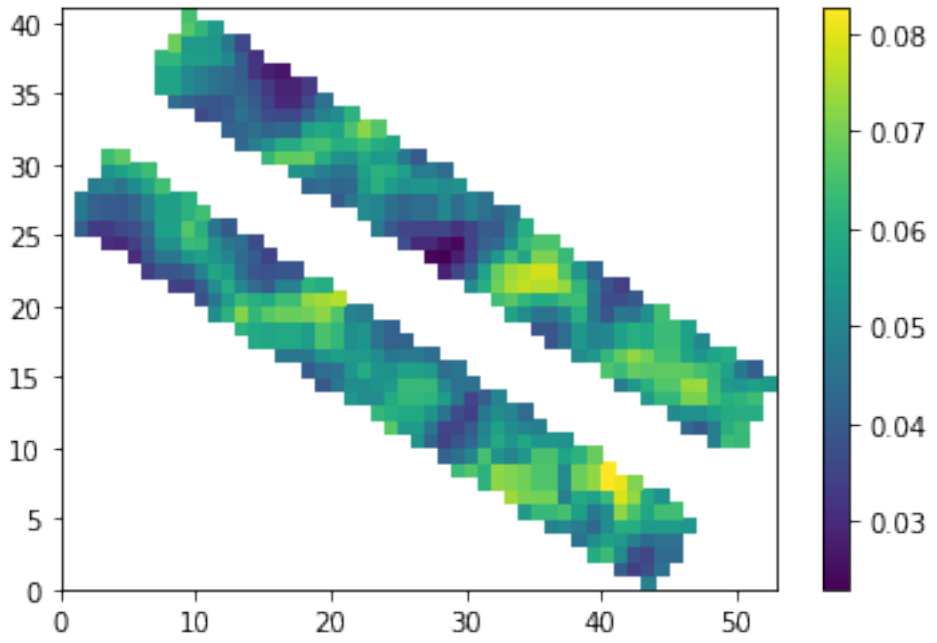
1.1 LibTIFF

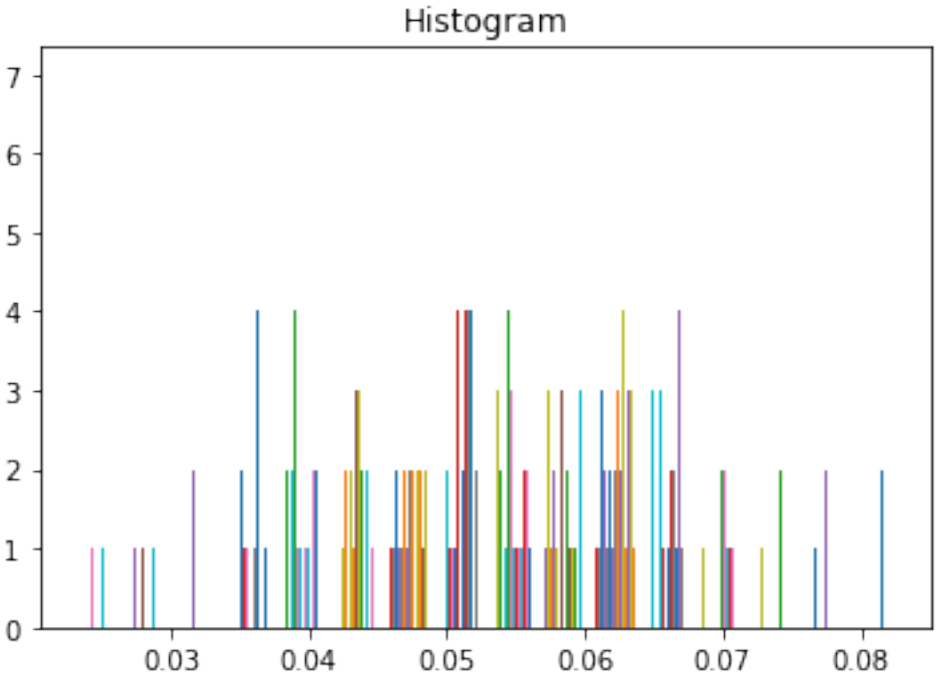
[21]:
```
def open_with_libtiff():
    for band in ['B1', 'B2', 'B3', 'B4']:
        print('Opening band', band)
        image = TIFF.open(os.path.join('data', FOLDER_SAMPLE,
                                       SAMPLE_INSTANCE + '_' + band
                                       + '.tif'))
        image = image.read_image()
        print(image.shape)
        plt.pcolormesh(image)
        plt.pcolormesh(image)
        plt.colorbar()
        plt.show()
        plt.close()
        print_histogram(image)

        image = remove_less_than_zero(image)
        plt.pcolormesh(image)
        plt.colorbar()
        plt.show()
        plt.close()
        print_histogram(image)

open_with_libtiff()
```

```
Opening band B1
(41, 53)
```

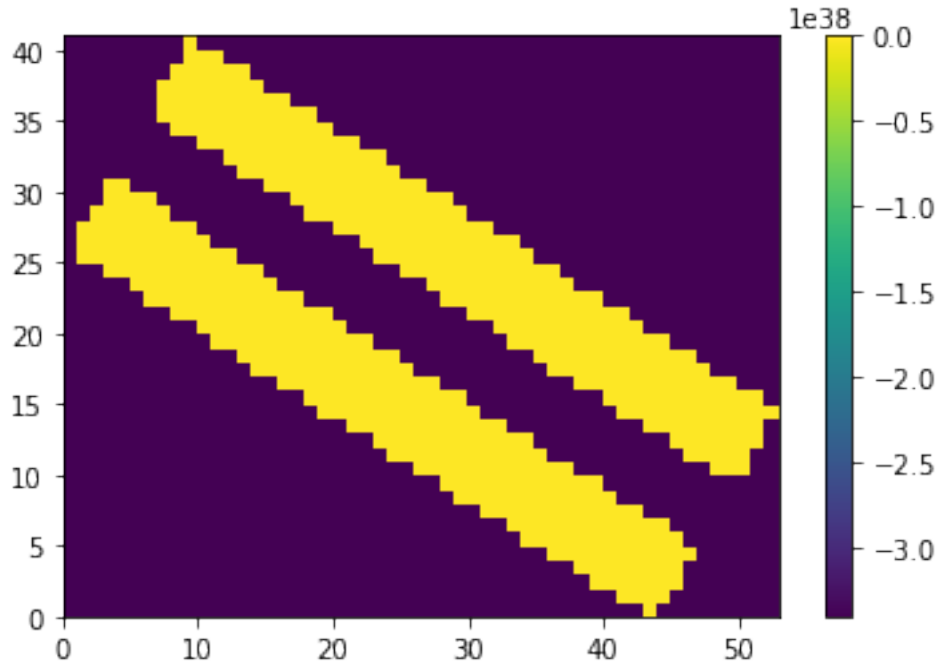

1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50

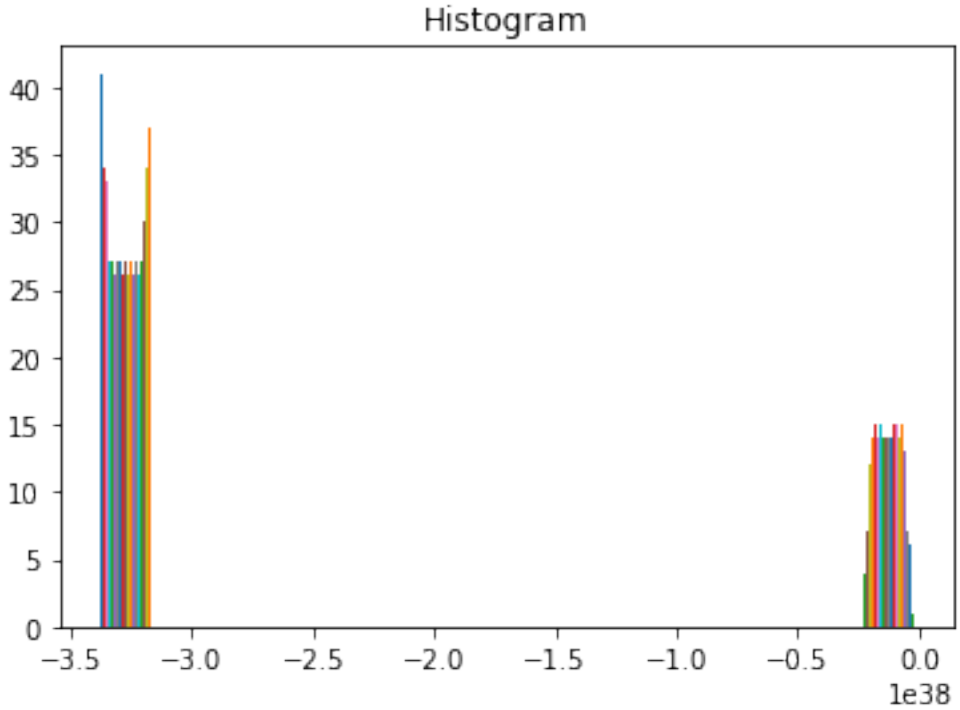

Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

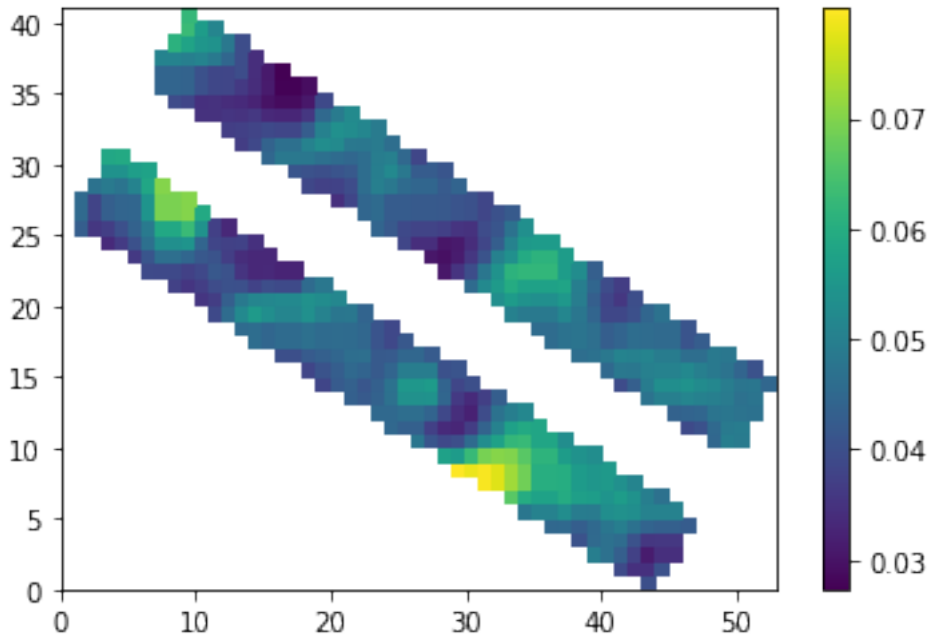


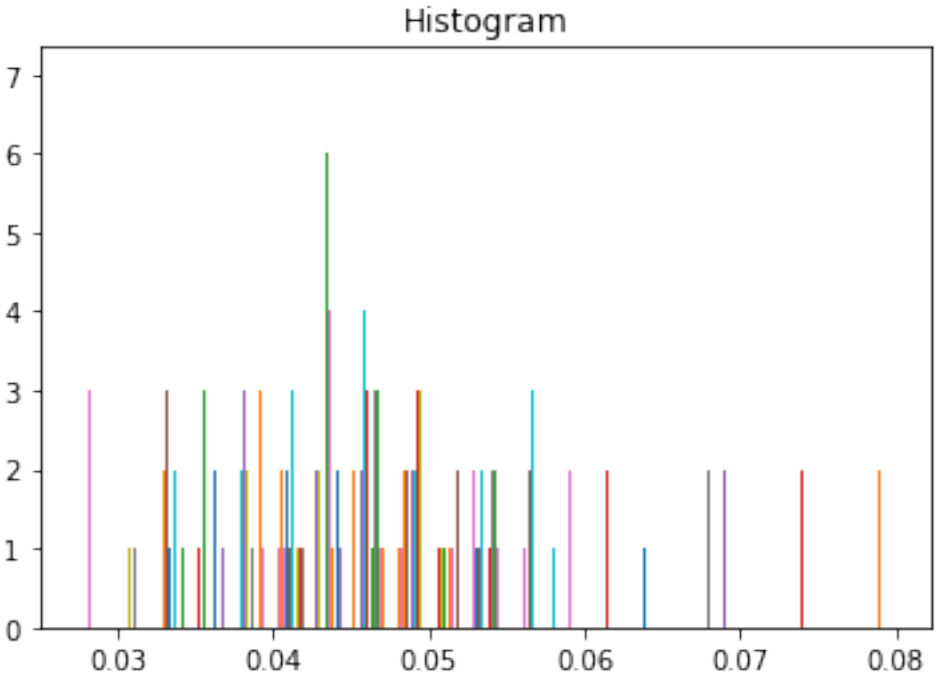



```
Opening band B2
(41, 53)
```

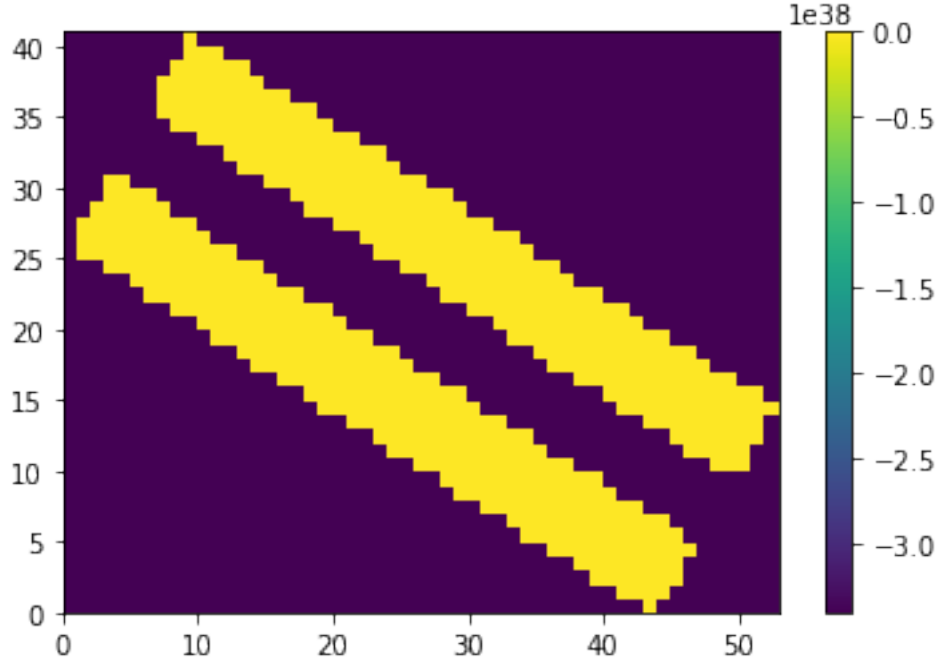

1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50

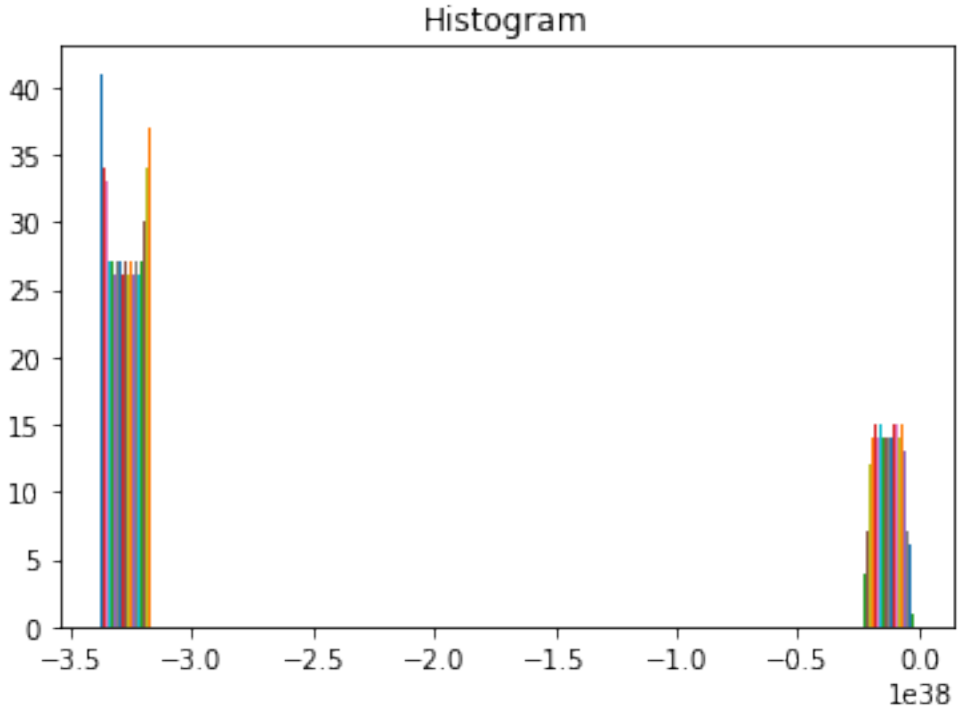

Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

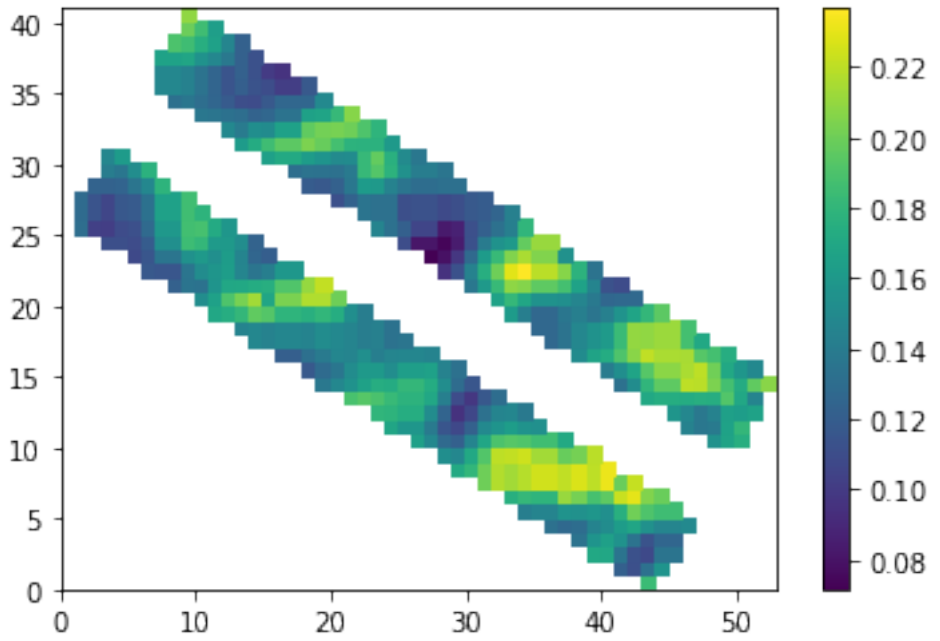


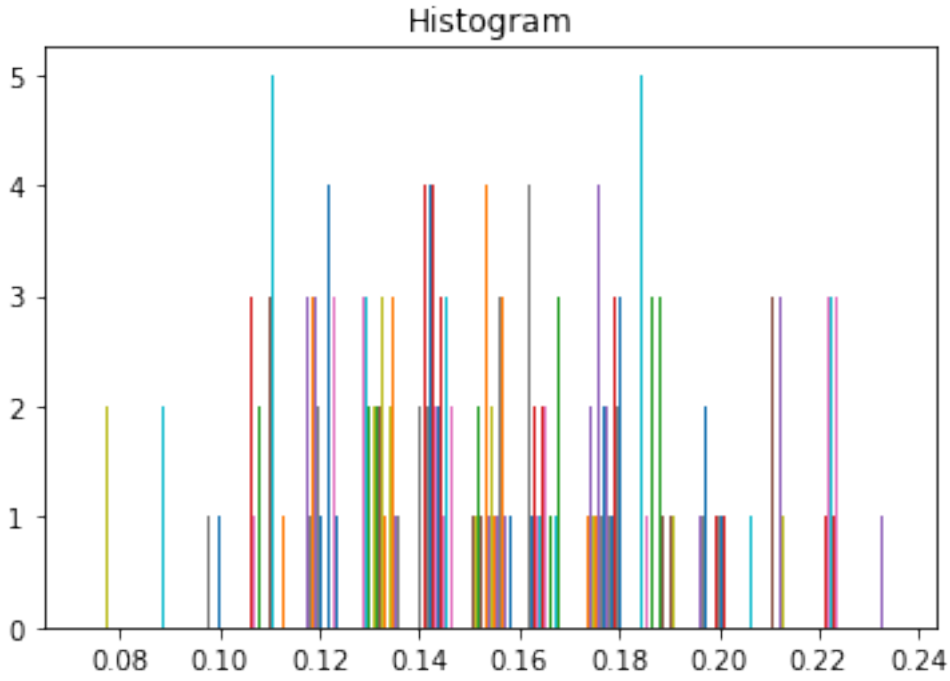



```
Opening band B3
(41, 53)
```

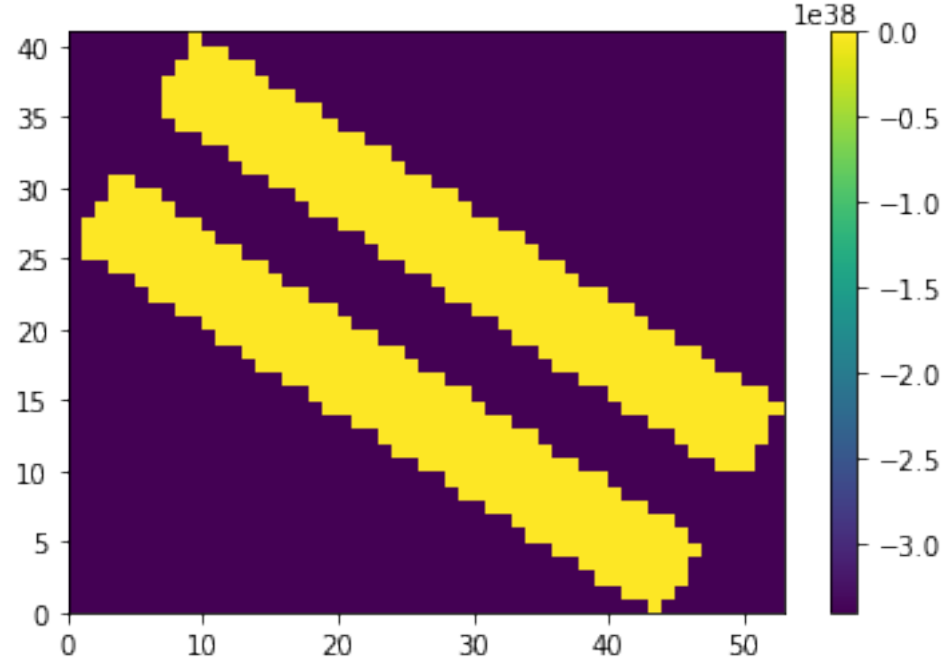

1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50

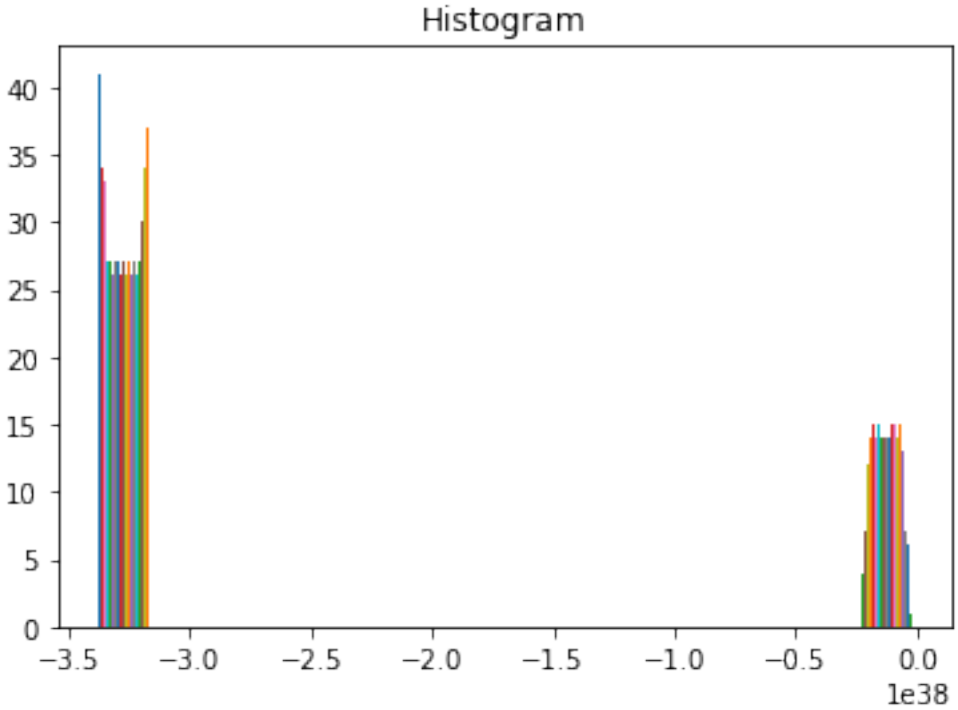

Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

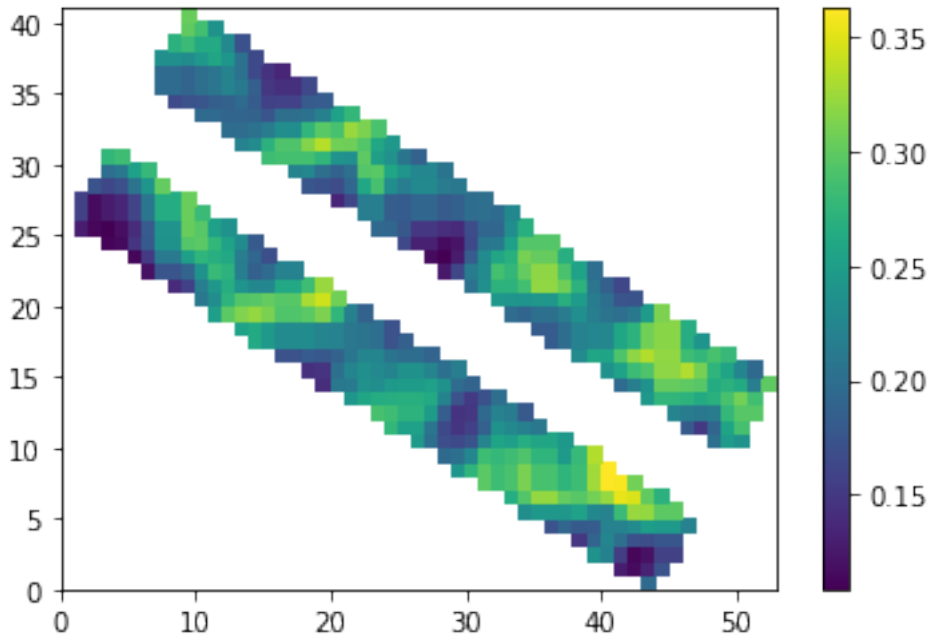


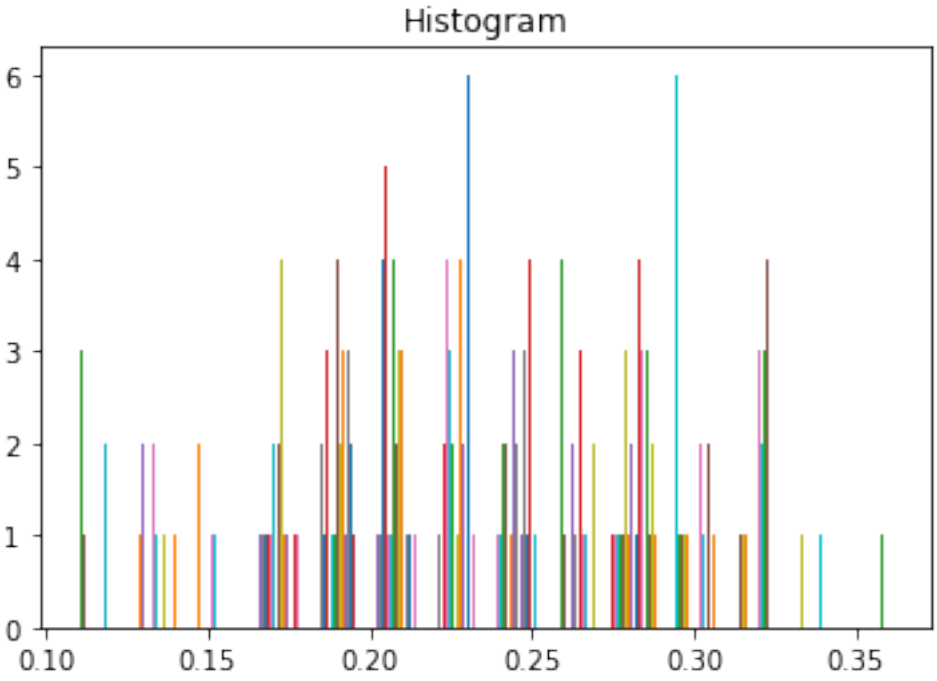



```
Opening band B4
(41, 53)
```


1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50


Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

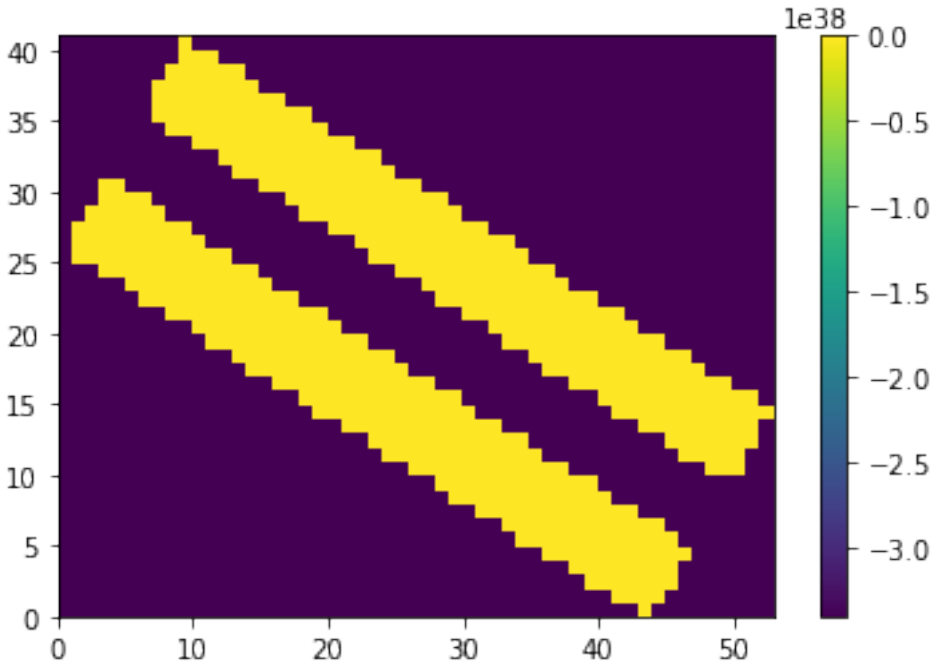

40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
0.35
0.30
0.25
0.20
0.15

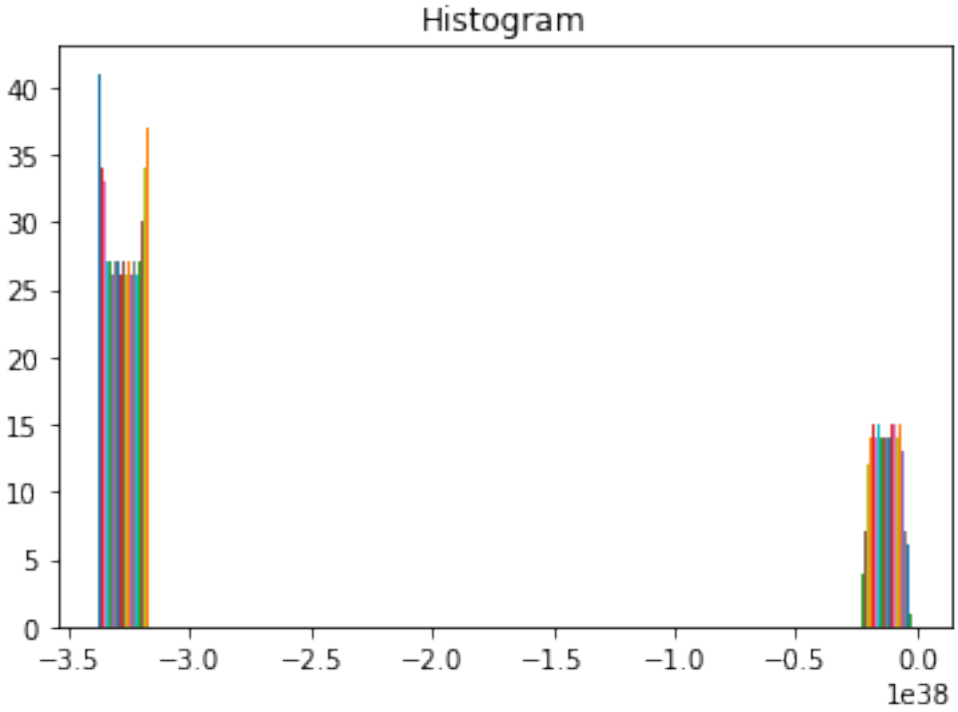

Histogram
6
5
4
3
2
1
0
0.10
0.15
0.20
0.25
0.30
0.35

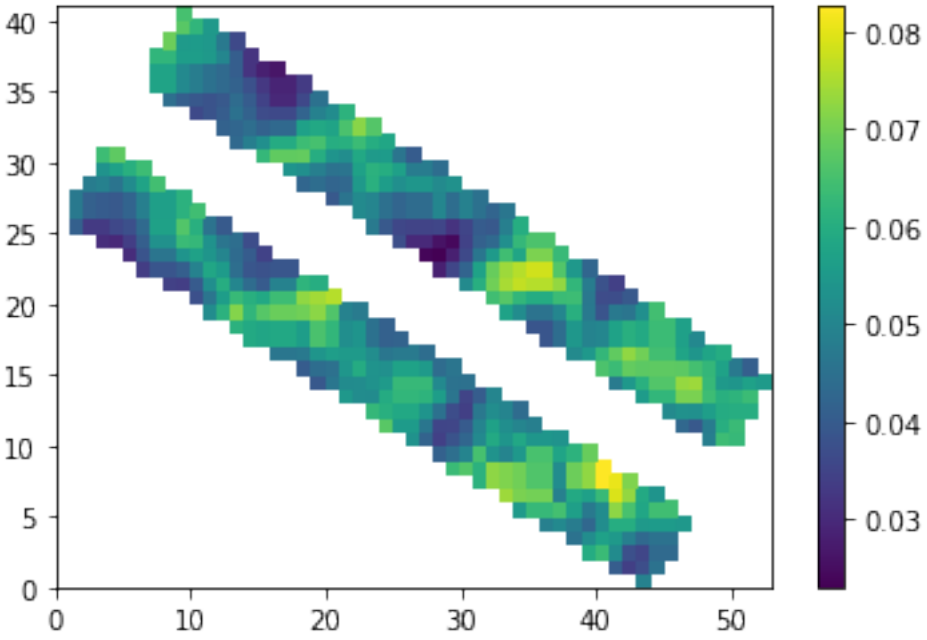
1.2 OpenCV

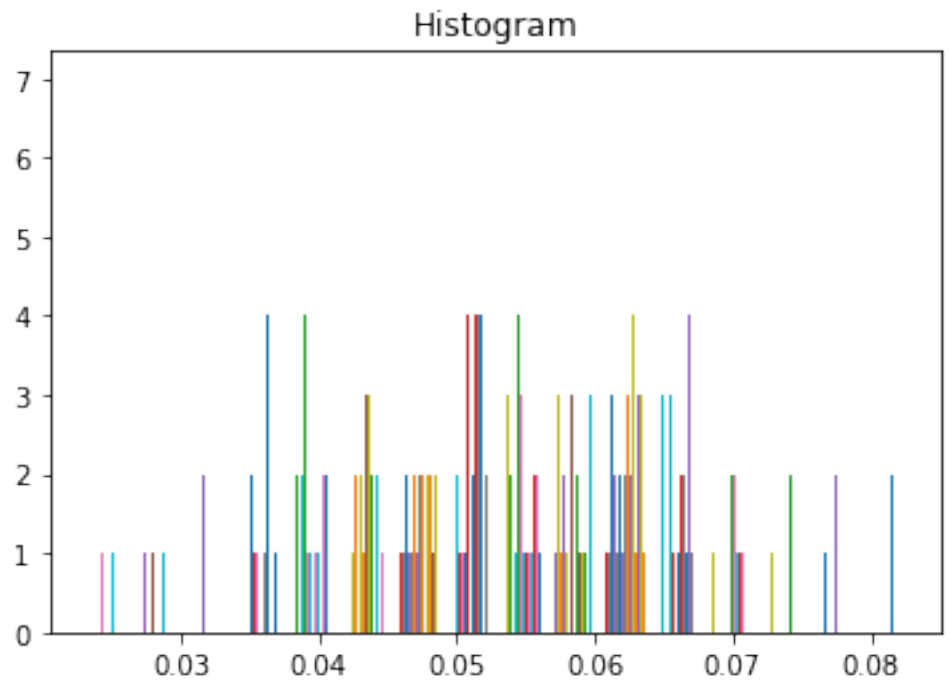
[22]:
```
def open_with_opencv():
    for band in ['B1', 'B2', 'B3', 'B4']:
        print('Opening band', band)
        path =os.path.join('data', FOLDER_SAMPLE, SAMPLE_INSTANCE + '_' + band
                           + '.tif')
        image = cv2.imread(path, cv2.IMREAD_UNCHANGED)
        print(image.shape)
        plt.pcolormesh(image)
        plt.pcolormesh(image)
        plt.colorbar()
        plt.show()
        plt.close()
        print_histogram(image)

        image = remove_less_than_zero(image)
        plt.pcolormesh(image)
        plt.colorbar()
        plt.show()
        plt.close()
        print_histogram(image)
open_with_opencv()
```

```
Opening band B1
(41, 53)
```

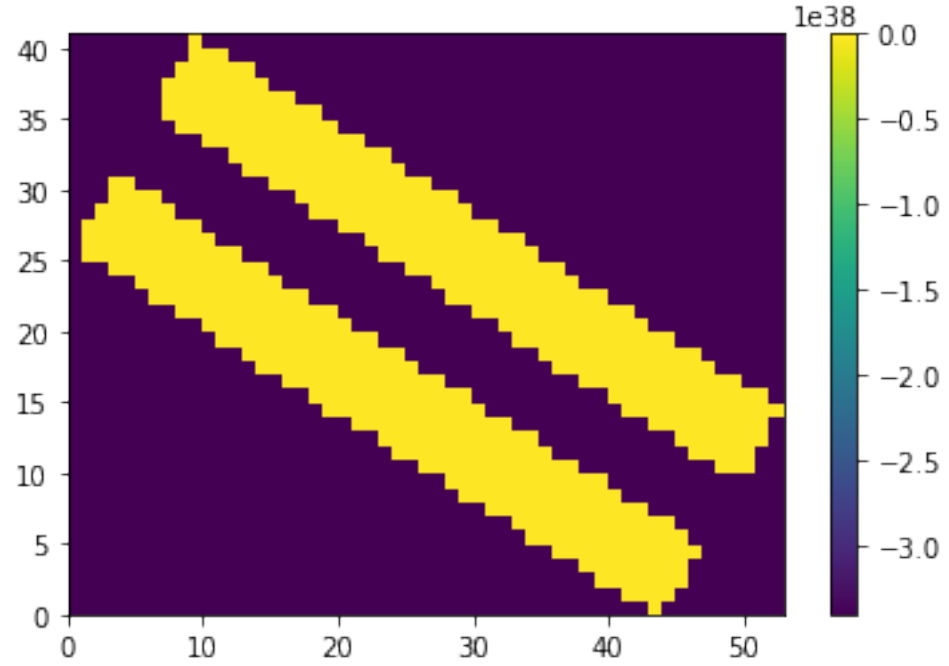


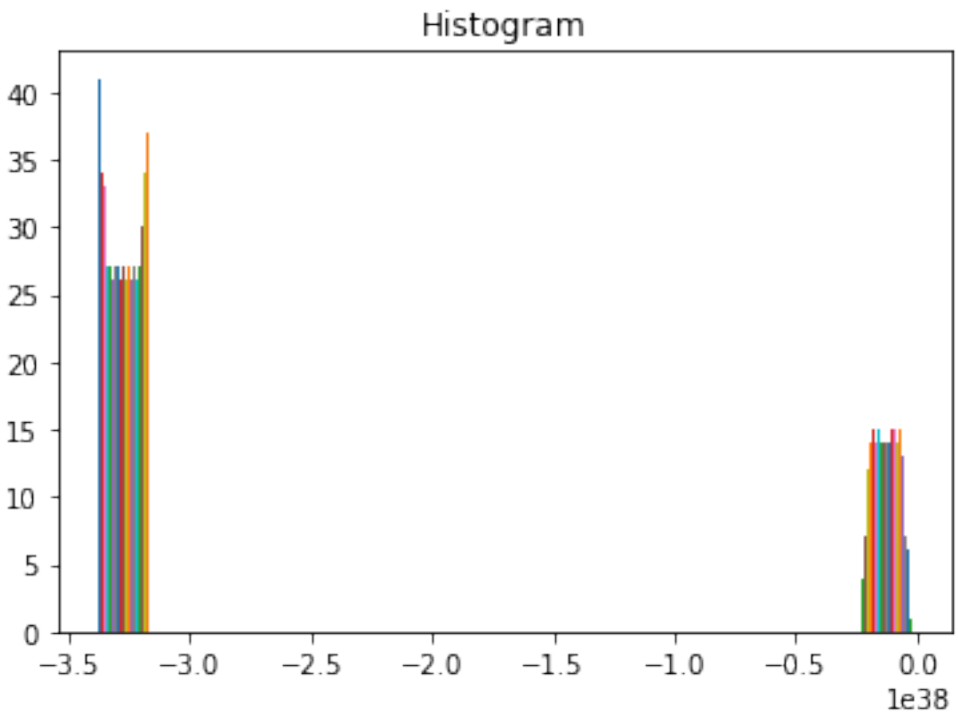

Histogram
40
35
30
25
20
15
10
5
0
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

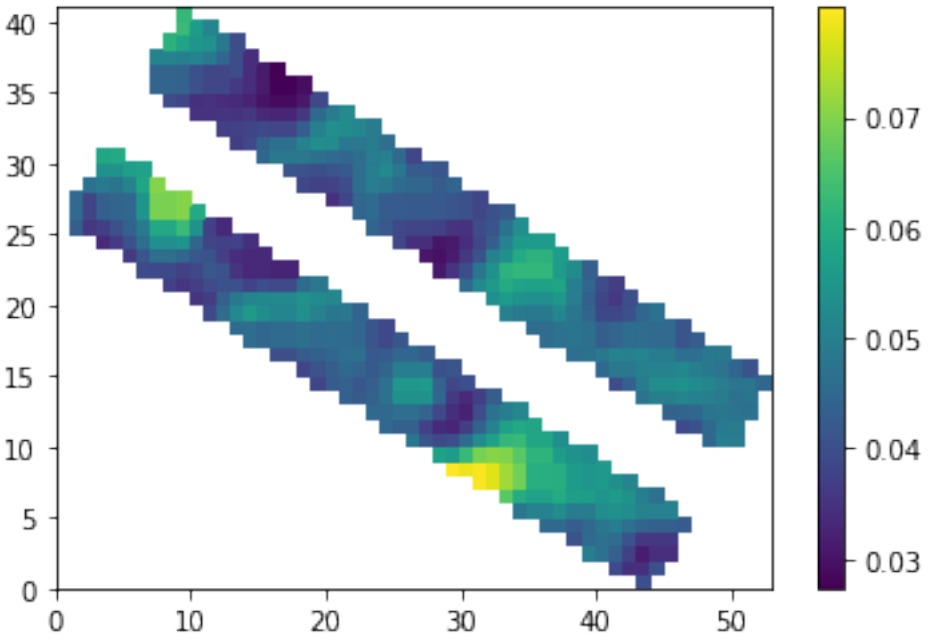

40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
0.08
0.07
0.06
0.05
0.04
0.03

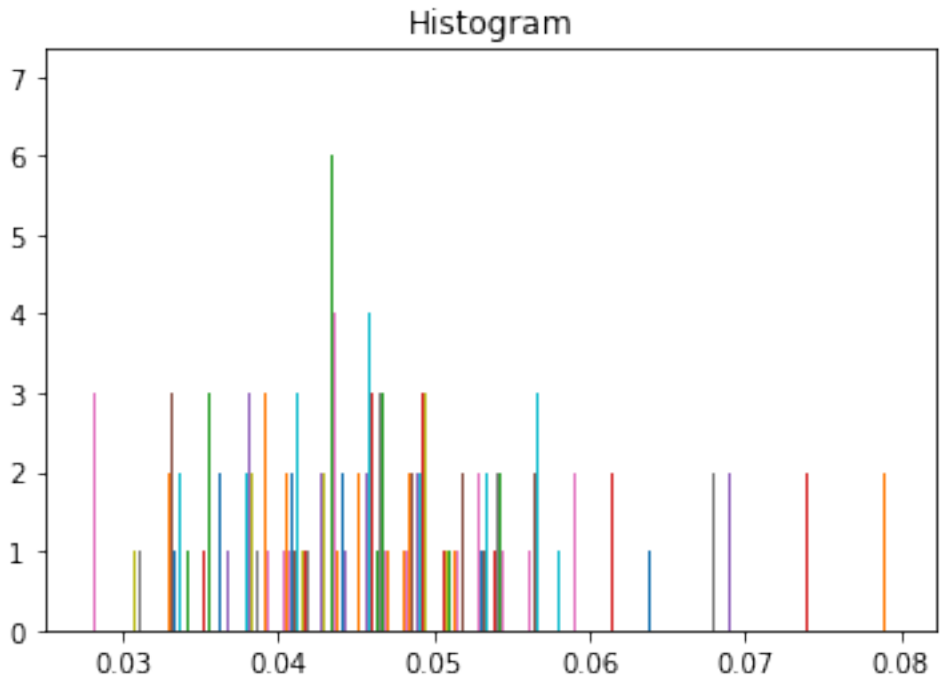



```
Opening band B2
(41, 53)
```

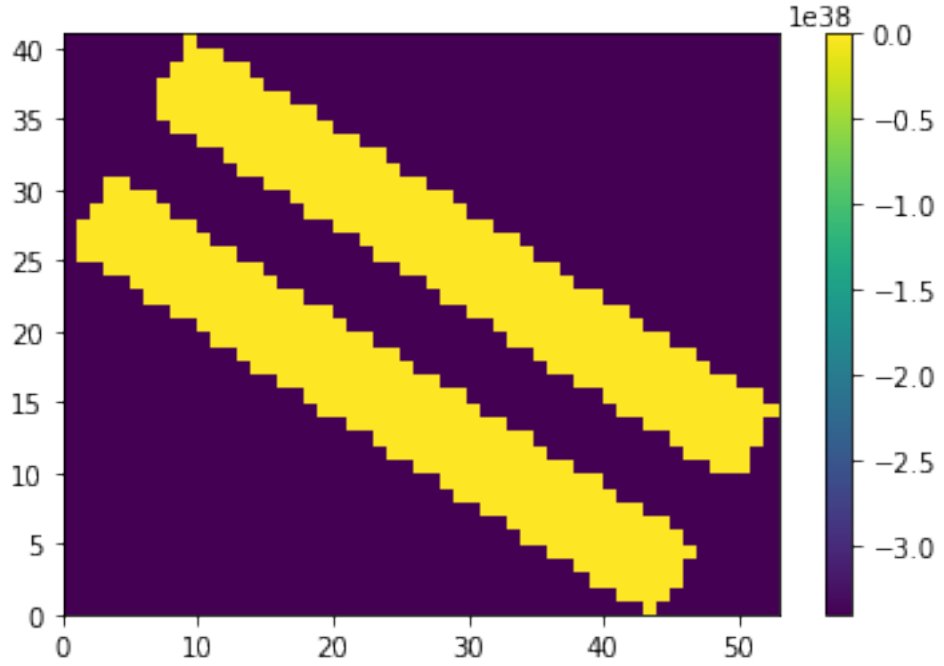


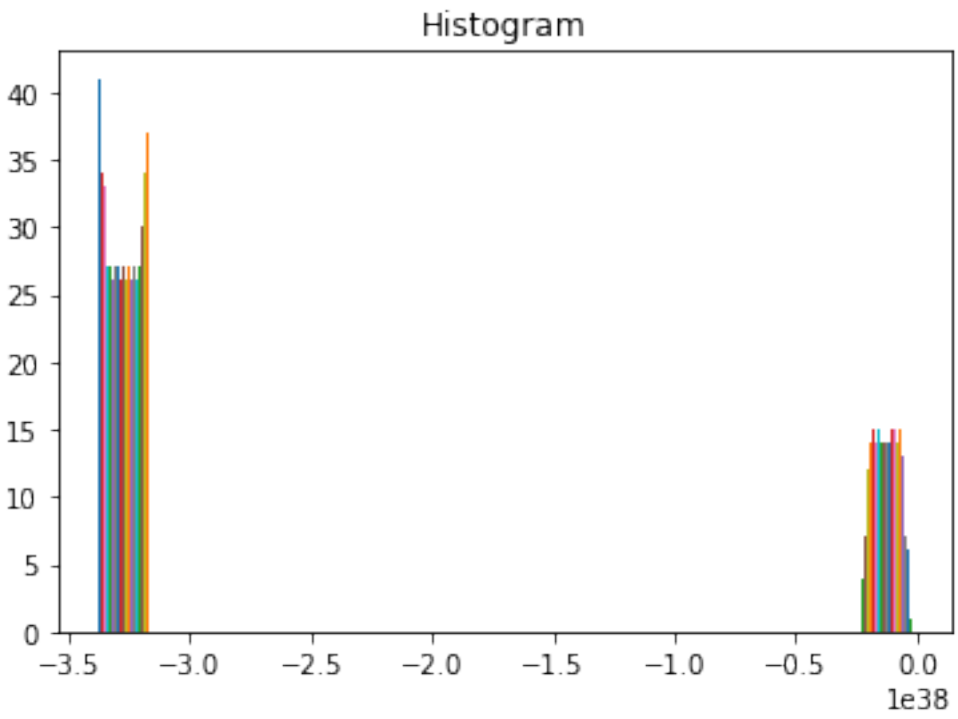

Histogram
40
35
30
25
20
15
10
5
0
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

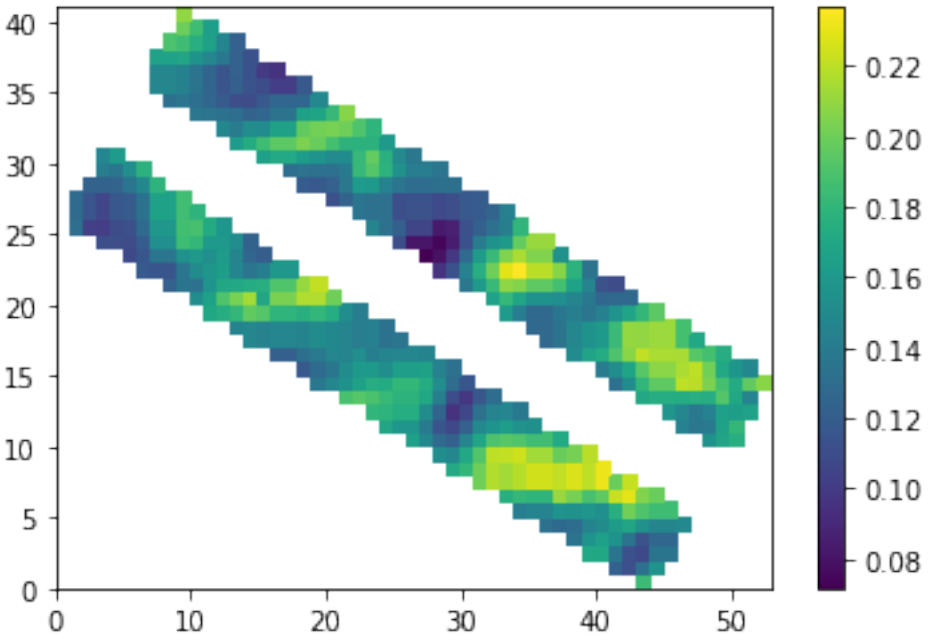

40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
0.07
0.06
0.05
0.04
0.03

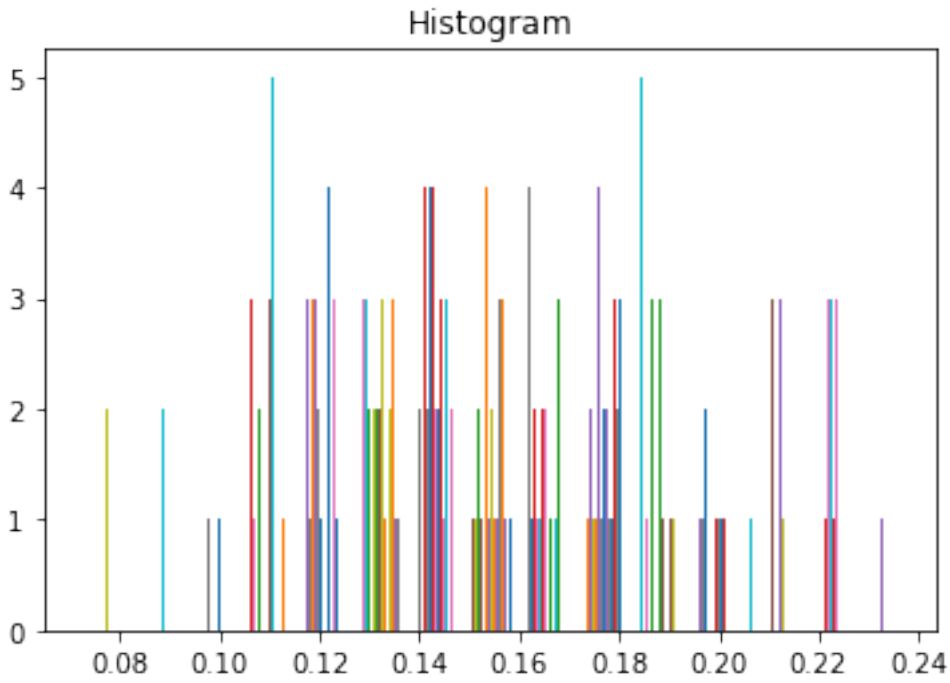



```
Opening band B3
(41, 53)
```

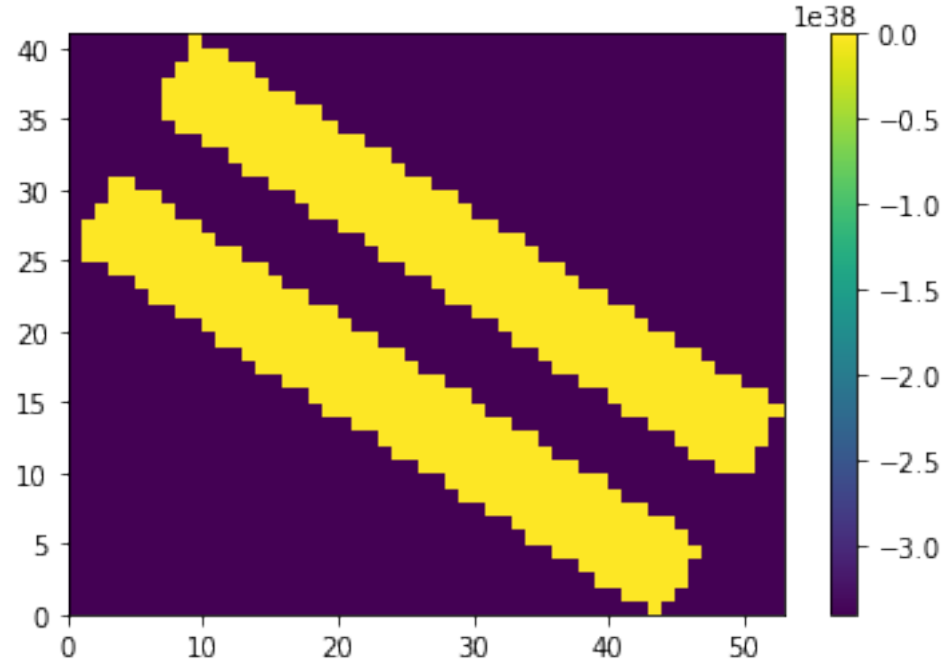


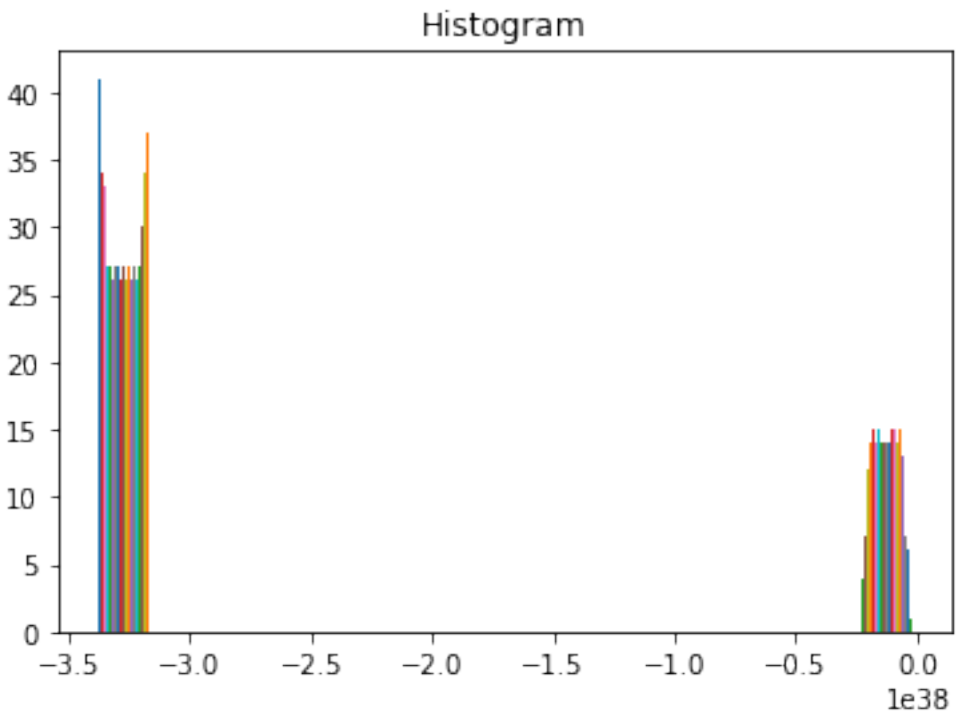

Histogram
40
35
30
25
20
15
10
5
0
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

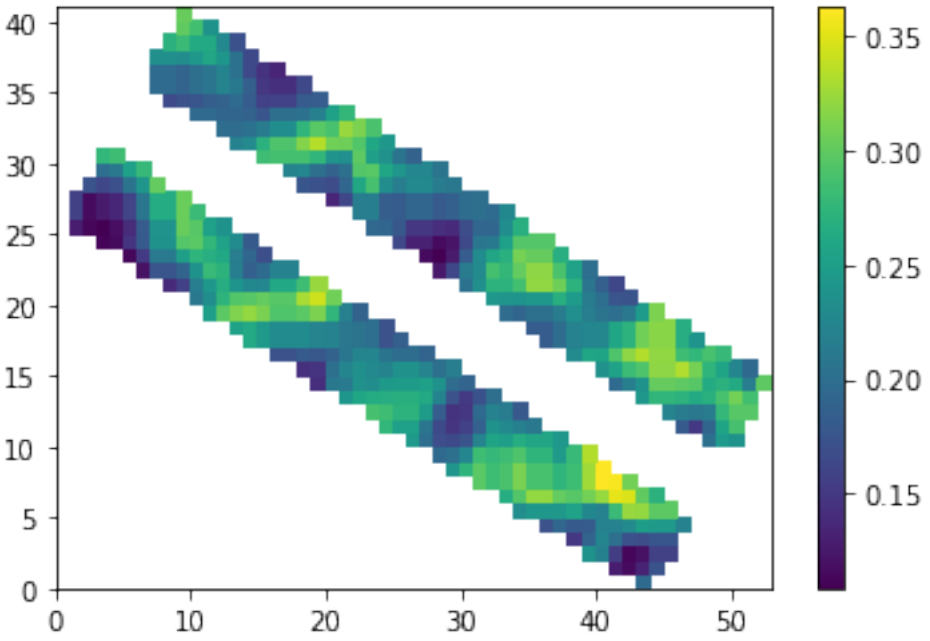

40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08

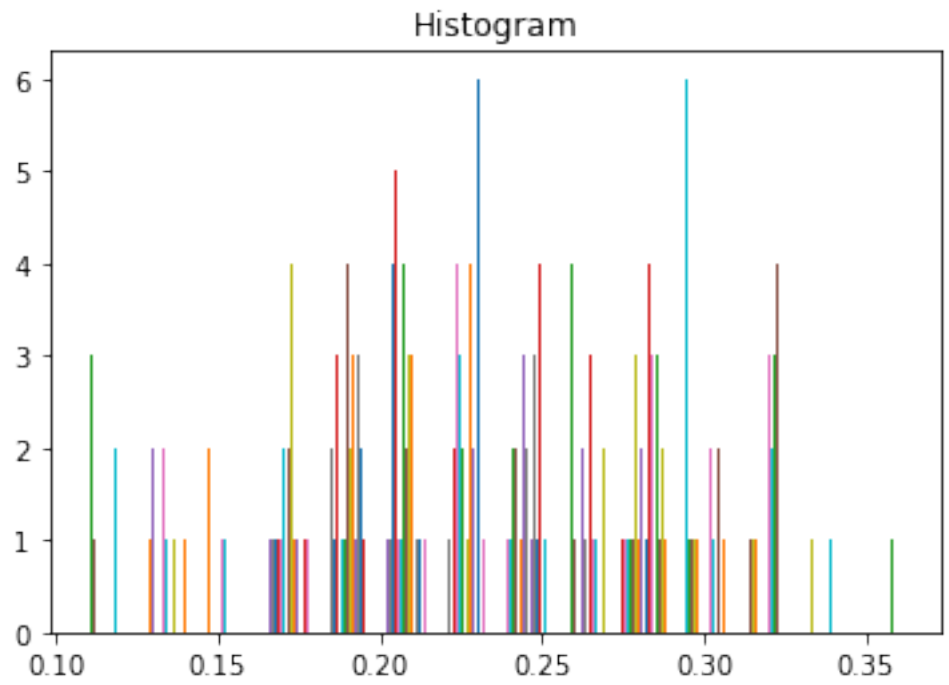



```
Opening band B4
(41, 53)
```




Histogram
40
35
30
25
20
15
10
5
0
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38


40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
0.35
0.30
0.25
0.20
0.15



1.3 Matplotlib

O Matplotlib parece estar tentando abrir a imagem como se houvessem vários canais de cor.

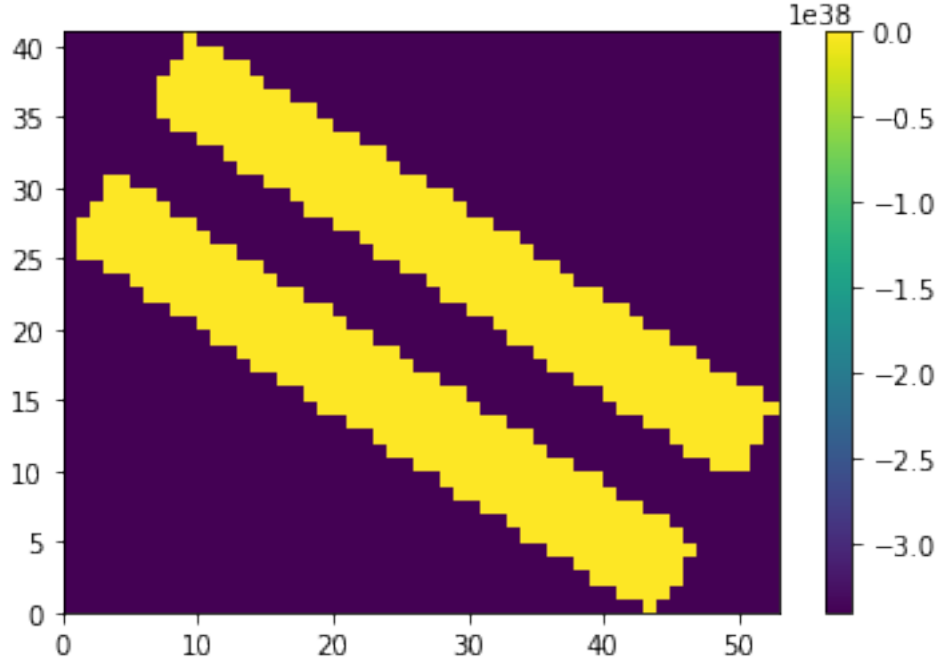
[8]:
```
def open_with_matplot():
    for band in ['B1', 'B2', 'B3', 'B4']:
        print('Opening band', band)
        path = os.path.join('data', FOLDER_SAMPLE,
                            SAMPLE_INSTANCE + '_' + band + '.tif')
        image = matplotlib.image.imread(path)
        print(image.shape)
        image = np.dsplit(image, image.shape[-1])
        for i, ch in enumerate(image):
            print(ch.shape)
            ch = ch[:, :, 0]
            plt.pcolormesh(ch)
            plt.show()
            plt.close()
            print_histogram(ch)

            image = remove_less_than_zero(ch)
            plt.pcolormesh(ch)
            plt.show()
            plt.close()
            print_histogram(ch)
```

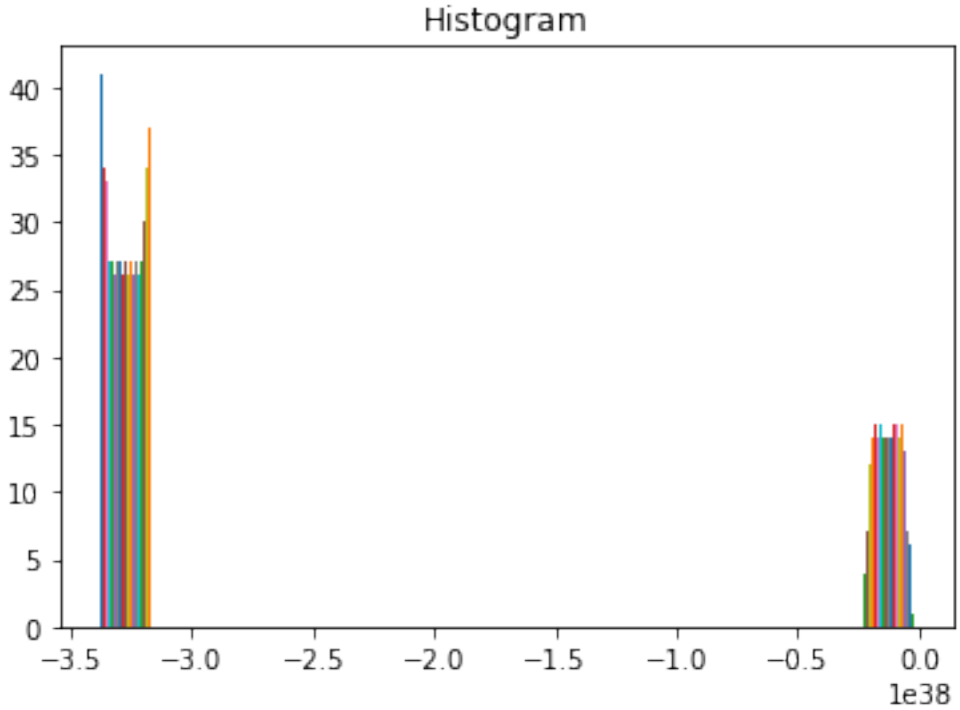
```
# open_with_matplot()
```

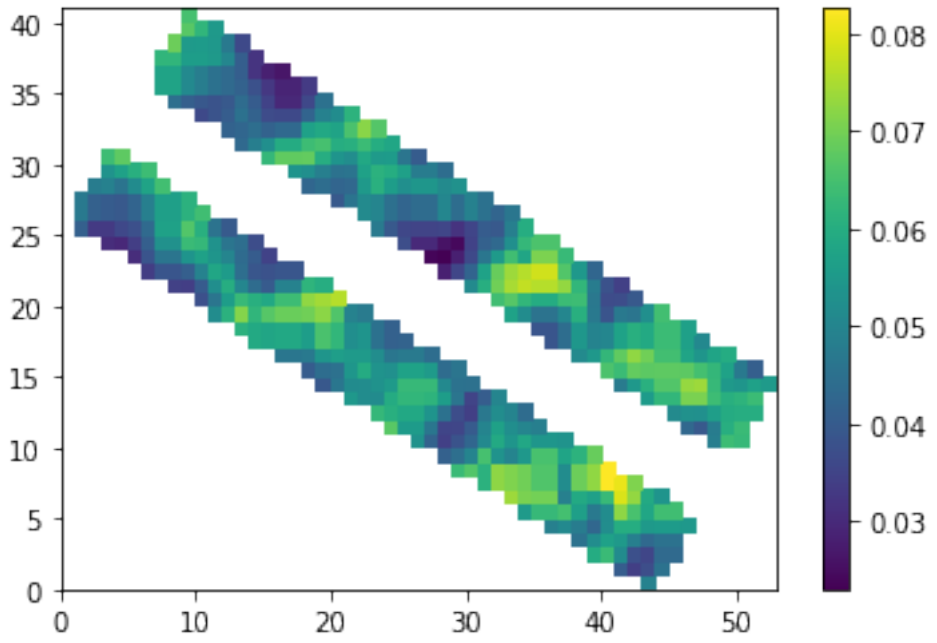
1.4 Gdal

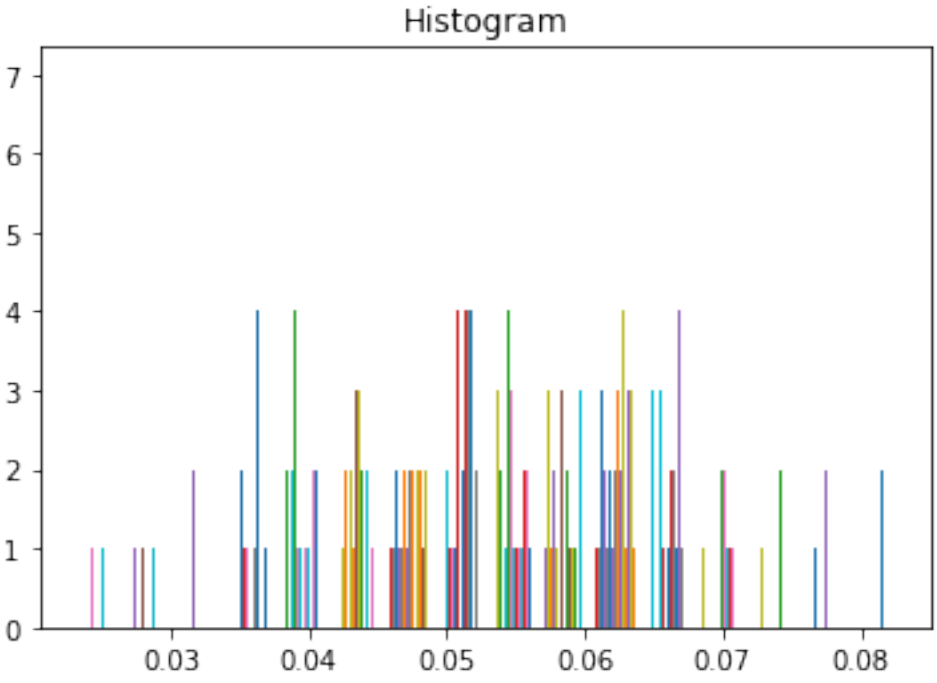
[24]:
```
def open_with_gdal():
    for band in ['B1', 'B2', 'B3', 'B4']:
        print('Opening band', band)
        image = gdal.Open(os.path.join('data', FOLDER_SAMPLE,
                                       SAMPLE_INSTANCE + '_' + band
                                       + '.tif'),
                          gdal.GA_ReadOnly)
        print(image.RasterCount)

        for x in range(1, image.RasterCount + 1):
            band = image.GetRasterBand(x)
            array = band.ReadAsArray()
            plt.pcolormesh(array)
            plt.colorbar()
            plt.show()
            plt.close()
            print_histogram(array)

            image = remove_less_than_zero(array)
            plt.pcolormesh(array)
            plt.colorbar()
            plt.show()
            plt.close()
            print_histogram(array)

open_with_gdal()
```

```
Opening band B1
1
```

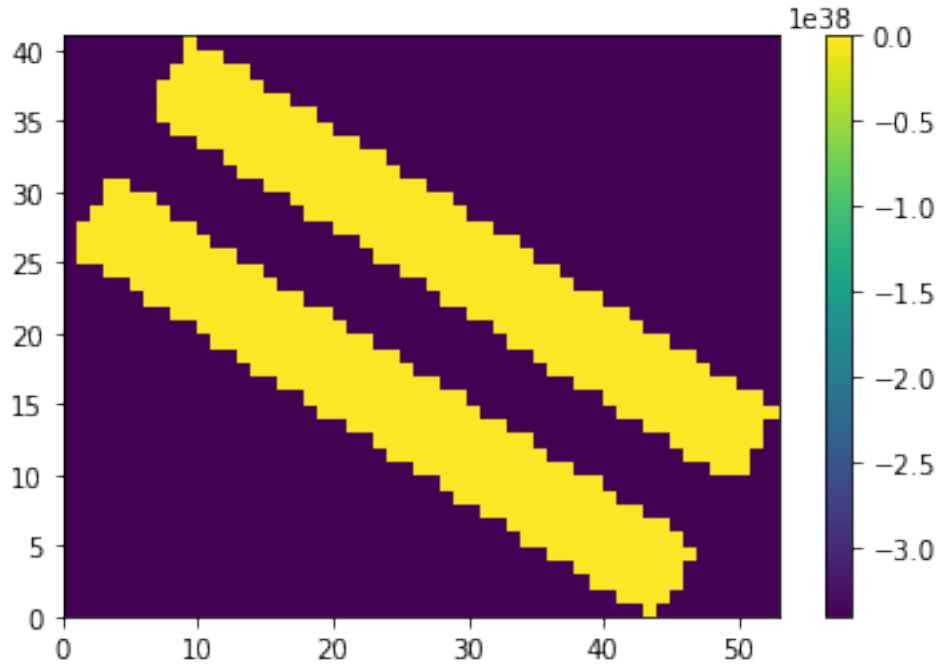

1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50

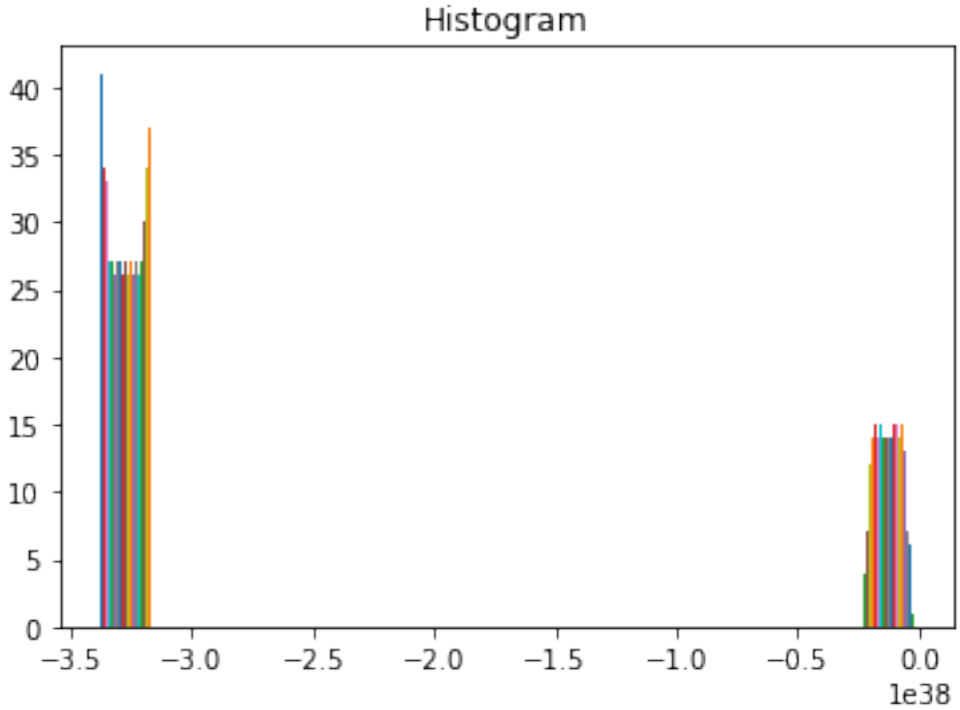

Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

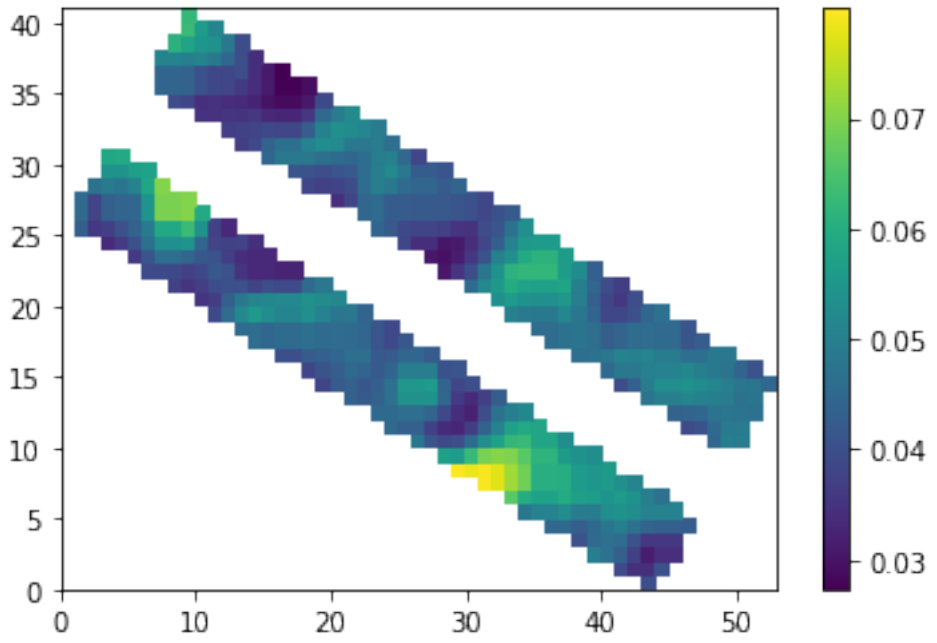


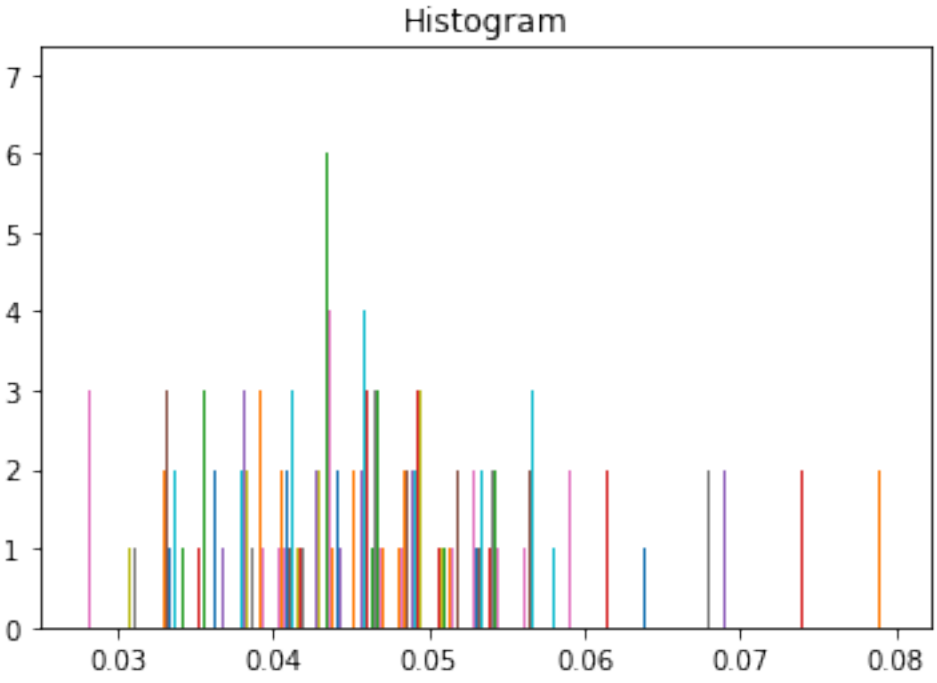



```
Opening band B2
1
```

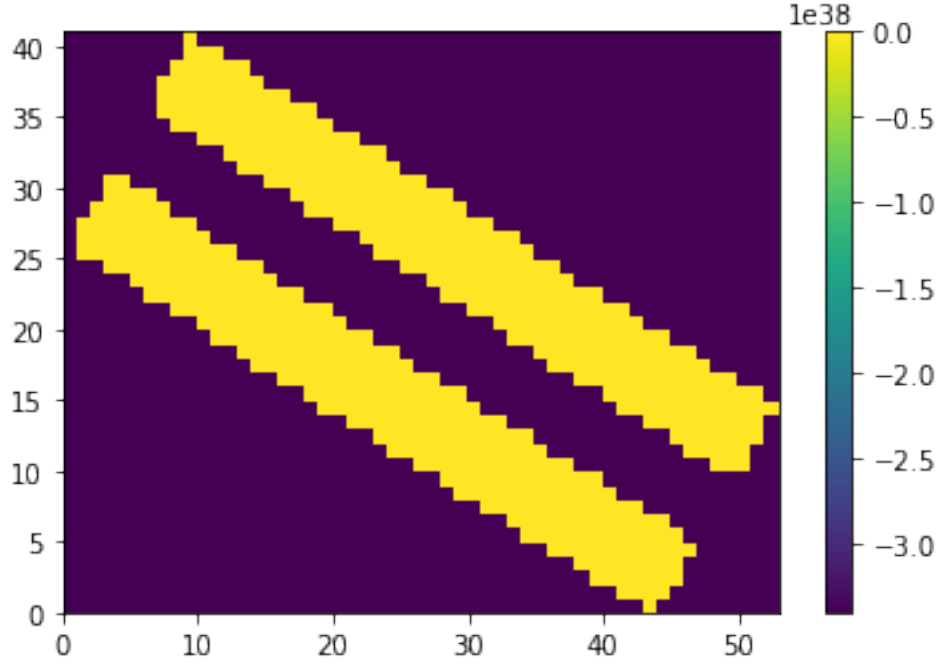

1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50

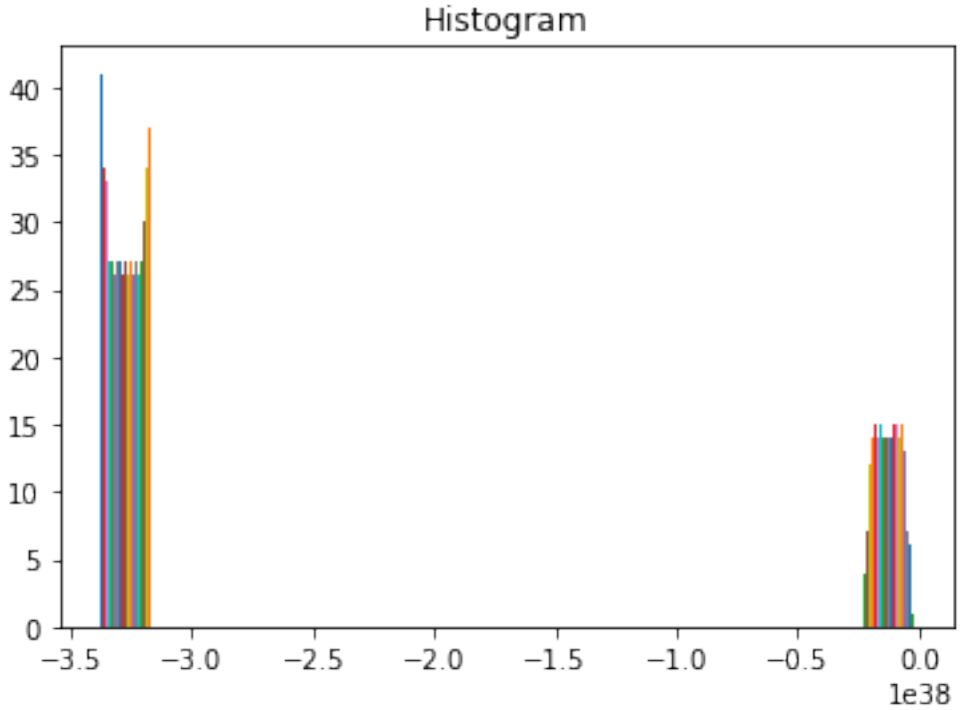

Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

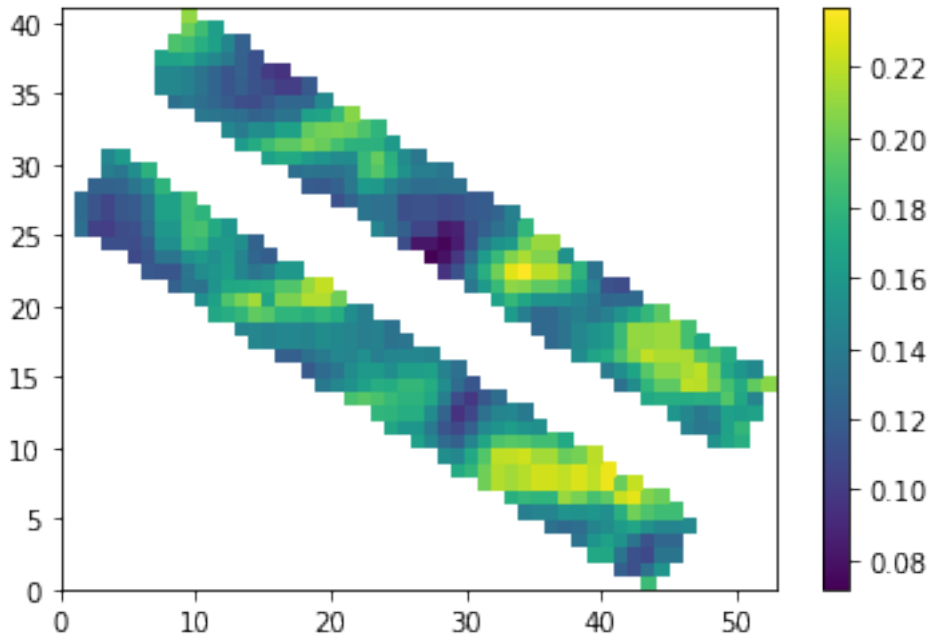


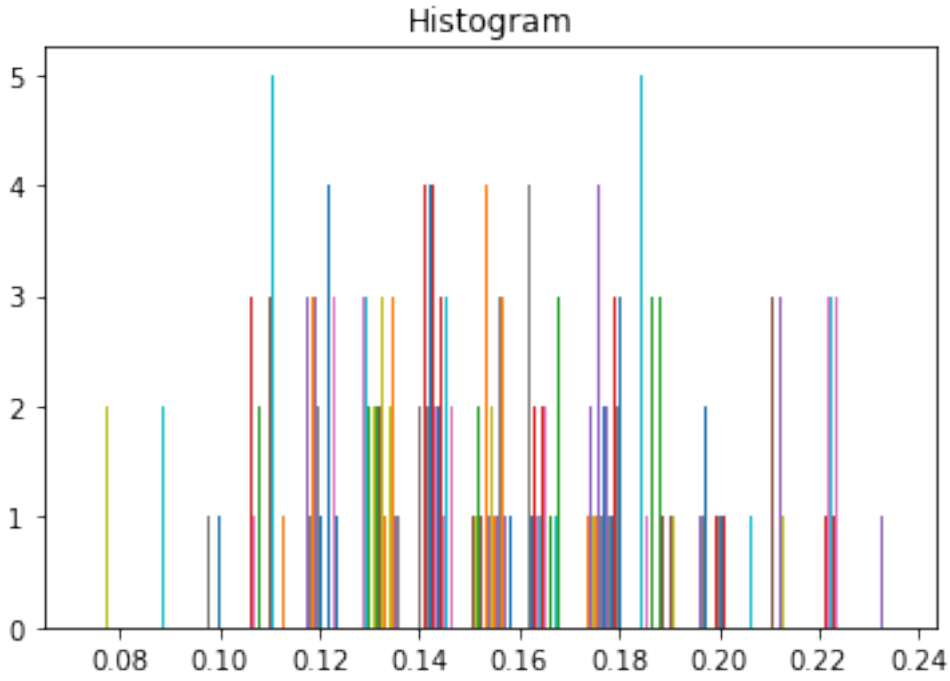



```
Opening band B3
1
```

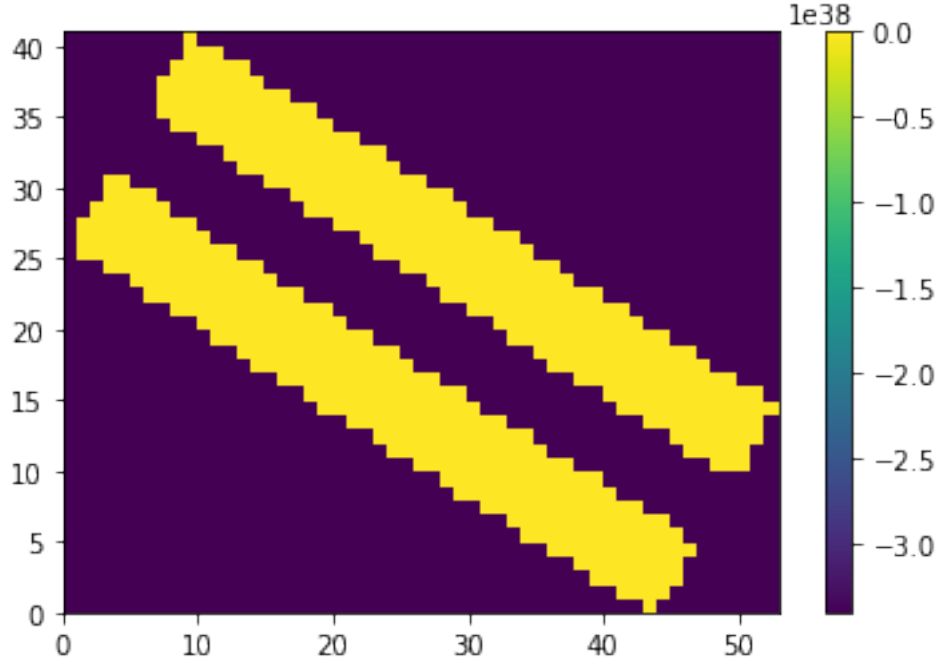

1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50

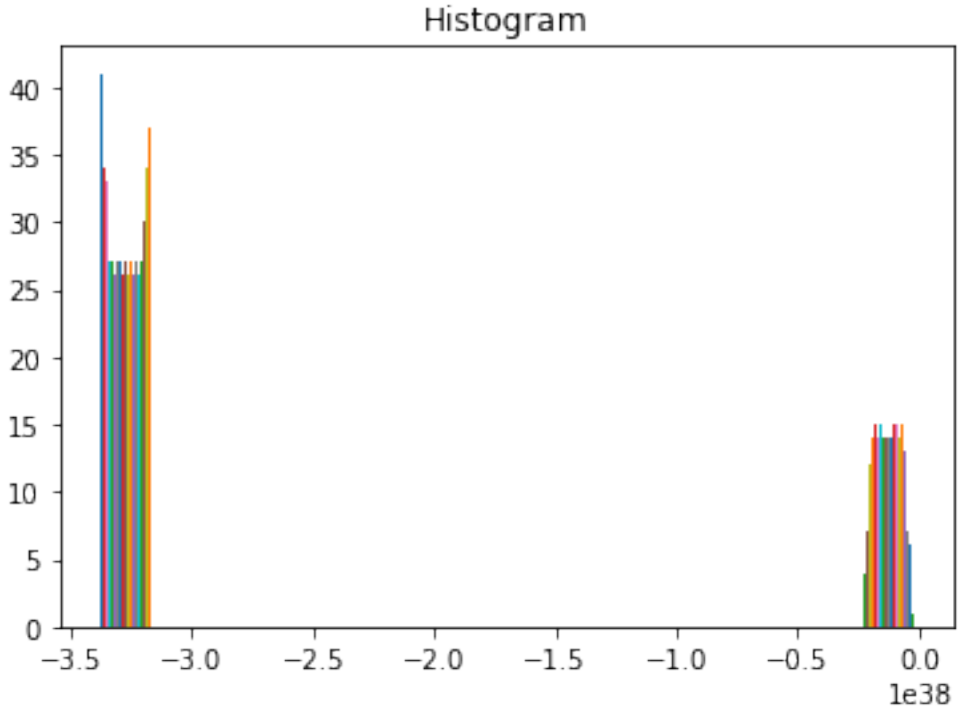

Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

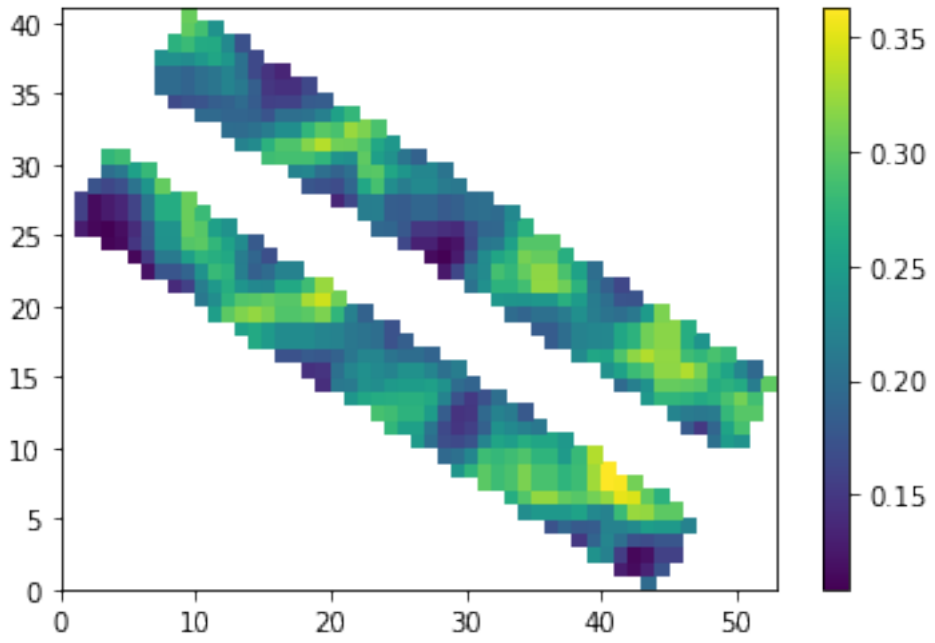


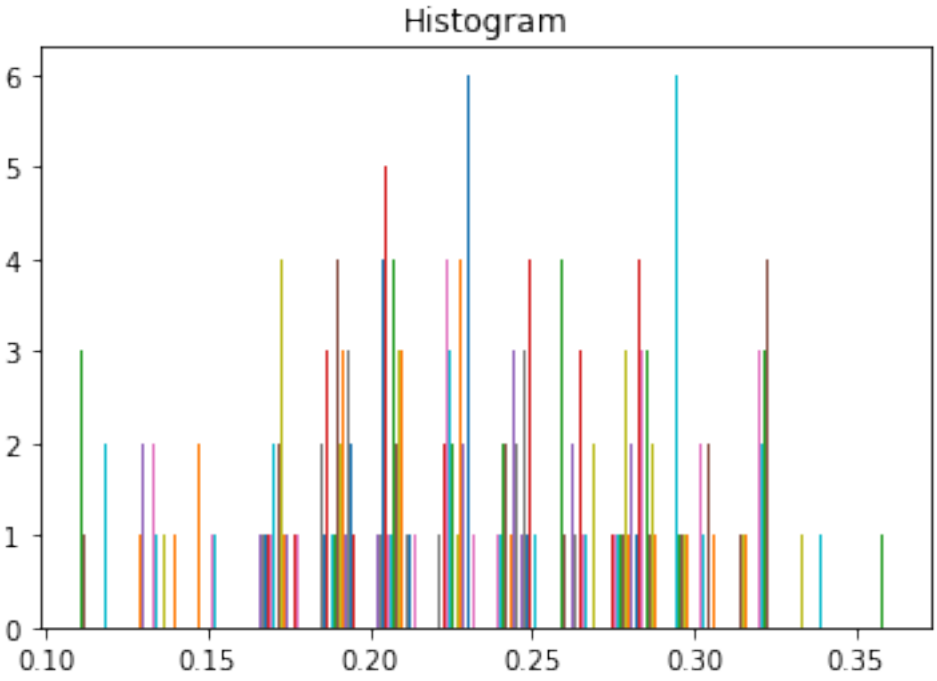



```
Opening band B4
1
```


1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50


Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

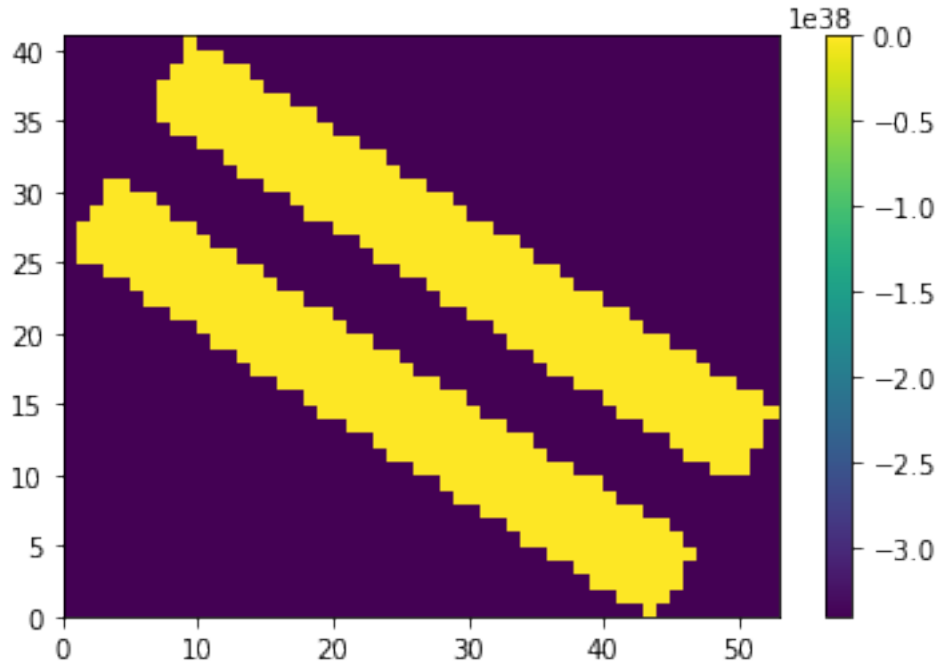

40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
0.35
0.30
0.25
0.20
0.15

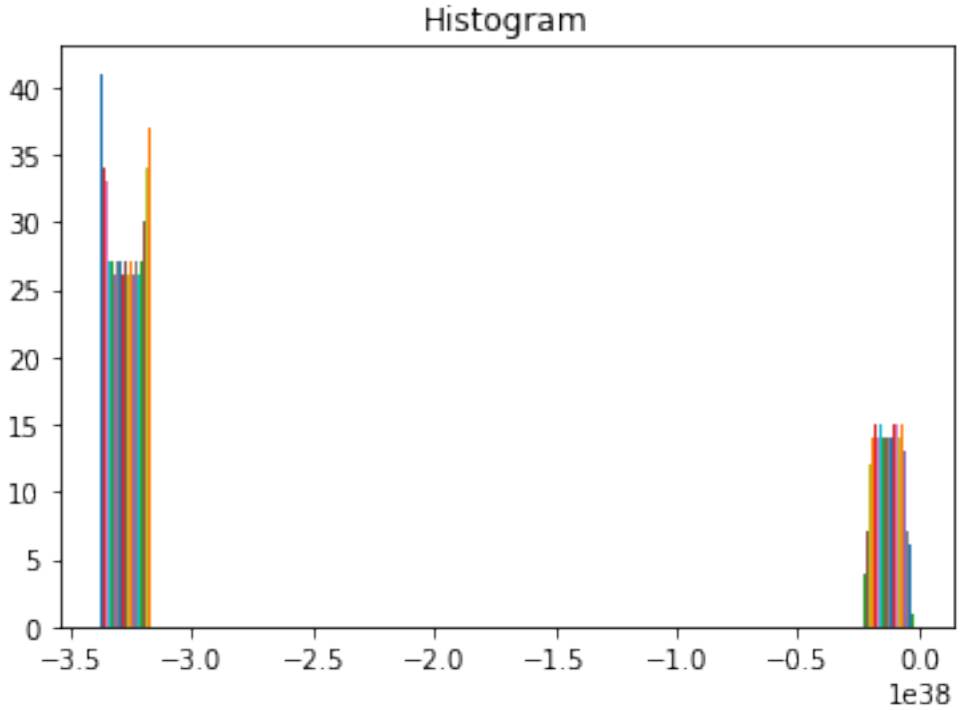

Histogram
6
5
4
3
2
1
0
0.10
0.15
0.20
0.25
0.30
0.35

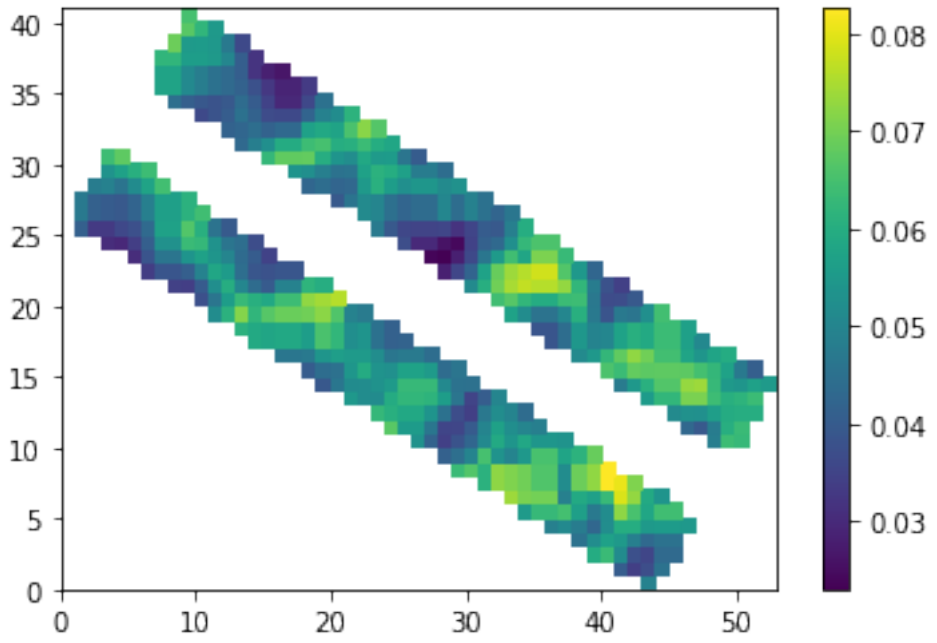
1.5 Rasterio

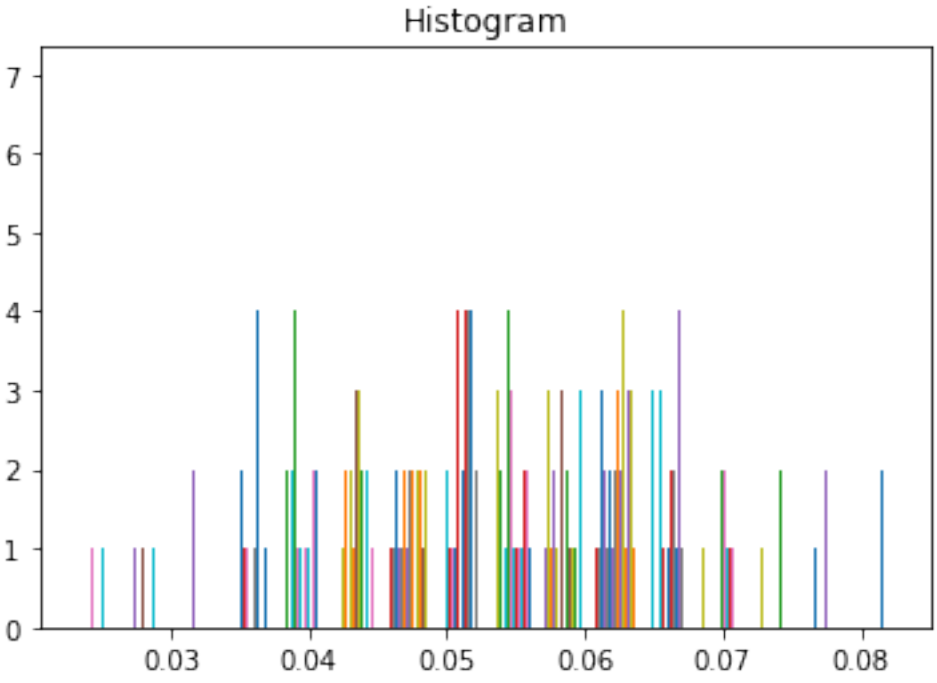
[25]:
```
def open_with_rasterio():
    for band in ['B1', 'B2', 'B3', 'B4']:
        print('Opening band', band)
        image = rasterio.open(os.path.join('data', FOLDER_SAMPLE,
                                           SAMPLE_INSTANCE + '_' + band
                                           + '.tif'),
                              driver='GTiff')
        image = image.read(1)
        print(image.shape)
        plt.pcolormesh(image)
        plt.pcolormesh(image)
        plt.colorbar()
        plt.show()
        plt.close()
        print_histogram(image)

        image = remove_less_than_zero(image)
        plt.pcolormesh(image)
        plt.colorbar()
        plt.show()
        plt.close()
        print_histogram(image)

open_with_rasterio()
```

```
Opening band B1
(41, 53)
```

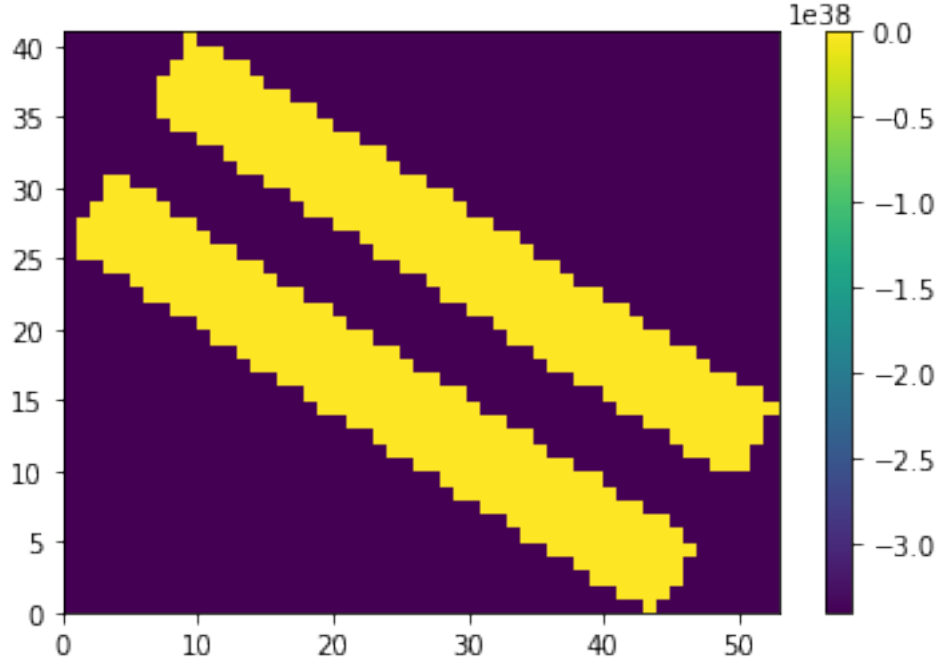

1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50

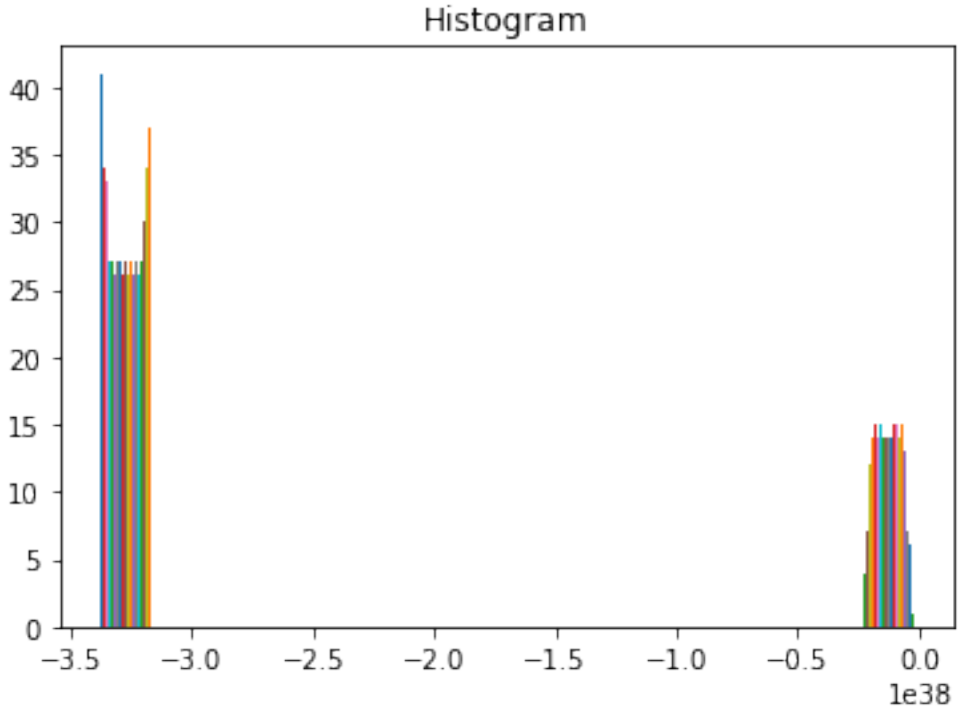

Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

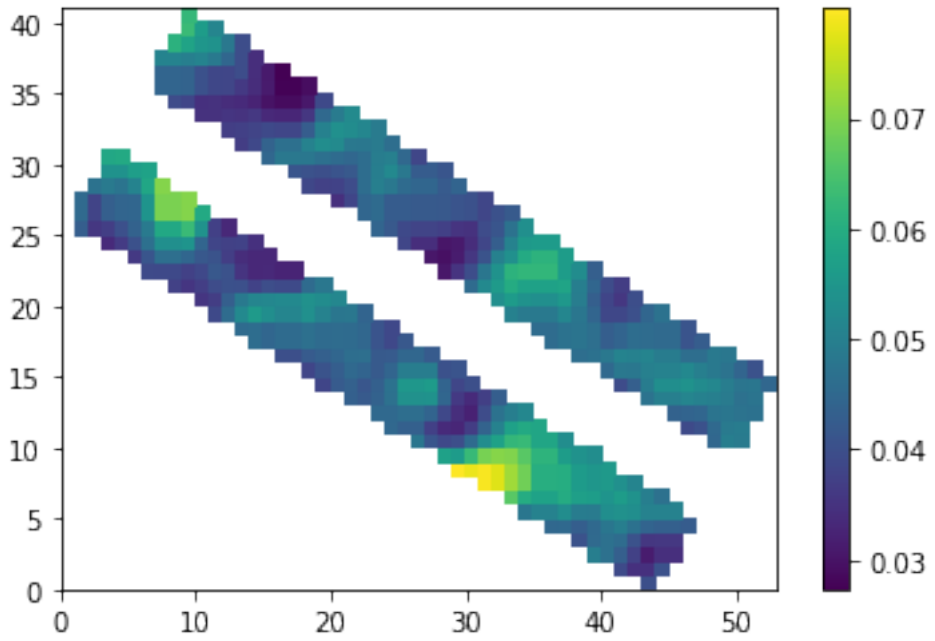


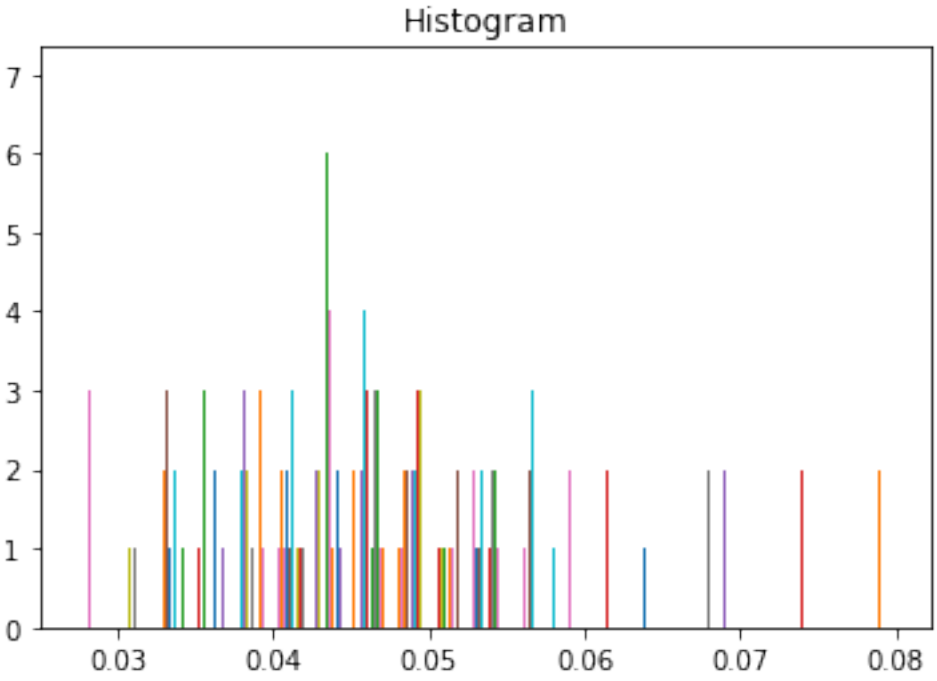



```
Opening band B2
(41, 53)
```

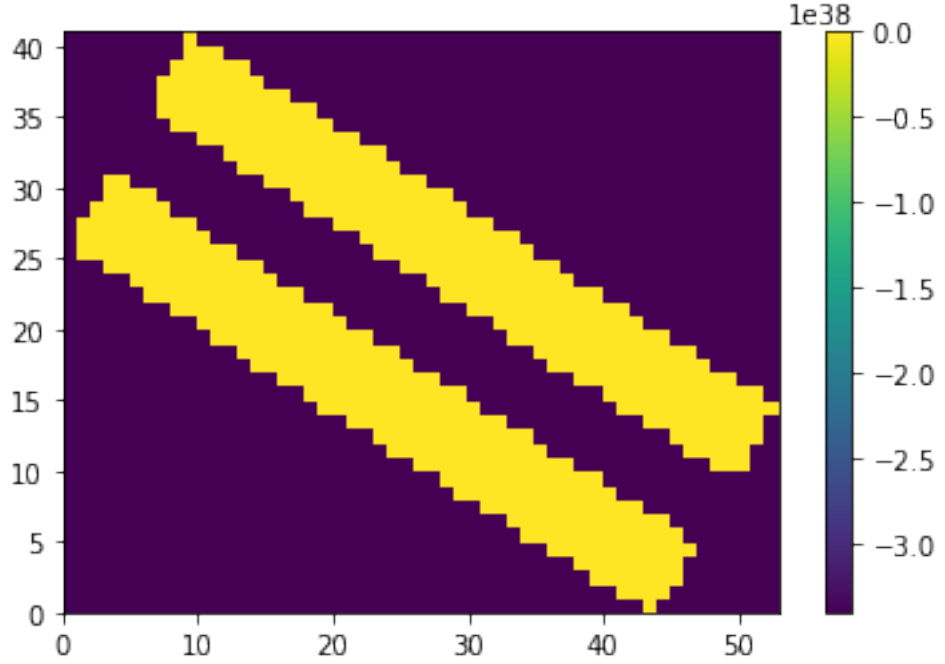

1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50

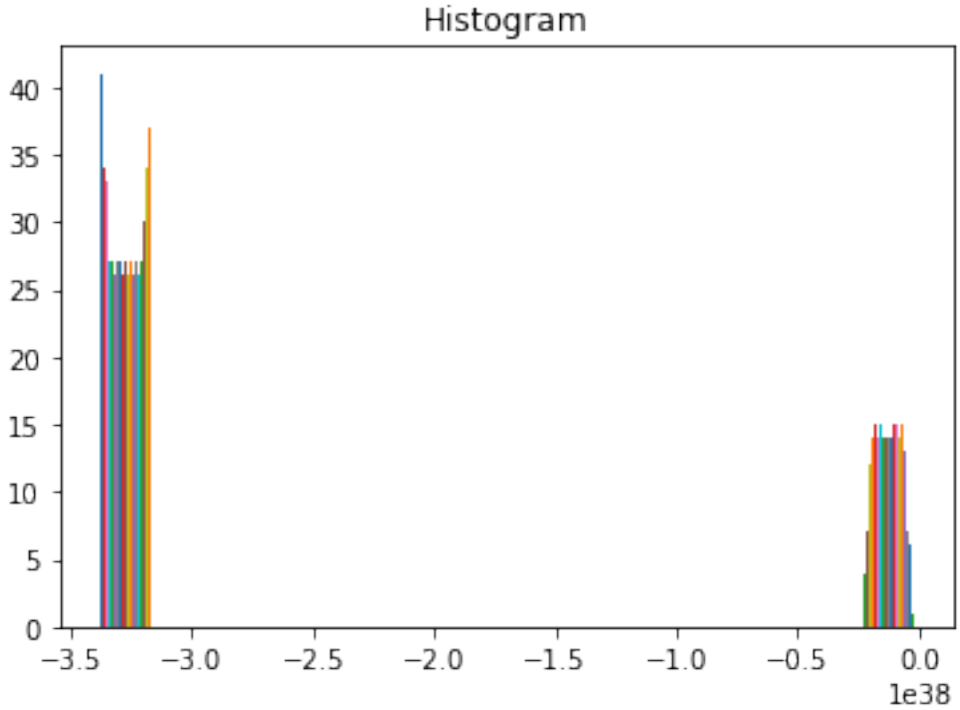

Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

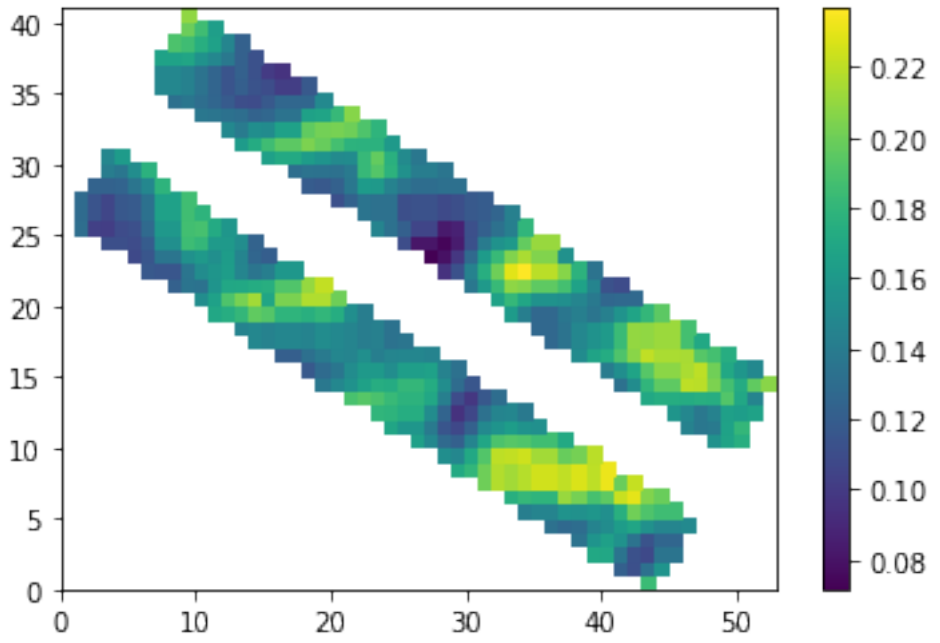


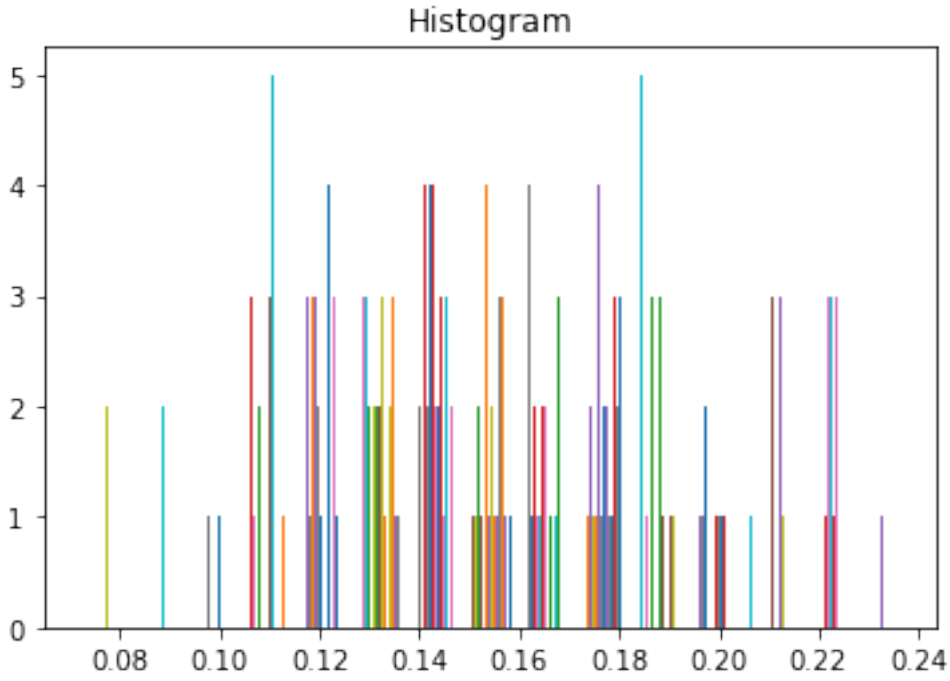



```
Opening band B3
(41, 53)
```

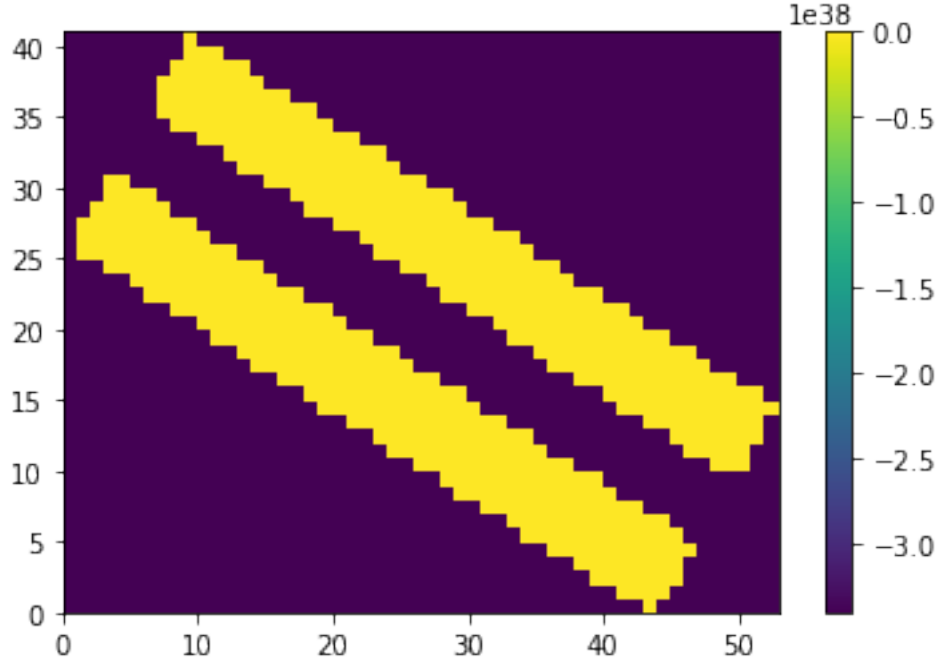

1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50

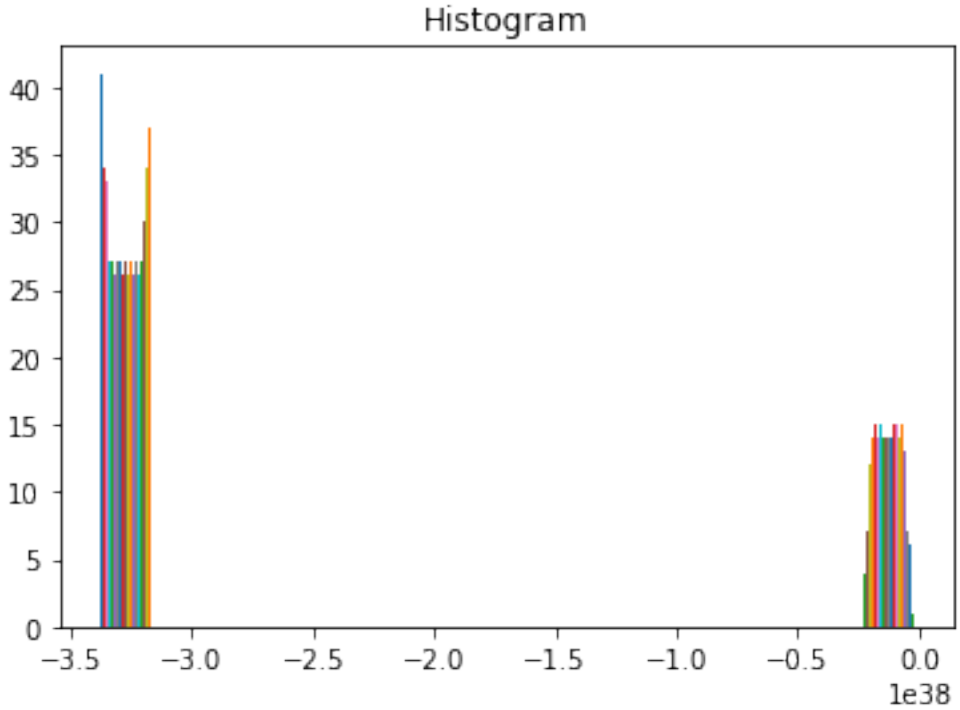

Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38

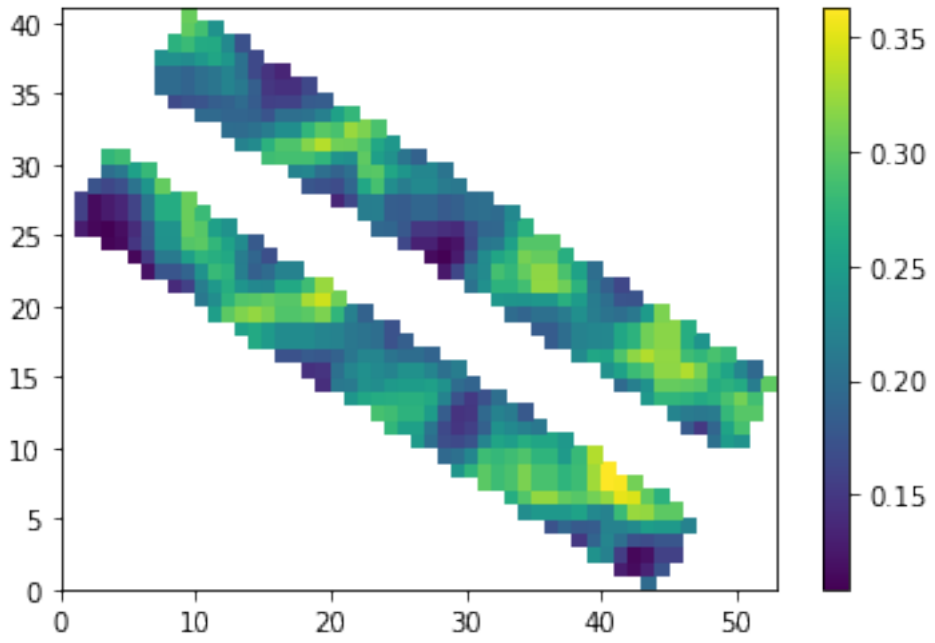


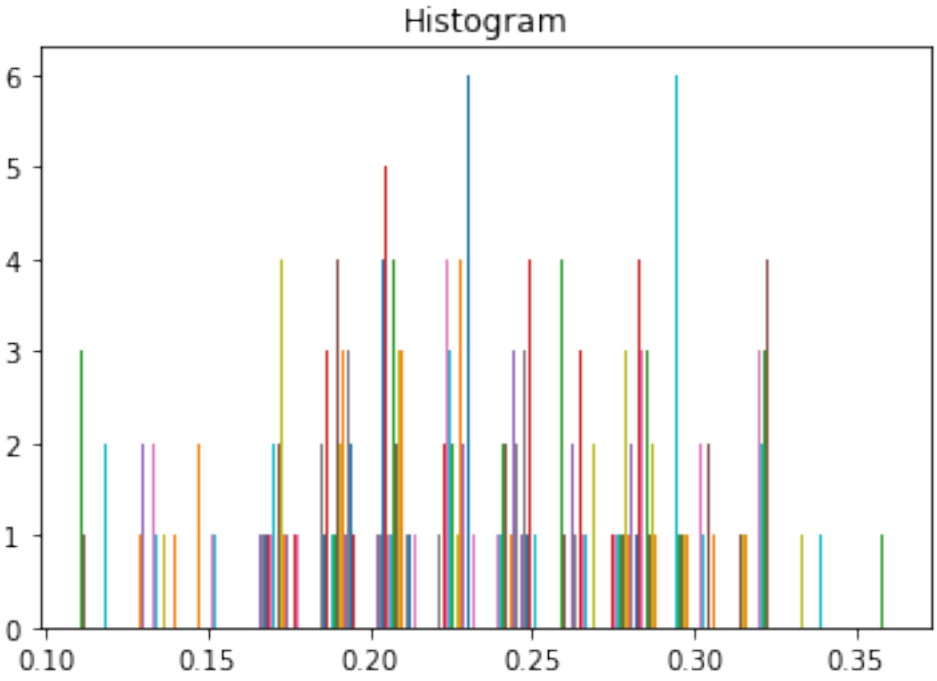



```
Opening band B4
(41, 53)
```


1e38
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50


Histogram
0
5
10
15
20
25
30
35
40
−3.5
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
1e38


40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
0.35
0.30
0.25
0.20
0.15

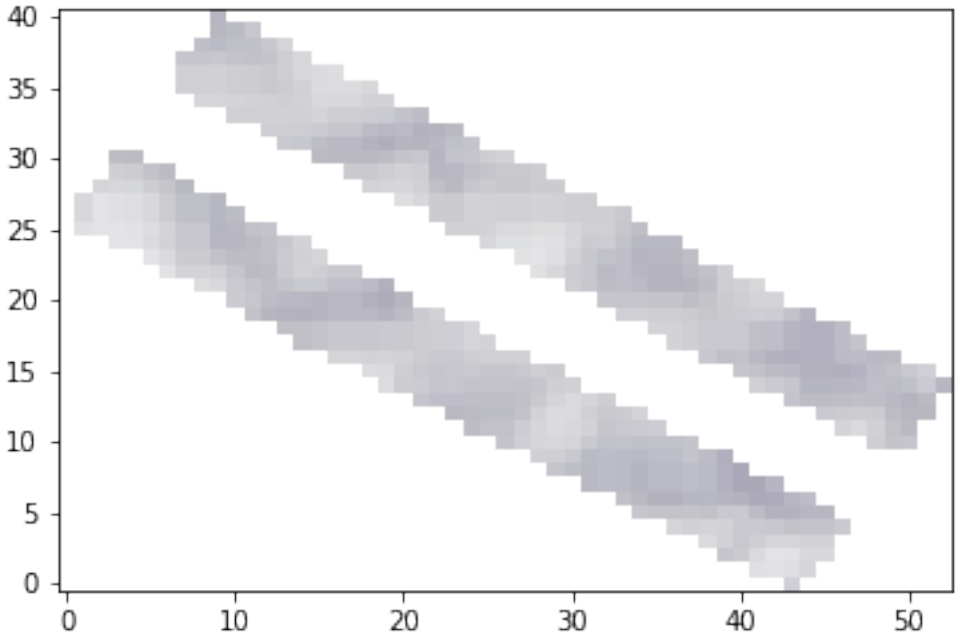

Histogram
6
5
4
3
2
1
0
0.10
0.15
0.20
0.25
0.30
0.35

1.6 Plot de algumas imagens (b2s e bfs)

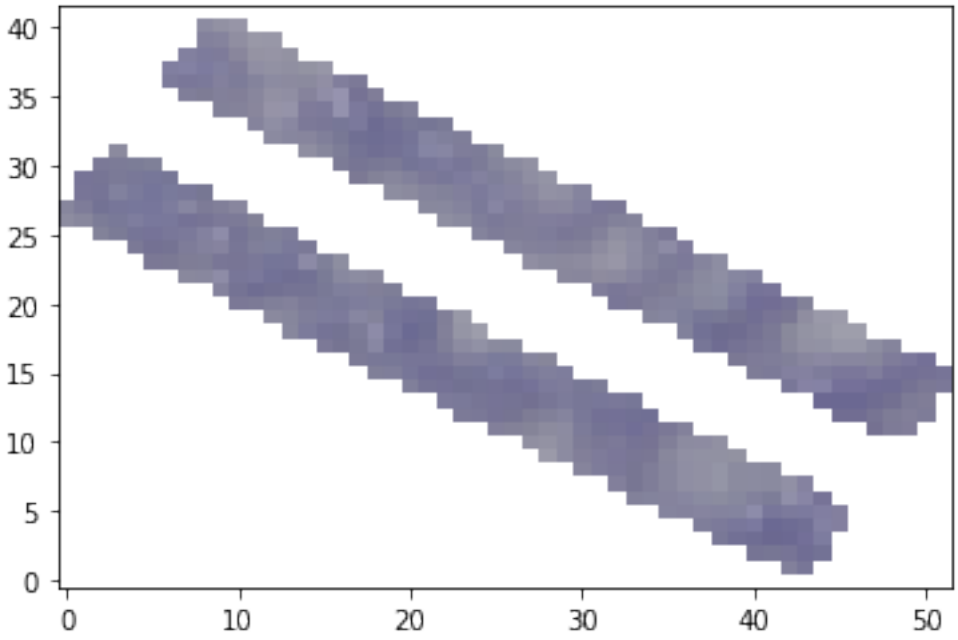
[28]:
```
samples = [
    "c160418tscrfl_nfung_64",
    "c160407tscrfl_fung_53",
    "c160418tscrfl_fung_72",
    "c160407tscrfl_fung_22",
]
folders = [
    "RAW/crop_tsc_2016_b2s",
    "RAW/crop_tsc_2016_bfs"
]
```

[29]:
```
for folder in folders:
    i = 0
    for sample in samples:
        bands = []
        for band in ['B1', 'B2', 'B3', 'B4']:

            image = rasterio.open(os.path.join('data', folder,
                                               sample + '_' + band
                                               + '.tif'),
                                  driver='GTiff')
            image = image.read(1)
            image = remove_less_than_zero(image)
            i+=1
            bands.append(np.asarray(image))
        fullim = np.stack(np.asarray(bands), axis=2)
        print(fullim.shape)
#         fullim = cv2.cvtColor(fullim, cv2.COLOR_BGR2RGB)
        plt.imshow(fullim, aspect='auto', origin='lower')
        plt.show()
        plt.close()
```

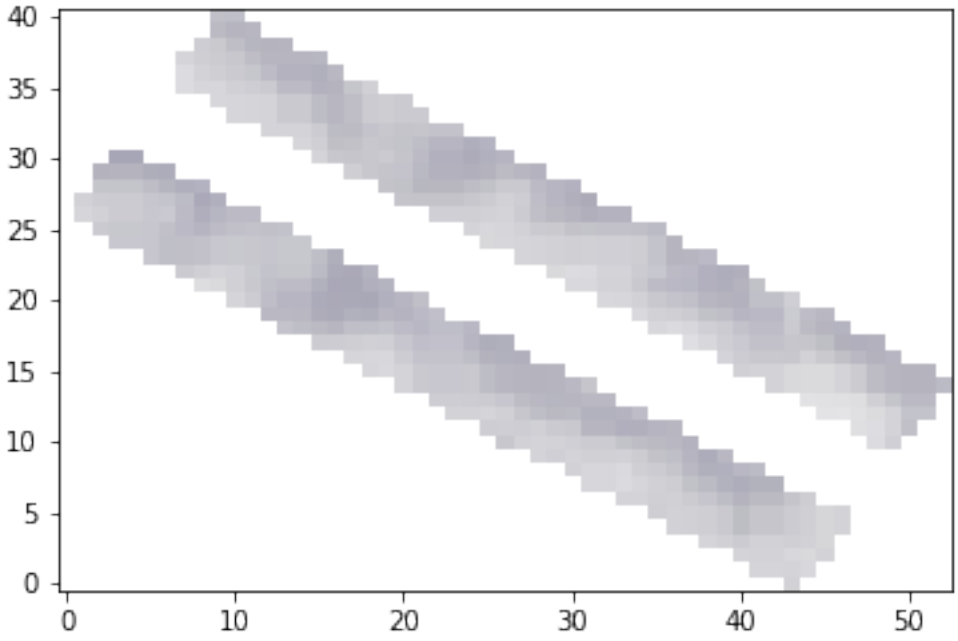
```
(41, 53, 4)
```


40
35
30
25
20
15
10
5
0
0
10
20
30
40
50

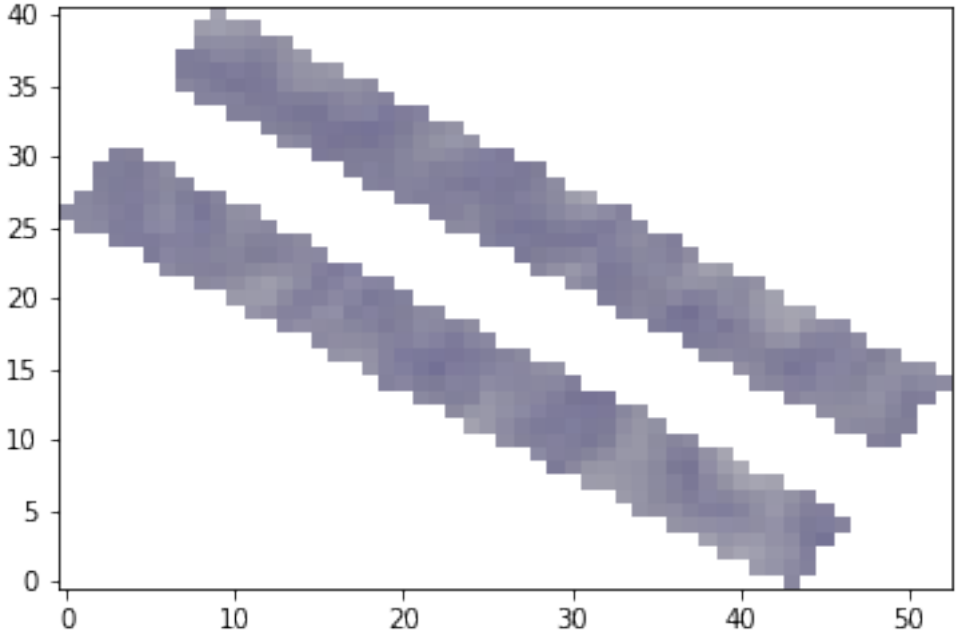
```
(42, 52, 4)
```


40
35
30
25
20
15
10
5
0
0
10
20
30
40
50

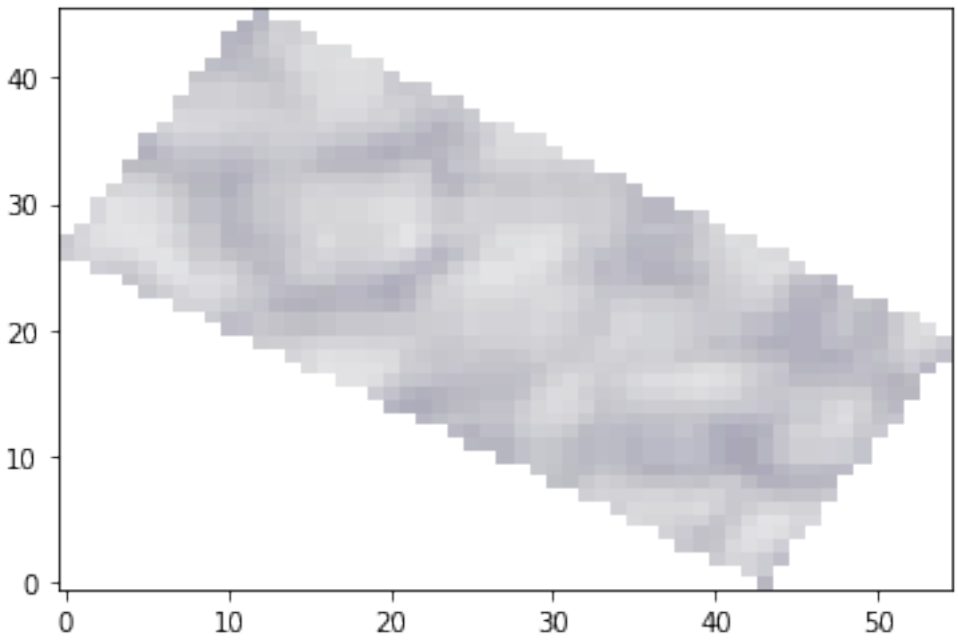
```
(41, 53, 4)
```


40
35
30
25
20
15
10
5
0
0
10
20
30
40
50

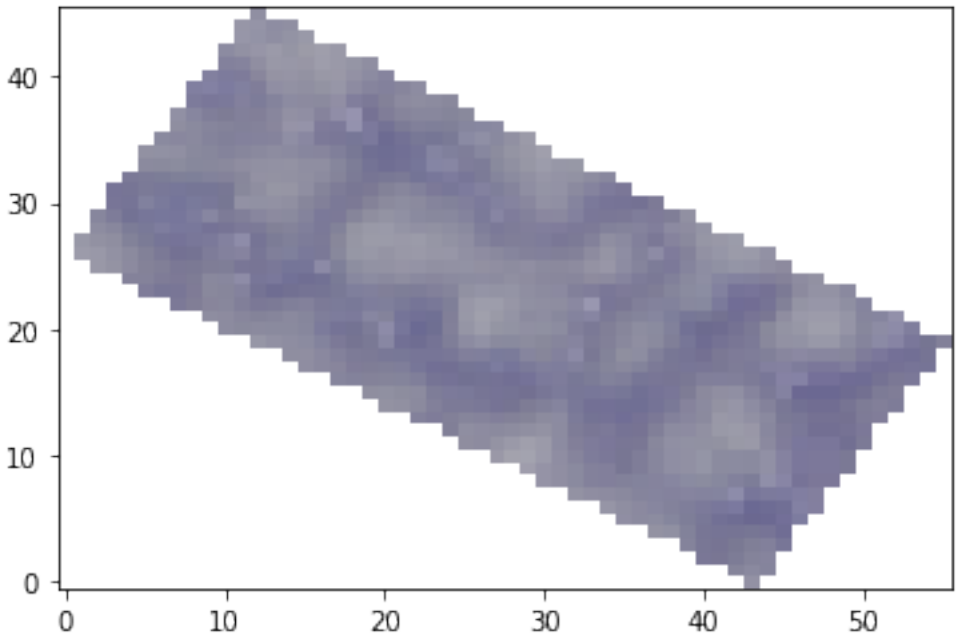
```
(41, 53, 4)
```


40
35
30
25
20
15
10
5
0
0
10
20
30
40
50

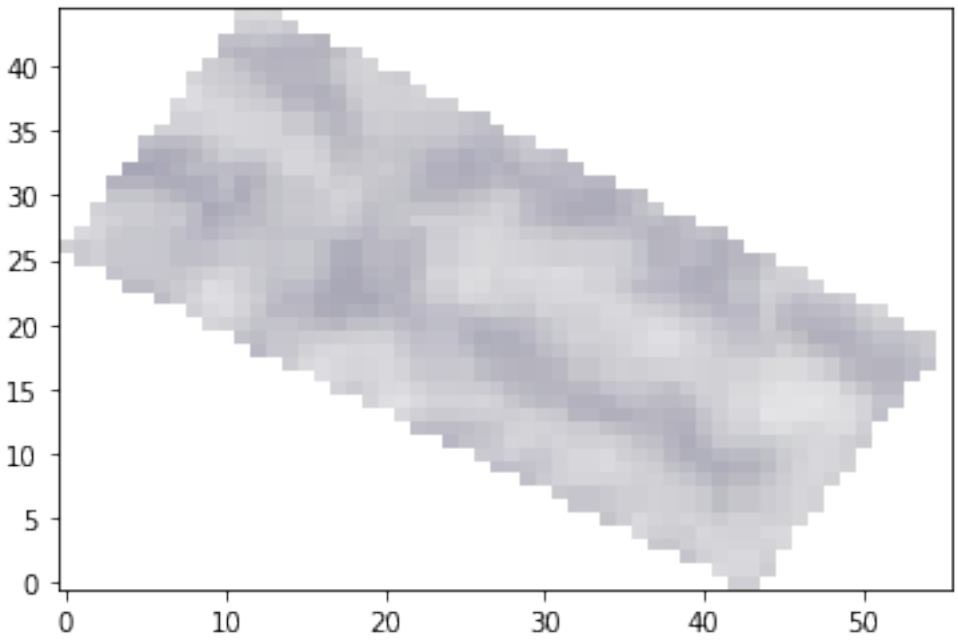
```
(46, 55, 4)
```



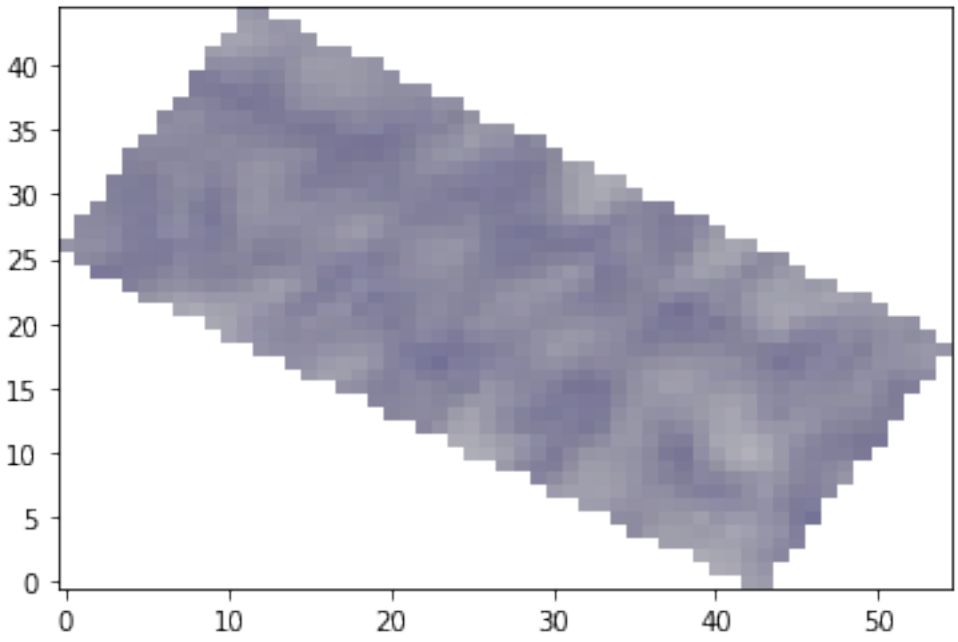

```
(46, 56, 4)
```




```
(45, 56, 4)
```

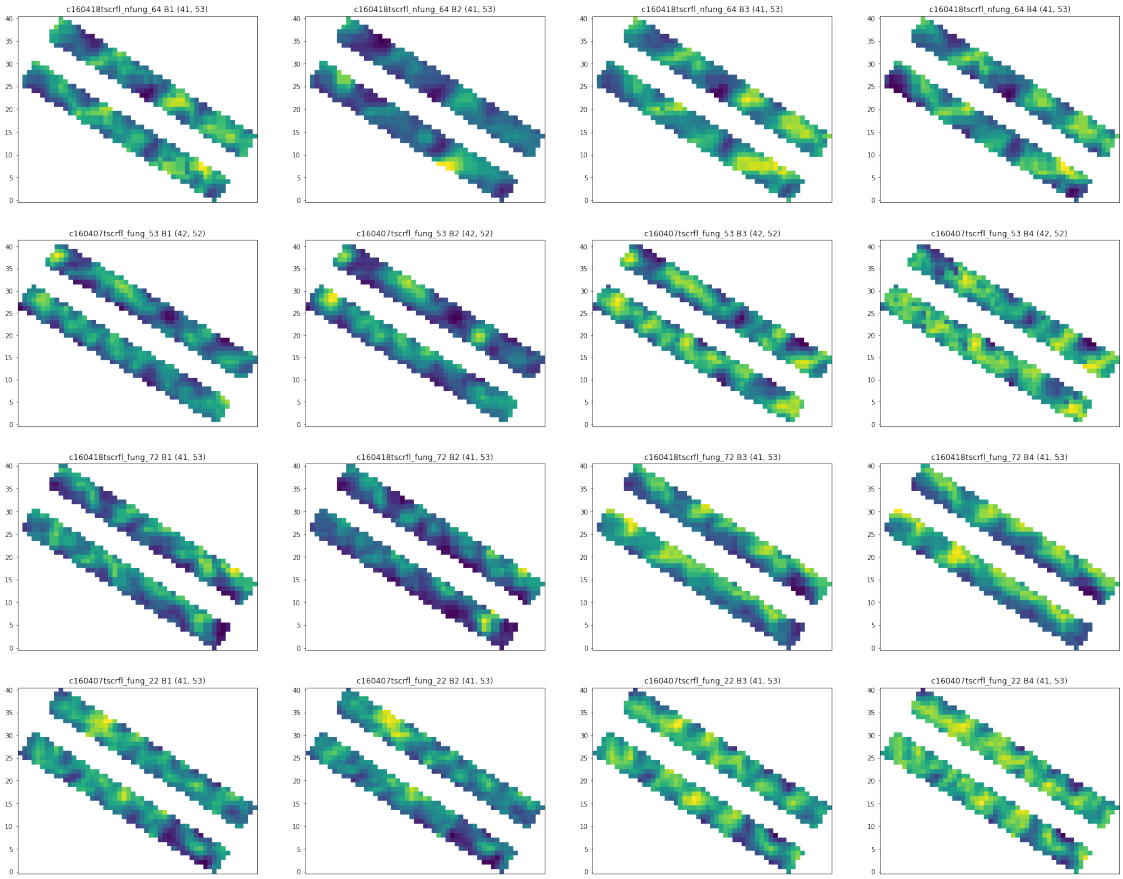


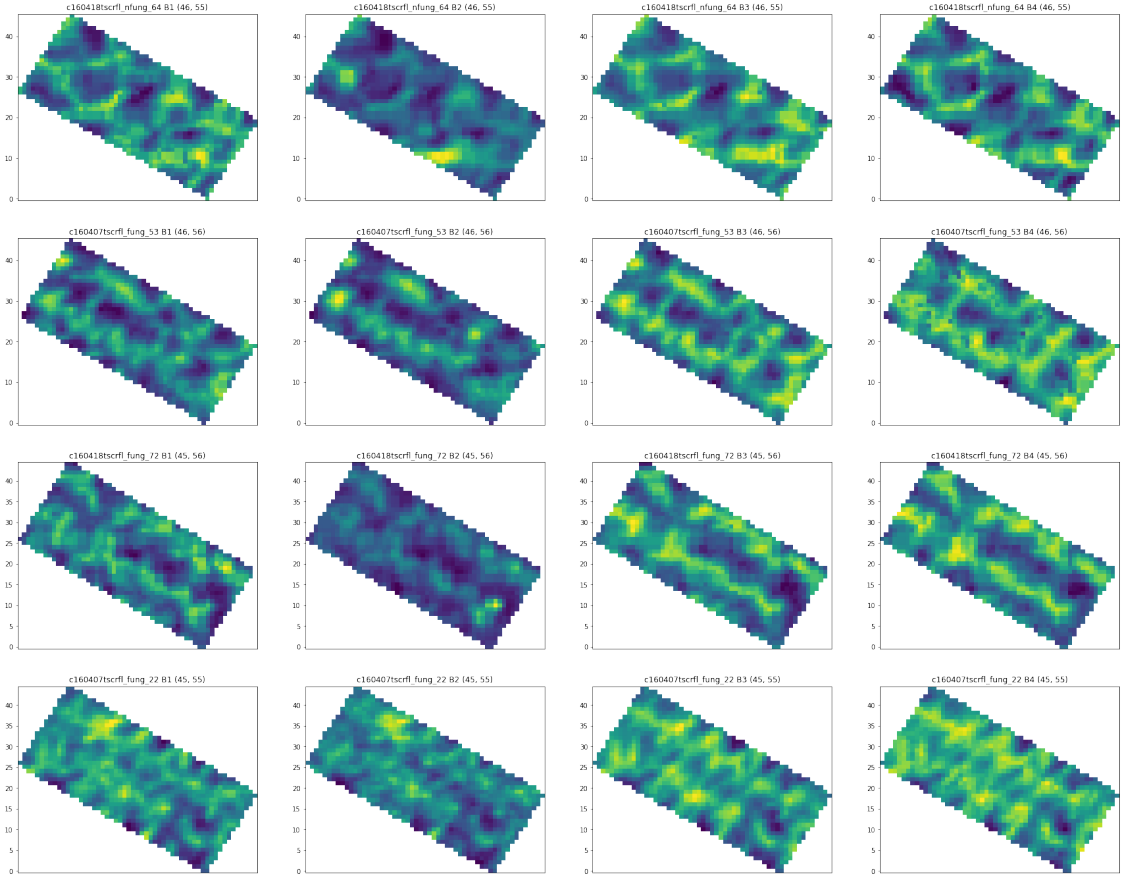

```
(45, 55, 4)
```



[31]:
```
for folder in folders:
    fig, ax = plt.subplots(4, 4, figsize = (30, 24))
```

```
    i = 0
    for sample in samples:
        for j, band in enumerate(['B1', 'B2', 'B3', 'B4']):
            image = rasterio.open(os.path.join('data', folder,
                                               sample + '_' + band
                                               + '.tif'),
                                  driver='GTiff')
            image = image.read(1)
#             print(sample, band, image.shape)
            image = remove_less_than_zero(image)
            ax[i//4, i%4].imshow(image, aspect='auto', origin='lower')
        #     ax[i//4, i%4].set_yticks(freqs[::40])
        #     ax[i//4, i%4].set_xticks(times[::40])
            ax[i//4, i%4].set_title(f"{sample} {band} {image.shape}")
            ax[i//4, i%4].get_xaxis().set_ticks([])
            i+=1
    fig.savefig(f"samples-{folder.split(os.sep)[-1]}", dpi=100)
```




c160418tscrfl_nfung_64 B1 (46, 55)
c160418tscrfl_nfung_64 B2 (46, 55)
c160418tscrfl_nfung_64 B3 (46, 55)
c160418tscrfl_nfung_64 B4 (46, 55)
c160407tscrfl_fung_53 B1 (46, 56)
c160407tscrfl_fung_53 B2 (46, 56)
c160407tscrfl_fung_53 B3 (46, 56)
c160407tscrfl_fung_53 B4 (46, 56)
c160418tscrfl_fung_72 B1 (45, 56)
c160418tscrfl_fung_72 B2 (45, 56)
c160418tscrfl_fung_72 B3 (45, 56)
c160418tscrfl_fung_72 B4 (45, 56)
c160407tscrfl_fung_22 B1 (45, 55)
c160407tscrfl_fung_22 B2 (45, 55)
c160407tscrfl_fung_22 B3 (45, 55)
c160407tscrfl_fung_22 B4 (45, 55)

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