In [119…

```
#Imports needed libraries
import rasterio
from rasterio import plot
import matplotlib
from matplotlib import pyplot as plt
import numpy as np
%matplotlib inline
import os
from skimage import io, exposure
```

In [ ]:

```
#Opens the rasters
band2=rasterio.open('Subsets/B2subset.tif')
band4=rasterio.open('Subsets/B4subset.tif')
```

In [121…

```
#Defining needed bands
green=rasterio.open('Subsets/subsetB2.tif').read(1).astype('float64')
nir=rasterio.open('Subsets/subsetB4.tif').read(1).astype('float64')
```

In [122…

```
#Functions were taken from GEO468E_notebook.ipynb
def normalize(array):
    array_min, array_max = array.min(), array.max()
    return (array - array_min) / (array_max - array_min)
def image_histogram(img):
    """
    Plot image histogram
    Input:
    img - 2D array of uint16 type
    """
    co, ce = exposure.histogram(img)

    fig = plt.figure(figsize=(10, 7))
    fig.set_facecolor('white')
    plt.plot(ce[1::], co[1::])
    plt.show()

def image_adjust_brightness(img, limit_left, limit_right, color_map, title):
    """
    Adjust image brightness and plot the image
    Input:
    img - 2D array of uint16 type
    limit_left - integer
    limit_right - integer
    color_map - string
    title - string
    """
    img_ha = exposure.rescale_intensity(img, (limit_left, limit_right))

    fig = plt.figure(figsize=(10, 10))
    fig.set_facecolor('cyan')
    plt.imshow(img_ha, cmap=color_map)
    plt.title(title)
    plt.colorbar()
    plt.show()

    return img_ha

def image_show(img, color_map, title):
    """
    Show image
    Input:
    img - 2D array of uint16 type
    color_map - string
    title - string
    """
    fig = plt.figure(figsize=(10, 10))
    fig.set_facecolor('white')
    plt.imshow(img, cmap=color_map)
    plt.title(title)
    plt.show()

def image_histogram(img):
    """
    Plot image histogram
    Input:
    img - 2D array of uint16 type
    """
    co, ce = exposure.histogram(img)

    fig = plt.figure(figsize=(20, 7))
    fig.set_facecolor('white')
    plt.plot(ce[1::], co[1::])
    plt.show()
```

In [123…

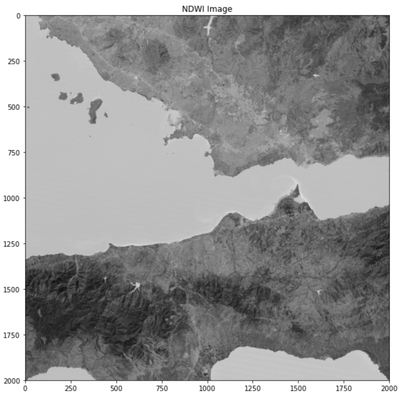
```
#Calculates ndwi index
ndwi=np.where(
    (green+nir)==0.,
    0,
    (green-nir)/(green+nir))
ndwi[:5,:5]
```

Out[123…

```
array([[0.01775974, 0.02652753, 0.01775974, 0.00854808, 0.01775974],
       [0.00854808, 0.00883257, 0.01775974, 0.02652753, 0.02652753],
       [0.00883257, 0.00883257, 0.02652753, 0.02652753, 0.01775974],
       [0.00854808, 0.01775974, 0.01775974, 0.00854808, 0.02652753],
       [0.02652753, 0.02652753, 0.01731871, 0.00854808, 0.00854808]])
```

In [124…

```
#Shows the results
image_show(ndwi,"gray","NDWI Image")
```



In [ ]:

```
#Exports the ndwi image
ndwi_img=rasterio.open("Outputs/NDWI.tif",'w',driver='gtiff',
                       width=band4.width,
                       height = band4.height,
                       count=1, crs=band4.crs,
                       transform=band4.transform,
                       dtype='float64')
ndwi_img.write(ndwi,1)
```

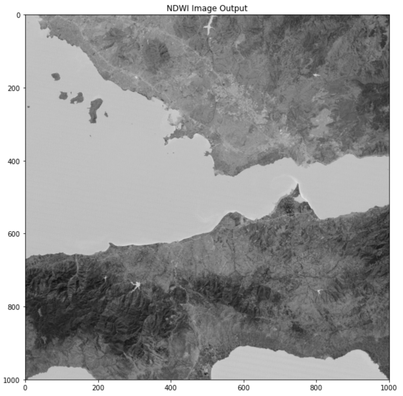
In [126…

```
#Closes image
ndwi_img.close()
```

In [127…

```
#Opens the exported output
ndwitif=rasterio.open('Outputs/NDWI.TIF').read(1).astype('float64')

image_show(ndwitif,"gray","NDWI Image Output")
```



In [128…

```
#Histogram
image_histogram(ndwi)
```