project

January 14, 2021

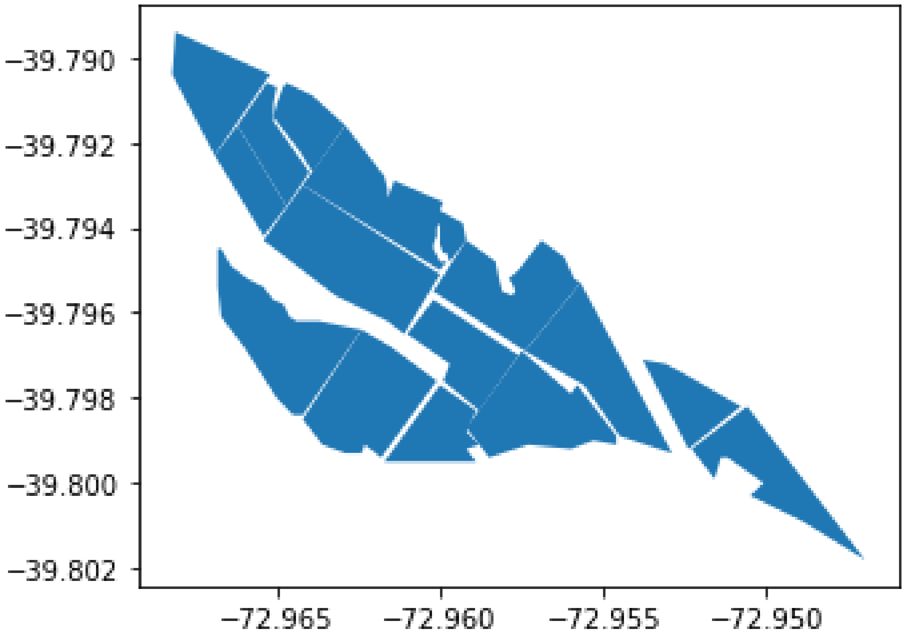
Import de librerías y directorios

[1]:
```python
import os
import scipy.sparse as sparse
import numpy as np
import pandas as pd
import geopandas as gpd
import rasterio
from rasterio.plot import show
import rasterstats
from shapely.geometry import Point, Polygon, LineString

import matplotlib.pyplot as plt
%matplotlib inline

# directory names
raster_dir = "raster/"
shape_dir = "shape/"
```

Visualización previa del geojson

[2]:
```python
potreros = gpd.read_file(shape_dir+"agrospace_piloto.geojson")
potreros.plot()
```

[2]:
```
<AxesSubplot:>
```



```
[3]: print(potreros.head())
```

```
   Sector   ID          Name          area  \
0     1.0  1.0  Punta estero  41369.504460
1     1.0  2.0        Laurel  22633.602809
2     1.0  3.0       Patagua  24631.063595
3     1.0  4.0   Lado estero  22348.761392
4     2.0  1.0        Maiz 2  80783.875155

                                            geometry
0  POLYGON ((-72.96810 -39.78940, -72.96520 -39.7…
1  POLYGON ((-72.96540 -39.79420, -72.96690 -39.7…
2  POLYGON ((-72.96470 -39.79350, -72.96620 -39.7…
3  POLYGON ((-72.96480 -39.79070, -72.96470 -39.7…
4  POLYGON ((-72.96540 -39.79430, -72.96420 -39.7…
```

Procesamiento de datos

```
[4]: def find_nodata_val(src_readed):
         # normally, src.nodatavals[0] would do it, but it seems that the actual␣
      ↪value used in src does not match
         for i in range(len(src_readed)):
             for j in range(len(src_readed[i])):
                 if src_readed[i][j] < 0:
                     return src_readed[i][j]
```

[5]:

```python
# metrics
measured_data = []

for raster in os.listdir(raster_dir):
    # we ensure the files we're going to read have the extension .tif
    if (raster[-4:] == '.tif'):

        date = raster.replace('agrospace_piloto_', '')
        date = date.replace('.tif', '')

        # raster to np array
        src = rasterio.open(raster_dir+raster)
        nodataval = find_nodata_val(src.read(1))

        measured_data.append(rasterstats.zonal_stats(potreros, src.read(1),␣
 ↪affine = src.transform, nodata=nodataval, stats="count min mean std max␣
 ↪median",
                                                     geojson_out = True))
        for i in range(len(measured_data[-1])):
            measured_data[-1][i]['date'] = date  # añadimos la fecha al␣
 ↪diccionario

        # plotting
        fig, ax = plt.subplots(1, 1)
        show(rasterio.open(raster_dir+raster), title = date)
        potreros.plot(ax=ax, facecolor='None', edgecolor = 'red')
        plt.show()
```

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
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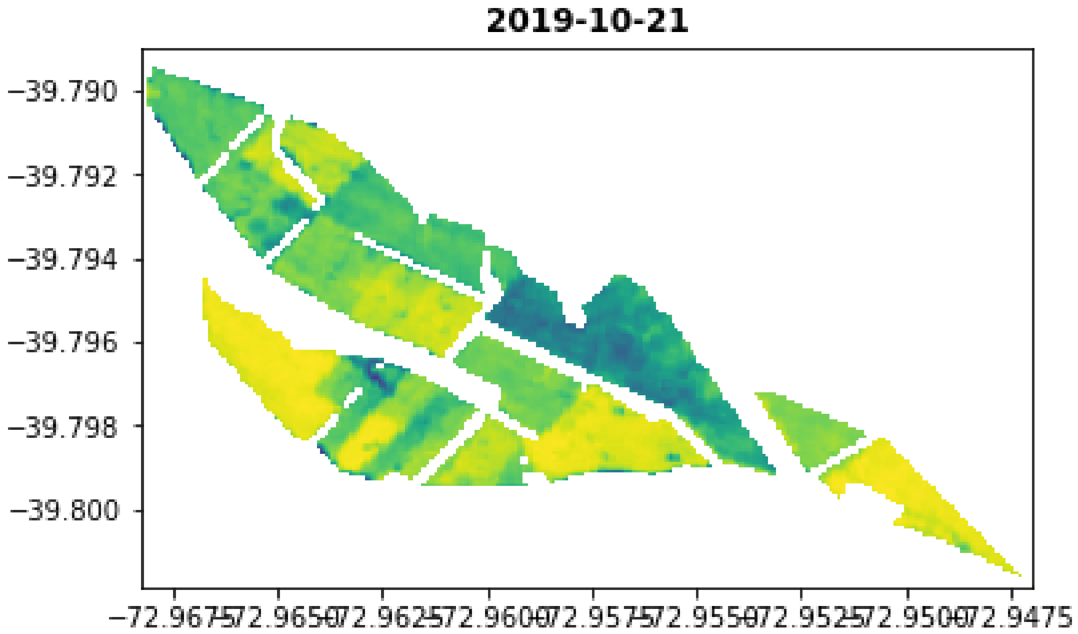

```
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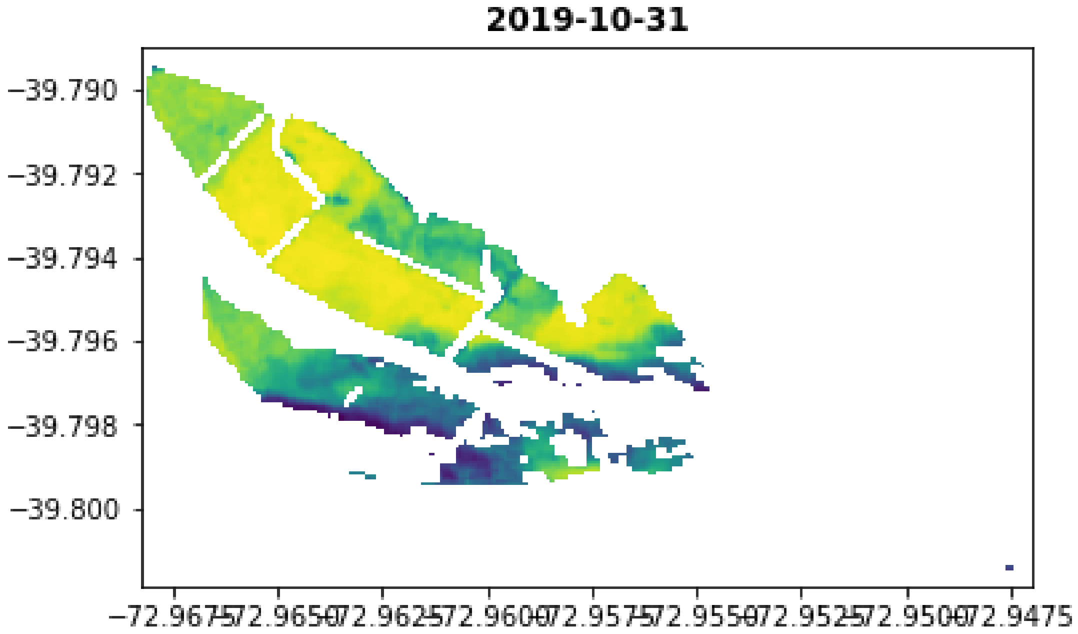

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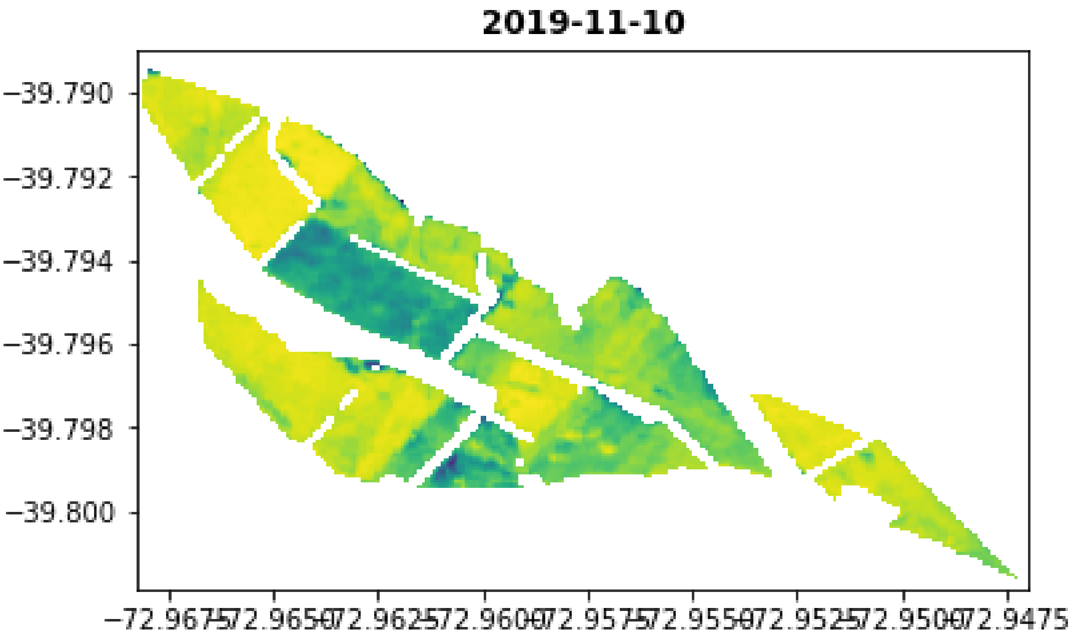

2019-11-10

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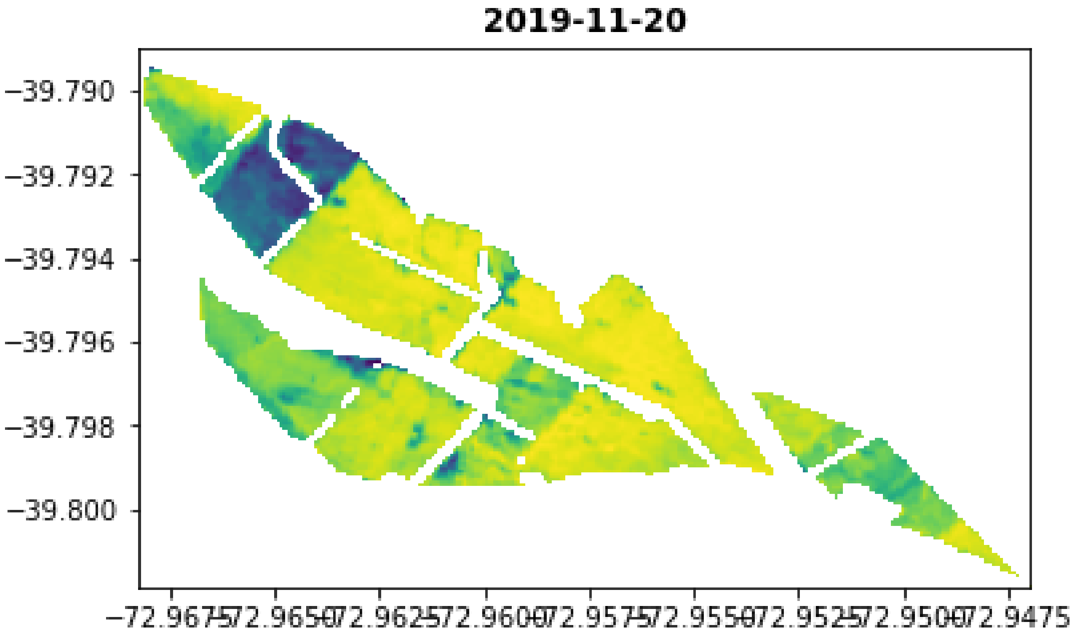

2019-11-20

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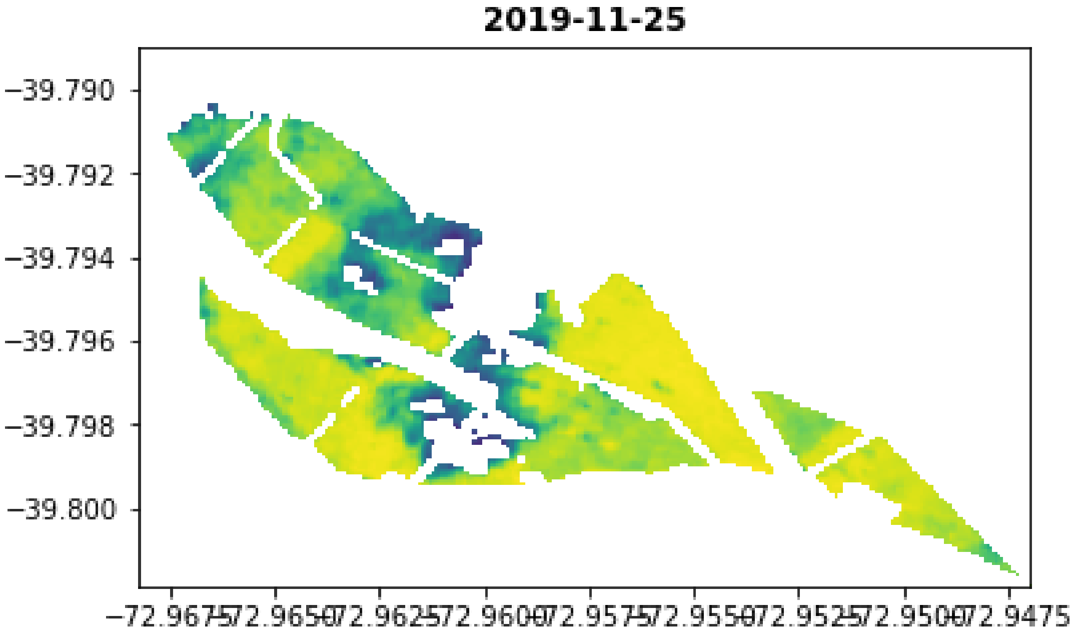

2019-11-25

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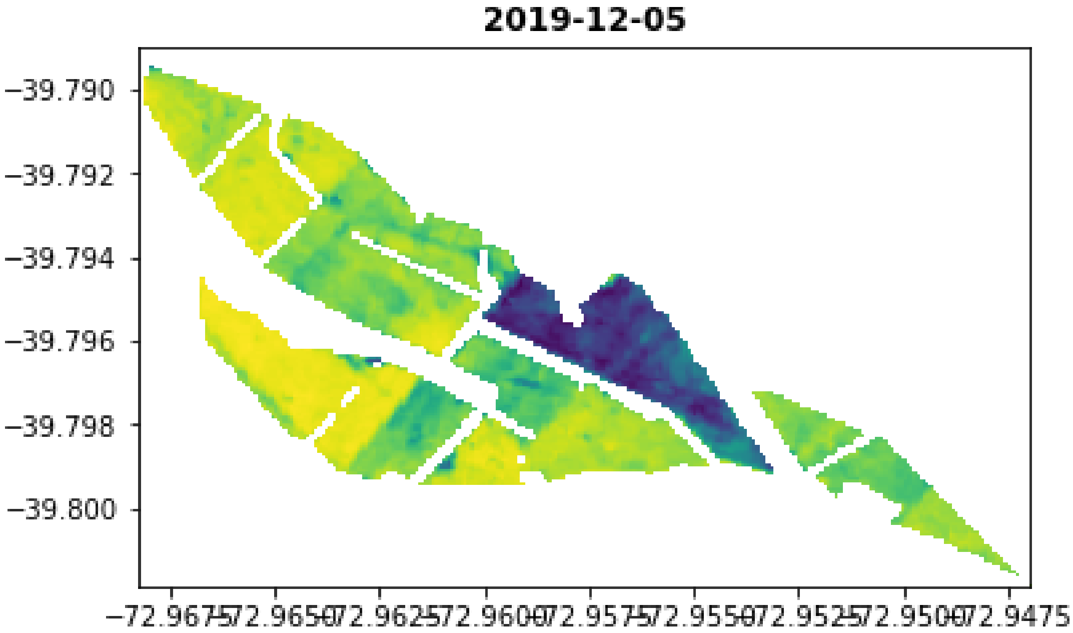

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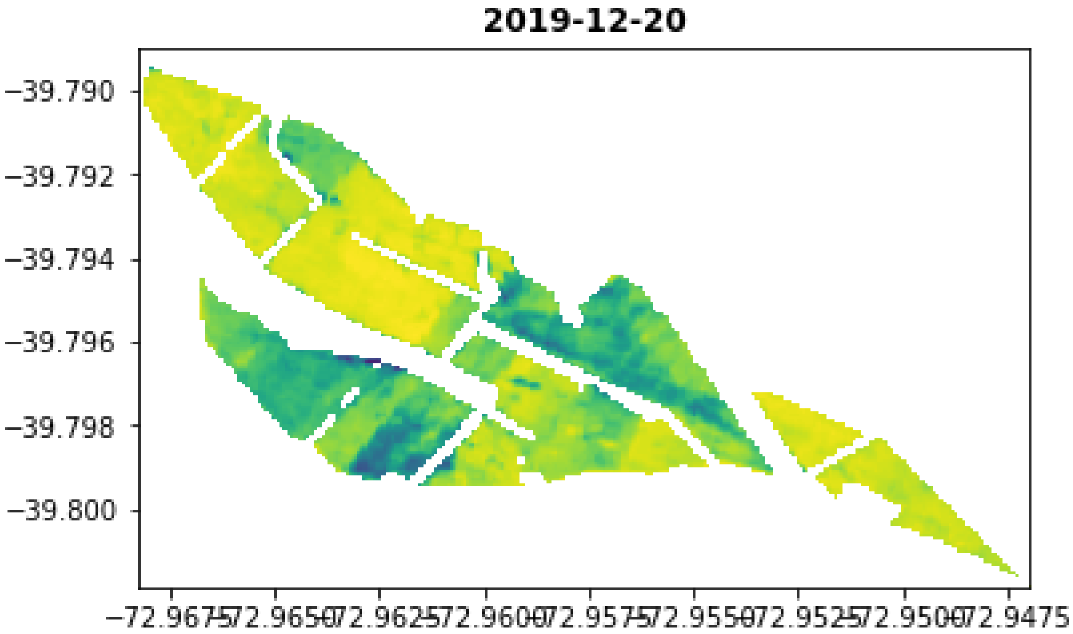

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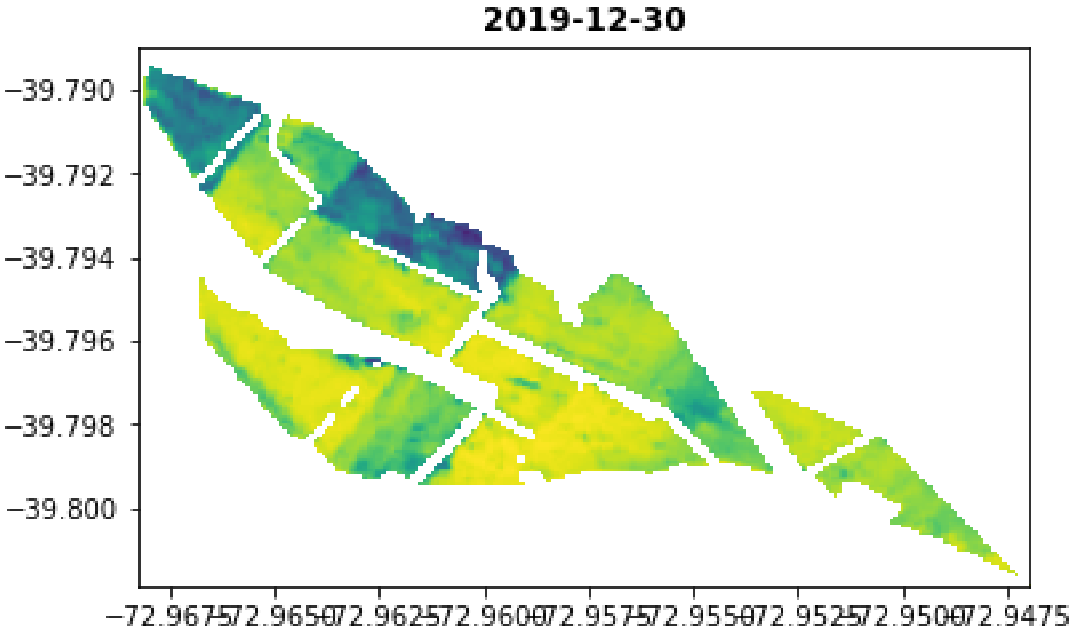

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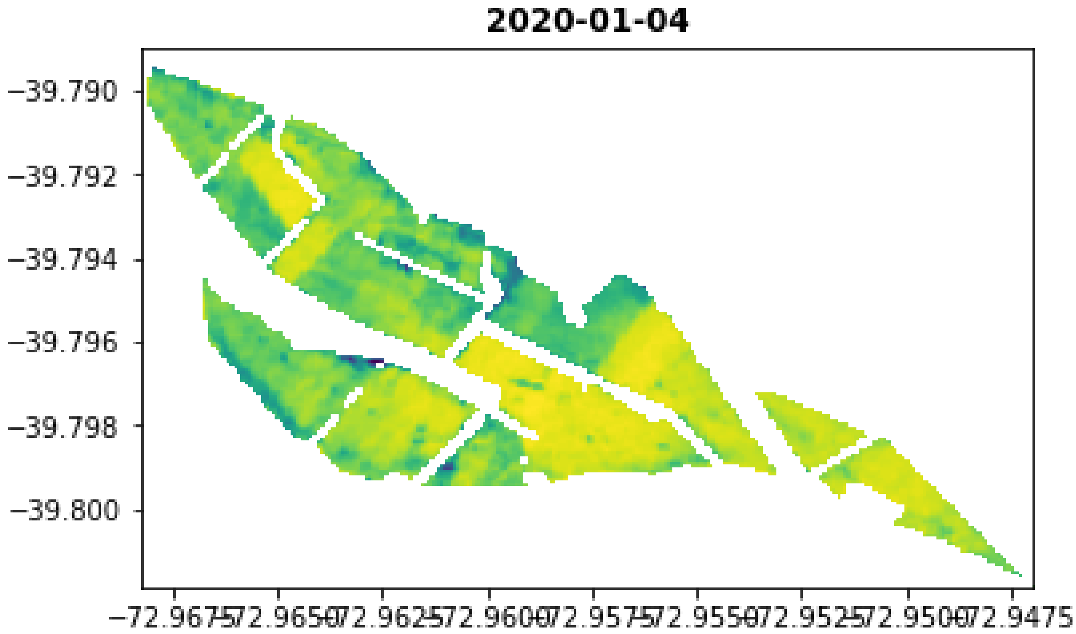

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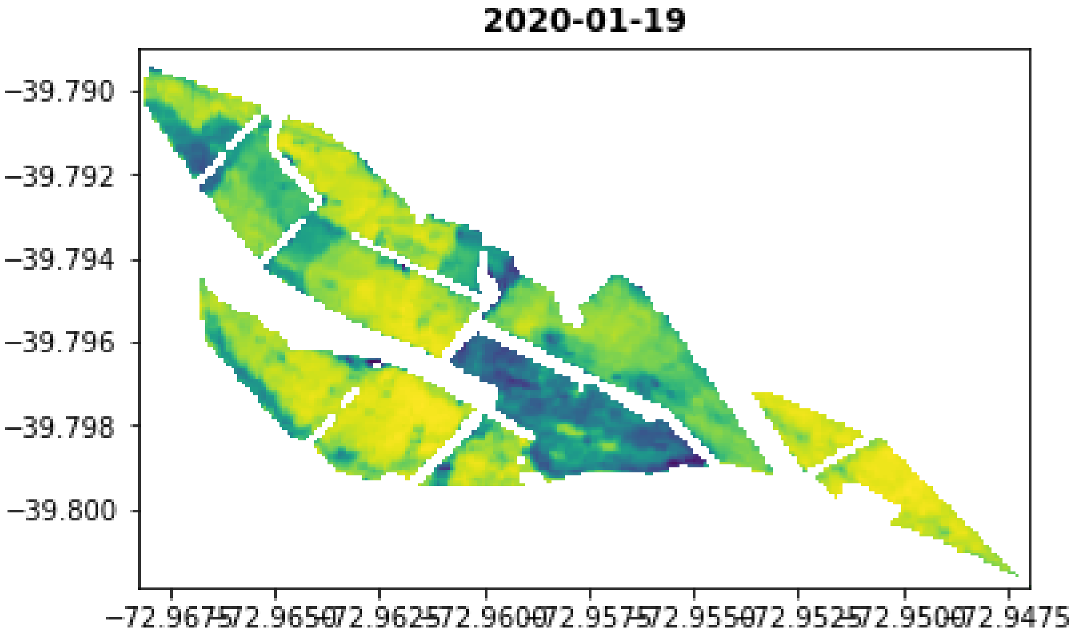
2020-01-19

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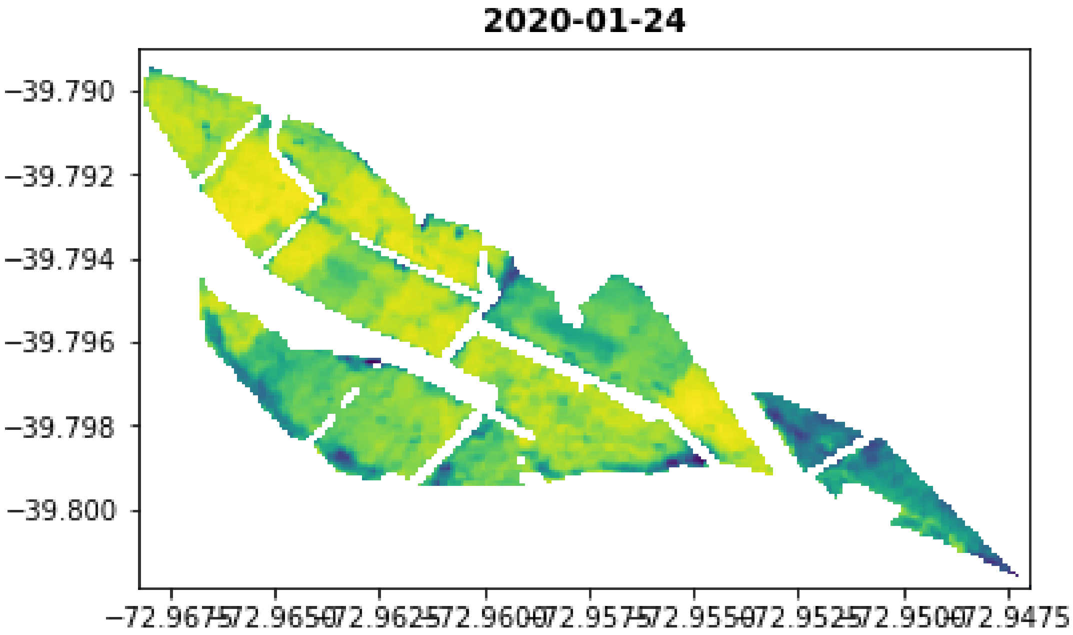
2020-01-24

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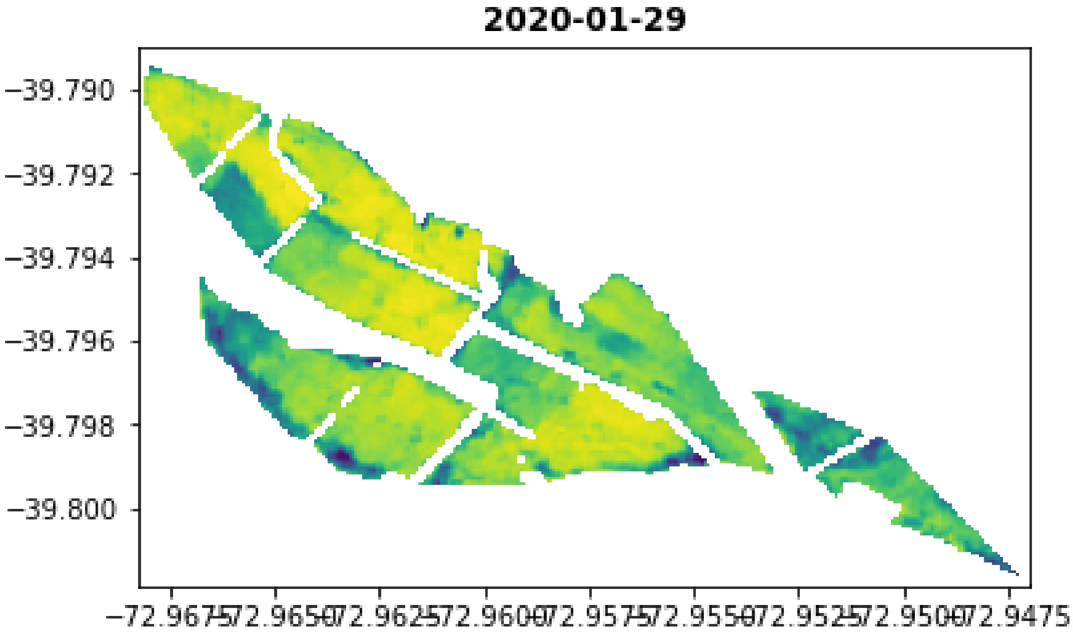

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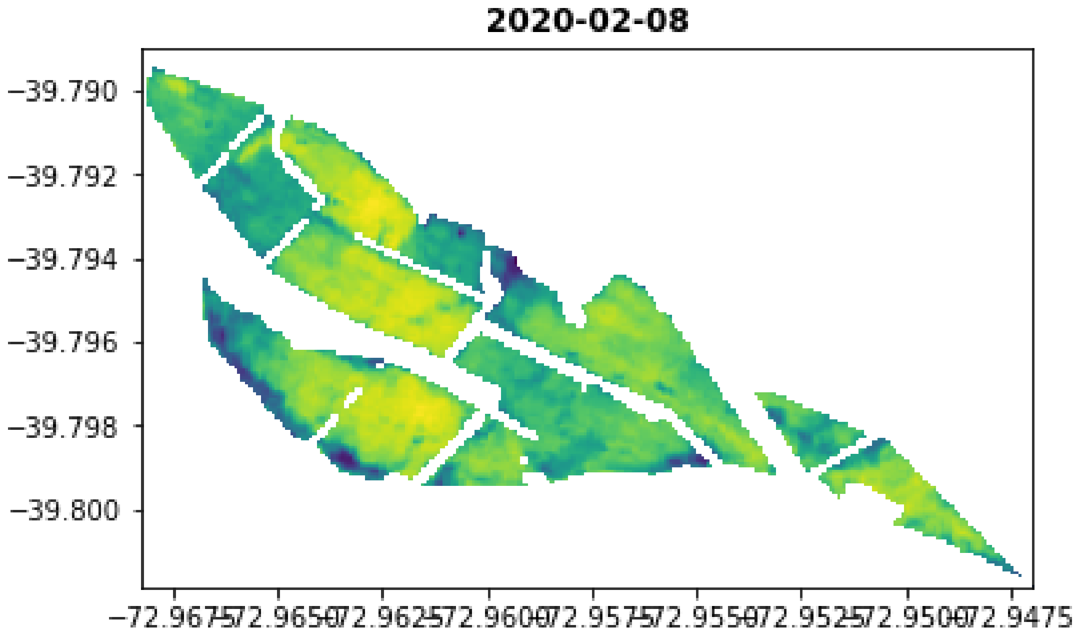
2020-02-08

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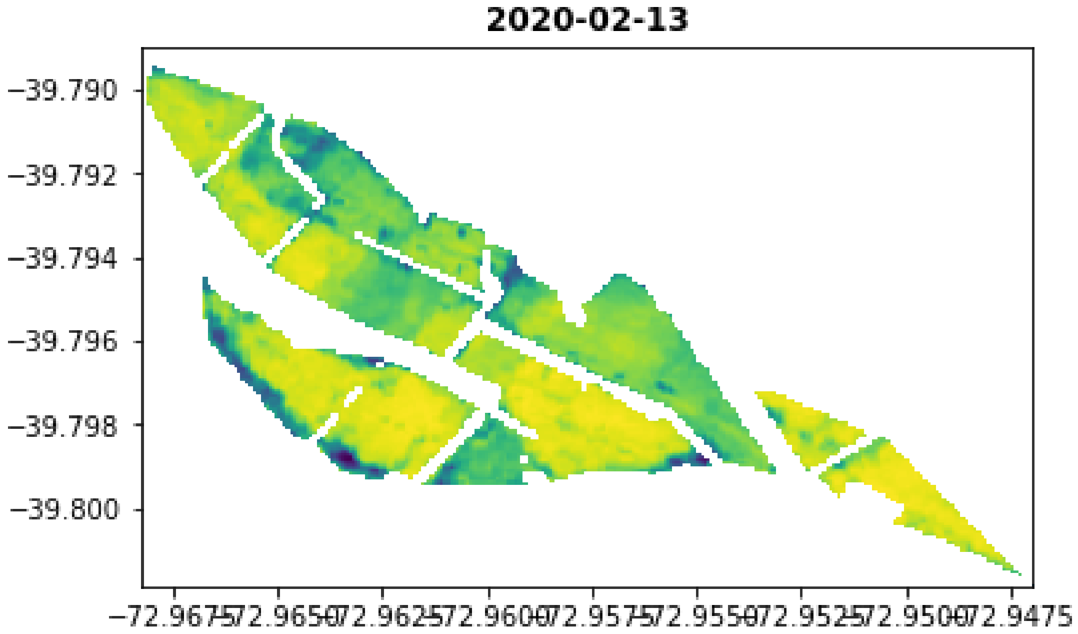
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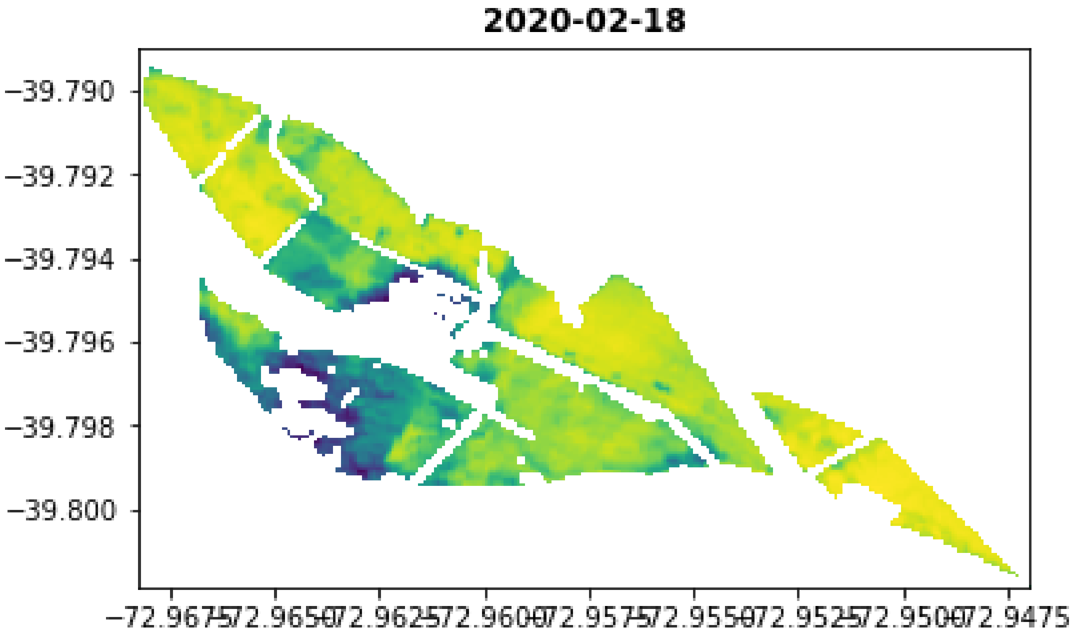

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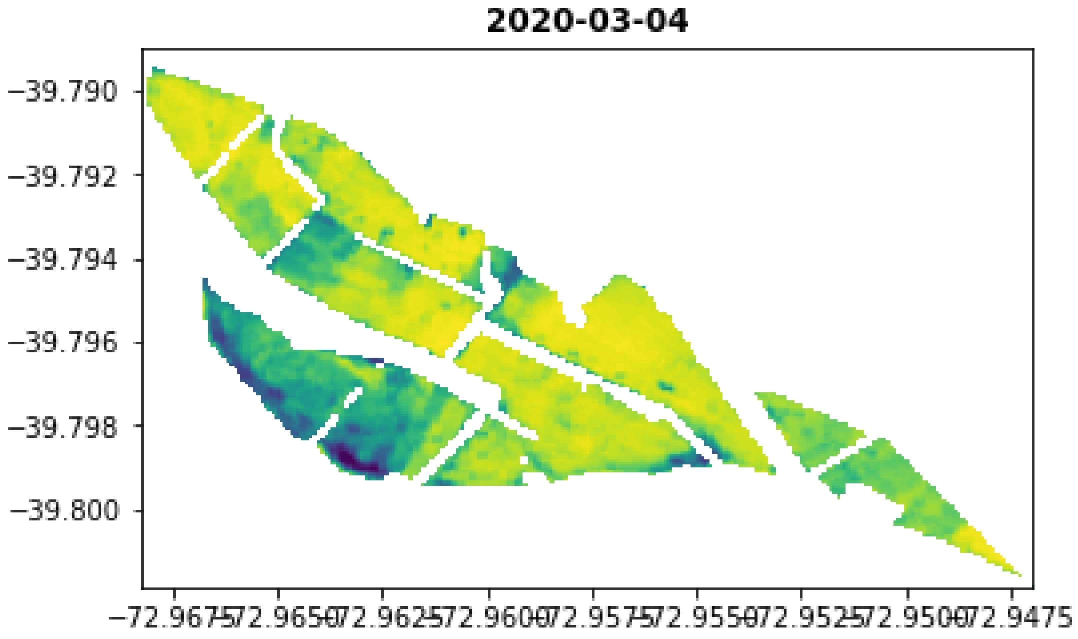

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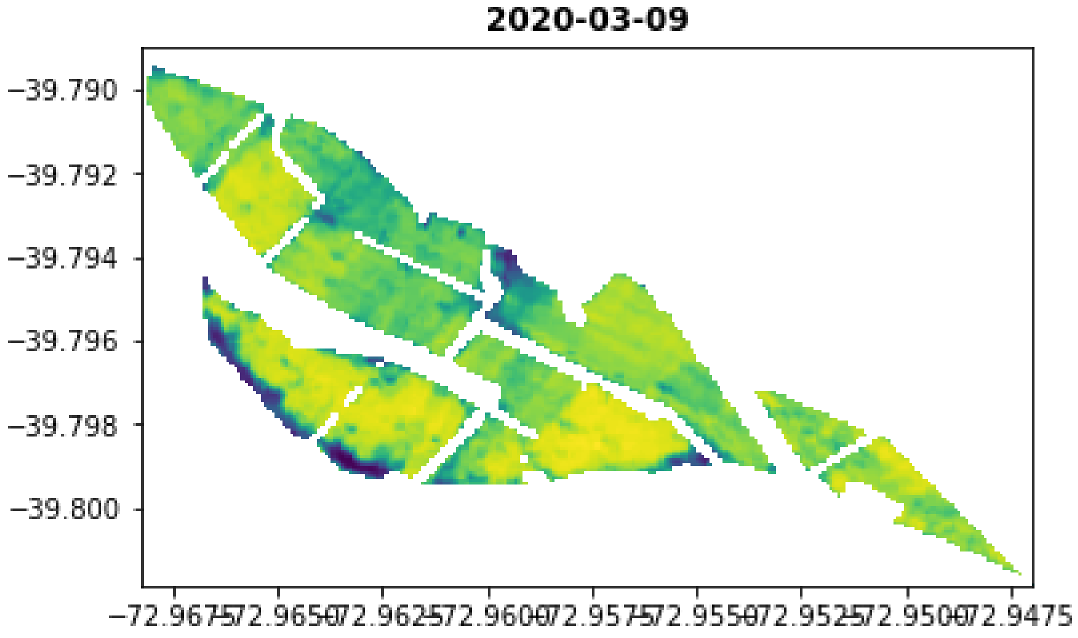

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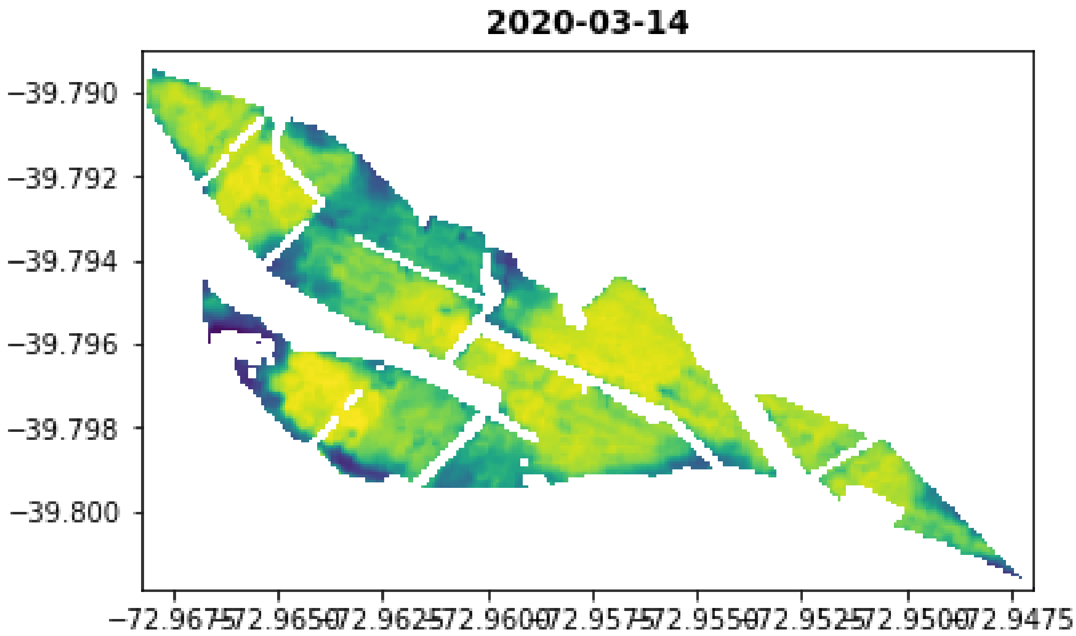

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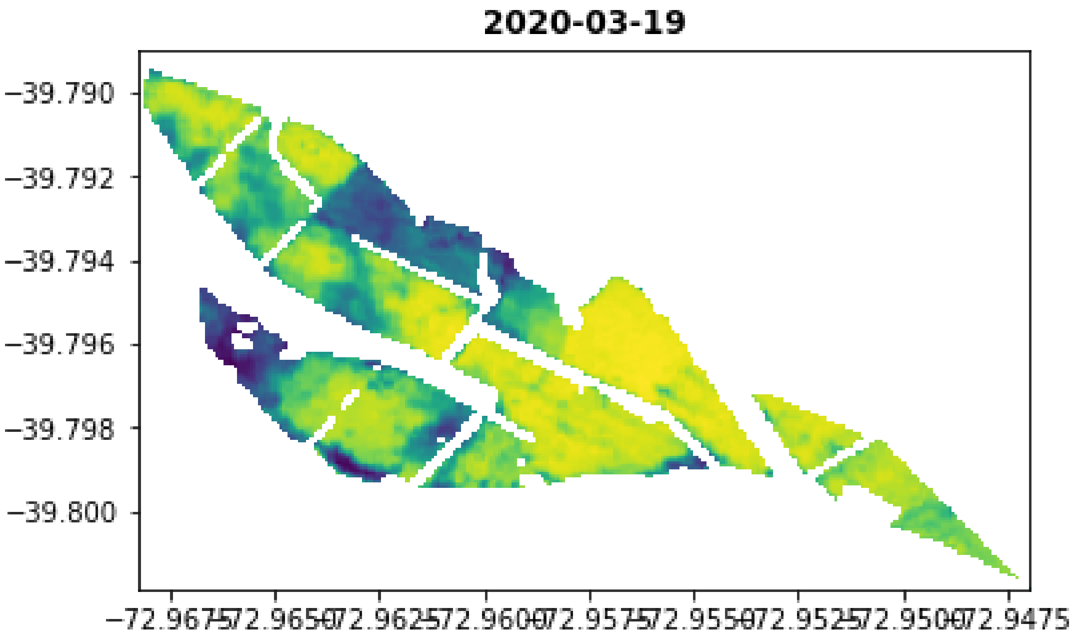
2020-03-19
−39.790
−39.792
−39.794
−39.796
−39.798
−39.800
−72.9675
−72.9650
−72.9625
−72.9600
−72.9575
−72.9550
−72.9525
−72.9500
−72.9475

```
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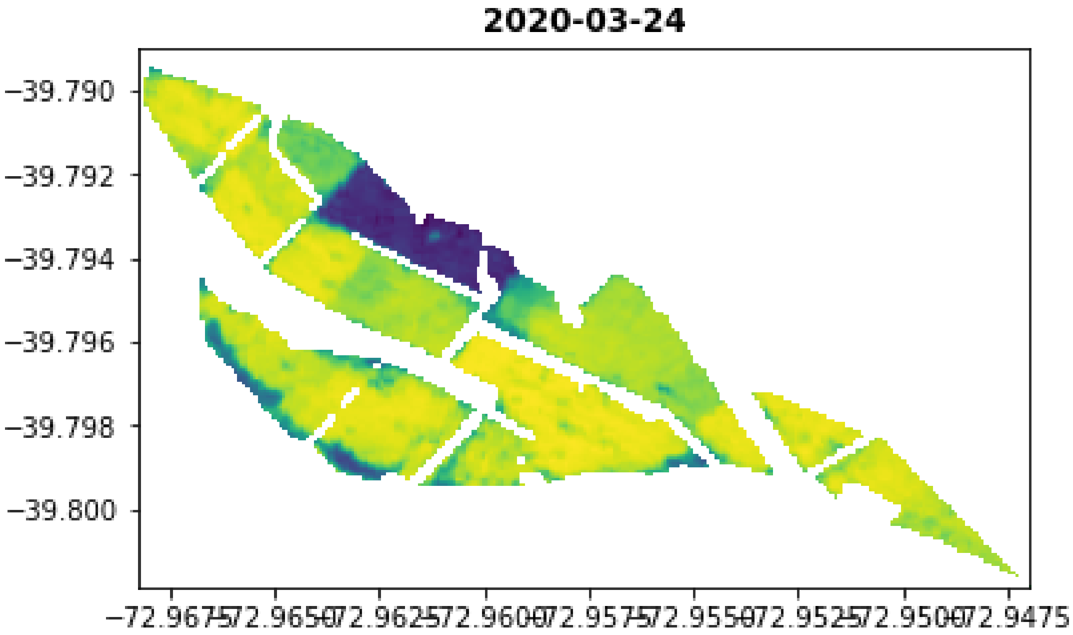
2020-03-24
−39.790
−39.792
−39.794
−39.796
−39.798
−39.800
−72.9675
−72.9650
−72.9625
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−72.9550
−72.9525
−72.9500
−72.9475

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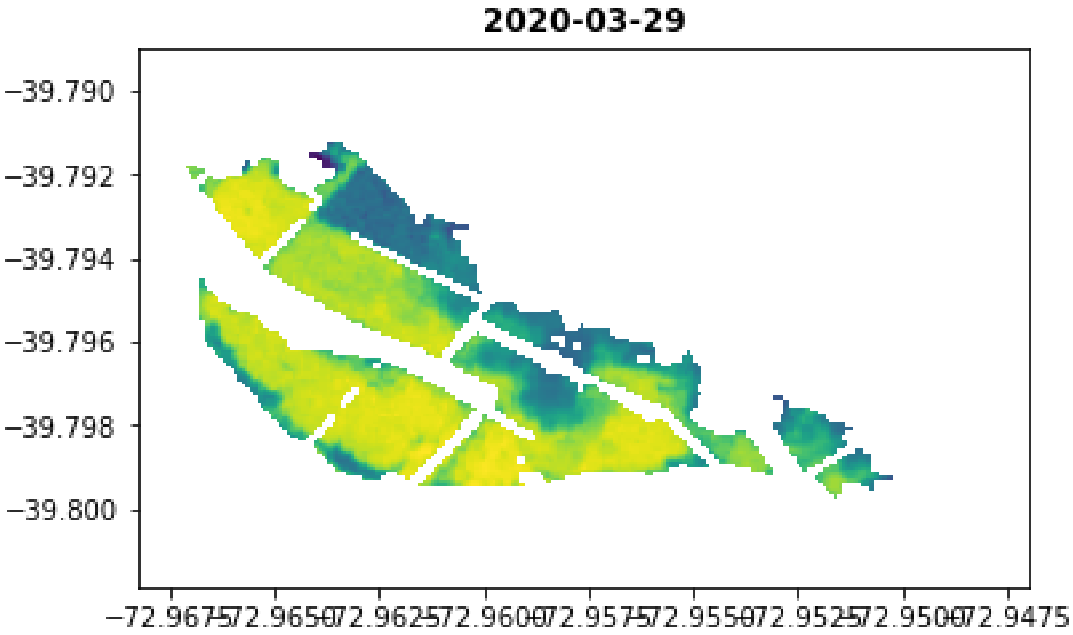

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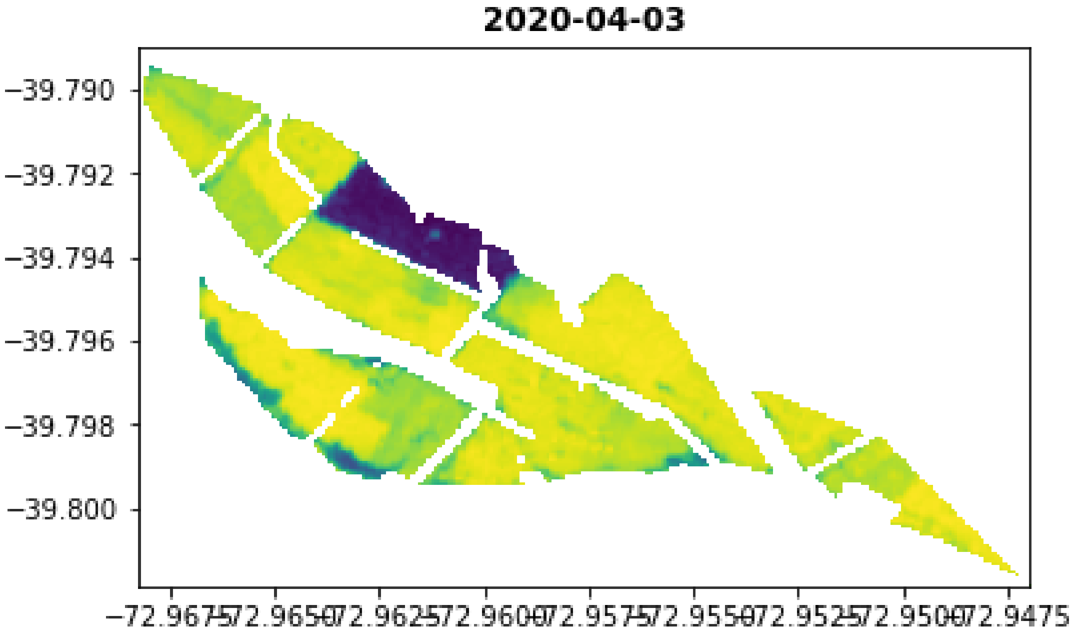

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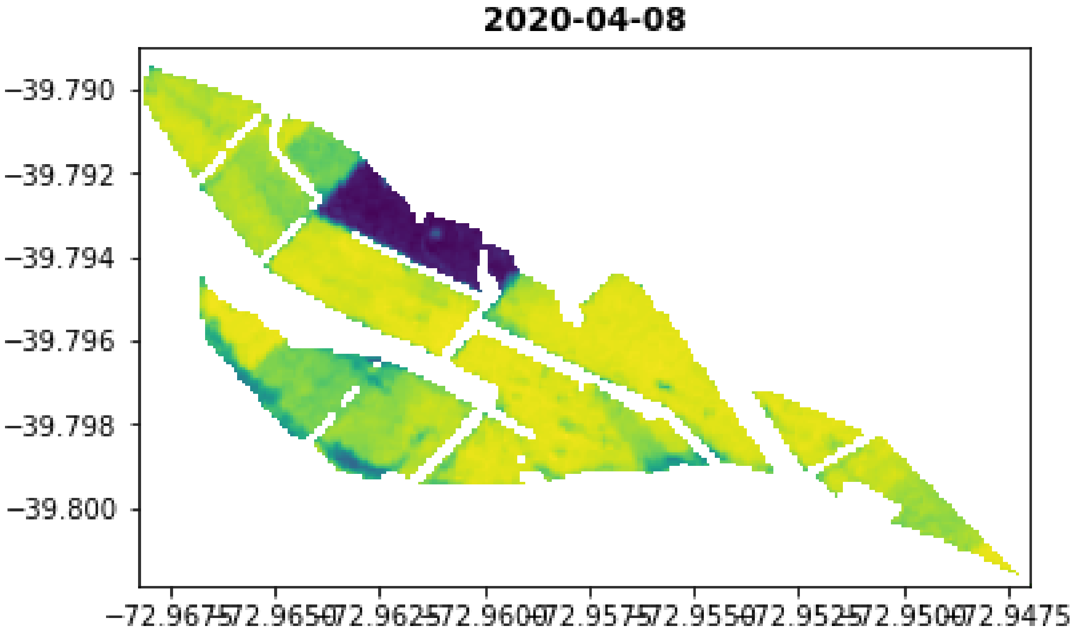
2020-04-08
−39.790
−39.792
−39.794
−39.796
−39.798
−39.800
−72.9675
−72.9650
−72.9625
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−72.9550
−72.9525
−72.9500
−72.9475

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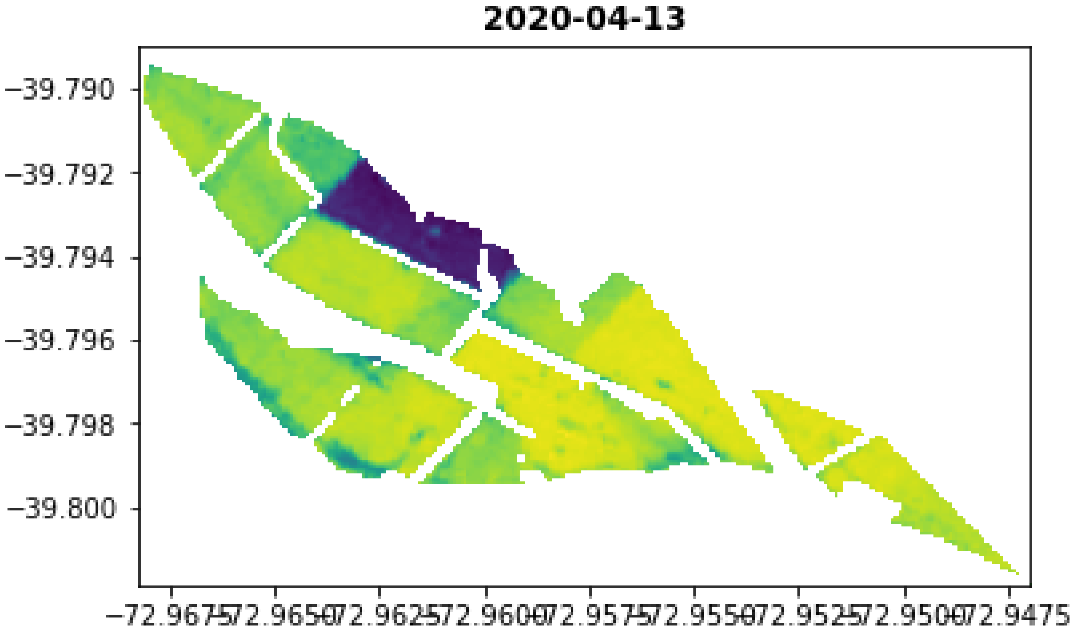
2020-04-13
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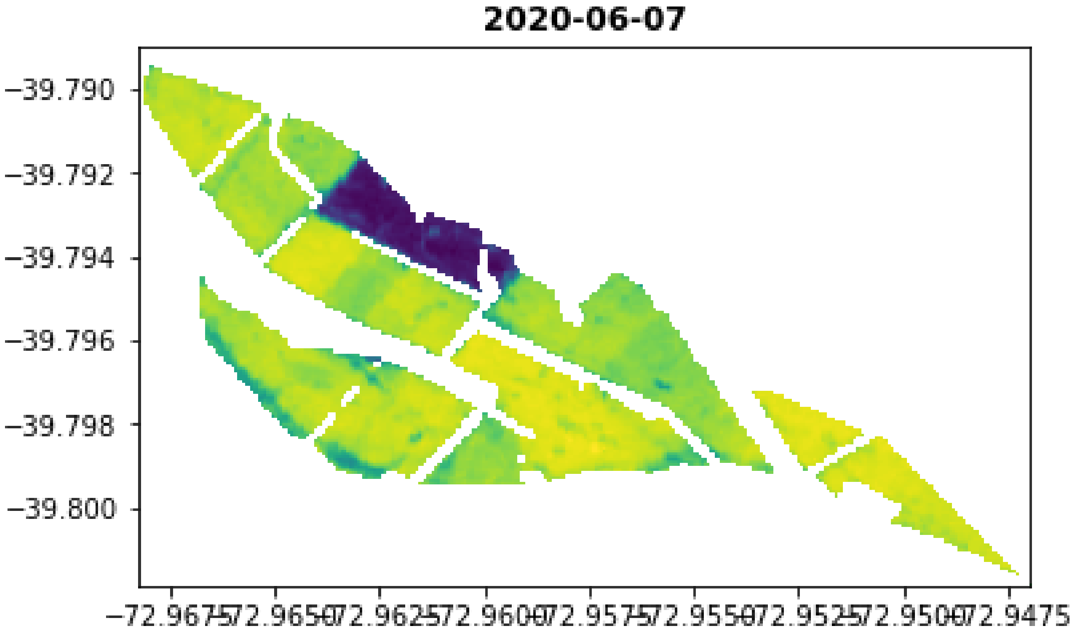

2020-06-07

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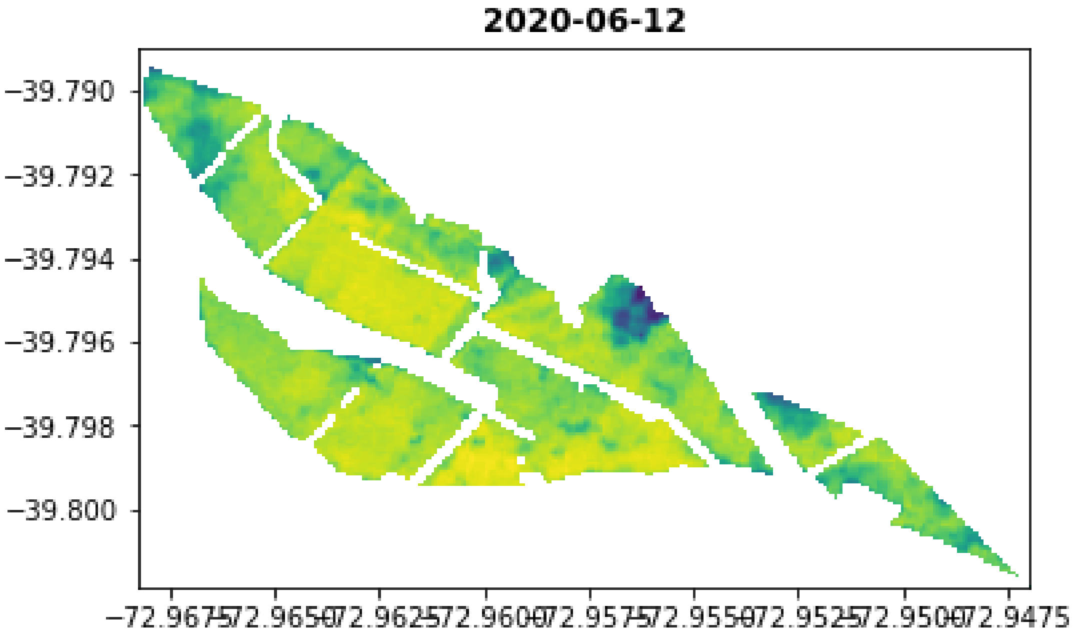

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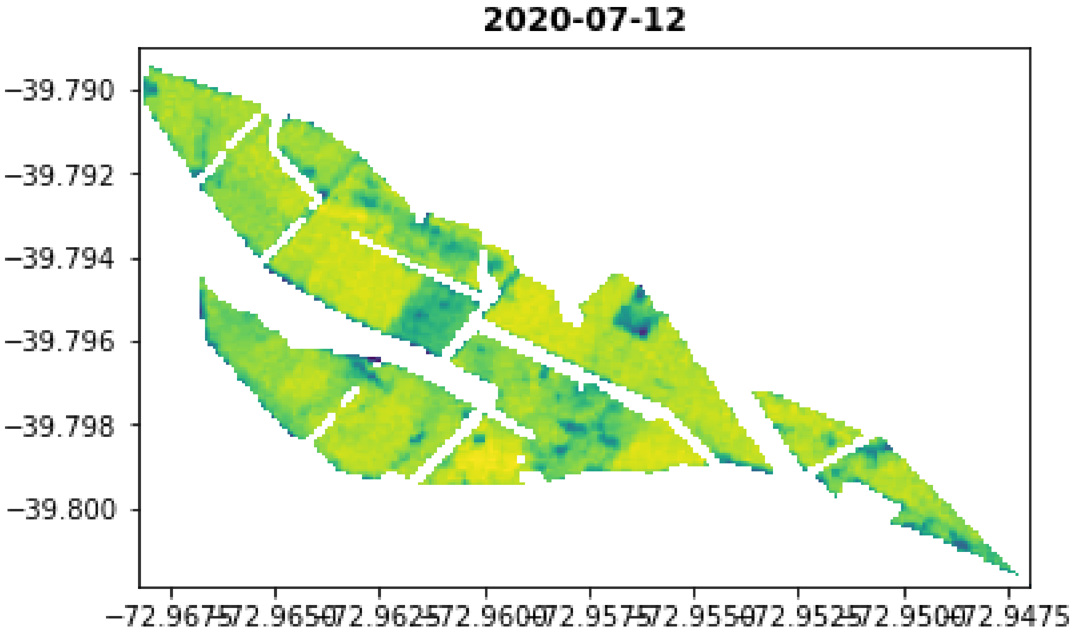

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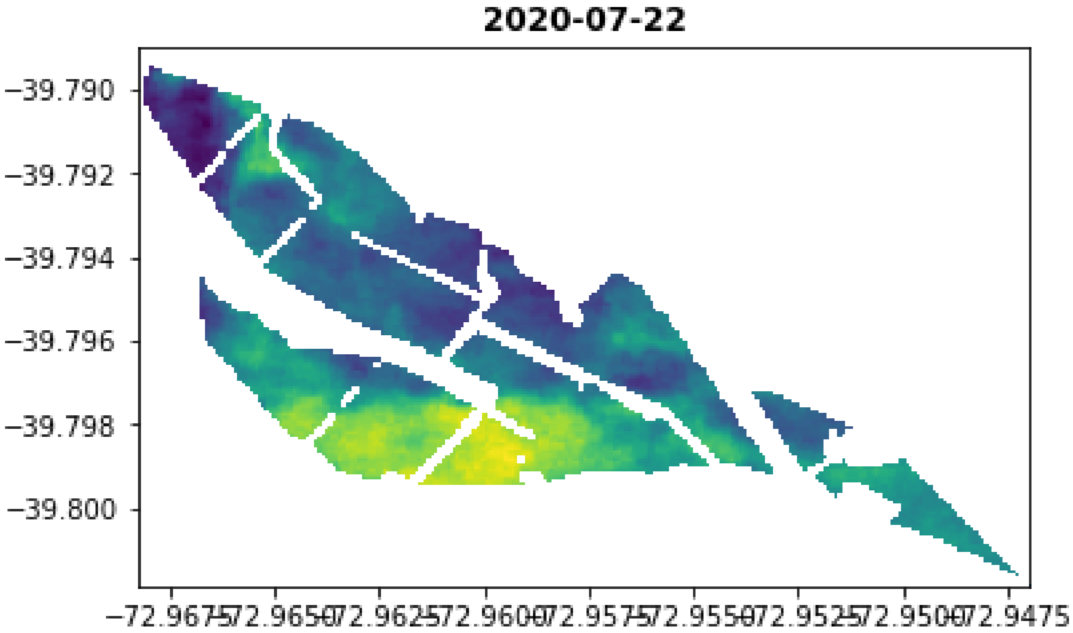

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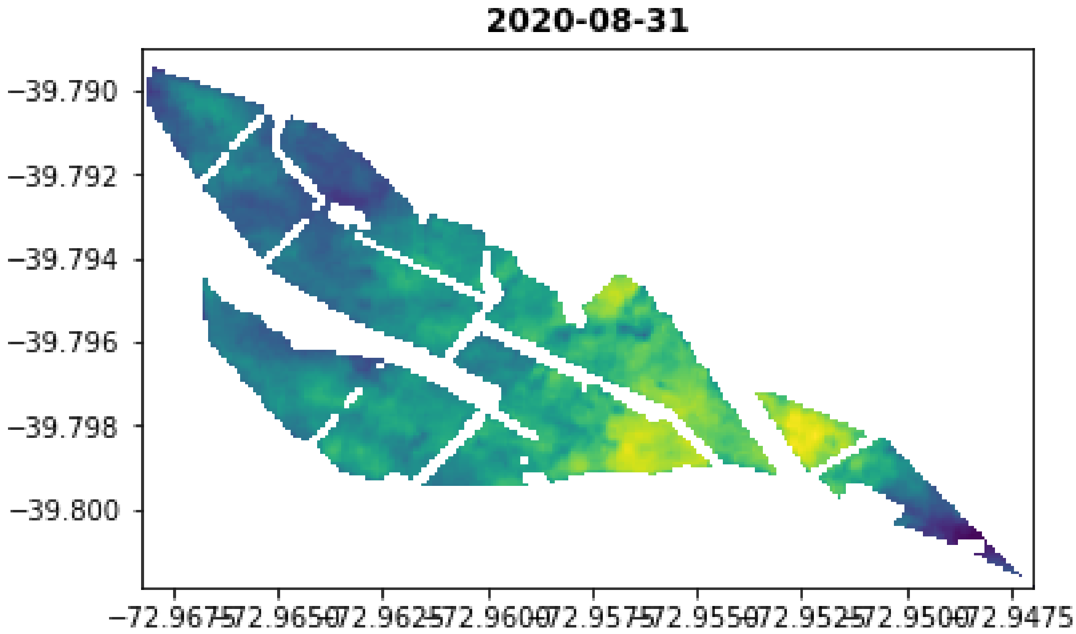

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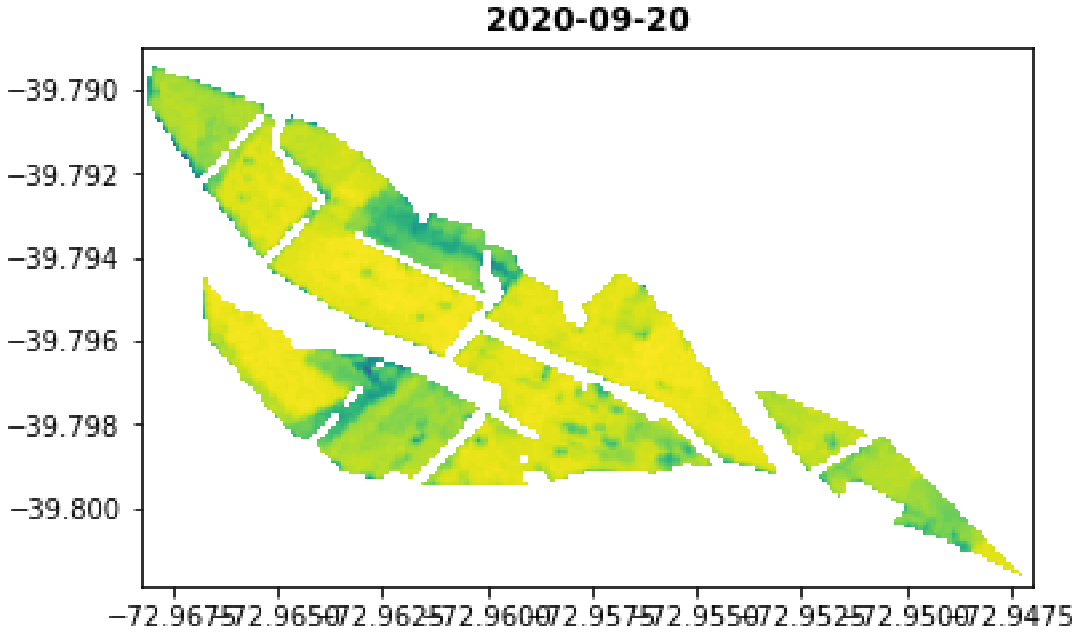

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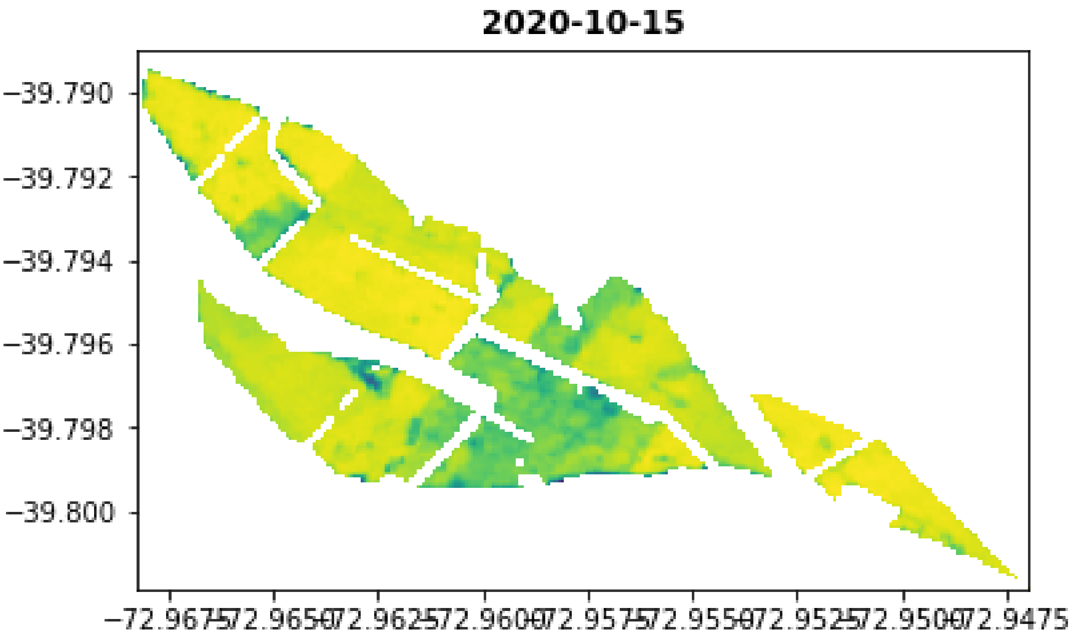

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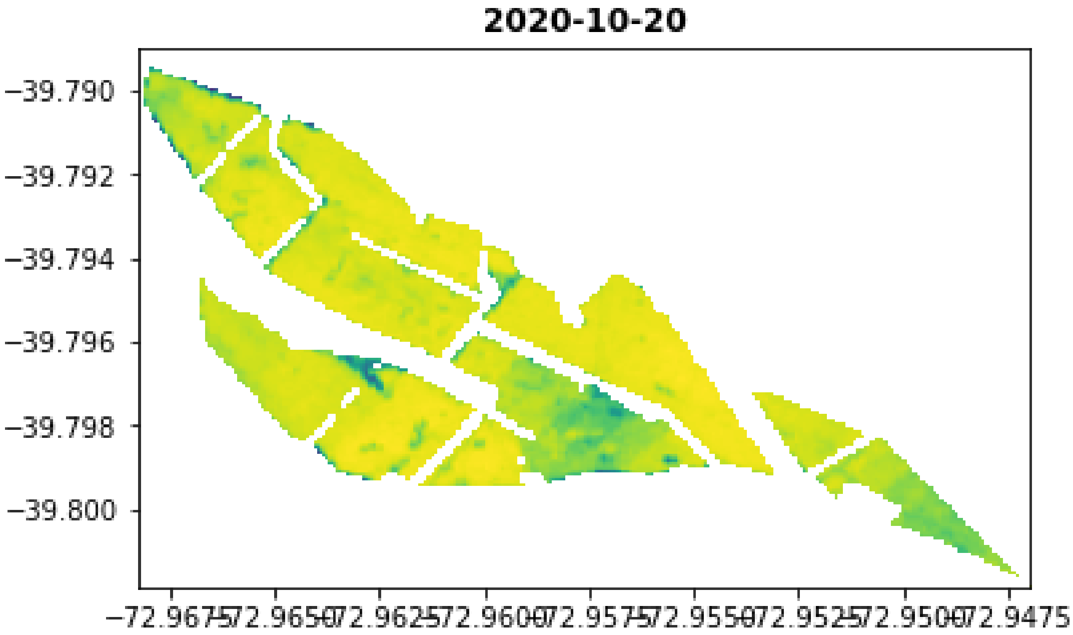

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```
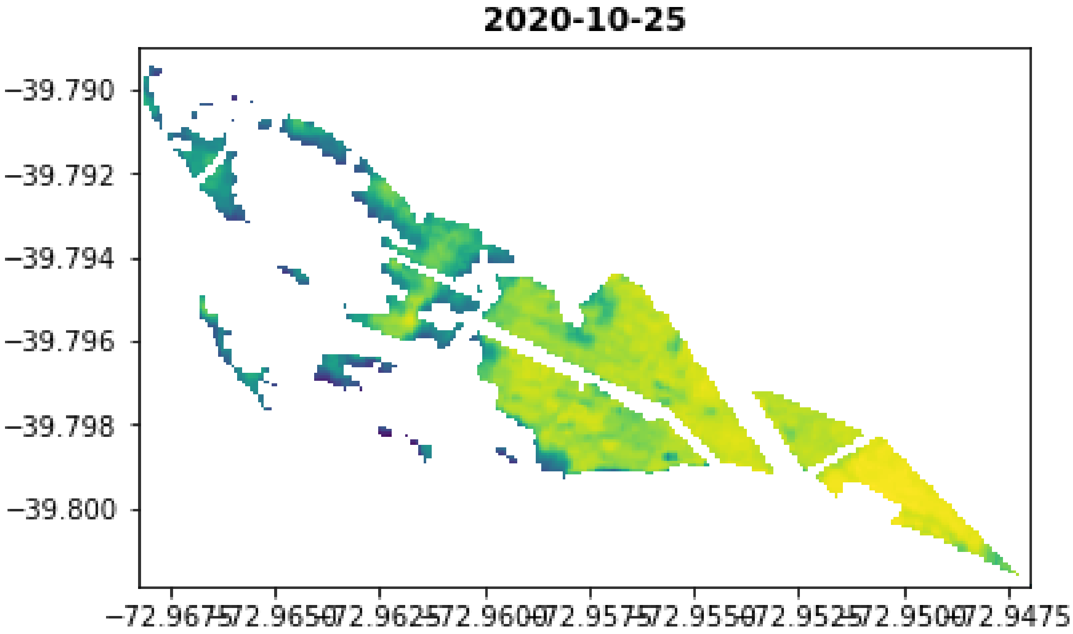
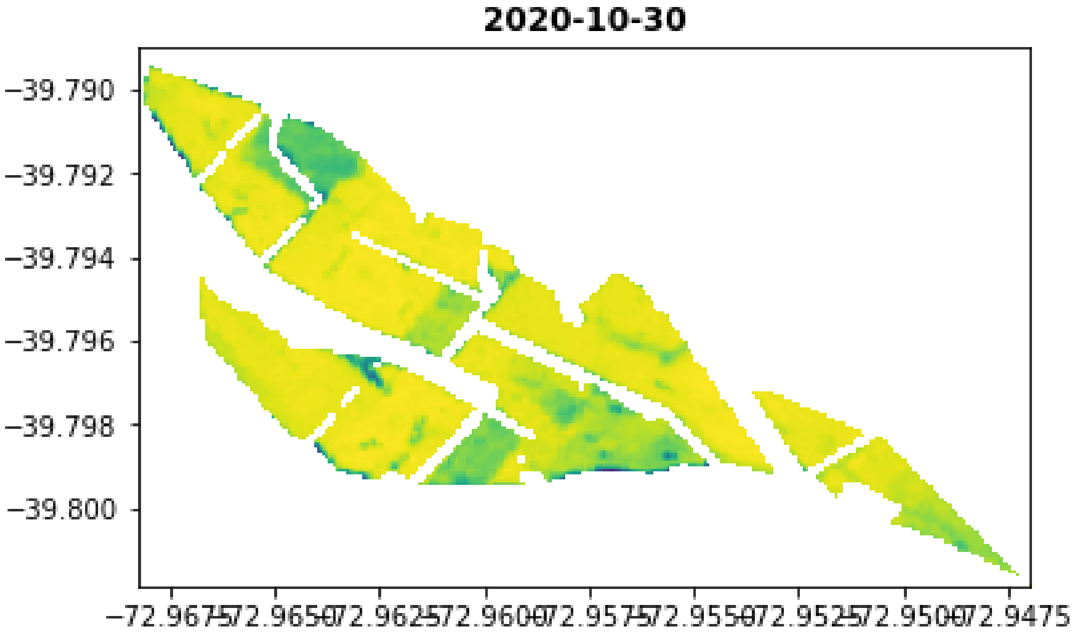

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
```



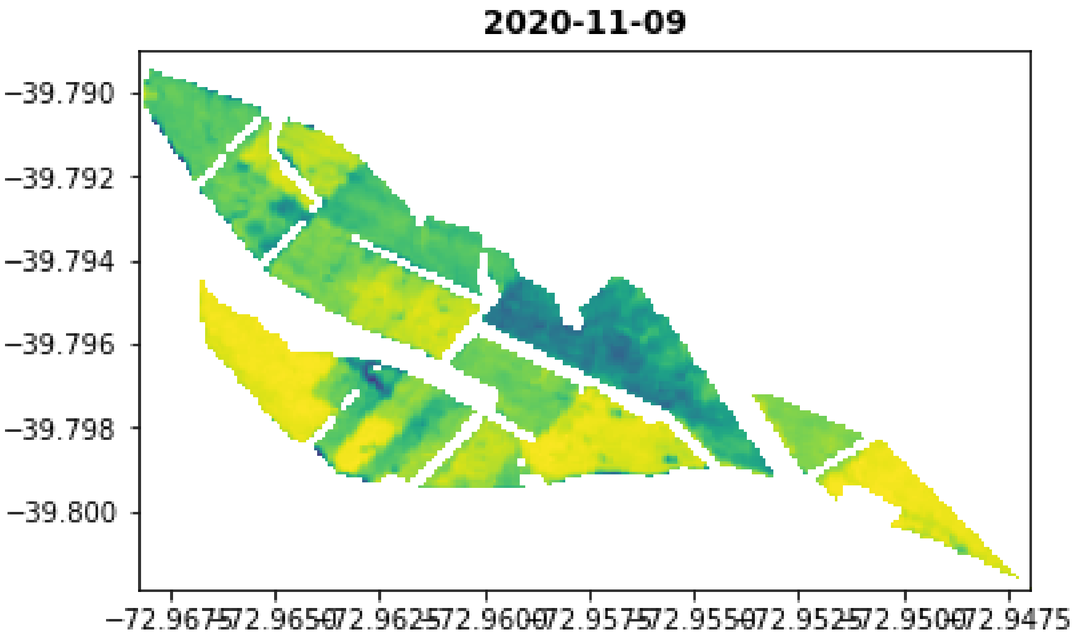
```
<Figure size 432x288 with 0 Axes>
```

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
```



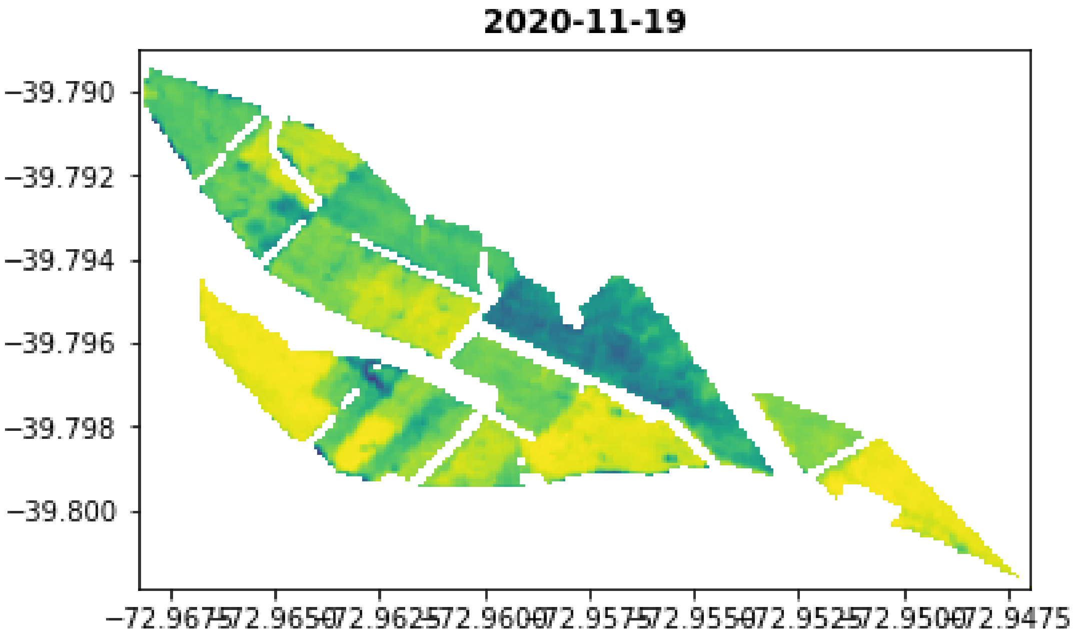
```
<Figure size 432x288 with 0 Axes>
```

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
```



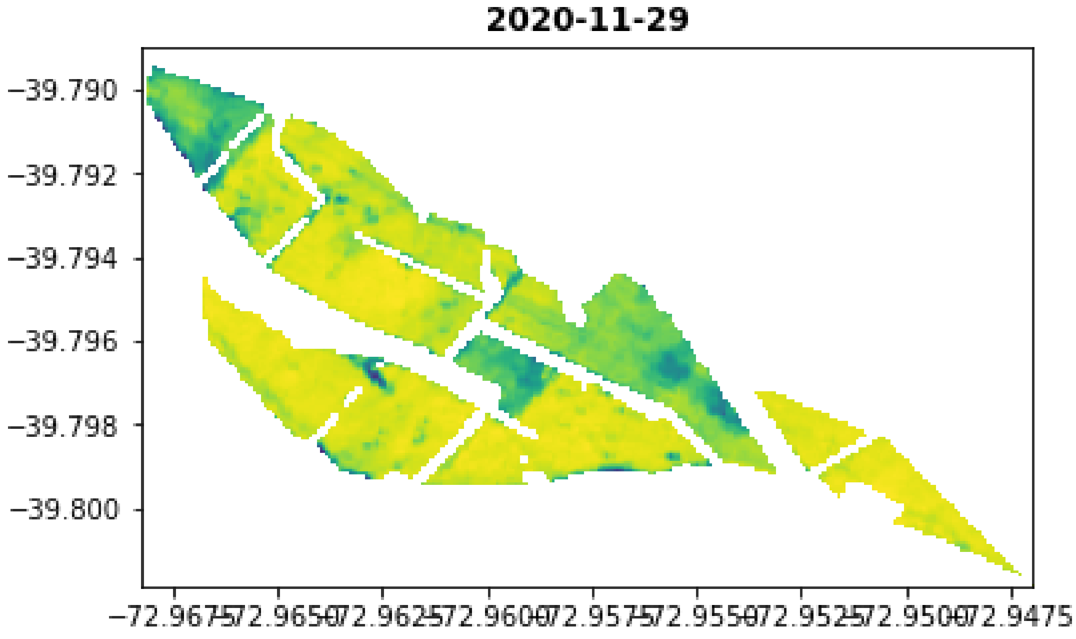
```
<Figure size 432x288 with 0 Axes>
```

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
```



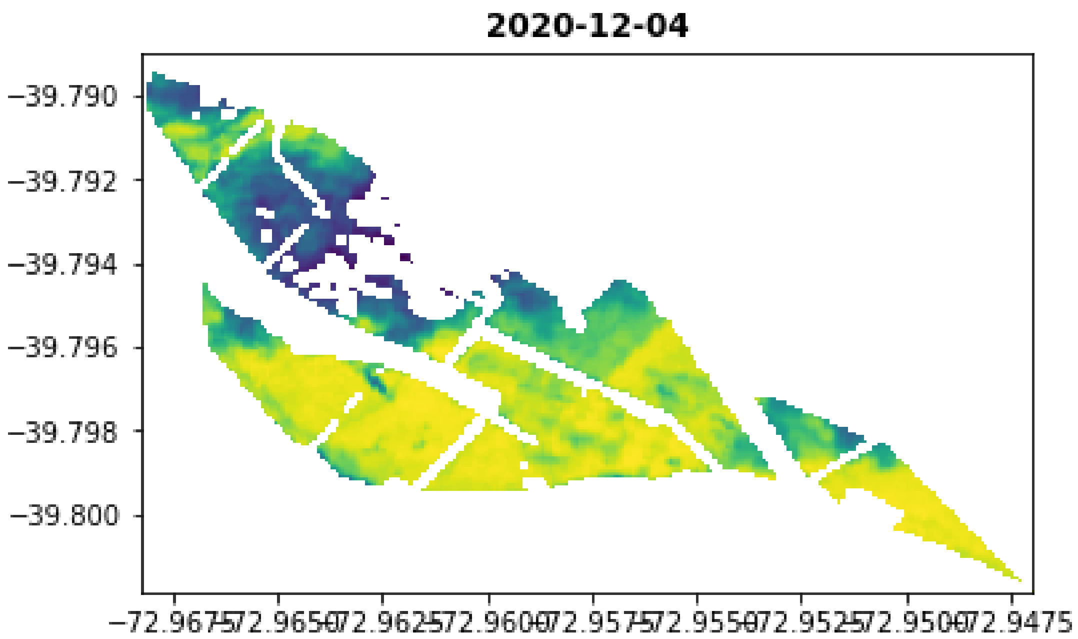
```
<Figure size 432x288 with 0 Axes>
```

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
```



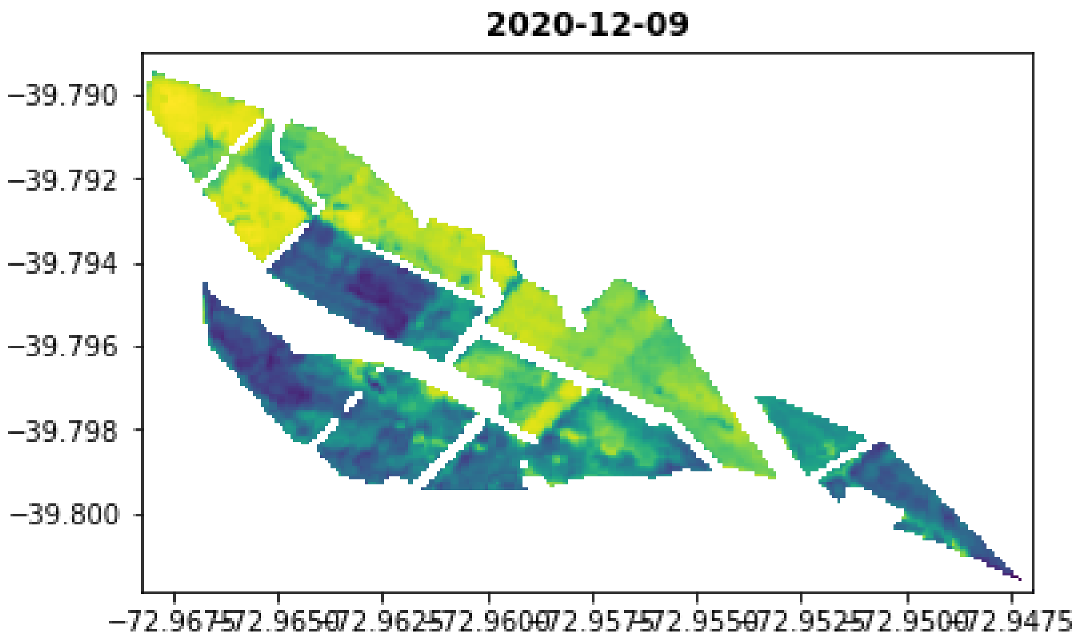
```
<Figure size 432x288 with 0 Axes>
```

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
```



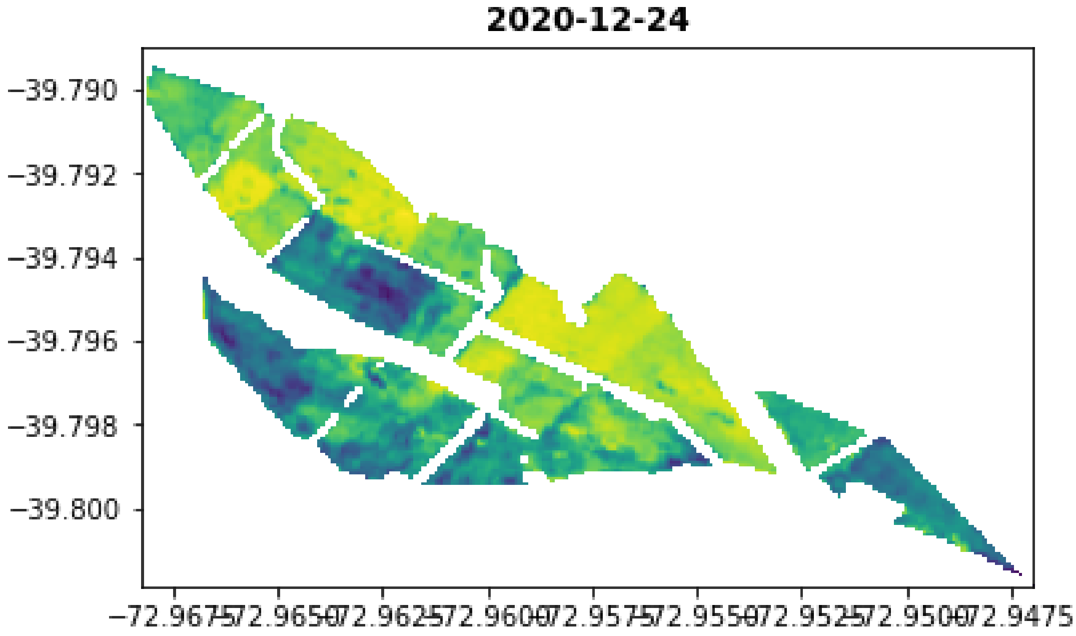
```
<Figure size 432x288 with 0 Axes>
```

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
```



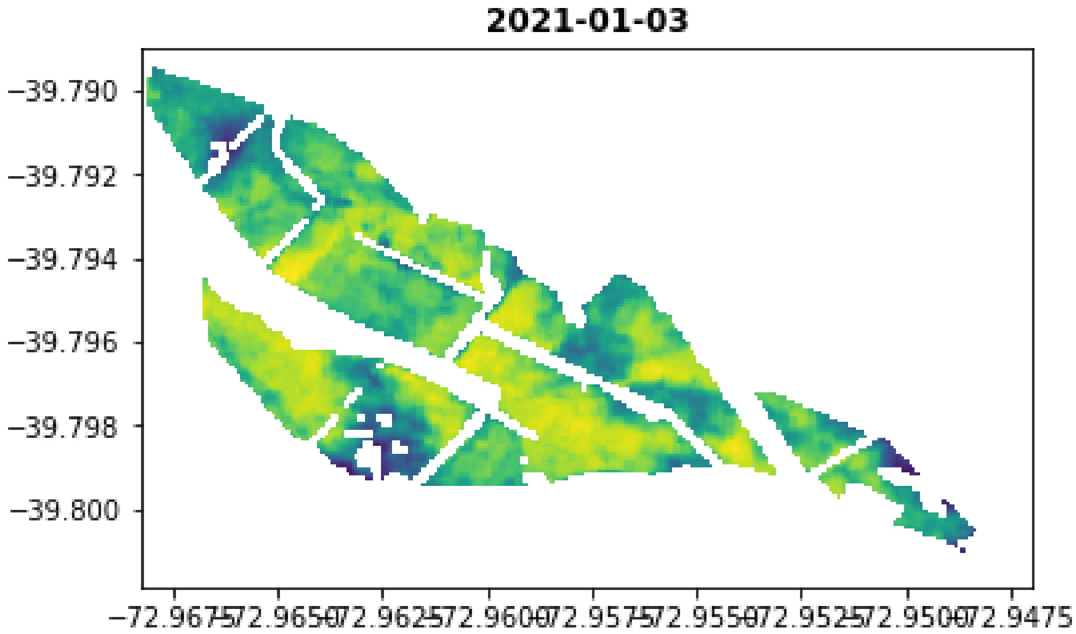
```
<Figure size 432x288 with 0 Axes>
```

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
```



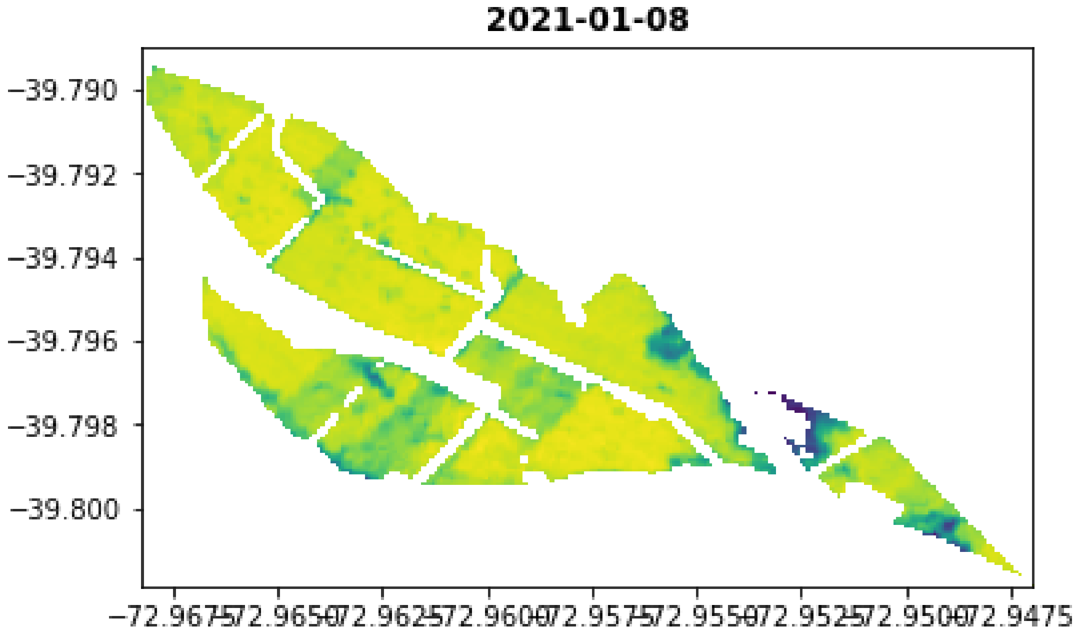
```
<Figure size 432x288 with 0 Axes>
```

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
```



```
<Figure size 432x288 with 0 Axes>
```

```
c:\users\major\desktop\friki\estudios\git\otros\agrospace-intern-
test\venv\lib\site-packages\matplotlib\image.py:490: RuntimeWarning: overflow
encountered in true_divide
  A_scaled /= ((a_max - a_min) / frac)
```



```
<Figure size 432x288 with 0 Axes>
```

[6]:
```
potreros = {}

def combined_mean(x1, n1, x2, n2):
    return (x1*n1 + x2*n2) / (n1+n2)

for p in range(len(measured_data[0])):
    for t in range(len(measured_data)):  # for each potrero, iterate over the␣
 ↪time dictionaries
        name = measured_data[t][p]['properties']['Name']
        if (name not in potreros.keys()):
            potreros[name] = {}
            potreros[name]['count'] = 0
            potreros[name]['mean'] = 0

        if (measured_data[t][p]['properties']['mean'] is not None):
            potreros[name]['mean'] = combined_mean(potreros[name]['mean'],␣
 ↪potreros[name]['count'], measured_data[t][p]['properties']['mean'],␣
 ↪measured_data[t][p]['properties']['count'])
            potreros[name]['count] +=␣
 ↪measured_data[t][p]['properties']['count']
        else:
            print(f"'None' mean value in {t}, {p}")

# vemos cómo quedó
potreros
```

```
'None' mean value in 1, 11
```

[6]:
```
{'Punta estero': {'count': 21542, 'mean': 0.6869895058211861},
 'Laurel': {'count': 11919, 'mean': 0.6953780474645226},
 'Patagua': {'count': 13077, 'mean': 0.7069154097357137},
 'Lado estero': {'count': 11854, 'mean': 0.6833478347238064},
 'Maiz 2': {'count': 42927, 'mean': 0.6961607849049886},
 'Maiz 1': {'count': 32256, 'mean': 0.5951252131619387},
 'Pero a': {'count': 30917, 'mean': 0.6791081397185122},
 'Los bolos a': {'count': 19987, 'mean': 0.7060206864565401},
 'El pero b': {'count': 30659, 'mean': 0.7033114909683204},
 'Los bolos b': {'count': 31527, 'mean': 0.7205316125198052},
 'Las piedras': {'count': 15300, 'mean': 0.6956205810723352},
 'Peña a': {'count': 13349, 'mean': 0.710624350742632},
 'Peña b': {'count': 24463, 'mean': 0.714134877463181},
 'Brazo Muerto': {'count': 34795, 'mean': 0.686549326594807},
 'La isla': {'count': 35943, 'mean': 0.6747425466847823}}
```

[7]:

```python
# ejemplo de uno de los datos
measured_data[0][0]
```

[7]:

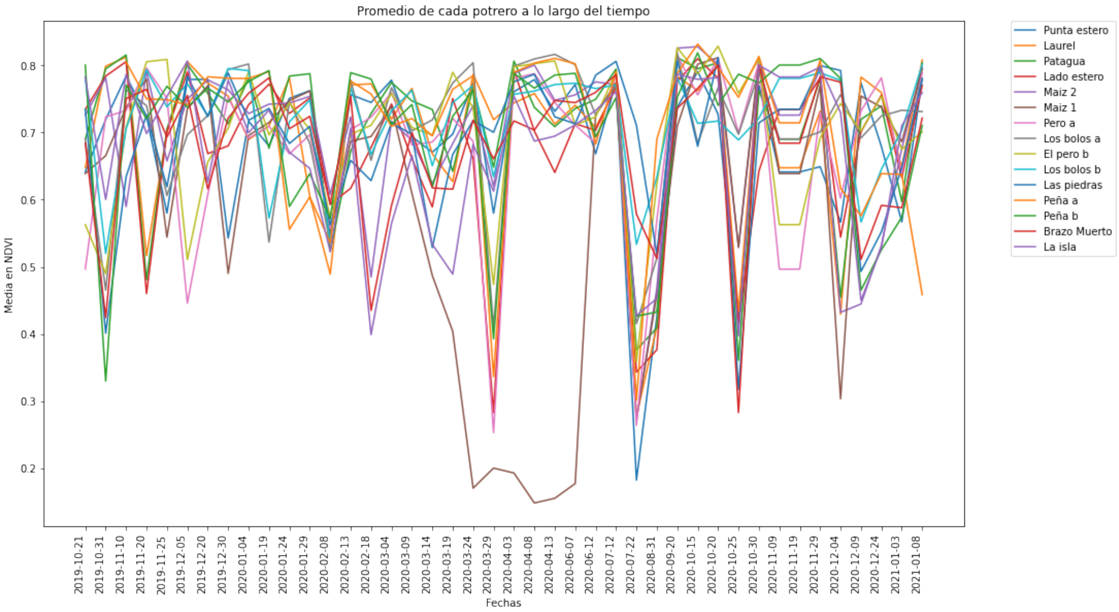
```
{'id': '0',
 'type': 'Feature',
 'properties': {'ID': 1.0,
  'Name': 'Punta estero',
  'Sector': 1.0,
  'area': 41369.504460029304,
  'min': 0.17624999582767487,
  'max': 0.7881987690925598,
  'mean': 0.6413577264933674,
  'count': 540,
  'std': 0.07386996942079899,
  'median': 0.6605344712734222},
 'geometry': {'type': 'Polygon',
  'coordinates': (((-72.9681, -39.7894),
    (-72.9652, -39.7904),
    (-72.9669, -39.7923),
    (-72.9682, -39.7904),
    (-72.9681, -39.7894)),)},
 'bbox': (-72.9682, -39.7923, -72.9652, -39.7894),
 'date': '2019-10-21'}
```

0.0.1 Gráficos del promedio de los Potreros en el tiempo

Gráfico general

[8]:

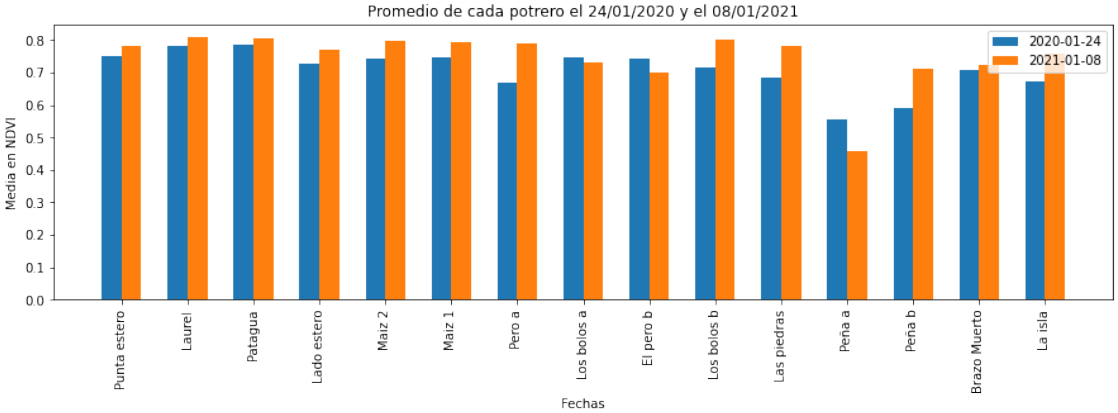
```python
date_list = []
for data in measured_data:
    date_list.append(data[0]['date'])

means01 = []
for data in measured_data:
    means01.append(data[0]['properties']['mean'])


plt.figure(figsize=(16,9))
plt.xticks(rotation=90, ha='right')
plt.plot(date_list, means01, label=data[0]['properties']['Name'])

for i in range(1, len(measured_data[0])):
    means = []
    for data in measured_data:
        means.append(data[i]['properties']['mean'])
    plt.plot(means, label=data[i]['properties']['Name'])

plt.title("Promedio de cada potrero a lo largo del tiempo")
plt.xlabel("Fechas")
plt.ylabel("Media en NDVI")
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', borderaxespad=0.)
plt.show()
```



Comparando potreros para las fechas 24/01/2020 y 08/01/2021

[9]:
```
compared_data = []
for i in range(len(measured_data)):
    if (measured_data[i][0]['date'] in ['2020-01-24', '2021-01-08']):
        compared_data.append(measured_data[i])

potreros_name = []
for i in range(len(measured_data[0])):
    potreros_name.append(measured_data[0][i]['properties']['Name'])


fig, ax = plt.subplots()
x = np.arange(len(potreros_name))
width = 0.3

# fecha 1:
mean_date1 = []
for data in compared_data[0]:
    mean_date1.append(data['properties']['mean'])
#ax.bar(potreros_name, mean_info, width)
rects1 = ax.bar(x - width/2, mean_date1, width, label=data['date'])
```

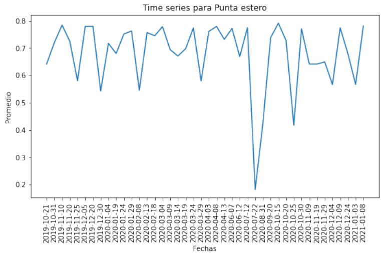
```
# fecha 2:
mean_date2 = []
for data in compared_data[1]:
    mean_date2.append(data['properties']['mean'])
#ax.bar(potreros_name, mean_info, width)
rects2 = ax.bar(x + width/2, mean_date2, width, label=data['date'])


# plot information
ax.set_title("Promedio de cada potrero el 24/01/2020 y el 08/01/2021")
ax.set_xlabel("Fechas")
ax.set_ylabel("Media en NDVI")
ax.set_xticks(x)
ax.set_xticklabels(potreros_name, rotation=90)
ax.legend()
fig.set_figwidth(15)
```

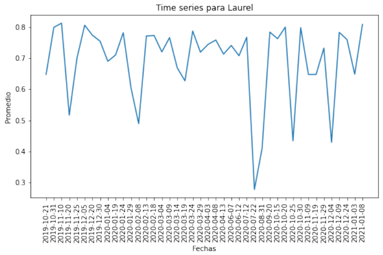


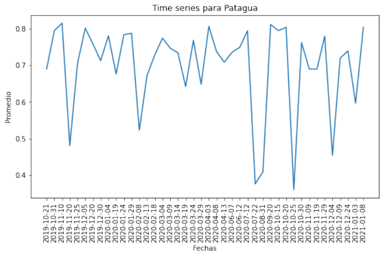
De lo que se observa que el mejor potrero puede ser variable a lo largo del tiempo. Por ejemplo, para la primera fecha el potrero con mejores resultados promedio fue Patagua, pero para la segunda fue laurel, aunque con 0.4 de diferencia.

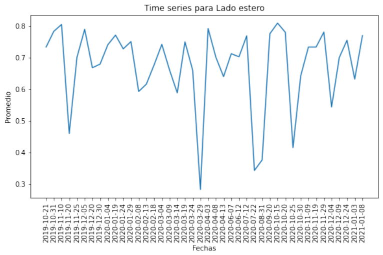
Serie temporal de cada potrero

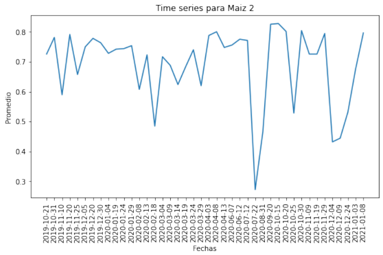
[10]:
```
fig, axs = plt.subplots(7, 2, figsize=(20, 49))
# avoiding overlap
fig.subplots_adjust(hspace=0.5)

potrero = 0
for ax_i in range(len(axs)):
    for ax_j in range(len(axs[ax_i])):
        ax = axs[ax_i][ax_j]
        # for each potrero, we get the displayable information
        dates = []
        means = []
        for f in range(len(measured_data)):
            dates.append(measured_data[f][potrero]['date'])
            means.append(measured_data[f][potrero]['properties']['mean'])

        ax.plot(dates, means)
        for tick in ax.get_xticklabels():  # rorating the x-labels
            tick.set_rotation(90)

        ax.set_title("Time series para " + measured_data[f][potrero]['properties']['Name'])
        ax.set_xlabel("Fechas")
        ax.set_ylabel("Promedio")
        potrero += 1
```

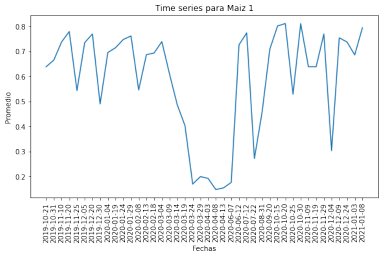

Time series para Punta estero
Promedio
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fechas
2019-10-21
2019-10-31
2019-11-10
2019-11-20
2019-11-25
2019-12-05
2019-12-20
2019-12-30
2020-01-04
2020-01-19
2020-01-24
2020-01-29
2020-02-08
2020-02-13
2020-02-18
2020-03-04
2020-03-09
2020-03-14
2020-03-19
2020-03-24
2020-03-29
2020-04-03
2020-04-08
2020-04-13
2020-06-07
2020-06-12
2020-07-12
2020-07-22
2020-08-31
2020-09-20
2020-10-15
2020-10-20
2020-10-25
2020-10-30
2020-11-09
2020-11-19
2020-11-29
2020-12-04
2020-12-09
2020-12-24
2021-01-03
2021-01-08

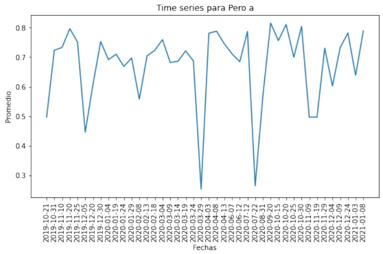

Time series para Laurel
Promedio
0.3
0.4
0.5
0.6
0.7
0.8
Fechas
2019-10-21
2019-10-31
2019-11-10
2019-11-20
2019-11-25
2019-12-05
2019-12-20
2019-12-30
2020-01-04
2020-01-19
2020-01-24
2020-01-29
2020-02-08
2020-02-13
2020-02-18
2020-03-04
2020-03-09
2020-03-14
2020-03-19
2020-03-24
2020-03-29
2020-04-03
2020-04-08
2020-04-13
2020-06-07
2020-06-12
2020-07-12
2020-07-22
2020-08-31
2020-09-20
2020-10-15
2020-10-20
2020-10-25
2020-10-30
2020-11-09
2020-11-19
2020-11-29
2020-12-04
2020-12-09
2020-12-24
2021-01-03
2021-01-08

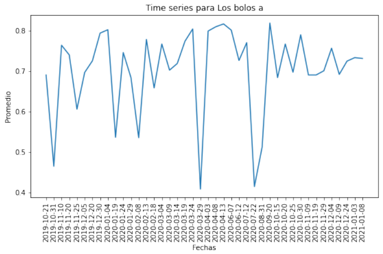

Time series para Patagua
Promedio
0.4
0.5
0.6
0.7
0.8
Fechas
2019-10-21
2019-10-31
2019-11-10
2019-11-20
2019-11-25
2019-12-05
2019-12-20
2019-12-30
2020-01-04
2020-01-19
2020-01-24
2020-01-29
2020-02-08
2020-02-13
2020-02-18
2020-03-04
2020-03-09
2020-03-14
2020-03-19
2020-03-24
2020-03-29
2020-04-03
2020-04-08
2020-04-13
2020-06-07
2020-06-12
2020-07-12
2020-07-22
2020-08-31
2020-09-20
2020-10-15
2020-10-20
2020-10-25
2020-10-30
2020-11-09
2020-11-19
2020-11-29
2020-12-04
2020-12-09
2020-12-24
2021-01-03
2021-01-08


Time series para Lado estero
Promedio
0.3
0.4
0.5
0.6
0.7
0.8
Fechas
2019-10-21
2019-10-31
2019-11-10
2019-11-20
2019-11-25
2019-12-05
2019-12-20
2019-12-30
2020-01-04
2020-01-19
2020-01-24
2020-01-29
2020-02-08
2020-02-13
2020-02-18
2020-03-04
2020-03-09
2020-03-14
2020-03-19
2020-03-24
2020-03-29
2020-04-03
2020-04-08
2020-04-13
2020-06-07
2020-06-12
2020-07-12
2020-07-22
2020-08-31
2020-09-20
2020-10-15
2020-10-20
2020-10-25
2020-10-30
2020-11-09
2020-11-19
2020-11-29
2020-12-04
2020-12-09
2020-12-24
2021-01-03
2021-01-08


Time series para Maiz 2
Promedio
0.3
0.4
0.5
0.6
0.7
0.8
Fechas
2019-10-21
2019-10-31
2019-11-10
2019-11-20
2019-11-25
2019-12-05
2019-12-20
2019-12-30
2020-01-04
2020-01-19
2020-01-24
2020-01-29
2020-02-08
2020-02-13
2020-02-18
2020-03-04
2020-03-09
2020-03-14
2020-03-19
2020-03-24
2020-03-29
2020-04-03
2020-04-08
2020-04-13
2020-06-07
2020-06-12
2020-07-12
2020-07-22
2020-08-31
2020-09-20
2020-10-15
2020-10-20
2020-10-25
2020-10-30
2020-11-09
2020-11-19
2020-11-29
2020-12-04
2020-12-09
2020-12-24
2021-01-03
2021-01-08


Time series para Maiz 1
Promedio
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fechas
2019-10-21
2019-10-31
2019-11-10
2019-11-20
2019-11-25
2019-12-05
2019-12-20
2019-12-30
2020-01-04
2020-01-19
2020-01-24
2020-01-29
2020-02-08
2020-02-13
2020-02-18
2020-03-04
2020-03-09
2020-03-14
2020-03-19
2020-03-24
2020-03-29
2020-04-03
2020-04-08
2020-04-13
2020-06-07
2020-06-12
2020-07-12
2020-07-22
2020-08-31
2020-09-20
2020-10-15
2020-10-20
2020-10-25
2020-10-30
2020-11-09
2020-11-19
2020-11-29
2020-12-04
2020-12-09
2020-12-24
2021-01-03
2021-01-08


Time series para Pero a
Promedio
0.3
0.4
0.5
0.6
0.7
0.8
Fechas
2019-10-21
2019-10-31
2019-11-10
2019-11-20
2019-11-25
2019-12-05
2019-12-20
2019-12-30
2020-01-04
2020-01-19
2020-01-24
2020-01-29
2020-02-08
2020-02-13
2020-02-18
2020-03-04
2020-03-09
2020-03-14
2020-03-19
2020-03-24
2020-03-29
2020-04-03
2020-04-08
2020-04-13
2020-06-07
2020-06-12
2020-07-12
2020-07-22
2020-08-31
2020-09-20
2020-10-15
2020-10-20
2020-10-25
2020-10-30
2020-11-09
2020-11-19
2020-11-29
2020-12-04
2020-12-09
2020-12-24
2021-01-03
2021-01-08


Time series para Los bolos a
Promedio
0.4
0.5
0.6
0.7
0.8
Fechas
2019-10-21
2019-10-31
2019-11-10
2019-11-20
2019-11-25
2019-12-05
2019-12-20
2019-12-30
2020-01-04
2020-01-19
2020-01-24
2020-01-29
2020-02-08
2020-02-13
2020-02-18
2020-03-04
2020-03-09
2020-03-14
2020-03-19
2020-03-24
2020-03-29
2020-04-03
2020-04-08
2020-04-13
2020-06-07
2020-06-12
2020-07-12
2020-07-22
2020-08-31
2020-09-20
2020-10-15
2020-10-20
2020-10-25
2020-10-30
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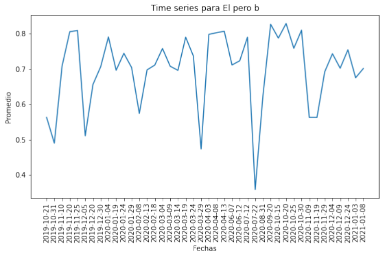
Time series para El pero b
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Fechas
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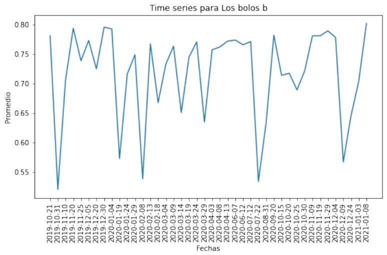
Time series para Los bolos b
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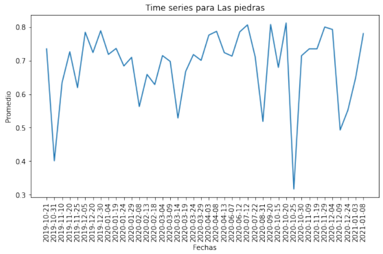
Time series para Las piedras
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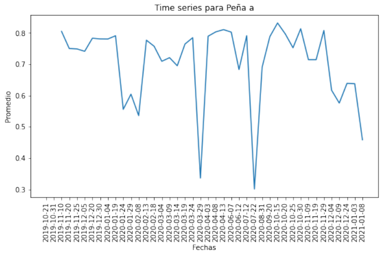
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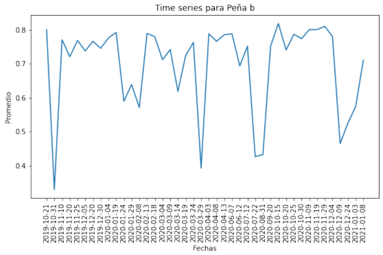
Time series para Peña b
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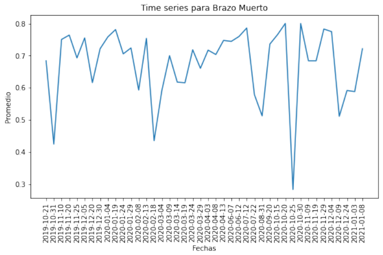
Time series para Brazo Muerto
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