mosaics

July 24, 2023

1 Plotting and analyzing ASI mosaics

[ ]:
```
from datetime import datetime

import matplotlib.pyplot as plt
import matplotlib.colors
import aacgmv2
import numpy as np
import scipy.interpolate

import asilib
import asilib.asi
import asilib.map

print(f'asilib version: {asilib.__version__}')
```

```
asilib version: 0.18.1
```

We first create an `asilib.Imagers()` object consisting of TREx-RGB `asilib.Imagers()` defined a list of location_codes.

[ ]:
```
asilib.asi.trex.trex_rgb_info()
```

[ ]:

	array	location_code	name	latitude	longitude
0	TREx_RGB	ATHA	Athabasca	54.60	-113.64
1	TREx_RGB	FSMI	Fort Smith	60.03	-111.93
2	TREx_RGB	GILL	Gillam	56.38	-94.64
3	TREx_RGB	LUCK	Lucky Lake	51.15	-107.26
4	TREx_RGB	PINA	Pinawa	50.26	-95.87
5	TREx_RGB	RABB	Rabbit Lake	58.23	-103.68

[ ]:
```
time = datetime(2021, 11, 4, 7, 3, 51)
location_codes = ['FSMI', 'LUCK', 'RABB', 'PINA', 'GILL']
map_alt = 110
min_elevation = 10
```

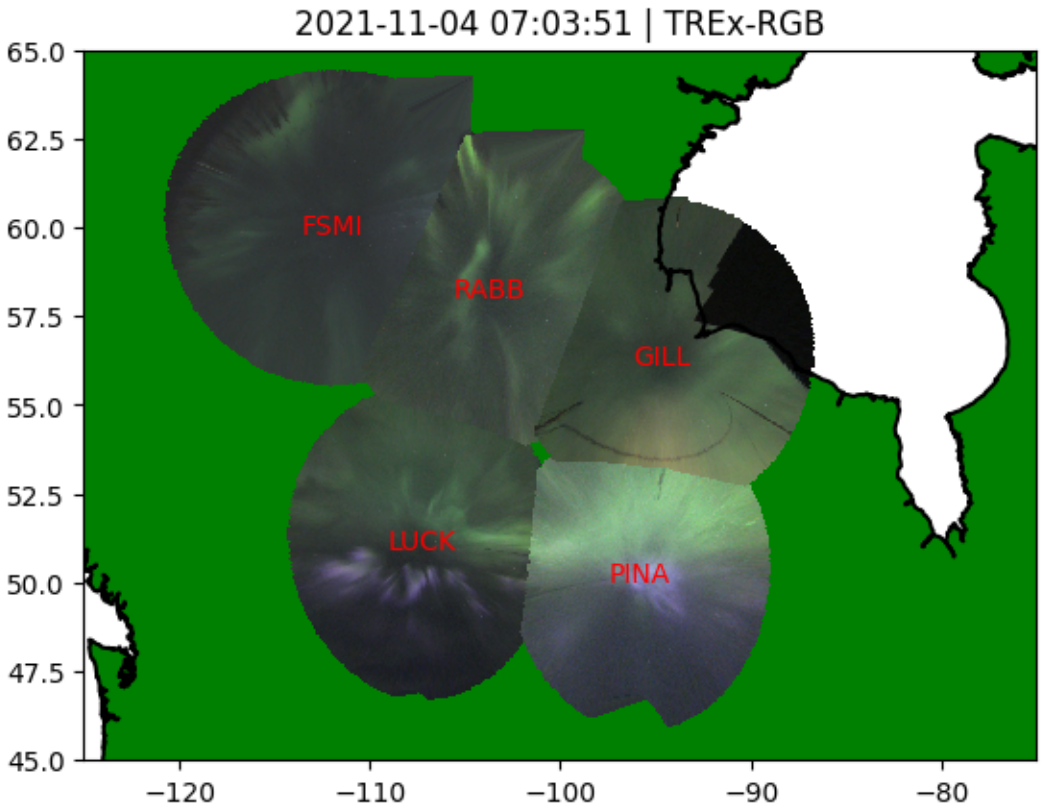
[ ]:
```
_imagers = []
```

```
for location_code in location_codes:
    _imagers.append(asilib.asi.trex.trex_rgb(location_code, time=time,␣
 ↪alt=map_alt))

asis = asilib.Imagers(_imagers)
```

Plot a TREx-RGB mosaic with and without AACGM magnetic latitude contours.

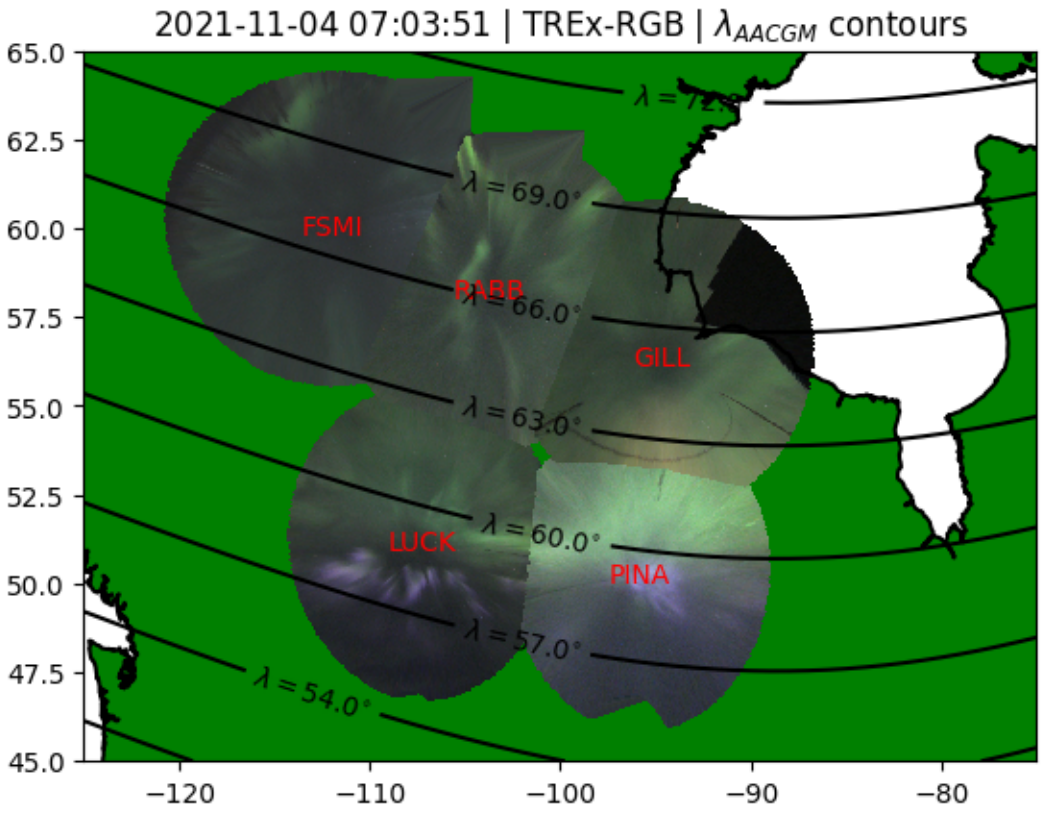
[ ]:
```
lon_bounds=(-125, -75)
lat_bounds=(45, 65)
ax = asilib.map.create_simple_map(lon_bounds=lon_bounds, lat_bounds=lat_bounds)
asis.plot_map(ax=ax, overlap=False, min_elevation=min_elevation)
plt.title(f'{time} | TREx-RGB');
```



[ ]:
```
lat_grid, lon_grid = np.meshgrid(np.linspace(*lat_bounds), np.
 ↪linspace(*lon_bounds, num=51))
# Need to pass flattened arrays since aacgmv2 does not work with n-D arrays.
aacgm_lat_grid, aacgm_lon_grid, _ = aacgmv2.wrapper.convert_latlon_arr(
    lat_grid.flatten(), lon_grid.flatten(), 110, time, method_code='G2A'
    )
aacgm_lat_grid = aacgm_lat_grid.reshape(lat_grid.shape)
```

```
aacgm_lon_grid = aacgm_lon_grid.reshape(lon_grid.shape)

ax = asilib.map.create_simple_map(lon_bounds=lon_bounds, lat_bounds=lat_bounds)
asis.plot_map(ax=ax, overlap=False, min_elevation=min_elevation)
cs = plt.contour(lon_grid, lat_grid, aacgm_lat_grid, colors='k')
ax.clabel(cs, inline=True, fontsize=10, fmt=lambda x: f'$\lambda =␣
 ↪{{{x}}}^{{\circ}}$')
plt.title(f'{time} | TREx-RGB | $\lambda_{{AACGM}}$ contours');
```

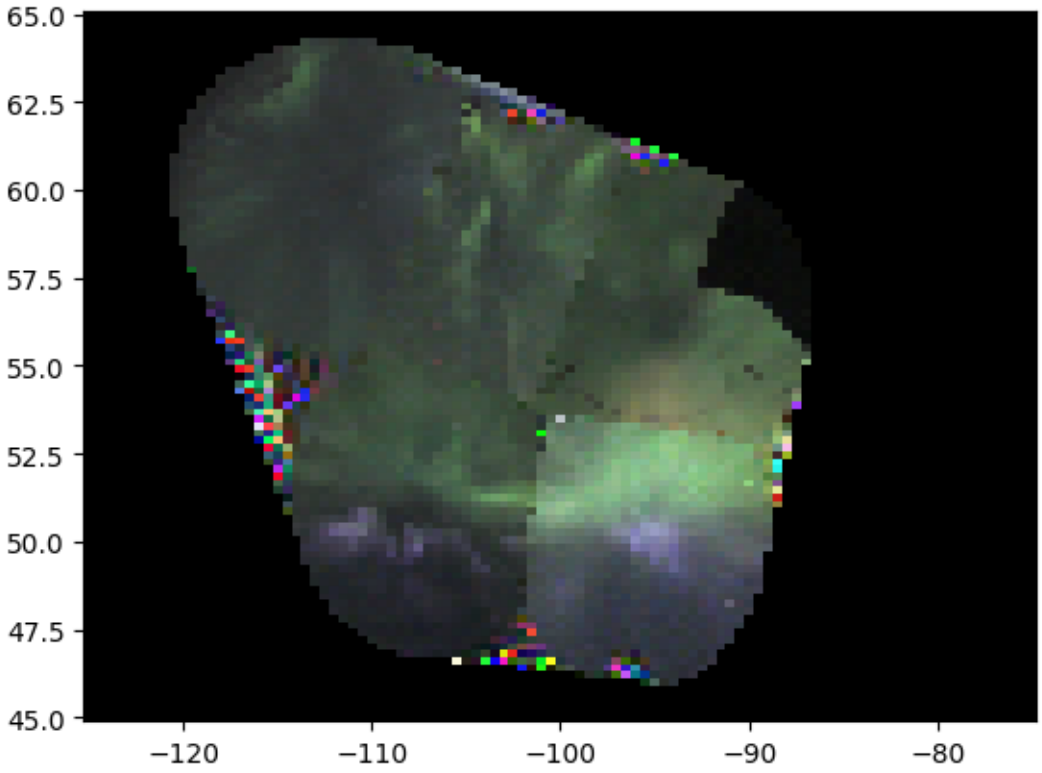


Now lets try to put the mosaic onto a custom grid.

[ ]:
```
lat_lon_points, intensities = asis.get_points(min_elevation=min_elevation)
lat_grid2, lon_grid2 = np.meshgrid(np.linspace(*lat_bounds, num=100), np.
 ↪linspace(*lon_bounds, num=101))
rgb_grid = scipy.interpolate.griddata(lat_lon_points, intensities, (lat_grid2,␣
 ↪lon_grid2), method='cubic')
g_grid = scipy.interpolate.griddata(lat_lon_points, intensities[:, 1],␣
 ↪(lat_grid2, lon_grid2), method='cubic')
b_grid = scipy.interpolate.griddata(lat_lon_points, intensities[:, 2],␣
 ↪(lat_grid2, lon_grid2), method='cubic')
```

[ ]:
```
plt.pcolormesh(lon_grid2, lat_grid2, rgb_grid/255)  # Need to divide by 255 to␣
↪indicate RGB channels to pcolormesh.
```

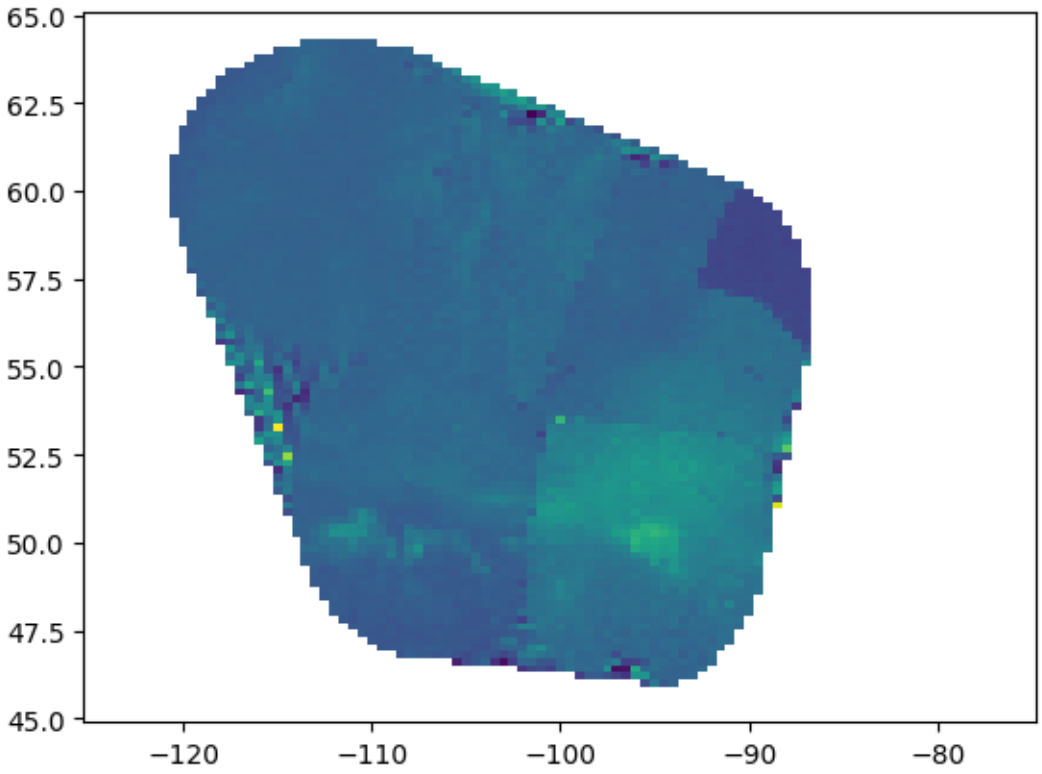
[ ]:
```
<matplotlib.collections.QuadMesh at 0x144c26e6190>
```



Looks good enough for a 100x101 grid! Now, how about the individual colors and green-blue ratio? First, the blue grid:

[ ]:
```
plt.pcolormesh(lon_grid2, lat_grid2, b_grid)
```

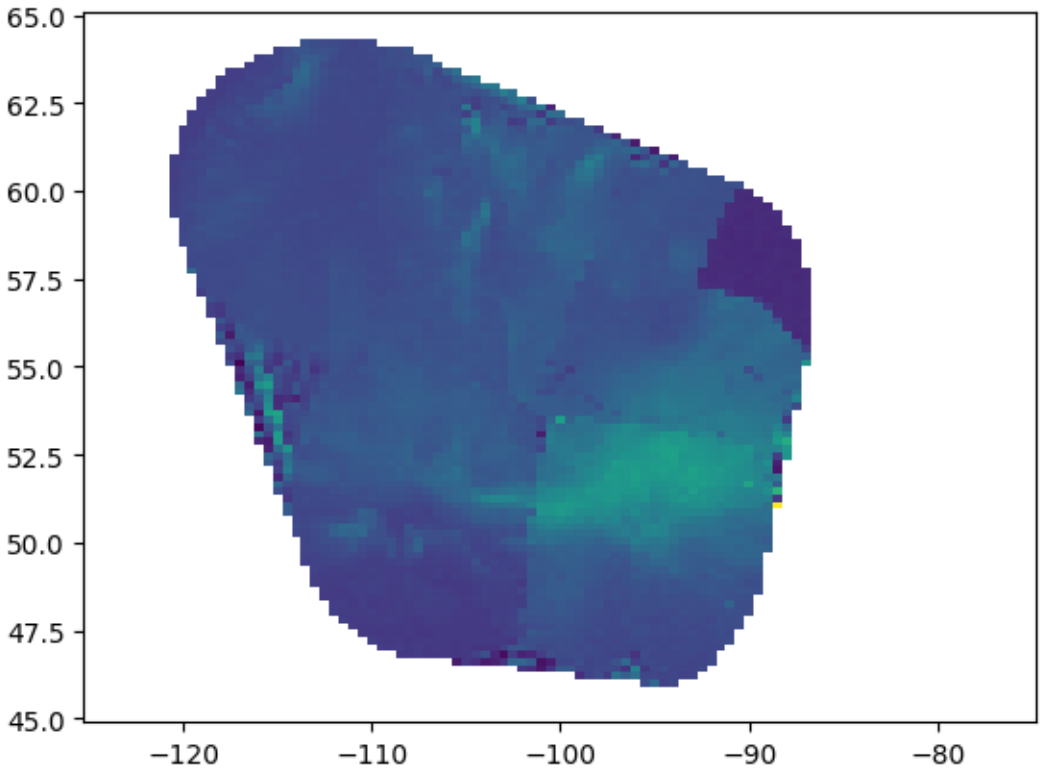
[ ]:
```
<matplotlib.collections.QuadMesh at 0x14491f20450>
```



And the green grid:

[ ]:
```
plt.pcolormesh(lon_grid2, lat_grid2, g_grid)
```

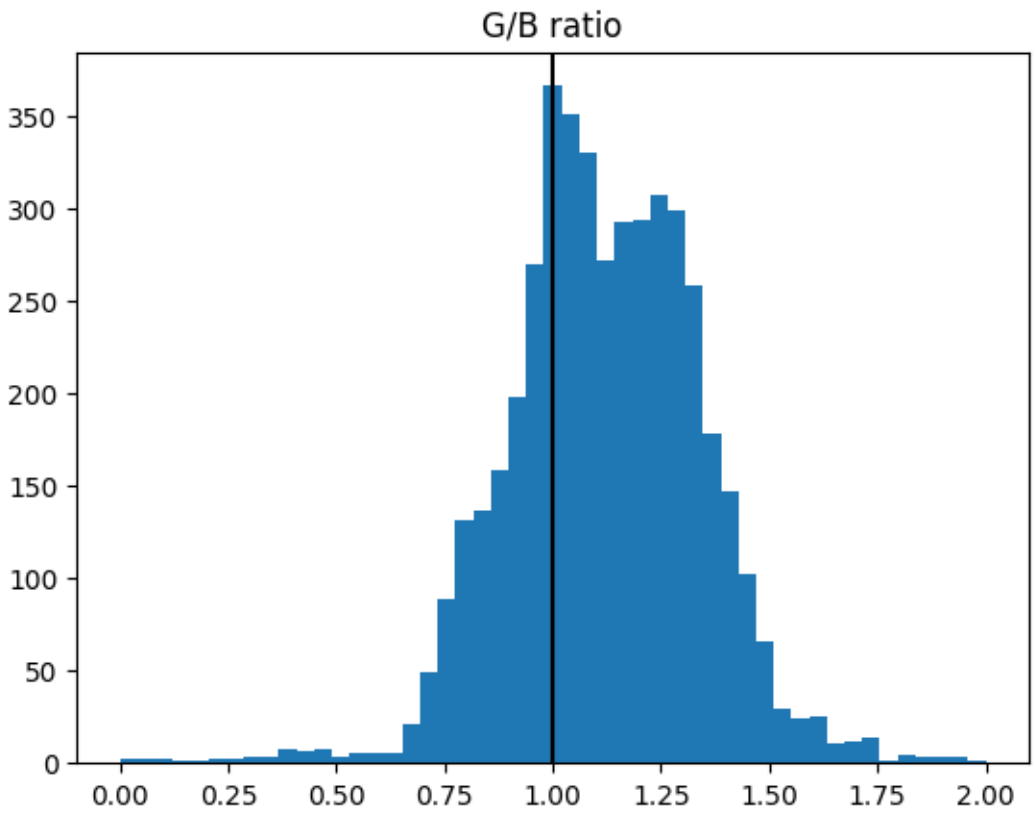
[ ]:
```
<matplotlib.collections.QuadMesh at 0x1449f606fd0>
```



And the ratio:

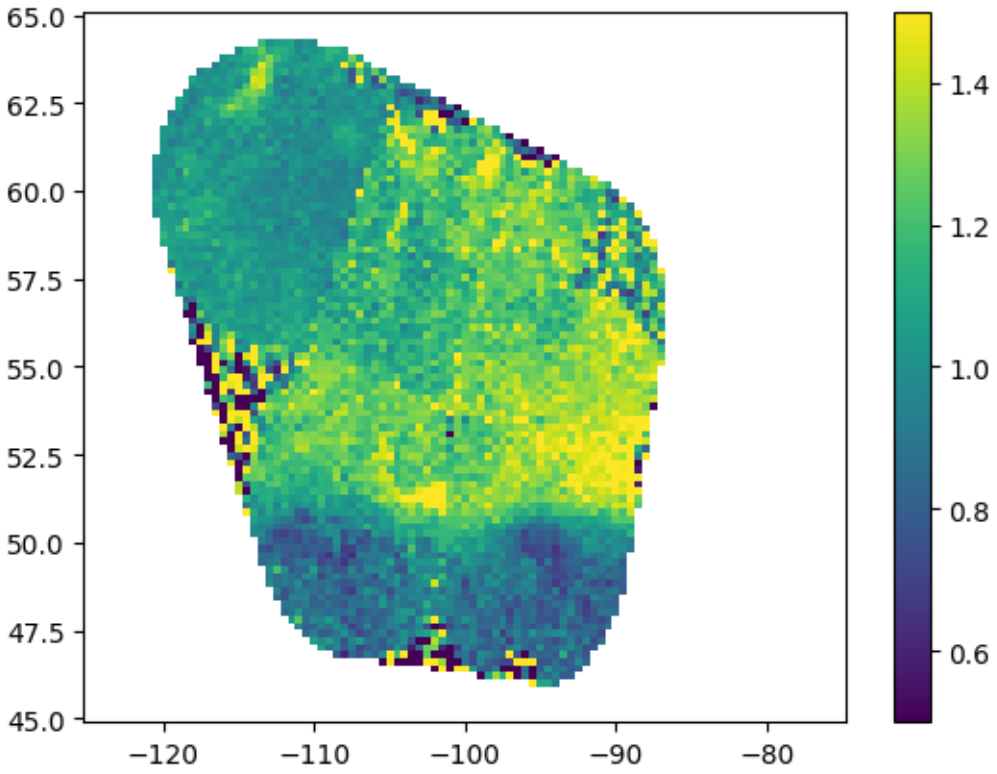
[ ]:
```
plt.hist((g_grid/b_grid).flatten(), bins=np.linspace(0, 2));
plt.title('G/B ratio')
plt.axvline(1, c='k')
```

[ ]:
```
<matplotlib.lines.Line2D at 0x144c264e910>
```



[ ]:
```
plt.pcolormesh(lon_grid2, lat_grid2, g_grid/b_grid, vmin=0.5, vmax=1.5)
plt.colorbar()
```

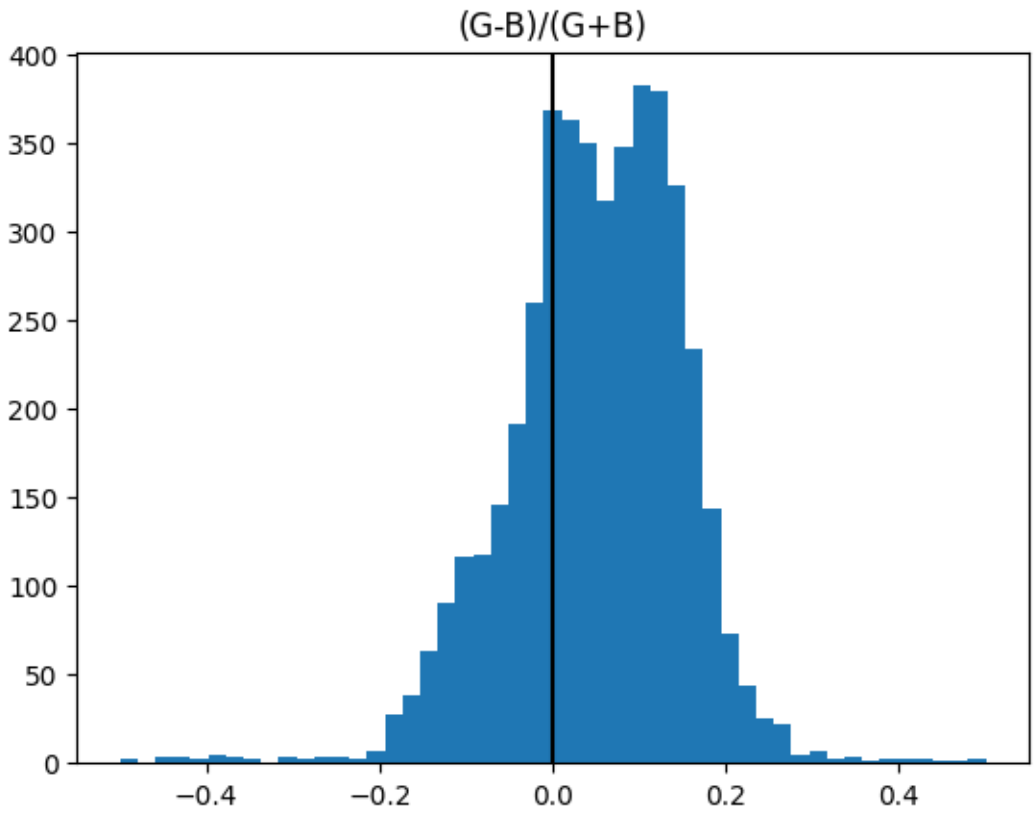
[ ]:
```
<matplotlib.colorbar.Colorbar at 0x144c5f00810>
```



Normalized ratio

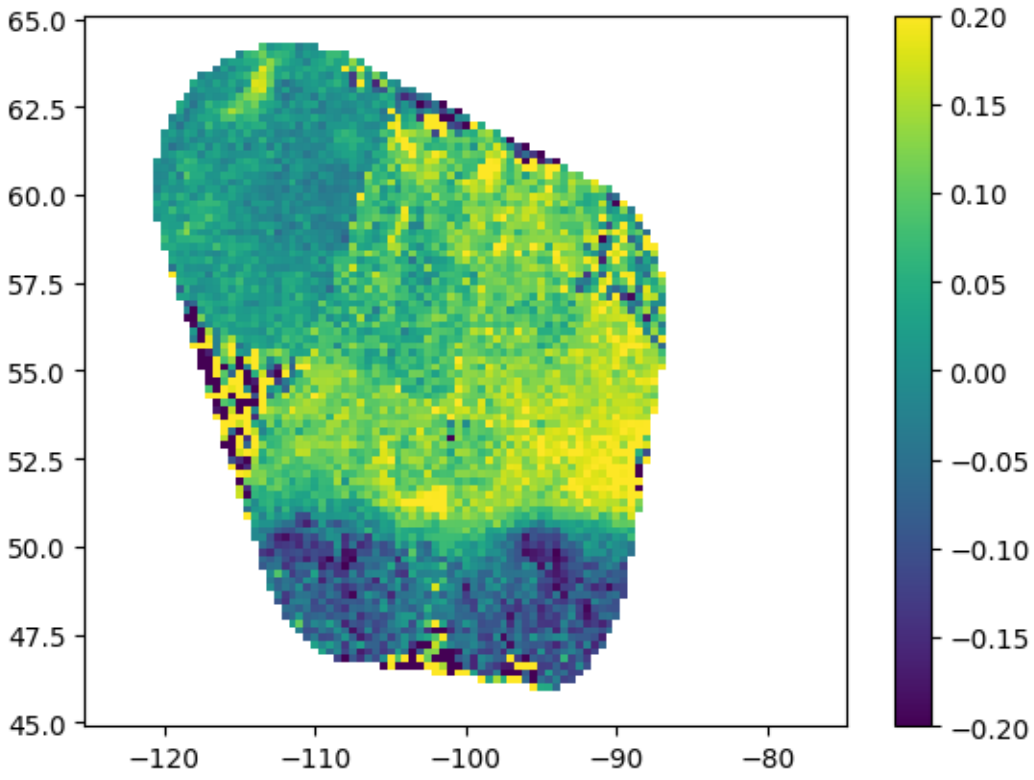
[ ]:
```
plt.hist(((g_grid-b_grid)/(g_grid+b_grid)).flatten(), bins=np.linspace(-0.5, 0.
↪5));
plt.title('(G-B)/(G+B)')
plt.axvline(0, c='k')
```

[ ]:
```
<matplotlib.lines.Line2D at 0x144c868d290>
```



[ ]:
```
plt.pcolormesh(lon_grid2, lat_grid2, (g_grid-b_grid)/(g_grid+b_grid), vmin=-0.
↪2, vmax=0.2)
plt.colorbar()
```

[ ]: <matplotlib.colorbar.Colorbar at 0x144c8c40810>


65.0
62.5
60.0
57.5
55.0
52.5
50.0
47.5
45.0
−120
−110
−100
−90
−80
0.20
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
−0.20